GEOLOGICAL SURVEY OF CANADA

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METALLOGENY OF THE WOODSTOCK AREA, NEW BRUNSWICK

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

0.0 ABSTRACT

The Woodstock area is underlain by Cambro-Ordovician quartz wackes and slates that have been intruded by Devonian granite (Benton Stock), granodiorite, tonalite and trondjhemite (Gibson Stock and Upper Woodstock Stock) amd quartz-feldspar porphyry (Lower Woodstock and Sharp's Mountain stocks). A porphyry-copper system, centered on Connell Mountain in the Gibson Stock is characterized by a core of phyllic alteration and chalcopyrite-pyrite-pyrrhotite mineralization in porphyritic trondjhemite and tonalite. A zone of propylitic alteration has been defined peripheral to the zone of phyllic alteration. Within the zone of propylitic alteration, vein-copper, lead-zinc and gold occurrences are described. For the most part the gold is associated with quartz veins in the intrusions and nearby metasedimentary rocks.

Unrelated Fe-Mn, Ba and Sb - (AU) occurrences are also described, as well as minor occurrences of copper and molybdenum.

The potential for finding other copper and gold deposits is good. At present, the known gold occurrences have not been fully evaluated. Furthermore, only the western portion of the porphyry copper system has been defined; to the east the area is drift covered and untested. Also few gold analyses have been made on the porphyry copper occurrence at Connell Mountain, and in the light of the data from this report, further work is warranted.

1.0 INTRODUCTION

The area studied comprises some 300 km² in the vicinity of Woodstock, New Brunswick in the southwest part of the Miramichi Zone. Within the area, interbedded quartz wackes and argillites of the lower part of the Tetagouche Group (Ordovician) and minor mafic volcanics of the upper part of the Tetagouche Group have been intruded by lower to middle Devonian felsic stocks. Thirty-nine mineral occurrences are known within the project area. These have been subdivided into porphyry-copper (7 occurrences), vein or porphyry affiliate copper (9 occurrences), fracture filling copper (8 occurrences), vein - lead (7 occurrences),vein-gold (3 occurrences), vein-barite (2 occurrences) and iron-manganese (3 occurrences).

The objectives of this project were two fold:

1. to conduct a comprehensive metallogenic study of the Woodstock area in order to provide a detailed documentation of the nature, distribution and interrelationships of known mineral deposits.

2. to assess the potential for the occurrence of other mineral deposits, particularly gold deposits within the area, from an assessment of the regional metallogeny.

2.0 ACKNOWLEDGEMENTS

Researching and conducting the field work for this project involved interviewing many people in the Woodstock area who provided much assistance in locating the occurrences, in directing the authors to several sources of information concerning the history of mining exploration in the area, and in granting permission for access to the occurrences. W.A. Lockhart gave freely of his time to explain the geology and history of development of the Connell Mountain area. Carvell Tompkins provided assistance in locating the Oak Mountain occurrence and information concerning the Tompkins occurrences. Merton Stewart granted permission to sample the Cobbler-Sexton occurrence and directed the authors to the Upper Northampton gold occurrence.

Mark Connell and Donald Hattie, Geosleuth Mineral Exploration Services provided information gathered as phase I of this project along with analyses and some thin sections. Randolf Paul, Economic Development Coordinator, gave permission to review the reports concerning the mineral exploration program conducted on the Woodstock Indian Reserve No. 23 by Department of Indian and Northern Affairs. This project was carried out by C.F. Gleeson and Associates Ltd. and financed by Department of Supply and Services contract number 51 SZ-23233-6-0080 as part of the Canada-New Brunswick Mineral Development Agreement

1984-1989. W.D. Sinclair, scientific authority for the project, provided much useful unpublished data and stimulating and helpful discussions.

3.0 LOCATION

The Woodstock Area is located in south central New Brunswick, (NTS sheets 21J/3 and 21J/4) in Northampton, Woodstock and part of Brighton parishes of Carleton County and in part of Southampton parish of York County. The area of investigation lies between latitude 46°00' and 46°14' and longitude 67°26' and the Woodstock Fault which trends north-northeast from 67°41'30" at the southern boundary to 67°32'00" at the northern boundary of the region (Figure 3.0).

The area is traversed by Highways 2 and 103 on the east side and byHhighway 105 on the west side of the Saint John River. Most of the area is accessible from secondary roads and logging roads leading from these highways.

About 1970 the Saint John River valley was flooded by a hydroelectric dam built at Mactaquac, approximately 85km downriver from Woodstock. The limit of flooding is shown on Map 1. The water level was raised approximately 10m which caused the submergence of many mineral occurrences that were reported adjacent to the old course of the Saint John River.

4.0 PREVIOUS WORK

Initial geological interest in the area concerned the Silurian iron-manganese deposits at Jacksonville, 6km north-northwest of Woodstock. These deposits were described by Dr. Charles T. Jackson (Potter, 1983) as part of an assessment of the mineral potential of the State of Maine (circa 1835). Between 1848 and 1884, some 63,600 tonnes (70,000 tons) of ore were mined, smelted at Woodstock (Potter, 1983) and shipped to England for use as armor plate and boiler plate (Bailey, 1864). Base metal investigations were also active prior to the 1850's as Gesner (1842) reported the occurrence of chalcopyrite at Meductic (1km south of the present area of study, on the Saint John River). The Carleton Sentinel (1857a) mentioned the copper works at Lower Woodstock in 1857 and reported on visits to the New Brunswick Mining Company mine (Bulls Creek No. 2) in 1857 and 1858 (Carleton Sentinel, 1857b, 1858). This latter mine produced copper for approximately four years (Anderson, 1968). Since this time mineral exploration has been intermittent and although many mineral occurrences have been found, none have been exploited.

The initial government survey in the Woodstock area was by the provincial geologist Gesner (1842) who followed the Saint

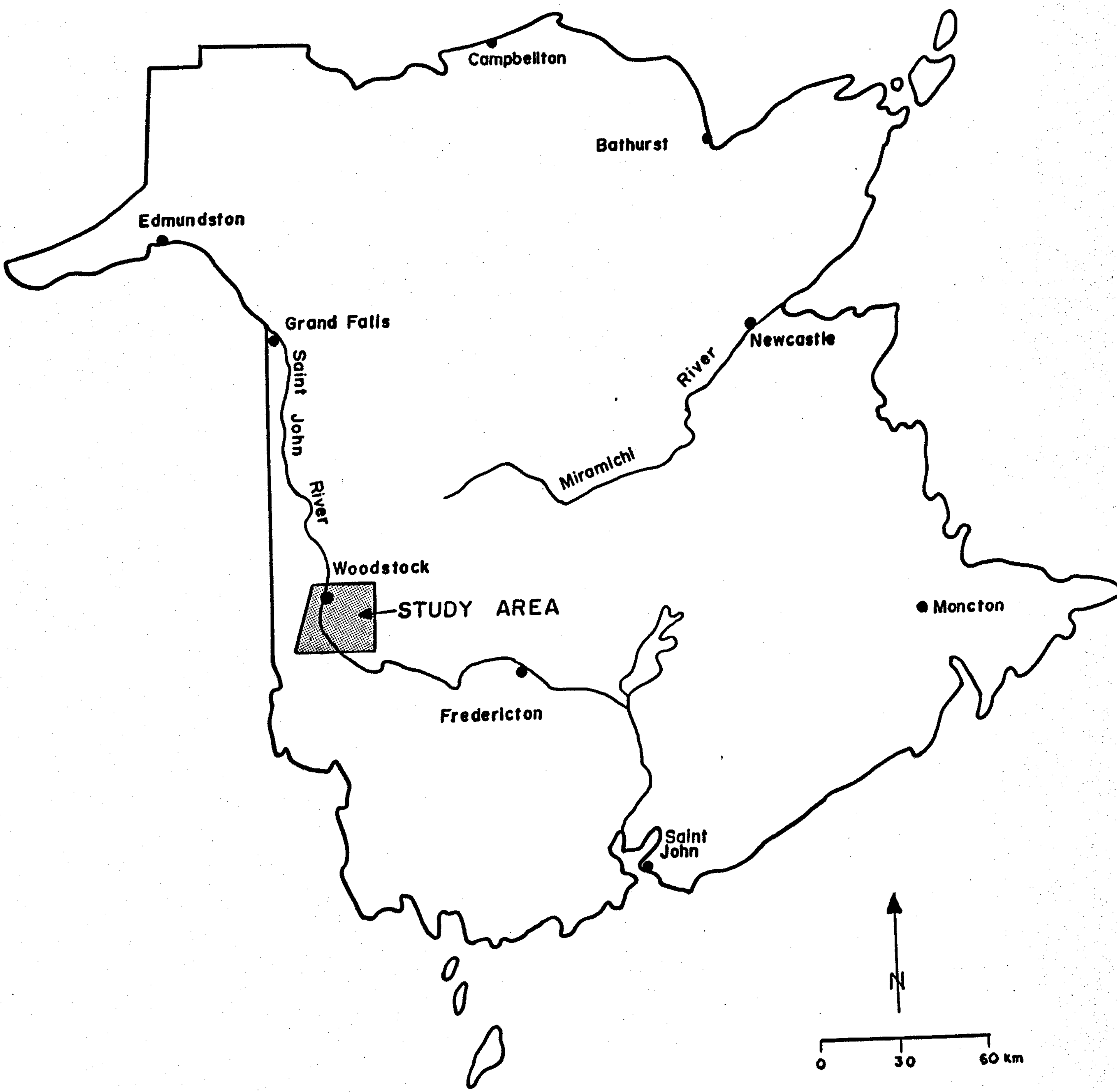


Figure 3.0: Location of study area.

John River and described in general terms the greywackes, slates and granites exposed along the river. He reported a year later (Gesner, 1843) that: "the grauwacke, grauwacke slate, and clay slate are of the Cambrian System based on the presence of a few organic remains". He also noted that these rocks are "highly metaliferous" with the presence of pyrite and chalcopyrite in quartz and calcite veins at Meductic and other locations.

Robb (1870) published the first geological map of the area. On it he showed the area to be underlain by metamorphic and calcareous slates with two bodies of granite, syenite or gneissoid rocks on the Saint John River between Bulls Creek and Woodstock. He described the sediments as interbedded argillaceous slates and quartzose sandstones which become highly deformed around Woodstock where they are intruded by granite, syenite and diorite containing epidote, pyrite, chalcopyrite, galena and other minerals.

Bailey (1884) completed a more detailed survey and ascribed the metasediments to the Cambro-Silurian, based on stratigraphic evidence. He made particular mention of the amygdaloidal rocks at Oak Mountain and the porphyritic rocks near Oak Mountain and Woodstock and of the extreme alteration of the sediments in contact with them.

Ells (1907) further discussed the Cambro-Silurian age of the metasediments, the nature of the granites and commented on the wide alteration zones around the granitic bodies.

Caley (1936) mapped the roads and some streams in the Woodstock area with a view to tracing the extent of the bedded iron deposits (Silurian). The metasediments he described as pre-Silurian quartzites and slates which near Oak Mountain occur with feldspathic sandstones and grits. The three syenitic intrusive bodies which he mapped near the Saint John River at Bulls Creek, at Millstream Brook and in the vicinity of the Benton stock he considered as small outliers of the Pokiok batholith.

Anderson (1954, 1955,1967, 1968) produced the first complete map of the Woodstock area on which the basic geology is similar to that described below and shown on Map 1. Mapping by Hamilton-Smith (1972) and Venugopal (1979, 1981) refined Anderson's work and provided more detail. Geology compilation maps of the Woodstock area have been produced at various scales by Patterson (1953), Anderson and Poole (1959), van de Poll (1967), Potter (1968), Potter et al (1979), and Fyffe (1982 a, b, c).

Geophysical surveys of the Woodstock area include an aeromagnetic survey by the Geological Survey of Canada (1953a, 1953b, 1965), Bouguer gravity surveys by New Brunswick Department of Natural Resources (Chanda et al, 1982 a,b) and radiometric maps by the Geological Survey of Canada (1976).

The Quaternary geology and physiography of the region was first described by Chalmers (1884, 1902) and was mapped by Lee (1962) and Rampton and Paradis (1981). Their results are described below. Geochemical reconnaissance till sampling programs have been conducted in the Woodstock area by Kettles and Wyatt (1985, 1986) and Lamothe (1986). Geochemical stream sediment surveys (Austria, 1973) were conducted for uranium (Austria, 1977, 1979a, 1979b) and copper, lead, zinc, manganese and antimony (Austria, 1980 a, b).

5.0 METHODOLOGY

This project was completed between June 16, 1986 and March 31, 1987. Preliminary investigations involved a literature search at the library of the Geological Survey of Canada in Ottawa and through the assessment, mineral occurrence and NTS files and in the library at the Mineral Resources Branch, Department of Natural Resources and Energy in Fredericton. Field work, completed between June 25 and September 15, 1986, involved locating each mineral occurrence, mapping the detailed geology and alteration of each site and collecting samples for geochemical, petrographic and mineralographic studies.

Geochemical analyses were performed by X-Ray Assay Laboratories Limited, Don Mills, Ontario for major and/or trace elements. The major and minor elements analysed by X-ray fluorescence spectrometry included SiO_2, TiO_2, Al_2O_3, Fe_2O_3, Cr_2O_3, MnO, MgO, CaO, Na_2O, K_2O, P_2O_5, Ba, Nb, Rb, Sr, Y, Zr, S and Cl. F, Co_2, H_2O^+ and FeO were analyzed by wet chemical techniques. The trace element package included Sb, Be, Bi, Cd, Cr, Co, Cu, Fe, Pb, Li, Mn, Mo, Ni, Se, Ag, Te, Sn, W, U, V, and Zn by ICP Mass Spectrometry, As by flameless atomic absorption spectrometry and Au by fire assay with a D.C. plasma emission spectrometry finish.

Twelve samples were submitted for major element analysis primarily to characterize the various lithologies in the area. They were collected by combining small grab samples from many outcrops over a fairly large area.

285 rock samples were submitted for trace element analysis including 38 "standards" and 20 duplicate samples. The "standards" comprised three bulk samples that were broken into 2cm cubes, homogenized and randomly sub-sampled. They were designed to contain high (1000ppb), medium (10-15ppb) and low (<1ppb) gold contents. The high standard was obtained from the Upper Northampton gold occurrence and the low standard from the Benton copper occurrence.

Post field activities included petrographic and mineralographic studies by J. Ayer and final compilation and analysis of data resulting in the preparation of this report. Two summary presentations have preceded this report and were based on preliminary data (Thomas and Gleeson, 1986 and 1987).

6.0 TOPOGRAPHY AND DRAINAGE

The area lies within the Chaleur Uplands subdivision of the Atlantic Uplands division of the Appalachians physiographic region (Williams et al, 1972; Rampton and Paradis, 1981). The area is characterized by steep sided, knobby hills, separated by broad valleys. Most peaks rise to over 200 m above sea level; the lowest point is the Saint John River which is controlled at approximately 41 m. The highest point (284 m asl.) in the area is Oak Mountain; other peaks worthy of note include Benton Ridge (200-230 m asl.), Connell Mountain (235 m asl.) and Patchell's Mountain (182-210 m asl.). The peaks are underlain by Devonian felsic intrusions; the latter two and several peaks nearby are also the locality of many of the mineral occurrences (Map 1).

Drainage within the area is toward the Saint John River in a well developed bedrock controlled trellis pattern. Lineaments from map and airphoto analysis (Figure 6.0) have prominent southeast and north northeast trends with less prominent northward and east northeastward trends. The north northeast trend is parallel to the Woodstock Fault and the lineaments are concentrated near the fault and in the Benton Granite. The southeast trend is most common in the northern part of the area and is parallel to cross faults from the Woodstock Fault (Venugopal, 1981).

The north trending lineaments are parallel to the Saint John River throughout much of the area. North trending shears in roadcuts along Highway 105 between Grafton and Northampton indicate that a north trending shear zone may underlie the Saint John River.

The east-northeastward trending lineaments in the Lower Northampton area are parallel to bedding and S, slatey cleavage (Venugopal, 1979).

It should be noted that the Woodstock Fault forms a prominent lineament that extends along the west boundary of the area.

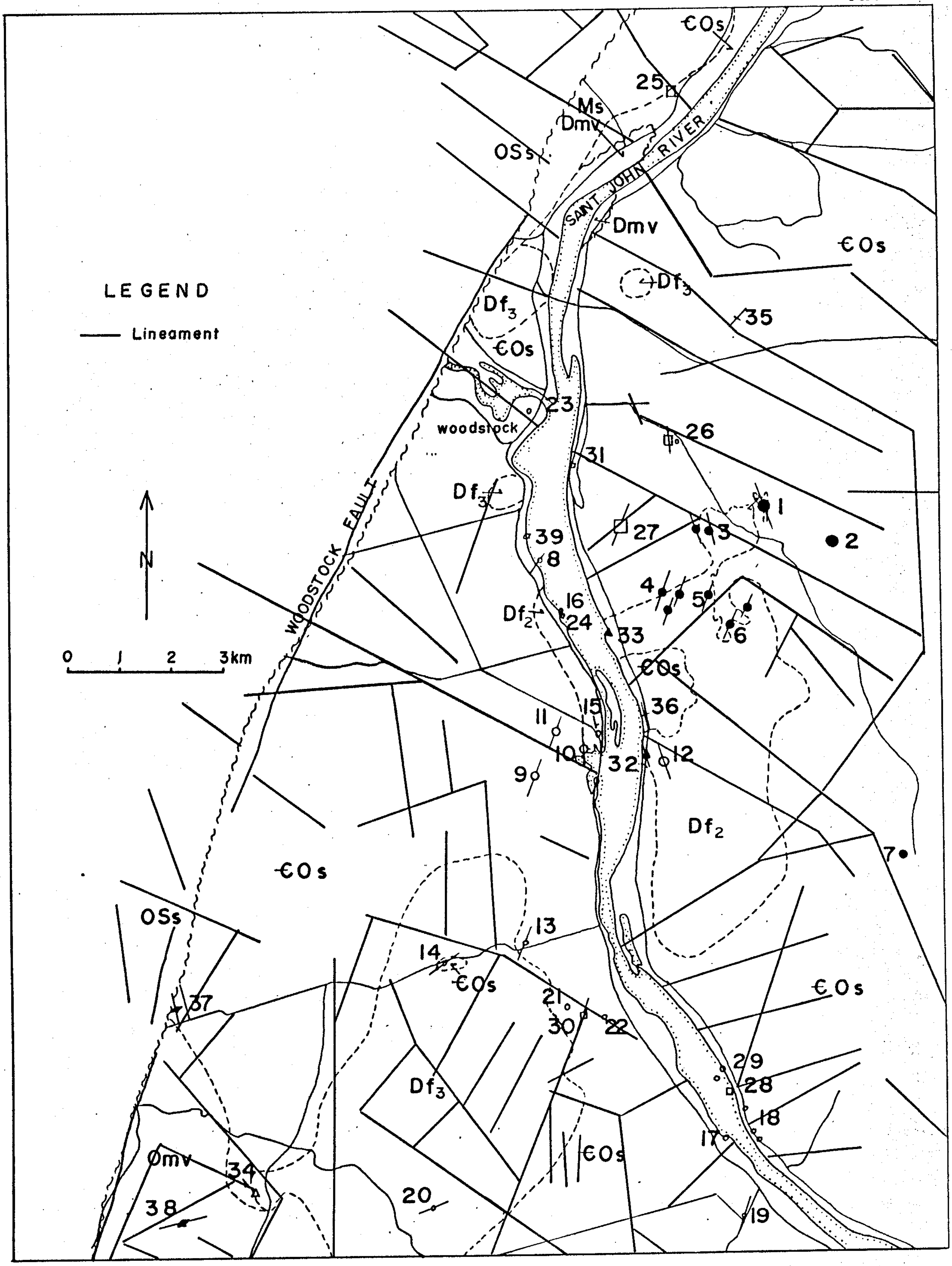


Figure 6.0: Lineament map. (for basemap legend see Map 1).

7.0 GENERAL GEOLOGY

The project area was restricted to the rocks of the Miramichi Anticlinorium (Rodgers, 1970), a tectonostratigraphic zone comprising Cambrian-Ordovician sediments, Ordovician mafic volcanics, Devonian felsic intrusions and minor areas of Devonian mafic volcanics and Mississippian sediments (Map 1). To the west, these rocks are in contact with Silurian rocks of the Matapedia Anticlinorium. The contact is marked by the Woodstock Fault (Venugopal, 1979), a southwestward extension of the Catamaran Fault (Fyffe, 1982 d).

7.1 Quaternary Geology

In general the Quaternary deposits of the Woodstock area are less than 3 m thick and are generally 1-2 m thick on uplands. Thicker deposits occur in valleys and lowlands, particularly along the Saint John River valley where thicknesses in excess of 20 m have been recorded (Lee, 1962). It should be noted however that drift cover is fairly continuous and outcrops are rare except along roads and streams.

Rampton and Paradis (1981) showed the area to be mainly underlain by thin morainal deposits, with thicker (>1 m) morainal deposits occurring in the headwaters of Bulls Creek - Lilly Brook area, along the Benton-Oak-Riceville roads and in the general northeastern part of the present map area. The moraine is composed of brown, silty, sandy, lodgement till deposited from ice which flowed initially southeastward and later southward during the last glaciation (Figure 7.1). An earlier glaciation by eastward flowing ice is indicated by rare striations but is generally not represented by tills.

The Saint John and Meduxnekeag river valleys and several smaller valleys are marked by thicker till deposits overlain by thick (up to 20 m) glaciofluvial sands and gravels (Finamore, 1979a, b). Postglacial submergence by estuarine water covered the Woodstock area to 137 m asl. forming terraces to this level (Rampton and Paradis, 1981).

7.2 Bedrock Geology

7.2.1 Cambro - Ordovician metasediments

Most of the project area is underlain by Cambro - Ordovician metasediments which have been described as mainly slate, greywacke and argillite (Anderson, 1968), quartzite and slate (Venugopal, 1979) or quartz wacke and red slate (Venugopal, 1981). For the purposes of this report these lithologies will be referred to as quartz wackes, siltstones and

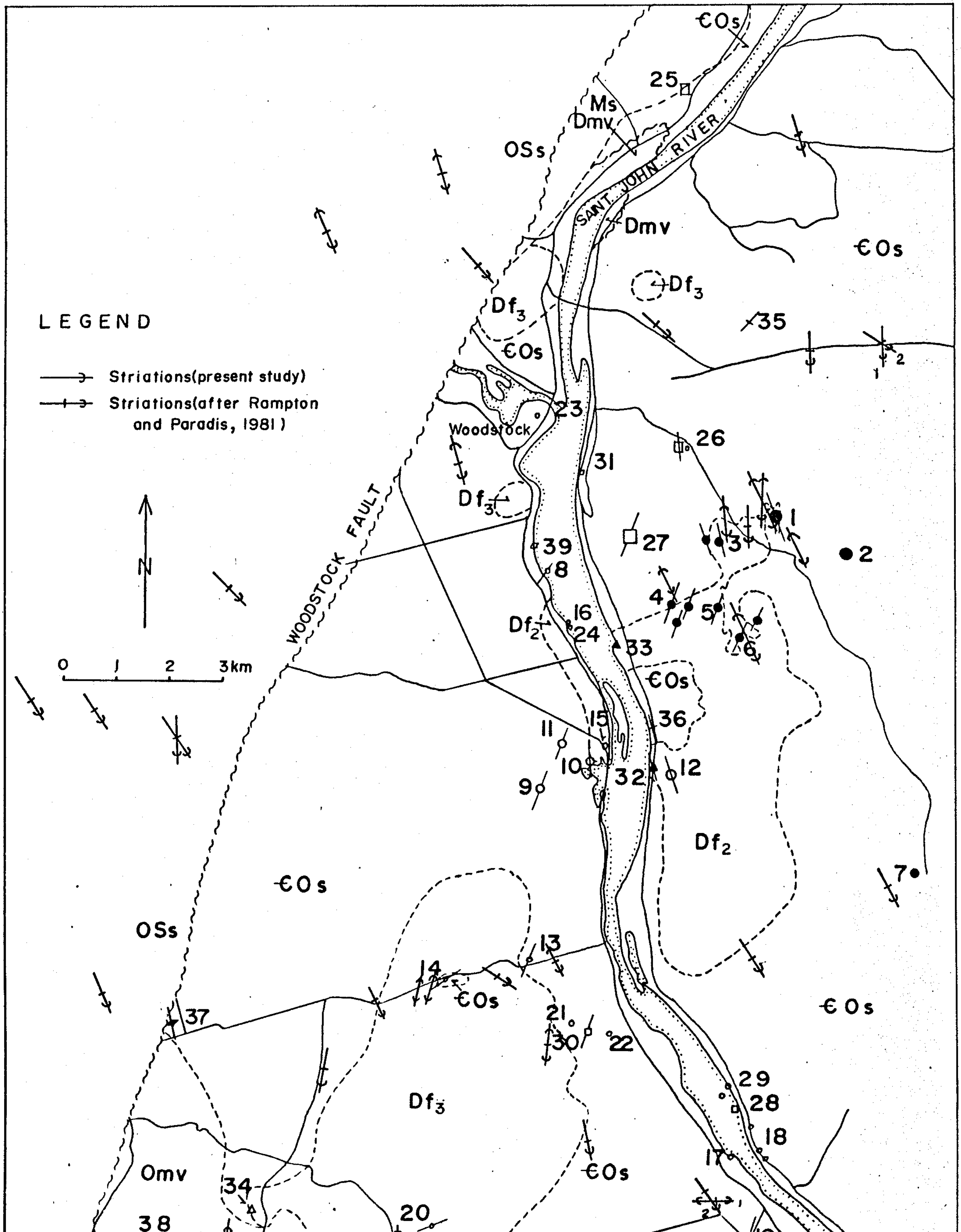


Figure 7.1:Ice flow directions. (for basmap legend seeMap 1).

argillites using the classification of Pettijohn et al., (1972, Fig. 5-3).

Quartz wacke is medium to dark greenish grey, weathering dark green, fine grained, and occurs in beds from several centimeters to one meter thick. It is commonly interbedded with argillite, the contacts being sharp. Venugopal (1979) noted the presence of current ripples, graded bedding and cross-laminations within the unit. Three thin sections of quartz wacke were examined (T281, T324, T256; Appendix I). They contain 70-80% framework comprising 60-94% sub-angular to sub-rounded quartz grains to 1 mm diameter, 4-10% sub-angular to sub-rounded feldspar to 0.5 mm diameter and up to 5% sub-angular rock fragments and sub-rounded opaque minerals. The matrix is composed of 5-40% sub-angular quartz, 10-35% sub-angular feldspar and 5-15% sericite, chlorite, epidote, zircon, apatite and opaques minerals. The chlorite appears to be mainly detrital whereas the sericite is a product of phyllic alteration. The opaque minerals are commonly altered to leucoxene or hematite.

Whole rock analyses of unaltered quartz wacke from Bulls Creek No.1 area (M004) and the Grafton pyrite area (M005) (Appendix II) show means of 71.9% SiO_2, 11.8% Al_2O_3, 0.50% CaO, 1.8% MgO, 1.97% Na_2O, 2.02% K_2O, 5.86% Fe_2O_3, 0.12% MnO, 0.80% TiO_2, 0.14% P_2O_5 and 2.5% LOI. In comparison to other rocks in the area, the quartzite contains elevated amounts of Zr (210-400ppm) probably related to detrital zircon.

Siltstones are present in places within the metasedimentary sequence. They are generally medium greenish grey, weathering medium - dark grey, well bedded in 10 -20 cm units interbedded with 1-20 cm argillite units. Thin sections from Bulls Creek No.1 (T329; Appendix I) and near Upper Northampton Au (T363; Appendix I) show variable compositions (75% and 35% quartz, 10% and 50% feldspar, 5% and 10% chlorite, 10% and 5% sericite, opaques, sphene and apatite respectively). In both thin sections sub-angular to angular grains of quartz and feldspar are enclosed in a chlorite - sericite matrix. The chlorite appears to be detrital whereas the sericite is a hydrothermal alteration product. Geochemical analysis of T363 (A251; Appendix II) show the rock to be enriched in Pb (51ppm), As (8.5ppm), Se (3ppm), and Ag (10.9ppm), probably related to the sulphide mineralization present in the sample.

Argillites are commonly medium to dark greenish grey, weathering dark grey, finely laminated and interbedded with sandstone or siltstone units. Individual argillite units are from several millimeters to several meters in thickness. Thin section examination revealed that the rock is comprised of very fine grained chlorite and sericite with minor quantities of silt-sized quartz and feldspar grains in some samples. The rocks are interpreted as being derived from clay rich sediments.

Geochemical analyses of visibly unmineralized argillites from the Lower Northampton Cu (A275), Upper Northampton Au (A278, A279), Grafton pyrite (A255) and Wright Brook (A260) areas indicate that most contain anomalous As (7.8-14ppm) and Ag (1.2-2.2ppm).

Commonly the metasediments have been altered to hornfels. The quartz wackes show overgrowths of sericite and in places the recrystallization of sericite in randomly oriented lepidoblastic crystals. Similarly the argillites have been altered to spotted hornfels by the growth of chlorite porphyroblasts.

Near the Devonian intrusions the metasediments are commonly bleached and exhibit propylitic and phyllic alteration. Geochemically the bleached quartz rock from Bulls Creek No. 1 area (M003; Appendix II) shows no appreciable increase in trace elements as compared to the unbleached samples quartz wacke from Grafton Pyrite (M005; Appendix II). In comparison to the nearby unbleached quartz wacke, (M004), the bleached quartz wacke (M003) is higher in most trace and major elements but lower in SiO_2, Na_2O, Sr and Y. The altered quartz wacke from the Dugan Road area (M006) contains slightly more CaO, K_2O, MnO, Rb, Ba, Pb, As, Co, Ni, and V than the other quartz wackes, also F (580ppm) appears to be enhanced.

Venugopal (1979) suggests that the metasedimentary sequence was formed by turbidity currents in a submarine basin. A relatively quartz-rich source terrane is also indicated. The stratigraphy within the metasediments has not been established because of lack of marker horizons and the complex deformation.

7.2.2 Ordovician mafic volcanics

The Ordovician mafic volcanics occur in the southwest corner of the map area near Oak Mountain. They comprise flows, tuffs and breccias. The flows are dark green, weathering medium brown, porphyritic to glomeroporphyritic, and locally amygdaloidal (Venugopal, 1979).

Within this unit is a sequence of red-maroon slates which host the Oak Mountain Fe-Mn occurrence. The slate is fairly uniform and occurs in a sequence of tuffs and flows with some chert beds.

7.2.3 Ordovician and Silurian sediments

These rocks lie to the west of the Woodstock Fault, and and are outside the area of investigation. They include limestone and slate of the Ordovician-Silurian Carys Mills Formation, and slate, siltstone, sandstone and minor limestone and conglomerate of the Silurian Smyrna Mills Formation. They have been described recently by Venugopal (1979, 1981) and Hamilton-Smith (1972).

7.2.4 Lower Devonian volcanics

These rocks lie on both sides of the Saint John River in the vicinity of Upper Woodstock. There are no mineral occurrences reported within this unit, and it is only of minor extent within the area, and hence was not examined in the field. It has been described by Venugopal (1981) as containing mafic flows and lapilli tuff. Part of this unit may be felsic volcanic (Venugopal, pers. comm.) and is described by Geosleuth Mineral Exploration Services (pers. comm.) as containing felsic tuff, volcanic breccia, and porphyritic rhyolite.

7.2.5 Devonian felsic intrusions

Benton Stock: A north northeasterly elongated (4.5 x 10.8 km) intrusive body of granite to granodiorite occupies an area of 27.85 km² in the southern part of the area west of the Saint John River. It has intruded the Cambro-Ordovician metasediments and contains an inlier or roof pendant of the same along the Dugan Road. The south part of the body has intruded Ordovician mafic volcanics from the vicinity of Oak Mountain, within the project area, to Benton, south of the area (Anderson and Poole, 1959).

The stock consists mainly of pink , to white plagioclase porphyritic granite that weathers light grey to brownish grey to orange. Phenocrysts of albite to andesine are 3-8 mm long, euhedral to subhedral and constitute 5-20% of the rock. Groundmass is fine to medium grained. Thin sections (T1, T4, T203; Appendix I) from the granitic phase of the stock have a composition of 25-30% quartz, 25-35% potassium feldspar, 25-40% plagioclase, 5-8% biotite, and up to 5% hornblende, epidote, sphene, apatite and opaques.

Whole rock analyses of the stock (M001, M002, M007; Appendix II) give a mean composition of 64.7% SiO_2, 15.1% Al_2O_3, 2.89% CaO, 1.88% MgO, 4.32% Na_2O, 2.68% K_2O, 5.12% Fe_2O_3, 0.12% MnO, 0.63% TiO_2, 0.18% P_2O_5, 2.5% FeO and 1.93% LOI. Trace element analyses show increases above the crustal abundance for Ag (1.4-1.6ppm) in all three samples, as well as in Mn (1800ppm), Fe (67000ppm), Co (22ppm), Ni (148ppm), Cu (65ppm), Zn (140ppm), F (640ppm), Ba (930ppm), V (167ppm) and U (8ppm) for sample M002.

The southwestern part of the stock (M002) at the base of Oak Mountain is granodioritic in composition. The rock is medium greyish green, light-brown-weathering plagioclase porphyritic granodiorite. It is composed of 10-25% subhedral, medium grained plagioclase laths in a fine to medium grained granophyric groundmass. Thin section analysis (T273B; Appendix I) gives 45% plagioclase, 25% hornblende, 15% quartz, 10% potassium feldspar, 3% opaques (magnetite and pyrite) and 2% epidote. Note that Anderson (1968) identified about 10% aegerine-augite in this part of the stock. Geochemical analyses (A173; Appendix II) show that this rock contains 1.1 ppm Ag.

Alteration of the stock is characterized by the overgrowths of very fine grained epidote and sericite on plagioclase with, in places, chlorite and carbonate. Hornblende is altered to chlorite and epidote and locally opaques and biotite may be altered to chlorite, sphene and epidote.

These data suggest that the Benton stock is a relatively high level intrusion and is a late differentiate from a more mafic parent magma. In general the whole rock analyses of other felsic plutons in the project area show less SiO_2 and Al_2O_3 and more Na_2O, Fe_2O_3, MnO, TiO_2, Sr and Zr than the analyses by Martin (1966) for the Benton stock. The sample obtained along the Benton - Oak Mountain road (M002) is quite different from his data (Table 10, p.53) for Ordovician granites in which he groups the Benton stock (Martin 1966). This may reflect the more granodioritic composition of the southwestern part of the stock. These rocks are classified by Crocco (1975) as adamellite, based on K-spar/plagioclase ratios of 0.8 and 0.9 for the two samples analyzed. Similar ratios for the samples from this study are 1.4, 1.0 and 0.625 for the granites and 0.2 for the granodiorite which indicates a much wider range of values. The true composition is probably close to equal parts potassium feldspar and plagioclase.

<u>Gibson Stock</u>: This northerly elongated (6.4 x 1.6 km) intrusive body occupies an area of 17.68 km² in the central part of the map area. For convenience in discussion it has been subdivided into its three spatially separated phases: Main Gibson phase (16.52 km²) on the east side of the Saint John River, Connell Mountain phase (0.08 km²) to the northeast of the Main Gibson Stock and Bulls Creek phase (1.16 km²) on the west side of the Saint John River. The stock has intruded Cambro-Ordovician metasediments altering them to hornfels.

The Main Gibson phase formed by multiple intrusions of porphyritic to subophitic rocks ranging in composition from granodiorite to tonalite to trondhjemite. Most of the stock is composed of various types of tonalite, with the granodiorites occurring along the Saint John River near the River Gold occurrence. Two phases of tonalite have been identified: an earlier fine grained, slightly porphyritic to equigranular tonalite occurring at Cobbler-Sexton, Smart Farm and Upper Northampton gold occurrences and a later, porphyritic tonalite occurring at Upper Northampton Au and Upper Northampton Cu occurrences. The trondhjemite occurs near Upper Northampton Au.

The fine grained tonalite is light to medium grey and medium grey on the weathered surface with up to 10% rounded quartz phenocrysts to 5 mm in places. The four thin sections (T103, T116A, T159, T193B; Appendix I) examined give an average composition of 50-60% euhedral to subhedral plagioclase, commonly altered to sericite, 20% anhedral quartz, 0-20% hornblende, 5-15% chlorite commonly containing inclusions of sphene and epidote and probably an alteration product of biotite, and 5-10% biotite, sphene, epidote and opaque minerals (pyrite and leucoxene).

The porphyritic tonalite is light to medium grey, weathering medium to dark grey. It is characterized by up to 20% rounded quartz eyes to 25 mm diameter. Eleven thin sections of this rock have been examined (T116, T116A, T125, T128, T129, T193B, T195, T230D, T234, T237, and T360; Appendix I). Its composition is 20-30% quartz as slightly to strongly resorbed phenocrysts with rare inclusions of fine grained plagioclase and as fine grained anhedral grains; 50-60% euhedral phenocrysts of plagioclase to 3 mm and euhedral to subhedral fine grained plagioclase (andesine) altered to sericite; 0-20% hornblende variably altered to actinolite, chlorite and epidote; up to 15% chlorite after either hornblende or biotite; up to 5% opaques (leucoxene, hematite and sulphides); and traces of epidote, sphene, zircon, apatite and carbonate.

The trondhjemite is medium to dark greenish grey and weathers brownish green. It contains 10% rounded quartz-eyes up to 2 mm in diameter. In thin section (T192B; Appendix I) it contains 45% subhedral plagioclase strongly altered to sericite, 40% anhedral quartz, and 15% chlorite after hornblende and biotite, with inclusions of epidote and opaques (pyrite).

The granodiorite is a light pink grey-weathering, massive rock with up to 5% quartz eyes and a maximum of 10 mm in diameter. Two thin sections (T366, T367; Appendix I) were examined and showed the composition to be: 40% euhedral plagioclase, altered to sericite and epidote; 25-30% strongly resorbed phenocrysts and anhedral; fine grained quartz, 8-15% subhedral potassium feldspar; 7-15% unaltered hornblende, 7-10% chlorite probably after biotite; 1-2% opaques (magnetite and leucoxene) and traces of epidote and sphene.

Whole rock analyses indicate that the porphyritic tonalite (M008) is similar to the fine grained tonalite (M009) in composition (Appendix II) but contains less CaO, and more MgO, K_2O and FeO. Cu (42ppm), Zn (76ppm) and Ba (320ppm) are slightly higher in M008 than in M009 while there is more As (4.4ppm) and Au (6ppb) in the latter. Martin (1966) reported more CaO, K_2O and Ba and less Na_2O and Zr in a sample that presumably was from this same road cut.. On a chemical basis, Martin classified his sample as a granodiorite.

The porphyritic tonalite in places has intruded the fine grained tonalite (T116A; Appendix I) and contains fragments of it (T193B; Appendix I); these relationships combined with the chemical and mineralogical data suggest that the main Gibson phase was emplaced by multiple intrusions. The sequence of intrusion indicated, in part,by cross-cutting relationships suggest that the porphyritic tonalite is later than the fine grained tonalite. In thin section (T116; Appendix I) the porphyritic tonalite contains irregular shaped diorite inclusions that may be from an earlier, more mafic intrusion. The relationship of the trondhjemite to the granodiorite is unknown.

The Bulls Creek phase consists mainly of granodiorite with one outcrop of granite. All samples were obtained from the Bulls Creek No. 2 area.

The granodiorite is light pink to pinkish grey and weathers medium grey. Generally it is medium grained with up to 10% rounded quartz eyes to 7 mm in a subhedral granular groundmass. Petrographic studies of 4 thin sections (T40a, T40c, T369, T376; Appendix I) show 25-35% quartz, 35-45% subhedral plagioclase, commonly altered to sericite with minor epidote and carbonate, 5-15% subhedral potassium feldspar, 0-10% hornblende partially altered to chlorite, 0-10% biotite altered to chlorite, sphene, and epidote and up to 5% opaques (mainly sulphides altered to hematite, and ilmenite or titaniferrous magnetite altered to leucoxene).

The granite occurs in one outcrop where it is juxtaposed with argillite in a zone of mylonitization. The rock is white, light-grey weathering, fine grained, subhedral granular and equigranular. It is composed of (T370B, T370C; Appendix I) 30-35% quartz, 30% subhedral potassium feldspar slightly altered to sericite and epidote, 25-30% subhedral plagioclase (oligocene) altered to epidote and sericite, 5% biotite altered to chlorite and hematized opaques, 5% sericite and traces of opaques (sulphides partially altered to hematite).

Whole rock analysis of the granodiorite (M010; Appendix II) from a sample collected some distance from the mine shaft gave results comparable to those of the main Gibson phase. However M010 is higher in CaO and K_2O than M008 and M009 from the Gibson phase. Such trace elements as Cu (130ppm) and Ba (460ppm) are higher in Bulls Creek granodiorite than in the porphyritic and fine grained tonalites from the main Gibson phase (M008 and 009 respectively).

The fine grained nature of these rocks points to an epizonal emplacement for the Bulls Creek phase. The presence of inclusions of fine grained tonalite (similar to that of the main Gibson phase) within the granodiorite (T376; Appendix I) would suggest Bulls Creek is a late phase of the Gibson stock.

The Connell Mountain phase consists of both tonalite and trondhjemite, the exact distributions of these lithologies are unknown. The tonalite is medium grey-brown weathering and porphyritic with 2% quartz eyes to 7 mm. The rock is composed of (T62A; Appendix I) 60% euhedral laths to 4 mm and subhedral fine grained plagioclase (andesine) altered to sericite and epidote, 20% quartz, 10% chlorite after hornblende and biotite and as an alteration product, 5% sericite and trace of epidote and opaques (sulphides in places altered to hematite). The trondhjemite (T249, T280; Appendix I) is white, yellowish-brown-weathering porphyritic and contains 40-50% quartz, 30% plagioclase as euhedral phenocrysts to 4 mm and subhedral fine grains altered to sericite and epidote, 10-15% chlorite (probably after biotite), 2-3% sericite, 2-8% opaques (sulphides partially altered to hematite) and up to 10% clinozoisite (?) as overgrowths on plagioclase.

The porphyritic textures seen in thin section imply that the Connell Mountain phase is high level epizonal emplacement.

South Woodstock Stock: Located 1.5 km south of Woodstock on the west side of the Saint John River, this stock is exposed only in a railway cut along the Canadian Pacific Railway. This lithology was not examined in the field, however Don Hattie (Geosleuth Mineral Exploration Services) kindly provided field data and samples including a thin section. This body was mapped by Anderson (1968) as gabbro, diorite, diabase and quartz diorite and described as highly altered and possibly originally a diorite or gabbro. Venugopal (1981) described it as massive, medium pinkish grey, light-grey-weathering quartz-feldspar porphyry. This is confirmed by the present thin section examination which shows a composition (Sample No.1; Appendix I) of 15% euhedral to subhedral quartz, 15% euhedral to subhedral plagioclase and 5% mafic phenocrysts in a very fine grained groundmass of 35% quartz and feldspar, 15% chlorite, 15% sericite and traces of carbonate and opaques. The feldspars are altered to sericite with minor carbonate and quartz and the mafics are altered to chlorite and sericite. Whole rock analyses (LWS-1; Appendix II) shows the rock to be higher in SiO_2 (73.6%) and K_2O (2.94%) than samples from the Gibson stock. In trace elements, Au (27ppb) and As (43ppm) are anomalous.

The rock is phyllically-altered and based on the presence of miarolitic cavities and the fine grained groundmass, it is thought to have been emplaced at high level (epizonal) in the crust.

North Woodstock Stock: Located between Upper Woodstock and Woodstock, this pluton is exposed in a railway cut and along the river bank near the west end of the Grafton bridge across the Saint John River. This stock was described by Anderson (1954, 1967) and Venugopal (1981) as being similar to the South Woodstock stock. Field data, rock samples and a thin section provided by Geosleuth Mineral Exploration Services indicate that this rock is a medium greenish grey, light-yellowish-green-weathering, plagioclase-quartz porphyritic quartz diorite. The rock is made up of 27% phenocrysts and 23% fine to very fine grained groundmass. The phenocrysts are mainly euhedral to subhedral plagioclase (20%), subhedral quartz (2%) and altered mafics (5%) (Sample No.16; Appendix I). The groundmass is plagioclase (50%), quartz (10%), chlorite (5%), epidote (5%), sphene (3%) and opaques (magnetite, trace). The plagioclase is altered to very fine grained sericite and epidote and the mafics to fine grained chlorite and minor epidote, sphene and carbonate. Quartz phenocrysts are strongly resorbed. The rock has undergone propylitic alteration. The fine grained groundmass and porphyritic texture suggest that the intrusion was emplaced at a relatively high level (epizonal) in the crust.

Major element geochemistry (UWS-16; Appendix II) is similar to samples taken from the Gibson stock.

Sharp's Mountain Stock: This stock is exposed in broken outcrop on the summit of Sharp's Mountain, 4.2 km northeast of Woodstock. It has been mapped by Venugopal (1981) as beingsimilar to the North and South Woodstock stocks and was described by Geosleuth Mineral Exploration Services (pers. comm.) as a light greenish-white feldspar - quartz porphyry which may be a tuff, similar to that exposed to the northwest and mapped by Venugopal (1981) as Devonian volcanics. The hand specimen provided by Geosleuth Mineral Exploration Services was analyzed for major, minor and trace elements. These results show that the Sharp's Mountain Stock has higher SiO_2 (76.4%) and K_2O (3.81%) (SMS-19; Appendix II) than other stocks in the area. The major element geochemistry of Sharp's Mountain Stock and South Woodstock Stock are similar. Also Au (11, 27ppb) and As (34, 43ppm) are anomalous in both intrusions..

Dykes: At various locations within the area, dykes of felsic porphyry and intrusive breccia are present. Most are near the Gibson stock which they resemble and with which they are associated. Several are exposed in the roadcuts along Highway 105 between Grafton and Ferryville, and have been described by Venugopal (1981). Another porphyritic dyke, similar to the Upper Woodstock stock is exposed on Downey Brook between the highway and the railroad at the northern limit of the area

(Geosleuth Mineral Exploration Services, pers. comm.).

7.2.6 Mississippian sediments

Interstratified red conglomerates, sandstones and shale of the Carlisle Formation occur on the western side of the Saint John River (Map 1). Because these rocks have no reported mineral occurrences in them, they were not examined in the field, however they have been described by Venugopal (1981).

7.2.7 Mafic dykes

Many northwesterly to northeasterly trending mafic dykes up to several meters wide, have been mapped in the area (Map 1). They are dark grey to black, brown-weathering, and have fine grained to amygdaloidal to porphyritic textures. Typically they contain (T233B, T308, T338B; Appendix I) 30-60% plagioclase of labradorite (Anderson, 1968) to by townite composition, with variable amounts of chlinopyroxene, orthopyroxene and opaques. The alteration of these rocks is variable,they are commonly carbonatized and appear to have chloritized the adjacent host rocks. Although the dykes are considered to be of Devonian age (later than felsic intrusions) some of them may be Triassic.

7.3 Structural Geology

The project area is restricted to rocks of the Miramichi Anticlinorium. These rocks have been affected by both Taconian and Acadian Orogenies and exhibit a complex structural history. Details of the structural features of the area have been described by Venugopal (1979, 1981) who recognized three generations of folding as represented by three cleavages. The latest period of folding, considered to be the result of the Acadian deformation imparted the overall north to northeasterly fabric to the terrane (Anderson, 1968). This was interpreted by Fyffe (1982 d) as indicating a steeply dipping, northerly closing fold, the axial plane of which would lie in the eastern part of the area. Anderson (pers. comm.) in compiling the regional structure of the area, showed a dominant north-south strike to the rocks with areas of intense secondary folding near the felsic intrusions.

The western side of the Miramichi Anticlinorium is defined by the north-northeastward trending Woodstock Fault which is a southwestward extension of the Catamaran Fault (Fyffe, 1982d). From the curved trace of the Woodstock Fault and the westward dip of the rocks of the Aroostock - Matapedia Anticlinorium to the west, Venugopal (1981) suggested that the latter rocks have been thrust over the rocks of the Miramichi Anticlinorium. Fyffe, however, (1982 d, Figure 3) indicated the opposite sense of movement.

The Devonian felsic intrusions are reflected in aeromagnetic surveys as prominent magnetic highs (Geological Survey of Canada, 1953 a, b). The West side of the Benton stock, correlating to the granodioritic phase of the intrusion, is the most magnetic feature (over 3600 γ). The eastern, granitic phase is similar to associated metasediments in magnetic intensity (3300 γ -3400 γ) but the contours on the granite exhibit a hummocky to ridged form with a north-northeasterly trend. The Gibson stock is also marked by a knobby to ridged magnetic pattern with northeasterly trends. The intensity ranges from 3380 to 3450 which is slightly higher than the adjacent metasediments. Lockhart (1967 a, b, 1970 a, b) completed detailed ground magnetic surveys over the Gibson stock and concluded that some of the knobby magnetic characteristics may be the result of magnetically-low metasedimentary inliers (roof pendants ?) lying within the magnetically higher intrusive rocks. He also found that some anomalies were caused by diabase dykes (Lockhart 1976). There is a north trending magnetic feature associated with the North Woodstock stock, but only a slight protuberance in the magnetic contours in the vicinity of the South Woodstock stock. There are also small, eliptical magnetic highs to the northwest of Connell Mountain and to the southwest of Kilmarnock Settlement. Lockhart (pers. comm.) has found porphyry float in the vicinity of Kilmarnock Settlement. The cause of the magnetic highs associated with the felsic intrusions have not been fully explained. They are in part related to mafic dykes but may also be reflecting more mafic phases of the stock, possibly at depth. Magnetite has only rarely been reported from the intrusions and the pyrrhotite is generally non-magnetic.

The metasediments show a strong north northwesterly trend to the east of the area (Geological Survey of Canada, 1953b) with intensities from 3300 γ to 3660 γ. This may be a reflection of the mafic dyke swarm (Venugopal, 1981) associated with them (Anderson, pers. comm.). Within the study area the metasediments do not show such a strong signature and only vaguely show a northeasterly trend. The lower magnetic intensity (3250 γ -3350 γ) may reflect the intense alteration of the metasediments by the felsic intrusions.

8.0 ECONOMIC GEOLOGY

8.1 Previous Work

Exploration for base metals in the Woodstock area was active by the mid 1800's. The earliest reported activity was in 1857 when The Carleton Sentinel (1857a) noted the copper works at Lower Woodstock; whether this refers to the Bulls Creek or Bedell Farm occurrence is unknown.

Several government reports assessing the mineral potential of New Brunswick noted base metal occurrences in the Woodstock area. Notable are the reports by Bailey (1864, 1884, 1899, 1908), Robb (1870), Gesner (1842, 1843) and Ells (1907). Bailey (1884) commented on the potential for gold mineralization in the Woodstock area and (Bailey, 1908) noted the occurrence of free gold at the Cobbler - Sexton Mine. More recently, mineral occurrence files and maps have been compiled by Hale (1961a, b, c), Abbot (1965), Take (1973 - 1974), Picklyk et. al. (1978) and Black (1982). The Geological Survey of Canada, under the Canada-New Brunswick Mineral Development Agreement commissioned a study on the metallogeny of the central and southwest Miramichi Zone (Connell and Hattie, 1985) which recommended two additional studies: the lithogeochemistry of red manganiferous slate and black slate-chert in the Miramichi Zone (Hattie and Connell, 1986) and the metallogeny of the Woodstock area, the topic of this report.

The record of the role of industry in the exploration of the Woodstock area in the 19th and early 20th centuries is not well documented except for specific occurrences where shafts were sunk. The New Brunswick Mining company performed the development work and mining of the Bulls Creek No. 2 copper occurrence in the mid 1800's. Between 1850 and 1880, exploration was active as the lists of occurrences in various publications include more notations; however there is no record of the type of work that was done or by whom the discoveries were made. In 1880's Messrs Shaw and Britton discovered native silver while deepening their common water well; this evolved into the Britton Mine occurrence. In the early 1900's John McClement (cobbler) and Ed Greer (sexton) of Woodstock discovered the Dominion No. 1 and the Cobbler - Sexton Mine occurrences. These and in particular the latter became the focus of much activity by the original owners with various partners including many residents of the town of Woodstock up until 1940.

After 1950, the history of exploration is well documented in the assessment files. Several companies were active in the area as well as individual prospectors. Notable are A.A. Fraser and M.A. Briggs who are credited with several discoveries in the Lower Northampton area in 1953, and F. Carvell Tompkins of Lower Woodstock who made the discovery bearing his name in 1965.

From 1965 to 1976, the area was actively explored by several companies, largely through the promotional efforts of A.W. Lockhart of Fredericton (Lockhart, 1976). Initially the known mineral occurrences of the Bulls Creek, Cobbler - Sexton Mine and Dominion No. 1 were staked by Phelps-Dodge Corporation of Canada Limited. When Phelps Dodge dropped the ground, Lockhart convinced Falconbridge Nickel Mines Ltd. to restake the property on the eastern side of the Saint John River. At about the same time, the Bulls Creek area was acquired by Imperial Oil

Enterprises Ltd. as the Silvermaque option. When Falconbridge dropped the property, Lockhart continued the work with Omni Mines Ltd., optioning the property to Bethlehem Copper Corporation, and United Sisco Mines Ltd. As each new company acquired the ground, the area was extended and a large porphyry copper system was defined. The present known reserves have been estimated at 21 million tons of protore grading 0.18% Cu and 1 million tons of supergene enriched material grading 0.04 - 0.7% Cu (Venugopal, 1981). Interest waned in the area with the demise of the price of copper in the mid - 1970's.

Gold exploration in the Woodstock area has not been intensive and few references to gold exist in the literature (eg. Bailey, 1908; Goodwin, 1928). Two gold occurrences, Oak Mountain and River Showing are poorly documented with no available analyses. Merton Stewart (pers. comm.), holder of claims on the Cobbler - Sexton Mine, recently discovered the Upper Northampton Au occurrence. It should be noted that prior to the present study, few gold analyses were available for the area .

8.2 Mineral occurrences

In the following sections, the mineral occurrences will be described. The present study did not confirm the presence of mineralization at all occurrences, but because they are listed in the literature, a description is included herein. The names of the occurrences are generally those of Take (1973, 1974) with alternate names listed to enable cross reference with the literature. The locations of the occurrences are shown on Map 1 by number as given in Table I and on each occurrence description.

In analyzing the geochemical data, the results were compared to their crustal abundance as given by Mason and Moore (1982). An element is considered to be anomalous when its concentration is equal to or greater than three times the Clarke value.

8.2.1 Porphyry - Copper: Seven mineral occurrences in the Woodstock area exhibit a porphyry - copper style of mineralization characterized by quartz veinlets and fracture fillings in highly fractured and altered porphyritic felsic intrusive rock and/or the adjacent metasediments. All are associated with the northern part of the Gibson stock, especially the Connell Mountain phase.

1. Connell Mountain (Figure 8.1)

Alternate names:

Lockhart Anomaly 1
Lockhart Woodstock Anomaly 1

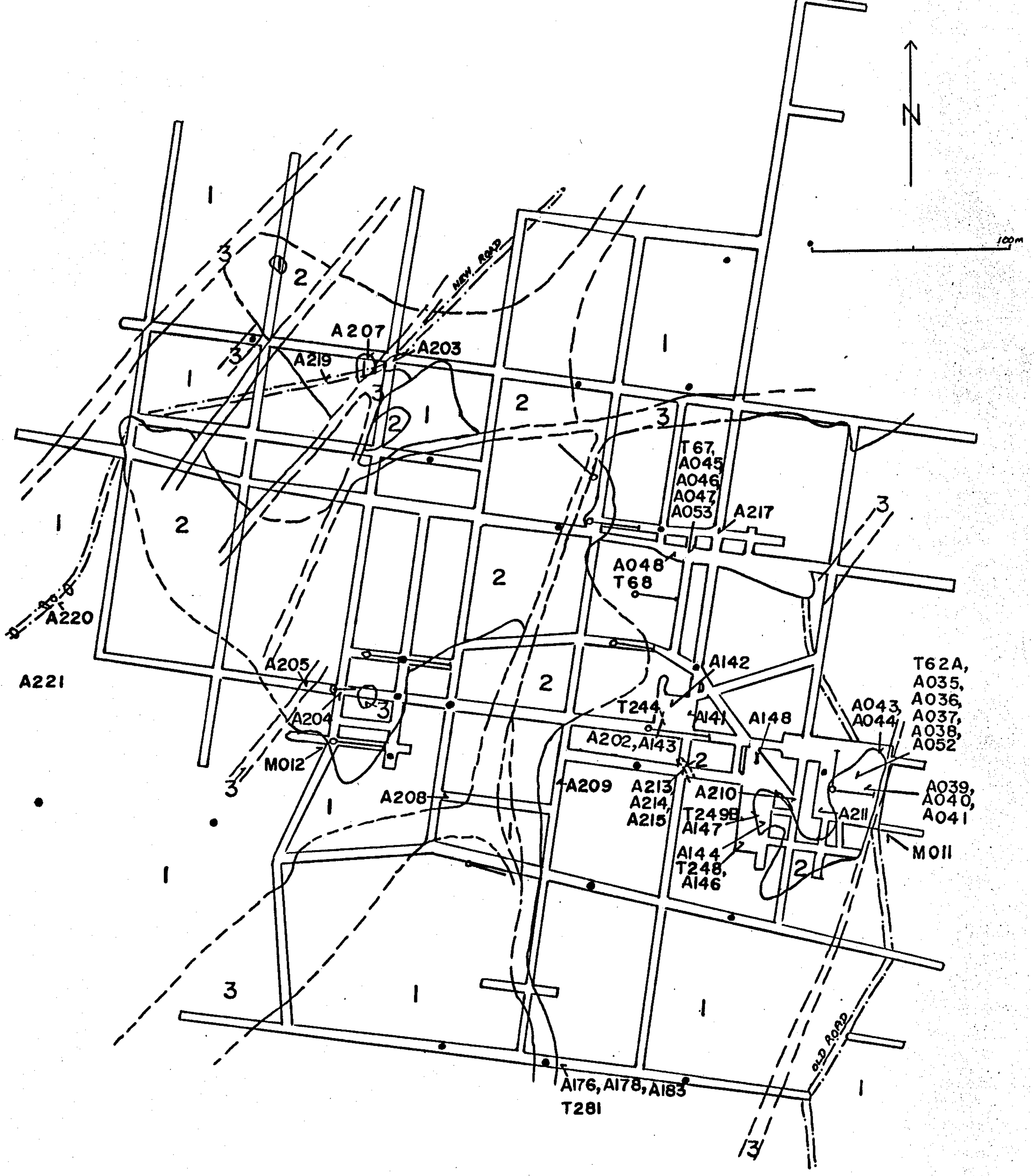


Figure 8.1: Connell Mountain (1:metasediments, 2:porphyritic tonalite, 3:diabase; modified after Lockhart, 1971d).

GENERAL LEGEND FOR FIGURES 8.1 to 8.37

CULTURAL FEATURES

Railway
Road
Fence
Creek

Lake or pond
Survey marker
Limit of trees
Swamp

GEOLOGICAL FEATURES

Rock outcrops
Float
Geological boundary (defined, approximate, assumed)
Bedding (inclined, vertical)
Foliation (inclined, vertical)
Shearing (inclined, vertical)
Shear zone
Mineralized seam
Joint (inclined, vertical)
General trend of joints
Glacial striae (ice flow direction known, unknown)
Rock dump or tailings
Trench
Open cut, hillside pit
Drill hole (diamond, percussion)
Shaft (abandonded)
A001 Sample for trace element analysis
M001 Sample for whole rock analysis
T69B Sample for thin or polished section

Commodity:

Copper

Location:

UTM 614500mE 5110920mN
Lat. 46°07'45" Long. 67°01'03"

History of exploration:

Initial exploration by Lockhart on behalf of Phelps Dodge Corporation of Canada, Limited included mainly the area surrounding the Cobbler - Sexton Mine and Dominion No. 1. When Falconbridge Nickel Mines Limited acquired the property in 1969, based on encouraging boulder prospecting and soil geochemistry results from the Phelps Dodge program, the staking was extended to include Connell Mountain (Lockhart, 1969). Following a more detailed soil geochemical (B-horizon) survey and bulldozer trenching disseminated chalcopyrite was discovered in place on June 5, 1970 (Lockhart, 1976). Diamond drilling of 8 AQ holes (Lockhart, 1971c) proved an average of 0.26% Cu over the 985 feet of drilling.

Omni Mines Limited of Fredericton staked the property in 1973 and optioned it to Bethlehem Copper Corporation (Vancouver) and United Siscoe Mines Limited (Toronto) in 1974. The percussion drilling program (Buchanan, 1974) of 23 holes to a target depth of 300 feet indicated 0.25% Cu over an area of 500 x 1000 feet.

Subsequently, at leat 5 diamond drill holes (NQ and BQ) were drilled on the property. There is no assessment work filed on these holes, but the casing is present in the trenches.

Various estimates of tonnage have been made. Lockhart (1976) estimated a total of 1 million tons of 0.5% Cu and Venugopal (1981) estimated 23 million tons of 0.18% Cu and one million tons of supergene material grading 0.04 to 0.07% Cu.

Access:

The deposit occurs on the top of a hill known as Connell Mountain and is exposed on the eastern side of the summit and on the western flank of the mountain. It is accessible by a logging road running northwest from the Kilmarnock Settlement Road, 4 km from its start at Highway 105. Originally access was attained by another logging road 1km farther down the Kilmarnock Settlement road, but this road was rendered impassable during the field season by logging operations.

Geology:

The Connell Mountain deposit is hosted in the Connell Mountain phase of the Gibson stock and in the adjacent Cambro - Ordovician metasediments. Two phases of the stock, porphyritic tonalite and porphyritic trondhjemite, have been identified in thin sections (T62A, T249, T280; Appendix I) from the eastern part of the mountain. However their distribution and relationship have not been determined. On the western side of the mountain, Lockhart (1971d) reported only quartz diorite (porphyritic tonalite) from his thin section studies. The metasediments are mainly interbedded quartz wackes and argillites in beds from less than 1 cm up to 1 m thick . Lockhart (1971d) also reports the presence of red slate (now in a flooded part of a trench) and conglomerate (which could be interpreted as a brecciated quartz vein).

The sediments generally strike north-northwesterly across the summit of Connell Mountain and have a moderate to steep south westward dip. Second phase folding has produced a tight series of southwest plunging folds with northeast trending axial planes. The porphyry appears to have intruded along the axes of these second generation folds (Lockhart, 1971d). Both the metasediments and the porphyry have been intruded by north trending fine grained basaltic and porphyritic diabase dykes.

Alteration of the felsic intrusive and metasedimentary rocks is extensive. Phyllic alteration of the tonalite and trondhjemite is characterized by intense sericitization of plagioclase and secondary replacement of chlorite by sericite. Lockhart (1971d) tested approximately 100 sawn rock samples for potassium alteration and found either a slight reaction or a reaction localized adjacent to fractures and quartz veins. The sedimentary rocks have been altered to hornfels and bleached and exhibit phyllic alteration with the extensive sericitization of the rocks. In places, sericite has grown as 0.3 mm to 0.5 mm poikiloblasts. All rocks have been extensively fractured and filled with chloritic material. Locally the fractures are filled with quartz veins and stringers which in places form extensive stockworks. The wall rock of the quartz veins is commonly highly chloritized. Carbonatization is not apparent on surface exposures because of the deep weathering of the bedrock. Below 15-30 m in some drill holes, calcite veins and slight pervasive carbonatization of the host rocks have been observed. Traces of selenite occur in fractures, commonly associated with 1-3 mm calcite veins at depth in some drill holes.

Mineralization:

Two zones of copper mineralization were identified by Lockhart (1971d): a north northwest trending zone 300 x 100 m on the eastern side of the summit of Connell Mountain and 100 m diameter area on the western flank of the mountain. These zones coincide with the near surface exposure of the felsic intrusion in which the copper mineralization has been shown to be twice as concentrated as in the metasediments (Lockhart, 1971c). Drilling (Lockhart, 1971c, Buchanan, 1974) has shown that the copper zones in the porphyritic tonalite continued to depth beneath the metasedimentary cover. Superimposed on the primary copper mineralization is a zone of supergene enrichment from 7 to 15 m deep characterized by the presence of tenorite, malachite and chalcocite coatings on pyrite and chalcopyrite (Buchanan, 1974). Copper grades in the supergene zone are up to three times the copper grades of the underlying rocks (Buchanan, 1974).

Sulphide minerals within the porphyritic tonalite consist dominantly of fine disseminations that make up to 5% of the rock. Three polished sections (T62A, T248, T249B; Appendix I) from the eastern zone have contain variable concentrations of pyrite, chalcopyrite, goethite, hematite, covellite and rutile. Pyrite occurs in euhedral crystals commonly up to Ø.5 mm; in places they contain inclusions of quartz. Chalcopyrite occurs as very fine to fine anhedral to irregular grains up to Ø.4 mm diameter. It commonly partially to totally includes gangue material but also occurs on microfractures and as disseminations. Goethite and hematite occur as oxidation products of pyrite and chalcopyrite whereas covellite occurs as surface alteration of chalcopyrite.

The western zone is similar in nature to the eastern one, except that pyrrhotite is more prominent and mutually exclusive of pyrite. The pyrrhotite is very weakly magnetic to non-magnetic and is commonly intergrown with chalcopyrite (Lockhart, 1971d). Lockhart (1971d) and Buchanan (1974) also noted the occurrence of bornite and chalcocite. Malachite and azurite are present on the surface of some of the bulldozed exposures.

Sulphide minerals in the metasedimentary rocks occur predominantly as fracture fillings and in quartz veinlets. In places the metasediments have been intensively shattered and many of the fractures have been healed with seams of sulphides. Chalcopyrite is the dominant copper mineral (T67B; Appendix I) and occurs as anhedral irregular masses on fractures and as blebs in the gangue. Pyrite is present both as disseminations and as fracture fillings. In places it is coated with chalcopyrite. Pyrrhotite is present on fractures in the metasedimentary rocks on the western part of the mountain. The sulphides are commonly oxidized (T244; Appendix I) with goethite and covellite replacing chalcopyrite and goethite and hematite replacing pyrite.

Lockhart (1971d) noted the presence of small flakes of molybdenite in quartz veins within the metasediments and porphyry. Magnetite occurs in one small pod of the intrusion (Buchanan, 1974).

Geochemistry:

Geochemical analyses from the eastern part of the mountain show that the mineralized porphyry (A035 to A041, A043, A052, A144, A147, A214) contains anomalous quantities of up to 36ppb Au, 9800ppm Cu, 60ppm As, 10ppm Se, 53ppm Mo, 3.8ppm Ag, 2ppm Cd, 7ppm Sn, 2ppm Te, 9ppm W and 52ppm Pb. The mineralized porphyry in the western part (A203, A204, A219) contains anomalous quantities of up to 10ppb Au, 1500ppm Cu, 9.8ppm As, 12ppm Se, 53ppm Mo, 9ppm Sn, 10ppm W and 52ppm Pb. Samples (A044, A047, A048. A141 to A143, A202, A209 to A211, A213, A217) of the mineralized metasediments from the eastern part of the mountain contain anomalous quantities of metal up to 1300ppb Au, 14000ppm Cu, 48ppm As, 52ppm Se, 17ppm Mo, 10ppm Ag, 3ppm Cd, 17ppm Sn, 4ppm Sb, 6ppm Te, 22ppm W and 18ppm Bi, and those from the western side (Samples A207, A208, A220): have up to 65ppb Au, 1400ppm Cu, 2ppm Se, 2ppm Sb, and 12ppm W in them. In general it appears that the eastern side of the mountain contains higher concentrations of most elements than the western side and that a similar suite of elements are anomalous in both areas.

Eight samples contain in excess of 50ppb Au.. The two highest (A143 - 1300ppb; A202 - 400ppb) are from a gossan zone in quartz wacke in the west central part of the eastern mineralized zone. A143 is a 50cm channel sample of the gossan whereas A202 is a grab sample of the adjacent quartz wacke. The quartz wacke is highly fractured and silicified and contains 5% pyrite and 2% chalcopyrite. The main mineralized fractures are oriented at 135 degrees and dip 80 degrees south. Another area of similarly silicified quartz wacke (A142) 10 m to the north contains 90ppb Au. A045 (130ppb Au), A046 (110ppb Au), A048 (290ppb Au) and A053 (59ppb Au) are from a highly silicified outcrop of quartz wacke containing approximately 5% sulphides. Sample A047 (6ppb Au) is of the quartz wacke host rock, A046 and A053 are of the quartz vein and the sulphide rich chloritized wall rock and A045 is of a pyrite cube which is described as polished section T67A (Appendix I). A048 is a 0.85 m chip sample across the sulphide bearing chloritized, silicified zone.

Sample A207 from the western zone (65ppb Au) is of a highly chloritized quartz wacke adjacent to a diabase dyke exposed on the present access road to Connell Mountain. There is no apparent silicification associated with this sample. Also a mafic dyke (A205) in the western part of Connell Mountain contains 14ppb Au.

In general, gold in the Connell Mountain occurrence is most abundant in silicified zones in quartz wacke associated with Cu, As, Se, Ag, Cd, Sn, Te, W and Bi. Many of the highest gold samples occur in the peripheral metasediments on the east side of the western intrusion. It should be noted that the eastern intrusion contains anomalous gold (generally 14 - 36ppb Au) with associated Cu, As, Ag and in places Se and Mo. Note that not all quartz veins contain anomalous gold (A148, A178, A215, A221).

Style of mineralization:

The four styles of mineralization that occur on Connell Mountain are summarized as follows:

1. disseminated sulphide in the Connell Mountain phase of the Gibson stock;
2. fracture filling sulphides in both the stock and adjacent metasediments;
3. sulphide-bearing quartz veinlets in metasediment;
4. supergene enrichment of the sulphide-rich intrusive and metasedimentary rocks.

2. Southeast Connell Mountain

Alternate Names:

Lockhart Anomaly 1a
Lockhart Woodstock Anomaly 1a
Heather Zone

Commodity:

Copper

Location:

UTM 615700mE 5108500mN
Lat. 46°07'18" Long. 67°30'13"

History of exploration:

The property was first staked in 1973 by Omni Mines Limited (Fredericton) and subsequently optioned to Bethlehem Copper Corporation (Vancouver) and United Siscoe Mines Limited (Toronto) in 1974. The staking was based on encouraging results from previous soil (B-horizon) geochemical and boulder prospecting surveys started over the Cobbler - Sexton and Dominion No.1 occurrences by A. W. Lockhart in conjunction with Phelps Dodge Corporation of Canada Limited and Falconbridge Nickel Mines Limited which culminated in the discovery of the Connell Mountain deposit. Subsequent prospecting followed by a reconnaissance

(B-horizon) soil geochemical survey in the area east of Connell Mountain (Lockhart, 1974, 1976) indicated that additional copper zones might be present and more claims were staked. A B-zone soil geochemical survey and a ten hole percussion drilling program in 1974 (Lockhart, 1974; Buchanan, 1974) were used to outline the copper zone.

Access:

The deposit occurs on a ridge which extends southeast from Connell Mountain; the occurrence is located 1.3 km southeast of the peak of Connell Mountain. It is accessible by an old logging road running east from the Kilmarnock Settlement Road, 5.4 km from its start at Highway 105.

Geology:

The deposit is not exposed at surface and is known only from percussion drill holes. The rocks encountered are similar to those of Connell Mountain (Buchanan, 1974). They are made up of light to dark grey-green quartzite (quartz wacke) and metasediments (argillites) intruded by light to medium grey granodiorite (tonalite). The metasediments have been sericitized and chloritized and the intrusive rocks have been sericitized, chloritized,and silicified. The drill holes mainly intersected metasediments, with the porphyry occurring in 7 to 30 m wide dykes or sills within the metasediments.

Mineralization:

Pyrite and chalcopyrite, occur as fracture fillings. Grades in excess of 1% copper have been found in the porphyry, with considerably lower copper values in the metasediments. The two best intersections reported by Buchanan (1974) were 0.60% Cu over 60 feet (Hole PL-37) and 0.24% Cu over 80 feet (Hole PL-24).

Geochemistry:

Three samples of metasediments from the access road to the occurrence have been analyzed. A chip sample (A222) taken of silicified, bleached quartz wacke at the intersection of the logging road and the Kilmarnock Settlement Road contains anomalous Pb (151ppm), Bi (2ppm) and Sn (15ppm). A highly shattered, granulated, rusty-weathering, green argillite 200 m farther up the road has been analyzed in duplicate (A223, A224). It contains anomalous Au (32ppb, 73ppb), Cu (410ppm, 1000ppm), As (330ppm, 560ppm), Se (1ppm, 2ppm) , Ag (1.3ppm, 1.8ppm), Sb (5ppm, 4ppm), W (18ppm, 9ppm), Pb (77ppm, 43ppm), Bi (12ppm, 9ppm), U (10ppm) and Te (3ppm). A silicified quartz wacke (A225) with 10 x 2 cm patches of pyrite on fractures and disseminated pyrrhotite from 20 m farther up the road contains anomalous Cu (1500ppm), As (130ppm), Se (8ppm), Te (6ppm) and Bi (7ppm).

Style of mineralization:

The style of mineralization is not well known because the main occurrence is only recorded in percussion drill holes. Lockhart (pers. comm.) feels that the style of mineralization is similar to Connell Mountain and joins the two areas to form a zone of mineralization which he calls the Heather Zone (Lockhart, 1974). The occurrence is therefore classed as a porphyry copper type deposit with disseminated and fracture-filling sulphides in the intrusive rock, fracture-filling sulphides in the metasediments and sulphide-bearing quartz veins throughout.

Based on the samples from this project, the copper appears to correlate with increases in As, Se, Te, Bi and in places with Au, Sb, W, Pb and U.

3. Connell Brook (Figure 8.3)

Alternate names:

Lockhart Woodstock Connells Brook
Connells Brook
Connell Brook Copper
Lockhart anomalies 3 and 4

Commodities:

Copper (Zinc)

Location:

UTM 613200mE 5108600mN
Lat: 46°07'18" Long: 67°32'07"

History of exploration:

The first recorded staking of the area was by Coppercliff Consolidated Mining Corporation in 1953 (Sidwell, 1954b). The property was transfered to Stratmat Limited in 1954 and they conducted electromagnetic and magnetic surveys The results were discouraging and no further work was done.

Phelps Dodge Corporation of Canada Limited staked the Cobbler - Sexton area in December, 1965 and conducted an orientation soil (B-horizon) geochemical survey and geological mapping. Prospecting beyond the staked Cobbler - Sexton area located many mineralized boulders. To locate the source of these

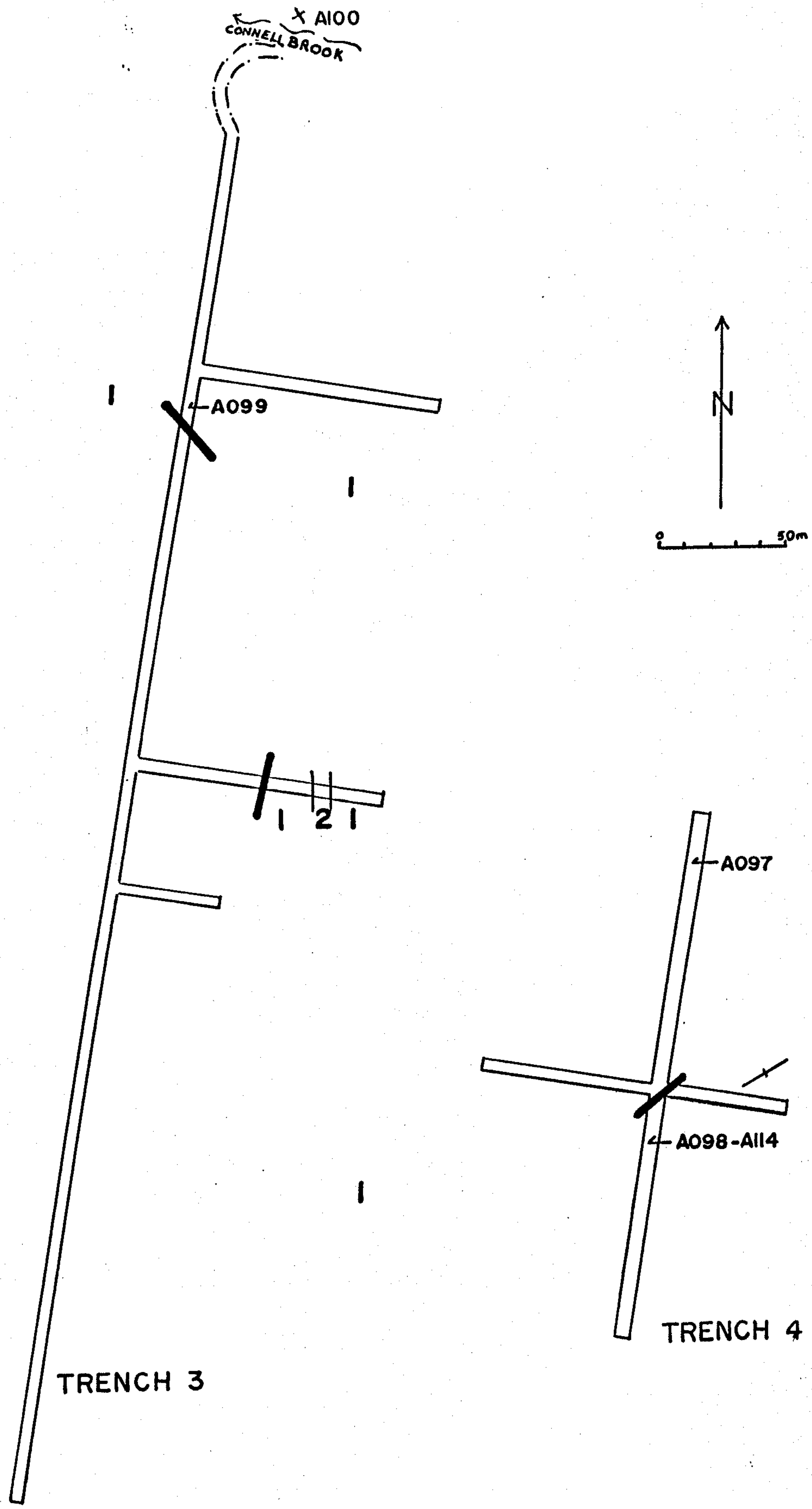


Figure 8.3: Connell Brook (1:metasediments, 2:porphyritic tonalite, ▬ :diabase; modified after Lockhart 1971d).

boulders, additional claims, covering the Connell Brook area were staked. Subsequent reconnaissance geological mapping and soil (B-horizon) geochemical surveys revealed anomalous copper in the Connell Brook area (Lockhart, 1968). Falconbridge Nickel Mines Ltd. restaked the Connell Brook area on October 25, 1968 (Lockhart, 1969). Subsequent exploration included a ground magnetometer survey (Lockhart, 1970a) and a vertical loop electromagnetic survey. The latter identified two weak high frequency anomalies. A detailed soil (B-horizon) geochemical survey outlined the two anomalies (3 and 4) which comprise the Connell Brook occurrence (Lockhart, 1971b). Anomaly 3 includes the vertical loop electromagnetic anomalies. Results from the 1140 m of bulldozer trenching that followed (Lockhart, 1971d) were generally inconclusive because of deep overburden and wet conditions and no further work was done.

Access:

The occurrence is exposed in two north-south trenches, 130 m south of Connell Brook. It is accessible by a logging road which intersects the Kilmarnock Settlement road 4 km from Highway 105. The trenches can be reached by walking south from a point 0.5 km along the logging road. The original access road has been rendered impassable by logging operations.

Geology:

In places the trenches exposed Cambro - Ordovician quartz wacke and argillites, and an 8 m band of Devonian porphyritic tonalite. The metasediments are dark grey to black, very fine grained, finely laminated argillite which weathers medium greenish grey to black. The quartz wacke is medium grey, fine grained, thinly bedded and weathers dark grey. The intrusive rock is fine grained tonalite with 5% rounded quartz phenocrysts typical of the Gibson intrusion. All lithologies are slightly to moderately chloritized and sericitized. Silicification, varies from a few 1 mm quartz stringers to quartz stockworks to 10 cm wide quartz veins.

The rocks are highly fractured to brecciated. At one location, 40 m from the north end of the main trench on anomaly 4, an outcrop of breccia is composed of 0.5 to 2.0 cm angular fragments of argillite in a chloritic matrix.

Mineralization:

The predominant copper mineralization is as fracture fillings and sulphide bearing quartz veins in all lithologies. Disseminated sulphide minerals are present in the quartz wackes and some boulders of tonalite. The dominant sulphides are chalcopyrite and pyrite, the former occurring only as fracture fillings. The quartz veins contain pyrite and chalcopyrite with traces of sphalerite (Lockhart, 1971d).

Geochemistry:

Lockhart (1971d) did not record any analyses from these trenches although he noted up to 2% chalcopyrite and 0.5% sphalerite in a quartz vein beneath the peak soil geochemical anomaly (650ppm Cu) of trench 4. Analysis from trench 4 of sulphide bearing argillite (A097, A099) and quartz wacke (A098, A114 duplicates) contain up to 170ppm Cu (A114), 150ppm Zn (A114), 1000ppm Mn (A098), 1.3ppm Ag (A098), 6ppm Sn (A098) and 9ppm W (A114). A sample of diabase from the side of Connell Brook (A100) contains low metal values, the highest being, Mn (1500ppm) and Ag (0.7ppm), Zn (120ppm) and V (333ppm).

Style of mineralization:

The trenching was unsuccessful in exposing mineralized bedrock, in fact trench 3 only uncovered the very edge of the soil anomaly. However, it did show the presence of the porphyry. Four styles of mineralization have been identified:

1. fracture-filling chalcopyrite and pyrite in metasediments and porphyry;
2. disseminated pyrite in metasediments;
3. dissemianted pyrite and chalcopyrite in porphyry; and
4. pyrite, chalcopyrite and sphalerite in quartz veins in metasediments.

4. Monteith Farm (Figure 8.4)

Alternate names:

Lockhart anomaly 5

Commodity:

Copper

Location:

UTM 612450mE 5107600mN
Lat: 46°06'53" Long: 67°32'43"

History of exploration:

First recorded staking was by Coppercliff Consolidated Mining Corporation in 1953. The claims were transferred to Stratmat Limited who conducted ground electromagnetic and magnetic surveys but obtained no results that warranted further

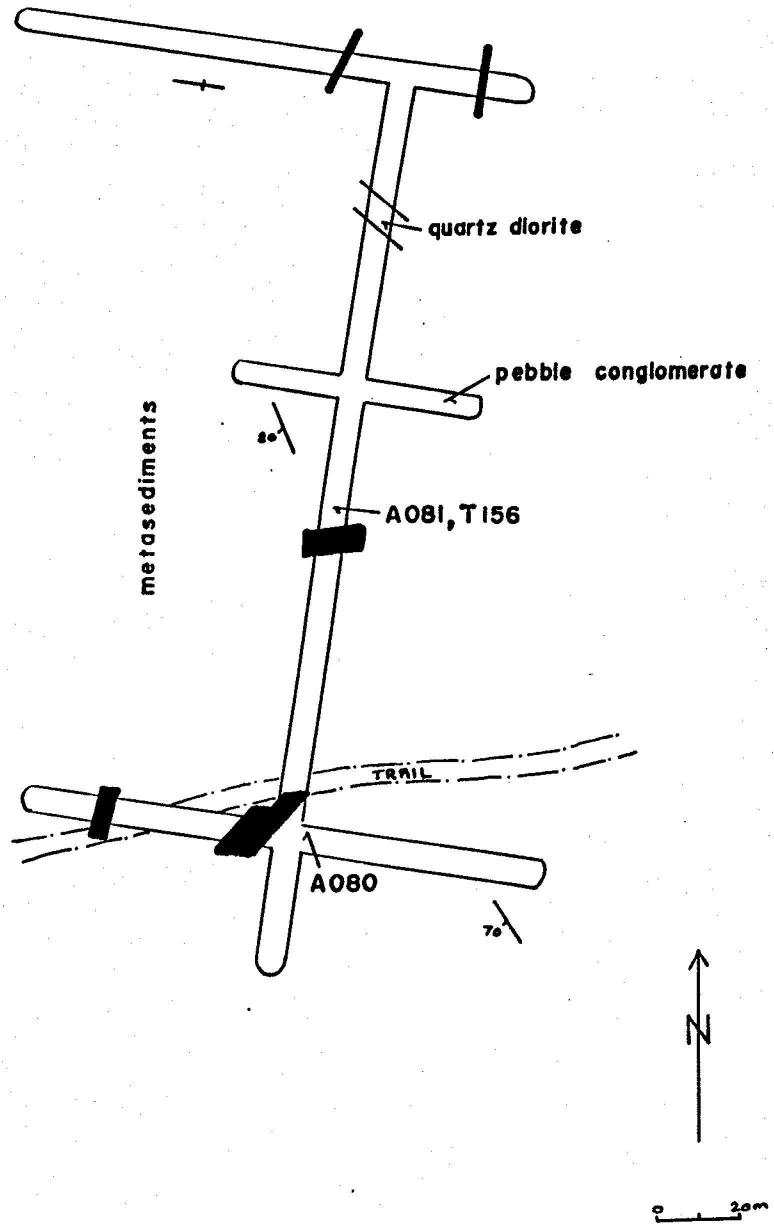


Figure 8.4: Monteith Farm (▬ :diabase; modified after Lockhart, 1971d).

exploration (Sidwell, 1954b).

Phelps Dodge Corporation of Canada Limited staked the area in 1966 based on boulder prospecting to the north and east of the originally staked Cobbler - Sexton area. Reconnaissance geological mapping and a soil (B-horizon)geochemical survey revealed a potential for copper mineralization in this area (Lockhart, 1968). When Falconbridge Nickel Mines Ltd acquired the property in 1968, they completed ground magnetometer (Lockhart, 1970a), and detailed soil (B-horizon) geochemical surveys (Lockhart, 1971b). The latter identified potential for copper at the Monteith occurrence but the ensuing 520 m of bulldozer trenching did not reveal significant copper zones (Lockhart, 1971d). No further work was done.

Access:

The occurrence is 1.1 km east of Highway 105 and is accessible by farm road on Mr. Earl Monteith's farm.

Geology:

Black, dark-grey-weathering, well laminated argillite and medium to dark grey quartz wacke are exposed in most of the trench. The two 20-foot wide dykes of fine grained tonalite reported by Lockhart (1971d) are not well exposed. Venugopal (1981) reported the presence of an intrusive breccia associated with one of these dykes. All rocks are slightly chloritized and sericitized and in places moderately silicified by numerous 2-4 mm quartz stringers. All rocks are fractured to brecciated. A thin section of sample T156 (Appendix I) indicates that the rock has undergone phyllic alteration. Several 1-10 m wide diabase dykes occur in the trench.

Mineralization:

Up to 10% pyrite and 1% chalcopyrite occur as fracture fillings and in quartz veins associated with and as disseminations in the porphyry. Traces of pyrite and chalcopyrite are on fractures throughout the occurrence.

Geochemistry:

Four ten-foot chip samples reported by Lockhart (1971d) at the contacts of one of the porphyry dykes contained 0.03 -0.07% Cu. Two samples of argillite containing up to 1% pyrite and chalcopyrite (A080, A081) contain above normal amounts of: Cu (510, 390ppm), As (72, 90ppm), Ag (1.8, 1.6ppm), W (9, 6ppm) and Sn (5, 11ppm).

Style of mineralization:

Three styles of sulphide mineralization attributable to porphyry copper style mineralization have been identified:

1. fracture filling sulphides in porphyry and metasediments;
2. disseminated sulphides in the porphyry; and
3. disseminated sulphides in quartz veins.

5. Smart Farm (Figure 8.5)

Alternate names:

Lockhart anomalies 6, 7 and 9
Smart Farm Copper (6 and 9); East Smart Farm Copper (7)
Upper Northampton Copper - Molybdenum

Commodity:

Copper, Gold, Molybdenum, Zinc

Location:

Utm Anom. 6	612800mE	5107500mN		
Anom. 7	613350mE	5107550mN		
Anom. 9	612600mE	5107250mN		
Lat: Anom. 6	46°06'49"		Long:	67°32'00"
Anom. 7	46°06'50"			67°32'27"
Anom. 9	46°06'43"			67°32'36"

History of exploration:

The first recorded staking was by Coppercliff Consolidated Mining Corporation in 1953. The claims were transferred to Stratmat Limited and they conducted electromagnetic and magnetometer surveys. The results did not warrant further work (Sidwell, 1954b).

Phelps Dodge Corporation of Canada Limited staked the area of this occurrence in 1966 following boulder prospecting outside the original area of staking at Cobbler - Sexton. Reconnaissance geological mapping and soil (B-horizon) geochemical surveys revealed a potential for copper in this area (Lockhart, 1968). Falconbridge Nickel Mines Ltd. acquired the property in 1968, and completed ground magnetometer and detailed soil (B-horizon) geochemical surveys (Lockhart, 1970a, 1971b). The latter outlined three adjacent soil copper anomalies (numbered 6, 7 and 9) which were subsequently trenched. Some 600 m of bulldozer trenching were completed at anomaly 6, 400 m at anomaly 7, and 300 m at anomaly 9. Generally the results of trenching were

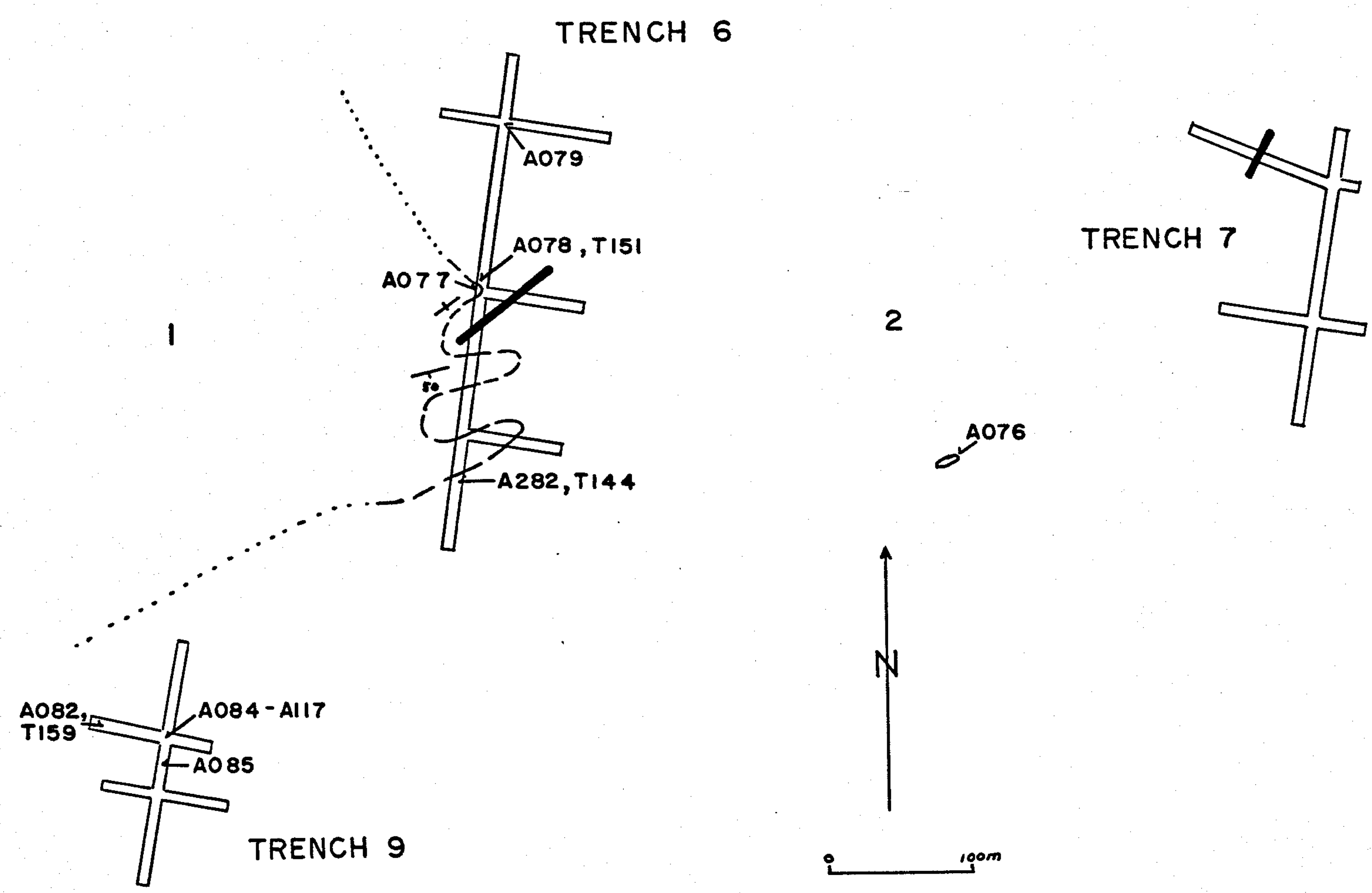


Figure 8.5: Smart Farm (1:quartz wacke, 2:tonalite, ▬ :diabase; modified after Lockhart, 1971d).

dissappointing and no further work was done.

Access:

The trenches are located 0.9 to 1.3 km from Highway 105 on the farm of Mr. Ivy (but worked by Mr. Raymond Smart) and they are accessible by farm road.

Geology:

Trench 6 is underlain predominantly by the Gibson stock comprising fine grained tonalite with 5% quartz phenocyrsts to 4 mm and fine grained, equigranular, biotitic tonalite. These have intruded the Cambro - Ordovician quartz wackes and argillites. The sedimentary rocks are rarely exposed in the trenchs but occur mainly as xenoliths and/or roof pendants. The metasediments have been altered to hornfels and slightly silicified by 1-3 mm quartz stringers. The intrusive rocks are slightly to moderately chloritized and silicified. Thin section T144 (Appendix I) (sediment or intrusive rock) exhibits strong phyllic alteration.

Trench 7 is mainly in thick overburden, the only rock exposed is at the end of a side trench. It is a pink quartz eye porphyry with no apparent alteration or mineralization. It has been deeply weathered to grus .

In trench 9 fine to medium grained, altered (phyllic) tonalite (T159; Appendix I) is exposed in the north end of the trench and a pink, slightly porphyritic tonalite with 10% quartz eyes to 6 mm, occurs in the south end. Lockhart (1971d) reported the presence of xenoliths of metasedimentary rocks within the intrusive rocks here.

Mineralization:

At trench 7, no sulphide minerals were reported by Lockhart except for a boulder of dolomite with 0.5 - 1% chalcocite and malachite stain (Lockhart, 1971d).

Sulphide minerals in trenches 6 and 9 consist of pyrite and chalcopyrite. They occur as disseminations in the intrusive rocks and as fracture fillings in the intrusive and metasedimentary rocks.

A sample of porphyritic tonalite with 10% disseminated sulphides was examined microscopically in polished section T151 (Appendix I). The metallic minerals are made up of 55% chalcopyrite commonly intergrown with pyrrhotite, 20% pyrrhotite, 20% pyrite, 5% rutile and traces of sphalerite and molybdenite. A similar rock from trench 9 (A084; Appendix III) contains 5-10% pyrite, 1% chalcopyrite and traces of molybdenite. Geochemical analyses (A078, and duplicate samples A084, A117) confirm the presence of molybdenum (190-261ppm). Note also that Lockhart (1971d) found a boulder of intrusive rock cut by a molybdenite bearing quartz vein and that Geosleuth Exploration Services (pers. comm.) identified scheelite from this area.

Geochemistry:

One sample of quartzite from trench 6 (A077) which contains traces of pyrite on fractures is slightly anomalous in Ag (0.9ppm) and As (9.8ppm). Mineralized tonalite from trench 6 (A078, A079, A282) contains up to 10000ppm Cu, 320ppm Zn, 3.2ppm Ag, 190ppm Mo, 94ppb Au, and 71ppm W and from trench 9 (A082, A084, A085, A117) contains up to 2500ppm Cu, 32ppb Au, 150ppm Zn, 16ppm As, 261ppm Mo, and 1.3ppm Ag, 20ppm Bi. Samples A078 from trench 6 and A084, A085 and A117 from trench 9 contain anomalous Au (13ppb to 94ppb) associated in part with high values in Cu, Zn, Ag, Mo, W and Bi. A078 is described in polished section T151 (Appendix I). A sample (A076) of slightly porphyritic tonalite from what resembled a very old trench part way between anomalies 6 and 7 contains anomalous Cu (330ppm) and Ag (0.8ppm).

Style of mineralization:

Two styles of mineralization have been identified at this occurrence:

1. disseminated sulphide minerals in intrusive rock; and
2. fracture-filling sulphide minerals in intrusive rock and metasediments.

The mineralized zone in the intrusion appears to be higher grade than that in the metasediments but this may be more a function of the lack of metasedimentary rock exposed in the trenches. The disseminated style of mineralization is important as a host for Au with associated Cu, Zn, As, Mo, Ag, W and Bi.

6. Upper Northampton Copper (Figure 8.6)

Alternate names:

Lockhart anomalies 2 and 8

Commodity:

Copper, Molybdenum

Location:

UTM	Anom. 2	613700mE	5106800mN
	Anom. 8	614100mE	5107300mN

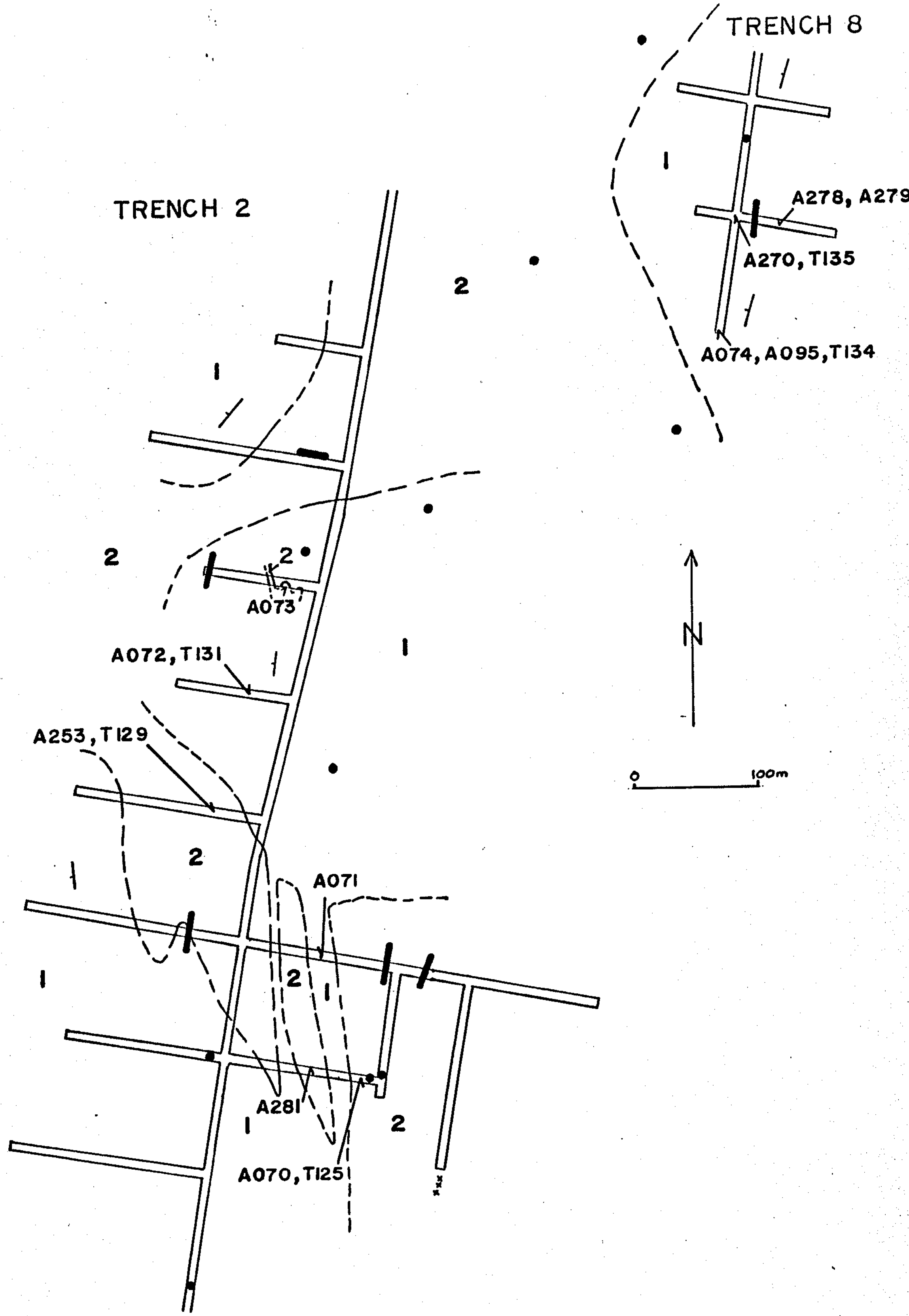


Figure 8.6: Upper Northampton Copper (1:metasediments, 2:plagioclase-quartz porphyritic tonalite, ▬ :diabase; modified after Lockhart, 1971d).

Lat: Anom. 2   46°06'26" Long:67°31'43"
     Anom. 8   46°06'42"   67°31'24"

History of exploration:

This area was staked in 1966 by Phelps Dodge Corporation of Canada Limited based on boulder prospecting to the east of their initial claim block at Cobbler - Sexton. The encouraging results of reconnaissance soil (B-horizon) geochemical surveys and geological mapping were followed up by an induced polarization survey and a 6-hole drilling program on coincident self potential, induced polarization and soil (B-horizon) geochemical anomalies (Lockhart, 1968). The drilling encounted both intrusive and metasedimentary rocks with chalcopyrite disseminated in the intrusive rock. The ground was restaked in 1968 by Falconbridge Nickel Mines Ltd. and magnetometer, induced polarization, detailed soil (B-horizon) geochemical surveys and bedrock mapping defined the anomalies which were subsequently trenched (approx. 3.2 km in trench 2 and 460 m in trench 8) (Lockhart, 1969, 1970a, 1970b, 1971d). The ground was restaked by Omni Mines Limited (Fredericton) and optioned to Bethlehem Copper Corporation (Vancouver) and United Siscoe Mines Limited (Toronto) in 1974. Further work included 4 percussion drill holes to a target depth of 300 feet which produced some interesting results, but the property was subsequently dropped.

Access:

The occurrence is located approximately 2.3 km east of Highway 105 at Upper Northampton and is accessible from the highway by the old government road through Mr. Allan Dukeshires apple orchards and a short walk around a field.

Geology:

The predominant rock exposed in the trenches is the Cambro - Ordovician quartz wacke and argillites. The quartz wacke is medium grey, weathering dark green, medium grained and in places it is moderately silicified with quartz veins. In zones of intense shearing it has been highly chloritized and silicified. The argillites are spotted and propylitically altered (see T131, T135; Appendix I).

The intrusive rocks occur only in trench 2 and are plagioclase - quartz porphyritic tonalite (see T125, T128, T129; Appendix I). The alteration is propylitic. To the southeast of these trenches, the intrusive rock grades from granodiorite to granite (Lockhart, 1971).

The metasediments in the trenches strike south to south-southwest, with no evidence of major deformation from the intrusion other than extensive fracturing and some shearing. The intrusive rocks occur as steeply dipping dykes or sills parallel to the bedding (Lockhart, 1968, 1971d, Buchanan, 1974).

Mineralization:

Pyrite and chalcopyrite are the main sulphide minerals and occur as fracture fillings in the metasediments and intrusive rocks. Some pyrite and chalcopyrite is disseminated in the intrusive rocks. A polished section (T134; Appendix I) of quartz wacke from trench 8 with 5% sulphides as fracture fillings shows that the sulphide minerals are made up of 96% coarse subhedral pyrite containing inclusions of chalcopyrite and pyrrhotite, 3% chalcopyrite commonly in irregular intergranular grains, 1% goethite after pyrite and chalcopyrite and traces of covellite and rutile. This sample analysed in duplicate (A074, A095) averages 3ppb Au, 310ppm Cu, 7.1ppm As, 1.5ppm Ag and 2ppm Sb.

Geochemistry:

Generally the geochemical results from this occurrence are relatively low with Cu ranging from 52 to 580ppm and Ag from 0.5 to 2.2ppm. Samples of intrusive rock (A070, A253, A073), quartz wacke (A071, A074 and A095 duplicate) or argillite (A072, A270) which contain variable sulphide contents to 5%, all have similar trace element contents. The only outstanding sample (A281) is of fine grained highly silicified and chloritized aphanitic tonalite with 5% pyrite as disseminations, fracture fillings and in quartz stringers, and traces of chalcopyrite and molybdenite. It contains anomalous Ni (1070ppm), Cu (290ppm), Zn (420ppm), Se (21ppm), Mo (132ppm), Ag (1.2ppm), Sn (53ppm), Sb (8ppm), W (8ppm) and U (59ppm). The drilling programs conducted by Phelps Dodge Corporation of Canada Limited and Bethlehem Copper Corporation showed values averaging 0.01% Cu, with sporadic values to 0.35% Cu (Buchanan, 1974).

Style of mineralization:

The following three styles of mineralization have been identified in a zone of propylitic alteration:

1. disseminated pyrite and chalcopyrite in intrusive rocks;
2. fracture fillings of pyrite and chalcopyrite in metasedimentary and intrusive rocks; and
3. minor pyrite in quartz veins.

7. Kilmarnock Settlement

Commodity:

Copper

Location:

UTM 617000mE 5102800mN
Lat: 46°04'13" Long: 67°29'16"

History of exploration:

Subsequent to the discovery of the Connell Mountain deposits, Lockhart (pers. comm.) prospected other hill tops in the area and found this occurrence.

Access:

The occurrence is on a hill top in a field on the west side of the road at Kilmarnock Settlement (Map 1).

Geology:

This deposit was not examined in the field during the course of this project. Lockhart (pers. comm.) states that boulders of sulphide-bearing porphyry occur scattered in the field. These boulders are similar to tonalite at Connell Mountain.

Mineralization:

According to Lockhart (pers. comm.) pyrite and chalcopyrite mineralization similar to that found at Connell Mountain occurs here.

Geochemistry:

Not sampled and no analyses reported in literature.

Style of mineralization:

Boulders of mineralized porphyry similar to that seen at Connell Mountain (Lockhart, pers. comm.).

8.2.2 Vein Type and/or Porphyry Affiliate-Copper

These deposits are characterized by chalcopyrite and pyrite in north to northeast trending quartz veins and stockworks. The host rocks are generally granodiorite and granite of the Bulls Creek Phase of the Gibson stock and the adjacent Cambro - Ordovician quartz wackes. The Cobbler - Sexton occurrence at the contact of the main Gibson stock and adjacent quartz wackes and the Bedell Farm occurrence, in slates are exceptions. All but the Dugan Road occurrences are spatially related to the Gibson stock. The Dugan Road occurrences are spatially related to the Benton Stock.

Silicification, chloritization, bleaching and/or hornfelsing and propylitic alteration are common at most occurrences.

8. Bedell Farm

Alternate names:

Bedell Farm Copper Prospect
Bedell Farm Creek
Scott - Knox

Commodity:

Copper

Location:

UTM 610150mE 517950mN
Lat: 46°07'06 Long:67°34'33"

History of exploration:

The property was supposedly worked by Mr. Stevens in the 1850's (Claudet, 1930) at the same time that he worked the Bulls Creek No. 2 mining operation. The next recorded work on this deposit was in 1928 - 1929 when the occurrence was staked by W.J. Scott of Fredericton. At this time several pits and a 12' x 6'x 10' deep trench were in existence. Claudet (1930) recommended more trenching and stripping, but the owners put down a 443-foot angled diamond drill hole, using the government drill, in 1929. No further work is recorded on the claims. The pits and trenches have since been flooded by the Mactaquac head pond.

Access:

The trenches lie beside the old course of the Saint John River on the Bedell homestead farm but are presently flooded (Mrs. Barbara Peabody, née Bedell, pers. comm.). The Bedell Farm is located on the west side of the Saint John River 3.4 km due south of the Meduxnekeag River bridge in Woodstock.

Geology:

The host is a light grey colored altered slate of the Cambro-Ordovician metasediments. The drill hole intersected slate, soft slate, and blue slate (argillite?) and interbedded hard grey rock, hard grey quartz (probably quartz wacke) (Claudet, 1930). The strike is given as east-west with a dip of 1.5° south. The rock appears to be silicified by the common presence of thin quartz veins. The closest outcrop of the Bulls Creek phase of the Gibson stock is about 800 m to the south.

Mineralization:

Claudet (1930) records the occurrence of a 1 foot vertical quartz vein oriented northeast containing 1 inch bands of pyrrhotite and chalcopyrite. The drill hole intersected "veins" of chalcopyrite generally 1/8 to 1/4 inch wide but up to 18 inches wide to a depth of 429 feet.

Geochemistry:

Claudet (1930) analysed a sample taken across the 12" quartz vein at the surface and it contained 1.5% Cu, 0.3oz/ton Ag and trace Au. A sample of the heavily mineralized part of the vein taken by Scott contained 7.41% Cu, 2.6 oz/ton Ag and trace Au.

Style of mineralization:

The surface occurrence is a quartz vein containing chalcopyrite and pyrrhotite. The drill hole appears to have intersected chalcopyrite as fracture fillings.

9. Bulls Creek No. 1 (Figure 8.9)

Alternate names:

Bull Creek

Bull Creek (Copper King)
Bulls Creek property
Bull Creek Copper
N.B. Mining (Copper King) prospect

Commodity:

Copper

Location:

UTM 610050mE 5104050mN
Lat: 67°04'59" Long:67°34'37"

History of exploration:

Although there is no specific evidence,most authors claim that this property was worked in the 1850's at the time mining at Bull Creek No. 2 was in progress. The property was again worked in the early 1900's by various prospectors (Hale, 1961a) and probably has been intermittently prospected up until the present. The workings appear to be in existence prior to 1931, as Anderson (1968) shows these trenches on a map he drew from data dated prior to 1931 including New Brunswick Mining Company

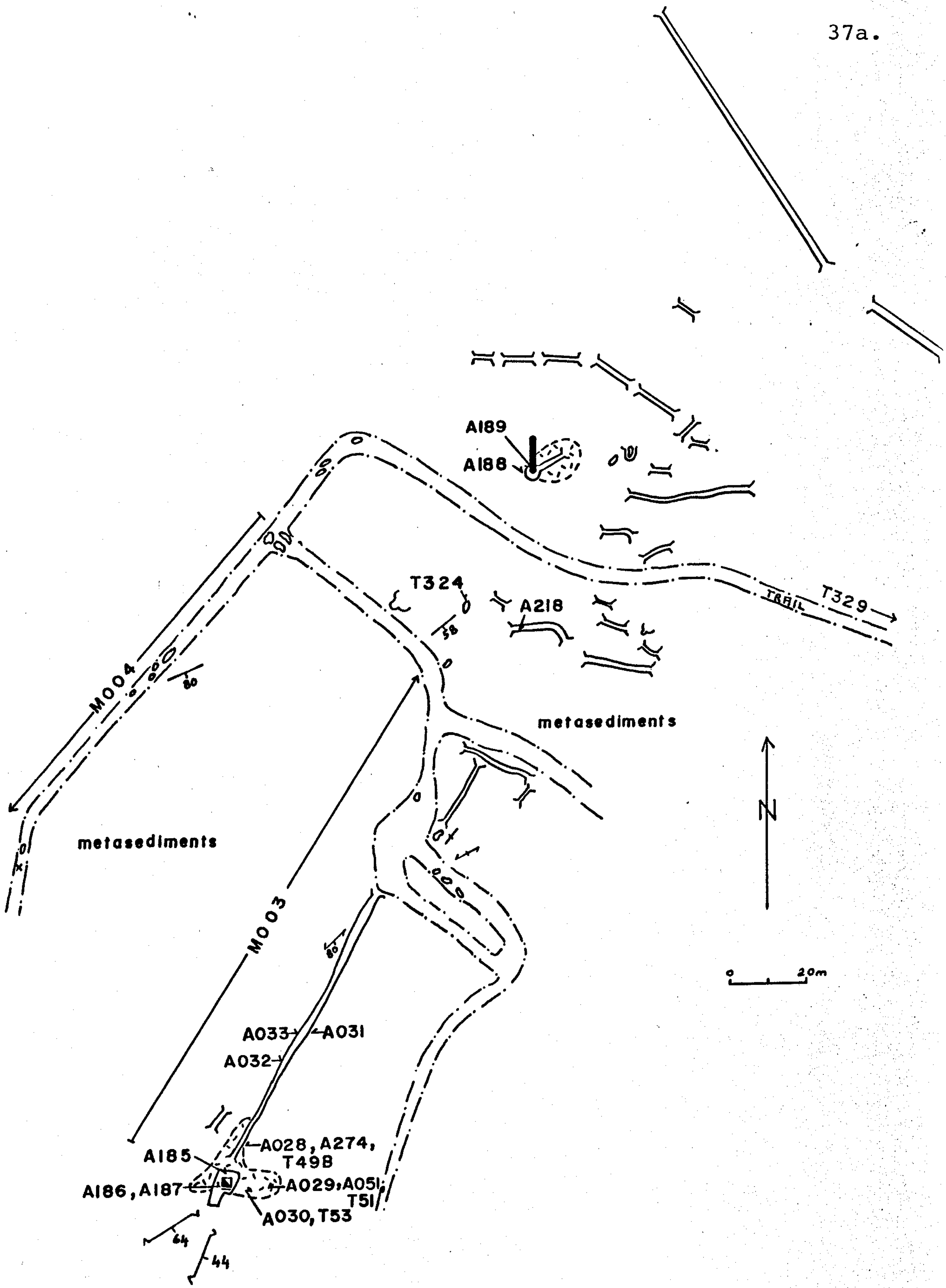


Figure 8.9: Bulls Creek No.1 (▬:diabase).

Plans of 1855, 1856 and 1857.

The first well documented exploration is by Noranda Mines Ltd. (1955) who staked the ground in 1955 and conducted self potential and electromagnetic surveys. They found no electromagnetic anomalies but they did obtain a weak self potential response over the workings.

Phelps Dodge Corporation of Canada Limited staked the property in 1965 and conducted orientation magnetic and soil (B-horizon) geochemical (Cu, Zn) surveys (Lockhart, 1967b). They did not obtain a magnetic response but found a Cu anomaly and a weak Zn anomaly over and downhill from the old workings.

Copper King Mines Ltd (Penton and Bell, 1970) staked the property when it came open and conducted an induced polarization survey. The results showed an anomaly at 150 feet depth near the old workings. It had a limited strike length.

Access

The deposit occurs on the northeast crest of a large flat topped hill 800 m southwest of the south end of the railway embakkment over Bulls Creek. There is a road from the occurrence to the fields to the west of the railway tracks, but the end of the road as it enters the field is completely overgrown by alders, and it is not distinguishable in the fields. Note that the workings and road are visible on airphoto A25021-149.

Geology

The only rocks exposed on the hill are in the workings and along the logging roads. The rocks are all of Cambro-Ordovician quartz wacke (T324; Appendix I), and argillite (T49B; Appendix I). One outcrop of well laminated siltstone (T329;Appendix I) occurs on the road half-way between the workings and the railway.

The quartz wacke is fine to medium grained and in workings it is carbonatized, chloritized in places silicified, slightly sericitized and bleached. Away from the trenchs, the rock is less altered. A comparison of the whole rock geochemistry of the bleached and unbleached quartz wacke has been discussed in section 7.2.1.

In the northern most pit there is a carbonatized one-metre wide mafic dyke oriented north-south and dipping steeply east. The dyke and adjacent quartz wacke are chloritized. Another small exposure of a mafic dyke occurs in a small trench 40m to the south.

The inclined shaft, was driven down a fault zone to a depth of 120 feet (Take, 1974). The exposure at the top of the shaft shows a 1 m wide shear zone of highly maganiferous, brecciated quartz wacke oriented at Ø58°T/64°SE, and secondary shears at Ø23°T/44°SE. The attitude of the bedding is Ø30°T/9Ø°.

Anderson (1968) shows a second shaft approximately 3ØØ m southwest of the main workings. There is no evidence of a shaft in this area. Note also that the trench system is diagramatic in Anderson's (1968) figure.

Mineralization

Trace amounts to 1% pyrite, pyrrhotite, chalcopyrite, malachite, and azurite are common on fractures in the quartz wacke throughout the workings. Several samples containing up to 3Ø% sulphides in carbonated and silicified quartz wacke breccias were found on the various waste piles. One sample (polished section T51; Appendix I) from these piles contain 9Ø% fine grained pyrite with included chalcopyrite, 8% chalcopyrite in lenses and filling fine fractures, 1% sphalerite disseminated in the gangue and as inclusions in chalcopyrite, 1% hematite disseminated throughout and traces of goethite. The averages of anomalous elements in duplicate samples (AØ29 and AØ51) from here are as follows: Au (21ppb), Cu (43ØØppm), As (51ppm), Mo (28ppm), Ag (1.3ppm), Sb (6ppm) and Bi (11ppm). A polished section of a second sample (T53; Appendix I) from a quartz vein with 2Ø% sulphides as disseminations and fracture fillings contains 85% chalcopyrite, 1Ø% goethite, after pyrite and chalcopyrite, 3% pyrite, 2% covellite and traces of cuprite (?). This sample (AØ3Ø; Appendix II) also is anomalous in Au (13ppb), Cu, (29ØØØppm), As (5Øppm), Mo (14ppm), Sb (2ppm), Pb (85ppm) and Bi (248ppm). Lockhart (1967b) noted the presence of galena and sphalerite in the Bulls Creek workings, but he is not specific about which workings.

Geochemistry

Samples of quartz wacke with up to 1% sulphides as fracture fillings (A028, A032, A186, A188, A189 and A274) contain the following anomalous values (averaged): Cu (529ppm), Ag (1.1ppm) and Bi (29ppm) with sporadically anomalous Cr (303ppm), Co (98ppm), Ni (107ppm), Zn (210ppm), As (5.8ppm), Mo (13ppm), Sb (3ppm) and Bi (30ppm). Those with more than 5% sulphides (A029, A051 and A030) are as reported above. Quartz veins (A187, A218) contain up to 1350ppm V, 12000ppm Cu, 4ppm Se and 19ppm Mo. The shear zone on which the shaft was sunk (A185) contains anomalous Au (8ppb), Cu (13000ppm), Zn (310ppm), As (19ppm), Se (4ppm), Mo (222ppm), Ag (3.9ppm), Cd (3ppm), Sn (14ppm), Sb (5ppm), Te (25ppm), Pb (82ppm), Bi (102ppm) and Li (79ppm). In the field this latter material was not noted as being particularly mineralized and the sample was taken as a chip sample over 1 m across the shear zone.

In summary Bull Creek No. 1 is a copper occurrence commonly associated with above normal amounts of As, Mo, Ag and Bi and in places Sb,Pb, Zn, Au, V, Cr and Li.

Style of mineralization

Two styles of mineralization are present:

1. sulphides as fracture fillings in sheared quartz wacke; and
2. sulphides disseminated in quartz and/or calcite veins.

10. Bulls Creek No. 2 (Figure 8.10)

Alternate names

Bulls Creek Copper
Bulls Creek Mine or Bulls Creek Copper Mine
Bull Creek
(note: Bull or Bull's are both used)

Commodity

Copper, silver, arsenic, gold

Location

UTM 611114mE 5104600mN
Lat: 46°05'06" Long:67°33'53"

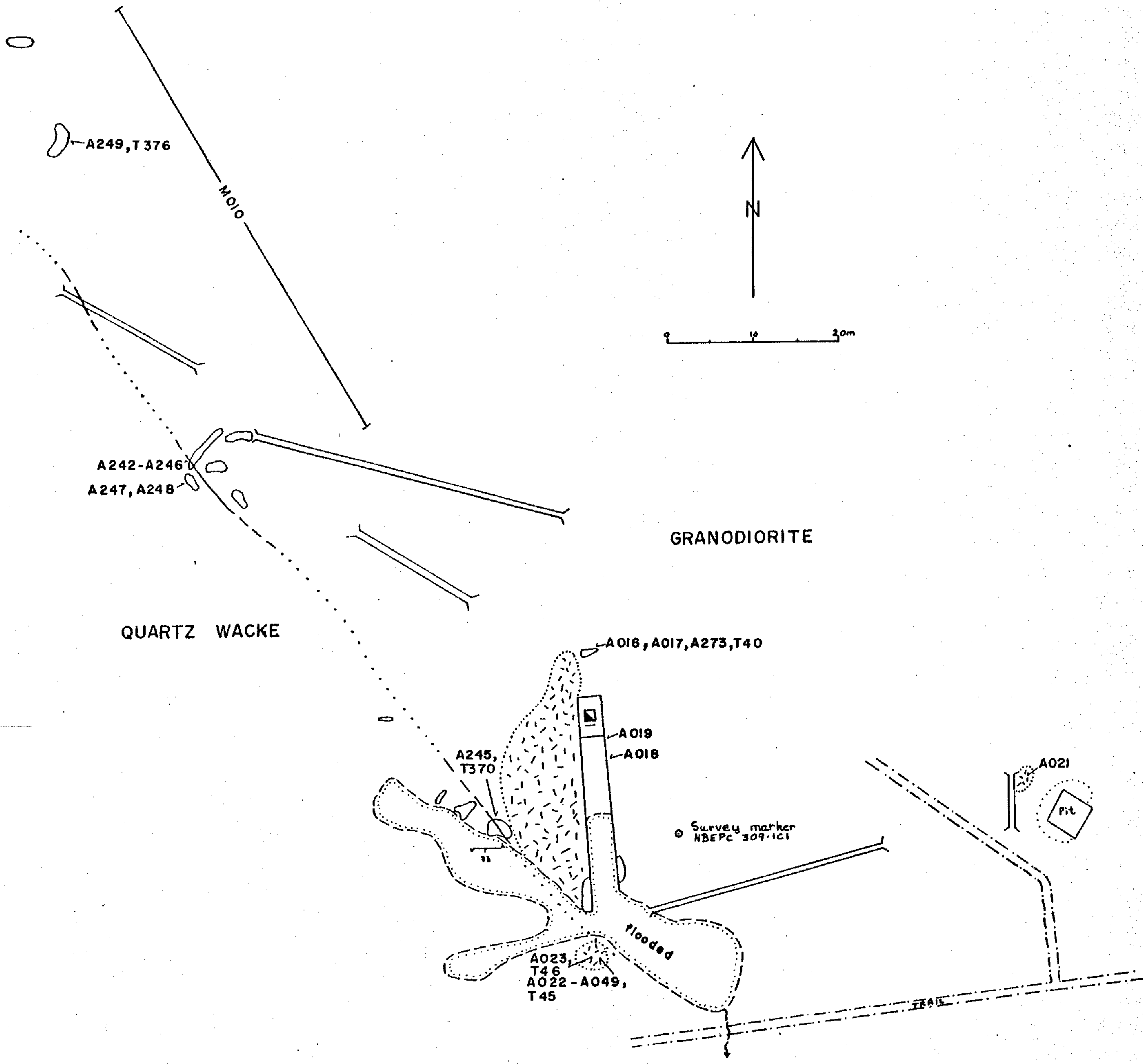


Figure 8.10: Bulls Creek No.2.

History of exploration

The deposit was worked prior to 1855 by Mr. Wm. Stevens of the New Brunswick Mining Company (Carleton Sentinel, 1857). Shaft sinking was in progress in October 1857 at which time it had reached a depth of 90 feet. The shaft was reached by a 140 foot horizontal drift or tunnel into the side-hill (Carleton Sentinel, 1857 b). By February 6, 1858, a very rich "vein or lode" had been struck in two places, at one site it was 4 feet wide (Carleton Sentinel, 1858). There are no available production records as, at the time, no royalties were required for the first 5 years of operations (Sutton, 1868). The mine was closed prior to 1864 (Bailey, 1864). The workings as surveyed in 1869 (Wright, 1932) show the shaft, the mill near the present railway embankment, the powder house and the money house beyond.

The ground was worked by various prospectors and companies (Hale, 1961a), including the Canadian Pacific Railway in 1926 (Claudet, 1926a). Noranda Mines Ltd. (1955) staked the property and completed electromagnetic and self potential surveys. There were no anomalies in the area that could be attributable to copper occurrences and hence they dropped the property.

Trans-Nation Minerals Ltd. (Bergman, 1959) staked the occurrence and completed horizontal loop electromagnetic and magnetic surveys. Generally the magnetic response outlined the intrusion, and they obtained magnetic and electromagnetic anomalies in the vicinity of the shaft.

Phelps Dodge Corporation of Canada Limited acquired the property in 1965 and conducted magnetic and orientation soil (B-horizon) geochemical (Cu, Zn) surveys (Lockhart, 1967b). A magnetic anomaly coincided with the old shaft; however, there was only a weak response in the Cu and Zn geochemistry.

Silvermaque Mines Ltd. staked the property and optioned it to Imperial Oil Enterprises Ltd. in 1969. The magnetic, self potential and limited soil (Cu, Zn) geochemical surveys showed coincident anomalies near the old shaft (Bergman, 1969).

Later work included an induced polarization (MacEachern, 1970), soil (B-horizon) sampling (Cu) (MacEachern, 1971a) and diamond drilling (MacEachern, 1971b, c). Three of the five holes in the vicinity of the shaft intersected chalcopyrite in seams and fracture zones associated with high silicification and chloritization. The best results were in hole 9. They consisted of 2.35% Cu over 5 ft with traces of Au and Ag in the granite and 0.44% Cu over 1.5 ft in hornfels.

Access

The shaft and lower trenches are flooded by Mactaquac head pond. They are accessible on foot by an old road along the north side of Bulls Creek from Highway 2 just north of its intersection with Highway 103.

Geology

The rocks exposed around the shaft are of the Bulls Creek phase of the Gibson Stock (mainly granodiorite) as described in section 7.2.5. One outcrop 15 m northwest of the entrance to the shaft (T370B, 370C; Appendix I) is of granite with inter-fingered argillite. The inter-fingering is the result of shearing as both rocks are mylonitized. This outcrop probably marks the contact of the intrusive and metasedimentary rocks. The contact is also exposed at T374 where the quartz wacke is highly silicified. The metasediments are propylitically altered whereas the granodiorite appears to have a superimposed phyllic alteration. In the drill holes beneath the shaft, MacEachern (1971 b,c) noted the presence of some potassic alteration. Unfortunately this could not be verified as the shack in which the core was stored near the road has recently collapsed spilling all of the core.

Mineralization

Three types of sulphide mineralization have been examined in polished section: disseminated sulphides in granodiorite, sulphide fracture fillings with calcite and quartz in granodiorite, and sulphide-bearing quartz veins in granodiorite.

Granodiorite (polished thin section T40A (2); Appendix I), which forms the wallrock of a sulphide quartz calcite filled fracture (T40A (1)), contains 4% opaque minerals which are made up of 55% pyrite, 2% chalcopyrite and 40% goethite after pyrite. Other minerals identified include rutile (2%) and hematite (1%) both of which occur in chloritized biotite. The chalcopyrite occurs as inclusions in micaceous minerals whereas the pyrite is disseminated throughout. Polished section T40A (1) (Appendix I) is of a 1 cm wide fracture filled with quartz and calcite containing 10% opaque minerals. The sulphides are predominantly chalcopyrite (96%) occurring as fracture fillings and associated with micaceous minerals and rutile (5%); pyrite (3%) is disseminated and commonly replaced by goethite (2%).

A sample (polished section T46; Appendix I)) of granodiorite from the waste pile contains 3% chalcopyrite as fracture fillings and coatings on quartz crystals. Minor disseminated hematite is also present in the granodiorite. This sample also contains a 3 mm wide quartz vein with 15% metallic minerals made up of pyrite (50%), chalcopyrite (30%), arsenopyrite (20%), and traces of spahlerite, cubanite and covellite.

A quartz-chlorite vein (polished section T45; Appendix I) from the waste pile, contains 10% opaque minerals made up of chalcopyrite (95%) as fracture fillings around large quartz crystals, disseminated pyrite (2%), disseminated hematite (3%), traces of goethite after pyrite and traces of covellite.

Geochemistry

Sample T40A(1) (A017) described above contains significantly anomalous Au (1200ppb), Co (5911ppm), Cu (40,000ppm), Zn (480ppm), As (37,000ppm), Ag (21.6ppm), Cd (4ppm), Sn (22ppm), Sb (20ppm), W (1300ppm) , Pb (118ppm) and Bi (1187ppm). The adjacent wallrock (A016) examined in polished section T40A (2) (Appendix I) is anomalous in Cu (410ppm), As (44ppm), Ag (1.0ppm) and Bi (5ppm) and slightly anomalous in Sn (6ppm) and W (11ppm). One meter away from the fracture the granodiorite (A273) is anomalous only in Cu (300ppm), As (7.0ppm) and W (16ppm).

Other analyses of granodiorite with sulphide-bearing fractures are A023 from the waste pile as described in polished section T46 (Appendix I) and A018 from the wall of the entrance to the shaft. They contain (A023, A018 respectively) anomalous Au (100, 150ppb), Cu (8700, 12000ppm), As (1600, 970ppm), Ag (2.3, 6.0ppm), Sn (18, 17ppm), W (136, 158ppm) and Bi (29, 51ppm). This is similar to the suite of elements found in the sulphide fracture discussed above (A017).

The quartz-chlorite vein as described in polished section T45 (Appendix I) was analysed in duplicate (A022, A049) and contains anomalous (average) Au (67.5ppb), Cu (13,650ppm), As (260ppm), Ag (4.0ppm), Sn (21ppm), Sb (12ppm), W (77ppm) and Bi (20ppm).

Granodiorite samples without apparent sulphide-bearing fractures (A019, A021, A245, A248 and A249) contain variably anomalous Li (77ppm; A021), Cu (590, 280, 170ppm; A021, A245, A248), Zn (330ppm; A245), As (16ppm;A019), Ag (0.6, 1.9, 0.6, 0.8ppm; A019, A021, A248, A249), Sb (3ppm; A021), W (6, 44ppm; A019, A249), Pb (42ppm; A245), and Bi (4ppm; A248). The quartz wackes are considerably lower in trace elements than the granodiorite; samples A242, duplicate A246 and A247, contain slightly anomalous As (18, 9.2, 2.2ppm) and Ag (1.2, 2.5, 0.8ppm).

Style of mineralization

Three styles of mineralization have been identified:

1. disseminated pyrite in quartz wacke and granodiorite,
2. sulphide ± calcite fracture fillings in granodiorite,
3. sulphide-bearing quartz-chlorite veins in granodiorite, and

4. blebs of chalcopyrite associated with silicified and chloritized zones in hornfels (MacEachern, 1971).

Of these, supposedly the third is the one from which most of the ore was produced. Few quartz veins greater than 10 cm wide are recorded in the drill logs.

11. Bulls Creek No. 3 (Figure 8.11)

Alternate names

Love Farm

Commodity

Copper, gold, zinc, lead, silver

Location

UTM 610450mE 5104900mN
Lat: 46°05'27" Long:67°34'19"

History of exploration

The origin of this occurrence is unknown. A shaft is shown at this location by Anderson (1968) and MacEachern (1970) but there is no evidence of the shaft when the site was visited in 1986. The shaft may have been part of the original workings of the Bull Creek Mine operated by New Brunswick Mining Company in the 1850's - 1860's, but a map from 1869 of the old workings (Wright, 1932) does not show a shaft at this location. This map does show a road going to this site and the northeasterly trending "course of No. 1 Lode" going through this location. Wright and Perry (1931) show a dump from lode No. 1 at this location. It appears unlikely that the piles of angular rock present along the base of the slope and on the flood plain would have been carried from the main shaft of Bulls Creek No. 2, a distance of some 700 m.

Noranda Mines Limited (1955) staked the area in 1955 but did not obtain encouraging results from the electromagnetic survey that they conducted.

Trans-Nation Minerals Ltd (Bergman, 1959) carried out electromagnetic and magnetic surveys over their 20 claim property and found an electromagnetic anomaly in this area but it was only on one line and not considered important. The results of the magnetic survey were negative.

Phelps Dodge Corporation of Canada Limited (Lockhart, 1967b)

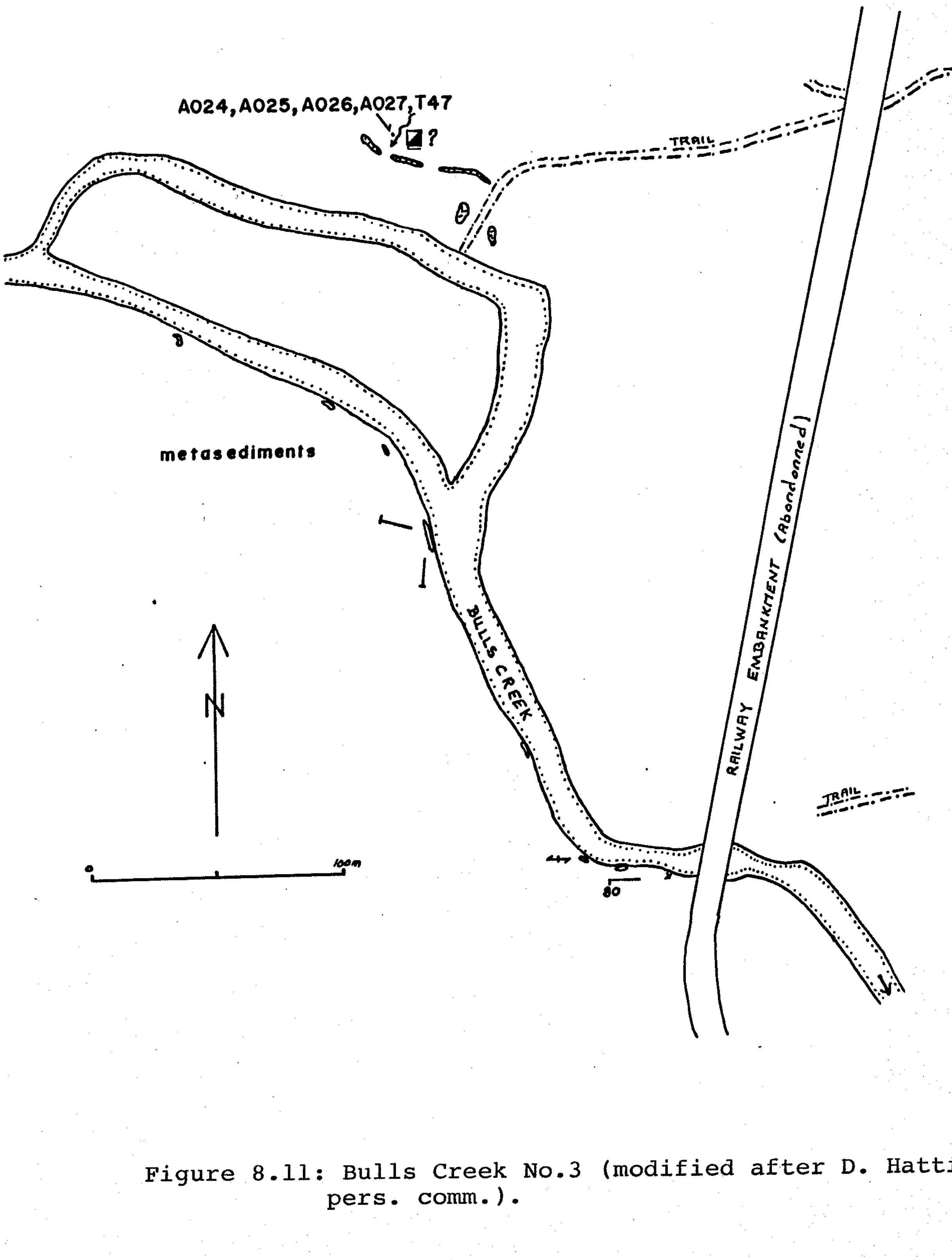


Figure 8.11: Bulls Creek No.3 (modified after D. Hattie, pers. comm.).

held the property in 1965 but their geochemical surveys did not cover this area. They outlined a weak north-south magnetic anomaly over the site.

Copper King Mines Ltd. (Penton and Bell, 1970) staked the occurrence but the induced polarization survey that they carried out appears not to have covered it.

Access

The occurrence is accessible by foot on the first old road at the north end of the abandoned CPR embankment over Bulls Creek, The general area of the shaft is 200 m west of the abandoned railway and a large pile of mine waste lies beside the road on the river terrace. The possible shaft entrance lies approximately 200 m west of the road at the foot of the slope from the railway.

Geology

There are no outcrops at this site. Material on the waste piles is mainly of fine grained quartz wacke with some pieces of white quartz vein and a breccia containing 50% angular fragments of quartz wacke and 50% white quartz matrix. Outcrops on the south side of Bulls Creek are of quartz wacke trending 090°T/90°.

Mineralization

The quartz wacke from near the possible shaft contains traces of pyrite and chalcopyrite on fractures. The quartz vein material contained up to 50% sulphides, mainly pyrite, but also up to 1% chalcopyrite, galena and sphalerite. The sulphide bearing breccia has been examined in polished section (T47B, Appendix I) and contains 5% disseminated sulphides which are composed of: 60% sphalerite, 20% chalcopyrite, 15% pyrite, 5% galena and traces of covellite, rutile and goethite. The surface of the sample is partially coated with malachite and cerrusite.

Geochemistry

Quartz wacke with traces of pyrite on fractures (A024; Appendix II) contains anomalous Mn (6500ppm), Cu (160ppm), As (36ppm), Ag (1.1ppm) and W (6ppm).

A quartz vein with 3% sulphides (A026) contains significantly anomalous Au (650ppb), Cu (3900ppm), Zn (1200ppm), Mo (58ppm), Ag (2.9ppm), Cd (15ppm), Sb (2ppm), Pb (791ppm) and Bi (10ppm). A sample of quartz vein and wall rock with 30% pyrite (A027) contains lower quantities of anomalous metals as follows: Cu (3300ppm), Mo (11ppm), Ag (3.1ppm), Pb (280ppm), Bi (10ppm), Au (12ppb), Mo (11ppm) and Sn (10ppm).

The breccia (A025) examined in polished section (T47B, Appendix I), contains anomalous Au (540ppb), Cu (6800ppm), Zn (4800ppm), Mo (81ppm), Ag (5.8ppm), Cd (62ppm), Sb (2ppm), Pb (1945ppm) and Bi (20ppm).

Style of mineralization

Three styles of mineralization are present:

1. sulphide fracture coatings in quartz wacke;
2. sulphides in quartz veins; and
3. sulphides in quartz breccias.

The breccia (A025) and the quartz veins are similar geochemically and contain anomalous amounts of Au, Cu, Zn, Mo, Ag, Cd, Sb, Pb and Bi.

The fracture coatings in quartz wacke do not appear to be of economic interest, but this conclusion is based on one sample of unknown spatial relationship to the quartz veins.

12. Cobbler - Sexton (Figure 8.12)

Alternate names

Cobbler - Sexton Mine

Commodity

Copper

Location

UTM 612500mE 5104350mN
Lat: 46°05'12" Long:67°32'41"

History of exploration

The occurrence was discovered by John McClement and Edward Greer of Woodstock in 1905 (Bailey, 1908), 1906 (Woodstock, N.B. Press, 1909) or 1907 (Greer, 1939). The two prospectors were examining a galena-bearing quartz vein on the east side of Saint John River when Greer climbed Patchell's Mountain 500 m away. He found an abundance of chalcopyrite bearing float and the next day staked a claim for copper, silver, lead, gold and zinc (Greer, 1939; Woodstock N.B. Press, 1909).

The property was worked by McClement and Greer with various partners into the 1940's. The work performed included excavating a 5' x 8' x 20' deep shaft (Claudet, 1926b), a 12 foot deep

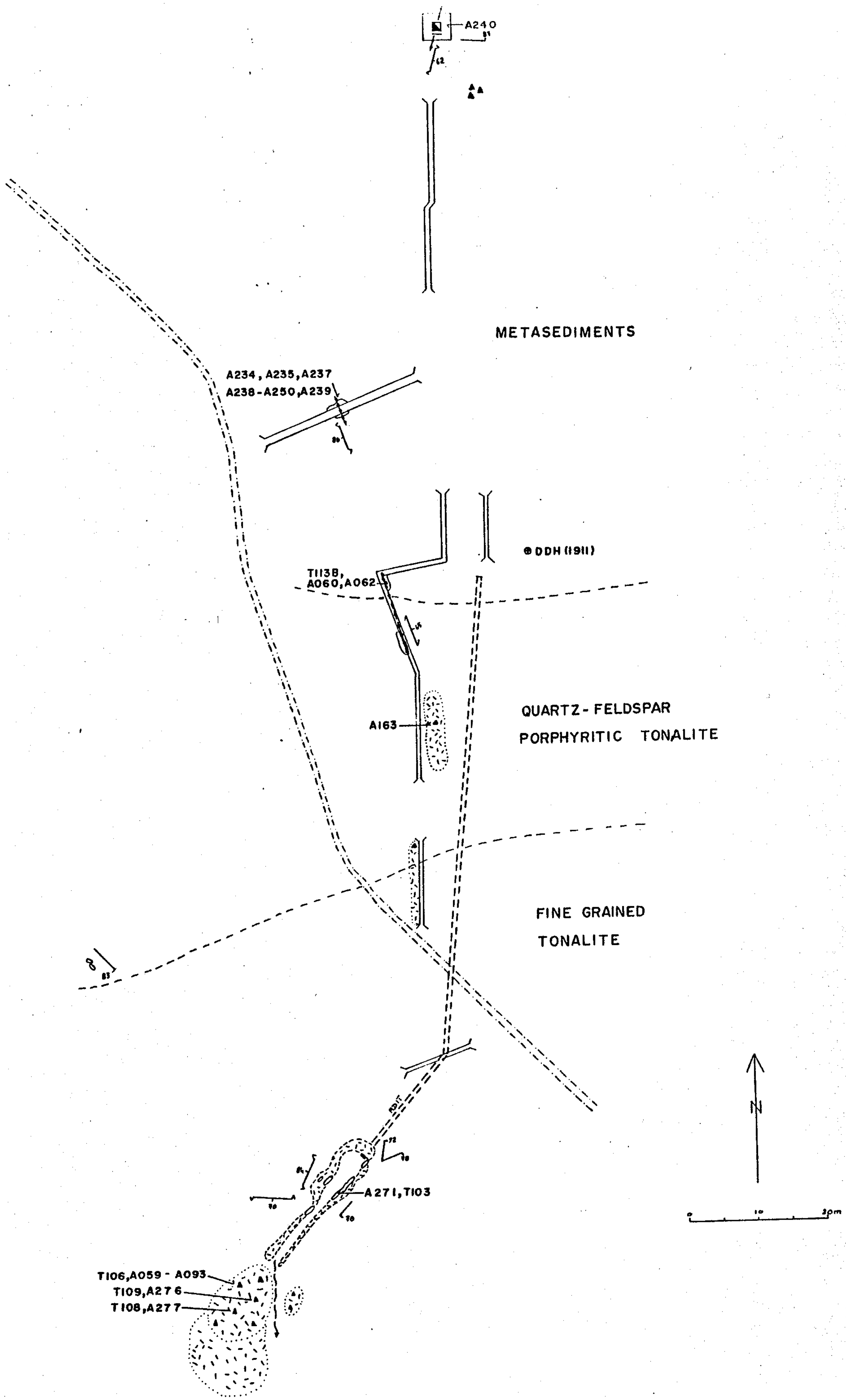


Figure 8.12: Cobbler - Sexton

pit,and a 324 foot adit. Reportedly the property was drilled between 1907 and 1911 (Sweeney, 1908, Parks, 1911) and Kyle (1940) supposedly drilled four holes in 1940.

The ground was staked by Trans-Nation Minerals Ltd. (Bergman, 1959); they detected a magnetic anomaly, believed to be due to intrusive rocks (diabase), and an associated weak horizontal loop electromagnetic anomaly in the area of the workings.

Phelps Dodge Corporation of Canada Limited staked the occurrence in December 1965 and carried out orientation studies to test various prospecting techniques with a view to finding additional copper occurrences in the area. The magnetometer survey outlined several anomalies in the vicinity of the old workings (Lockhart, 1967a). The program (Lockhart, 1967a) also included geological mapping and a soil (B-horizon) geochemical survey for Cu and Zn. The latter produced only weak anomalies in the vicinity of the Cobbler - Sexton workings. Later work by Falconbridge Nickel Mines Ltd. included a magnetometer survey (Lockhart, 1970a) which confirmed the anomalies associated with the workings, a vertical loop electromagnetic survey (Lockhart, 1971a) which was not considered reliable, petrographic studies of boulders and outcrops (Lockhart, 1971a) and soil (B-horizon) geochemistry for Cu, Pb and Zn. The latter indicated significant copper anomalies in the vicinity of the workings.

The main focus of Falconbridge Nickel Mines Ltd. activities changed to the northeast where they discovered the main porphyry copper occurrences and no further work was done around the Cobbler - Sexton.

In 1986 the occurrence was held by Merton Stewart. He completed geochemical soil sampling and prospecting mainly for gold, (M. Stewart, pers. comm.) the results of which are not available. The claims were allowed to lapse and the area was restaked in May 1987 by Maritime Resource Research Ltd.

Access

The workings are accessible by foot from highway 105, a distance of 300 m.

Geology

The workings lie across the contact of the Gibson Stock and the Cambro - Ordovician metasediments. Several northeast trending mafic dykes occur adjacent to the workings (Wright and Perry, 1931).

The Gibson Stock is composed of fine grained tonalite (T103, Appendix I) exposed at the entrance of the adit, and quartz -

feldspar porphyritic tonalite (A163) occurring in the trenches 65 m to the north. Both types of tonalite exhibit propylitic alteration. In places the fine grained tonalite contains xenoliths of black, highly chloritized quartz wacke. All rocks show variable degrees of silicification and pervasive carbonatization as well as variable intensities of fracturing and brecciation.

The Cambro - Ordovician metasediments in the workings occur to the north of the Gibson intrusive rocks. Where exposed they are light to medium greenish grey, fine to medium grained quartz wacke that is variably bleached, chloritized and silicified. In the shaft and trenches it is highly fractured and in places sheared. The bedding trends 030°T/62°NW and is cut by shears at 165°T/80°W and 015°T/62°E and subparallel quartz veins and fractures.

Mineralization

The focus of early exploration activity at the Cobbler - Sexton was the mineralized quartz veins. These are up to 25 cm wide and can be traced up to 15 m in the trenches. Sulphides identified in polished sections T106 and T109 (Appendix I) from the waste pile at the adit are mainly chalcopyrite (80-85%) as fracture fillings and pyrite (15-20%) as disseminations and in irregular veins. In places pyrite is fractured and infilled with chalcopyrite.

The quartz wacke wall rock (T113B; Appendix I), exposed in a trench, contains hematite and rutile disseminated throughout and pyrite and chalcopyrite in 1-10 mm thick, sulphide-rich quartz veins.

A sample of highly chloritized and silicified porphyritic tonalite (T108, Appendix I) from the waste pile at the adit contains 4% disseminated pyrite, 0.5% chalcopyrite as fracture fillings and minor disseminated hematite and rutile.

Galena in a chalcopyrite seam in tonalite (granite) was reported in the 1911 drill hole, (Parks, 1911) and free gold was identified by Dr. R.W. Ells from a trench half way between The shaft and the adit (Woodstock N.B. Press, 1909). Baily (1908) also reports the presence of free gold at this occurrence.

Geochemistry

Fine grained tonalite (A271) from the entrance of the adit (thin section T103; Appendix I) contains background concentrations of all elements. Porphyritic tonalite with 5% sulphides A277 (polished section T108; Appendix I) contains anomalous Cu (1800ppm), Se (5ppm), Ag (0.8ppm), Sn (10ppm) and Bi (3ppm). Porphyritic tonalite (A163) with 30% sulphides contains anomalous Cu (2000ppm), As (400ppm), Se (6ppm), Ag (0.8ppm), Sn (22ppm), Te (6ppm), W (21ppm) and Bi (48ppm). Samples A277 and A163 also contain above normal amounts of Au, 4 and 12ppb respectively.

The sheared quartz wacke (A240) exposed in the shaft is anomalous in Au (8ppb), Cu (2900ppm), Se (4ppm), Ag (0.8ppm) and Bi (20ppm).

A 25 cm wide by 15 m long quartz vein (A060) exposed in one of the trenches contains 2% sulphides and anomalous Cu (870ppm) and Bi (3ppm). The quartz wacke wall rock (A062) has anomalous Cu (3300ppm), Ag (1.0ppm), Sn (31ppm), Pb (421ppm) and Bi (22ppm) in it. Samples A060 and A062 contain 6 and 7ppb Au respectively.

Other quartz (A059 - A093, duplicate and polished section T106) and quartz-calcite (A276 and polished section T109) veins sampled from the waste pile at the adit contain 10% sulphides and anomalous Cu (24000, 190000, 9000ppm), Ag (2.3, 1,3, 1,3ppm), Te (10, 10, 3ppm) and Bi (27, 24, 17ppm); all are anomalous in Au (25, 17, 13ppb) and A059 is anomalous in Cd (2ppm) and A276 is anomalous in Se (8ppm), Mo (15ppm) and Sn (11ppm).

A shear zone trending 165°T/80°W in quartz wacke exposed in a trench was sampled as follows: A234 - quartz wacke with 40% pyrite is 1 m from the shear; A235 - quartz wacke with 60% pyrite is adjacent to the shear; A237 - is the shear zone, mylonitic with 30% pyrite; A238 - A250 (duplicate) is highly chloritized and silicified quartz wacke in the shear zones with 30% pyrite; and A239 is the wall rock of the quartz veins. All samples are high in Fe (140,000 - 290,000ppm) and generally show anomalous amounts of As (6.8-11ppm), Se (3-7ppm), Sn (11 - 36ppm), Te (2-3ppm) and Bi (7 - 343ppm). Cu (40 - 10000ppm), Zn (120-280ppm), Ag (0.5-3.4ppm), Pb (10-1290ppm), Bi (7-343ppm) and (Au 8-71ppb) are highest in sample A238 from the chloritized-silicified centre of the shear zone.

Other analyses reported in the literature are:

	Au oz/ton	Ag oz/ton	Cu %	Fe %	Zn %	Pb %
Bailey (19Ø8):	-	3	5-6	-	-	-
Claudet (1926b):						
from dump:	tr	Ø.2	2.5	11.34	-	-
5'deep, W pit:	Ø.Ø1	2.6	4.17	-	Ø.49	1.12
Quartz vein near adit:	Ø.Ø3	2.6	-	-	-	-
Lockhart (1967a):						
1Ø'chip from adit	-	-	Ø.45	-	-	-
1Ø'chip from adit	-	-	Ø.25	-	-	-
5'chip-surface trench	-	-	Ø.51	-	-	Ø.12
Greer (1938):	$18/ton gold, silver, copper.					

Style of mineralization

Three styles of mineralization are present:

1. sulphide-bearing quartz ± calcite veins;
2. sulphides with quartz as fracture fillings in sheared quartz wacke; and
3. disseminated and fracture filling sulphides in highly chloritized and silicified porphyritic tonalite.

The vein mineralization was the focus of early exploration at the site. The present study has shown that the major concentrations of metals are in shear zones and in the associated quartz veins and wall rock. The presence of significant gold as described by Ells has not been confirmed.

13. Dugan Road East (Figure 8.13)

Alternate names:

Commodity:

Copper ?

Location:

UTM 6Ø985ØmE 51ØØ85ØmN
Lat: 46°Ø3'15" Long:67°34'51"

History of exploration:

No mineral exploration work is recorded for this area. The occurrence was found by Venugopal and Hattie (pers. comm.) who

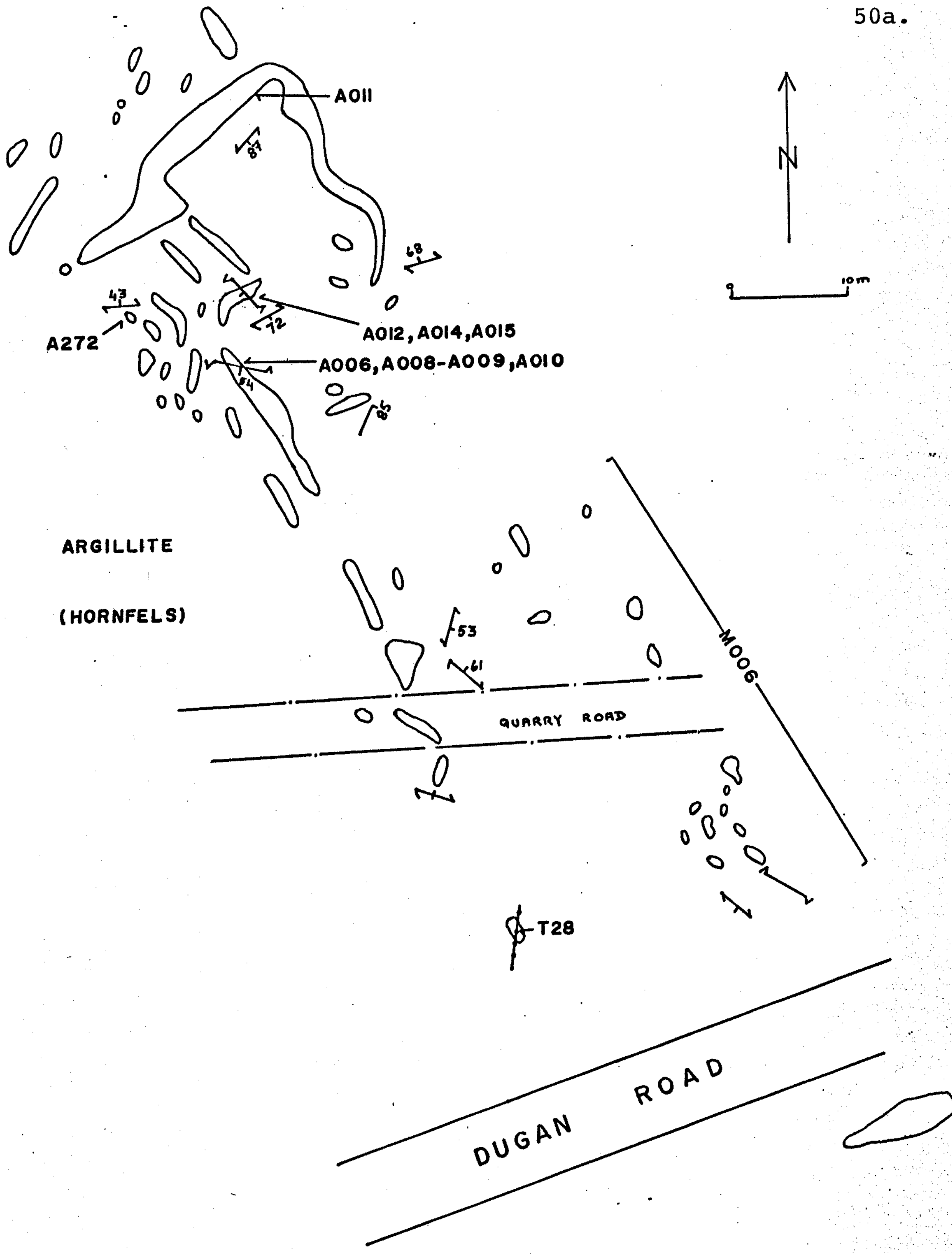


Figure 8.13: Dugan Road East (modified after D. Hattie, pers. comm.).

claim to have found traces of chalcopyrite. It was examined in Phase I of this project (Geosleuth Exploration Services, pers. comm.).

Access

The occurrence is in a rock quarry on the north side of the Dugan Road, 1.4 km from Highway 2.

Geology

The only lithology exposed in the quarry is a dark grey, fine grained, silty argillite (T28, Appendix I). The rock is altered to hornfels and subsequently chloritized, sericitized and carbonatized. There is much manganese and iron oxides on the fractures. Three breccia or shear zones occur within the quarry. These zones are up to 1 m wide, are highly carbonatized and contain up to 5% pyrite. The shear zones are oriented east-west, dip steeply south and are comprised of a 4-50 cm central mylonitic to brecciated core with 40-90 cm highly brecciated zones on either side.

Mineralization

Pyrite is the only sulphide that was observed during the present study. The two common forms of occurrence are as disseminations on fractures in or associated with shear zones, and as lenses up to 10 cm diameter by 2 cm thick on fractures in the metasedimentary rocks.

Geochemistry

All samples (A006 to 015) analysed contain anomalous (average) As (120ppm), Ag (2.8ppm) and Sb (5ppm).

Sections across two of the shear zones were sampled. A009 and A014 are from the cores of the zones and contain anomalous As (30, 48ppm), Ag (3.8, 2.6ppm) and Ni (115, 110ppm). A009 is also higher in Li (63ppm) and Mo (9ppm) and A014 contains 1600ppm Ba. A008 and A015 from the adjacent brecciated zones contain anomalous As (110, 60ppm), Ag (5.5, 2.5ppm) and Sb (8, 2ppm); A008 is also anomalous in Li (100ppm), Mo (17ppm) and U (7ppm). A006, A010 and A012 are in less deformed rock and contain anomalous As (6.4, 50, 32ppm), Ag (1.6, 1.6, 2,2ppm) and Sb (3, 4, 1ppm) with A006 being anomalous in Li (61ppm), Zn (270ppm), Se (2ppm), Cd (2ppm) and U (7ppm). A010 exhibits increases in Li (94ppm), Mn (11000ppm), Ni (114ppm) and Sn (7ppm) and A012 contains 3800ppm Mn. Both zones are geochemically similar in that they show enrichment in As, Ag and Sb with variable Cd, however coincident geochemical anomalies in Li, Mo and U are found only in samples A006, A008, A009.

Samples A011 and A272 are from two lenses of massive pyrite. They are both anomalous in Au (55, 20ppb), As (580, 170ppm), Ag (2.3, 2.7ppm) and Sb (20, 4ppm); A011 is also anomalous in Mo (9ppm) and Pb (101ppm).

Style of mineralization

The following two styles of mineralization are evident:

1. disseminated pyrite on fractures in or associated with shear zones, and
2. lenses of massive pyrite along fractures.

The presence of chalcopyrite as previously reported was not confirmed; Cu values in the samples taken range from 31 to 99ppm.

14. Dugan Road West (Figure 8.14)

Alternate names

Dugan Road Copper

Commodity

Copper (?)

Location

UTM	6083000mE	5100450mN
Lat:	46°03'04"	Long:67°06'01"

History of exploration

This occurrence is described by Take (1974) and noted by Fyffe (1982a). It was examined by Geosleuth Mineral Exploration Services (pers. comm.) in Phase I of the study of the metallogeny of the Miramichi Zone.

Access

The occurrence is an outcrop on the south side of the Dugan Road 3.1 km west from Highway 2. It is the first outcrop after a long section through the drift filled Lilly Brook valley.

Geology

The host rock is a dark grey, very fine grained hornfels which weathers light to medium brown. The rock is highly fractured with prominent north to northeast trending fractures, and less prominent easterly and southeasterly fractures. The fractures are commonly stained by Fe and Mn hydroxides.

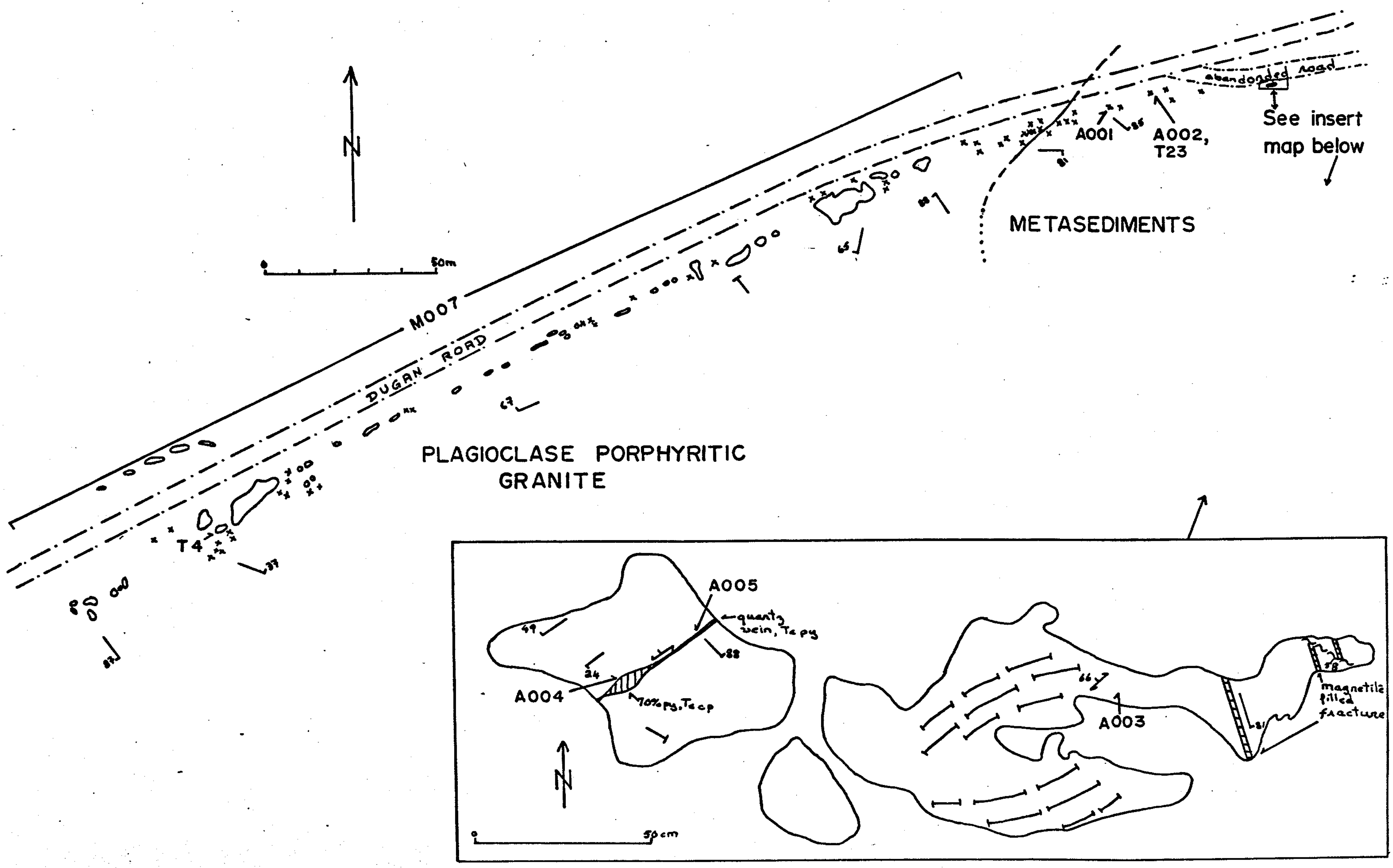


Figure 8.14: Dugan Road West.

Seventy metres to the west, the hornfels is in sheared contact with plagioclase porphyritic granite of the Benton Stock. To the east, on the opposite side of Lilly Brook valley, the Benton Stock also outcrops. Hence this occurrence is a roof pendant, of Cambro-Ordovician rocks, within the Benton Stock. Thin section T4 (Appendix I) is from the granite some 250 m west of the contact.

Mineralization

Pyrite occurs as disseminations on fractures and as lenses or seams to 3 cm wide in fractures. Magnetite is also present as 1 cm fracture fillings. Chalcopyrite was reported from this outcrop by Take (1974).

An outcrop of hornfels 50 m to the west contains fine-grained pyrite on microfractures and medium-grained pyrite in seams up to 4 mm wide. A polished section (T23; Appendix I) shows the seam to be composed of 50% pyrite and 50% calcite with traces of magnetite, rutile and covellite. The wall rock, which is bleached up to 3 mm adjacent to the vein, contains 2% disseminated magnetite.

Geochemistry:

Samples of hornfels with traces of disseminated pyrite on fractures (A002, A003) contain anomalous Ag (1.5, 1.5ppm). A002 is also anomalous in Mn (4100ppm) and Cu (150ppm) is above normal in A003. Hornfels with traces of pyrite on quartz filled fractures (A005) is anomalous in Li (63ppm), Mn (3100ppm), Cu (380ppm), As (6.8ppm), Ag (2.0ppm), Sn (26ppm), Sb (2pmm) and Bi (2ppm). Massive pyrite (A004) lenses contain anomalous Mn (4600ppm), Fe (150000ppm), Cu (200ppm), Ag (1.6ppm), Sn (41ppm), Sb (5ppm), W (7ppm) and Bi (6ppm). Massive pyrite with calcite seams (A001) as studied in polished section T23 (Appendix I) contains anomalous Au (7ppb), Mn (3100ppm), As (42ppm), Mo (13ppm), Ag (3.5ppm), Sb (3ppm), Pb (40ppm) and U (8ppm).

Style of mineralization:

Two styles of sulphide mineralization are present:

1. disseminated sulphides on fractures; and
2. sulphide seams and lenses in quartz- and/or calcite-filled fractures.

The former style of mineralization is low in trace elements, in places (A003) it is anomalous in Cu (150ppm), while the latter may contain anomalous Ag, Cu, As, Sn, Sb and Bi and rarely anomalous Li, Mo, W, Pb, U and Au.

15. Interchange Copper

Alternate names

Commodity

Copper

Location

UTM 611320mE 5104800mN
Lat: 46°05'21" Long:67°33'38"

History of exploration

The property was staked by Silvermaque Mining Limited and optioned to Imperial Oil Enterprises in 1969. An induced polarization survey was carried out and an anomaly (MacEachern, 1970) with a 300 m strike length was subsequently drilled (MacEachern, 1971a).

Access

The mineral occurrence is restricted to a diamond drill hole under the Trans-Canada Highway, 90 m north of the interchange with Highway 103. The core from this program was stored in a shack in the field to the west of the highway, but the building has since collapsed and the core spilled.

Geology

The drill hole intersected interbedded argillite and quartz wacke exhibiting varying degrees of potassic, chloritic, epidotic and sericitic alteration. Silicification and brecciation were noted in places (MacEachern, 1971a).

Mineralization

Up to 2% pyrite and traces of chalcopyrite occur in quartz-filled fractures in metasedimentary rocks. This type of mineralization was considered by MacEachern (1971a) to be insufficient to explain the induced polarization anomaly, which he attributed to road salt.

Hole DDH 14, at the north end of the anomaly encountered 349ft of brecciated hornfels overlying altered (potassic) quartz monzonite (MacEachern, 1971a).

Geochemistry

A sample of hornfels from this hole with minor chalcopyrite in fractures contained 0.32% Cu over 1.5 ft, and hornfels with

5-10% pyrite and traces of chalcopyrite contained 0.03% Cu over 5.0ft (MacEachern, 1971a). No other analyses were reported and no additional work was done (MacEachern, pers. comm.).

Style of mineralization

The only type of mineralization recognizable from the drill logs is sulphide-bearing, quartz-filled fractures.

16. Silvermaque

Alternate names

Silvermaque Copper Prospect
Silvermaque Woodstock

Commodity

Copper

Location

UTM 610470mE 5107150mN
Lat: 46°06'41" Long:67°34'20"

History of Exploration

The property was staked by Silvermaque Mining Limited and optioned to Imperial Oil Enterprises in 1969. A subsequent induced polarization survey (MacEachern, 1970) identified an anomaly which was later drilled (MacEachern, 1971a).

Access

The occurrence was intersected by a diamond drill hole under Highway 103 and is not exposed at surface.

Geology

The drilling results (MacEachern, 1971a) here showed that fine grained diabase intrudes quartz monzonite of the Gibson Stock. MacEachern also reported chloritic and potassic alteration with associated epidote. The diabase-quartz monzonite contact is highly brecciated and carbonatized. Some hornfels may be present.

Mineralization

Rare quartz veins up to 15 cm wide contain minor pyrite and chalcopyrite.

Geochemistry

No analyses were carried out (MacEachern, 1971a, pers. comm.).

Style of mineralization

Quartz veins with sulphides is the only type of metallic mineralization recorded.

8.2.2 Fracture Filling - Copper

These occurrences are characterized by thin fracture fillings or coatings of chalcopyrite in Cambro-Ordovician quartz wacke and Devonian felsic intrusive rocks (Benton Stock). The chalcopyrite is commonly associated with quartz stringers parallel to the main fractures and chloritic alteration of the wall rock adjacent to the stringers.

17. Hillman Copper

Alternate names

Fraser and Briggs copper occurrence

Commodity

Copper

Location

UTM 613700mE 5097030mN
Lat: 46°01'10" Long:67°31'53"

History of exploration

In the early 1950s A.A. Fraser and M.A. Briggs of Plaster Rock, New Brunswick staked claims and did surface prospecting, trenching and diamond drilling. They optioned the claims to I.C. Stairs of Meductic who intended to complete geophysical surveys but was unsuccessful in his first attempt because of power line interference (Stairs, 1955). There is no other recorded work on these claims.

Access

The mineral occurrence was intersected in a diamond drill hole and is not exposed at the surface. The low ground in the vicinity is now flooded by Mactaquac head pond. The hole was drilled northwestward under a creek into Gyles Cove before flooding.

Geology

The drill log (Hole 1, Stairs, 1955) was reported to intersect quartzite and basalt dykes up to 19 ft thick. In places the sediments were observed to be sheared and a one foot zone of quartz stringers was present at a basalt dyke contact.

Mineralization

Pyrite and pyrrhotite were noted in both sediments and basalt and chalcopyrite accompanied pyrite and pyrrhotite over a 3 ft width in quartzite adjacent to basalt. In places "heavy mineralization" (pyrite?) was noted in sheared sediments.

Geochemistry

No analyses have been reported

Style of mineralization

The style of sulphide mineralization would appear to be as fracture fillings.

18. Lower Northampton Copper (Figure 8.18)

Alternate names

Highway 1Ø5 occurrences

Commodity

Copper

Location

UTM 614ØØØmE 5Ø97ØØØmN
Lat: 46°Ø1'Ø9" Long:67°31'32"

History of exploration

These occurrences were discovered by W.F. Take (1973) in 1973 in road cuts excavated for the relocation of Highway 1Ø5. The area has been staked at various times (Stairs, 1955, Tompkins, 1965) but there is no work recorded in this immediate area.

Access

The occurrences are in road cuts 16.2 km south of the Grafton Bridge on the east side of Highway 1Ø5.

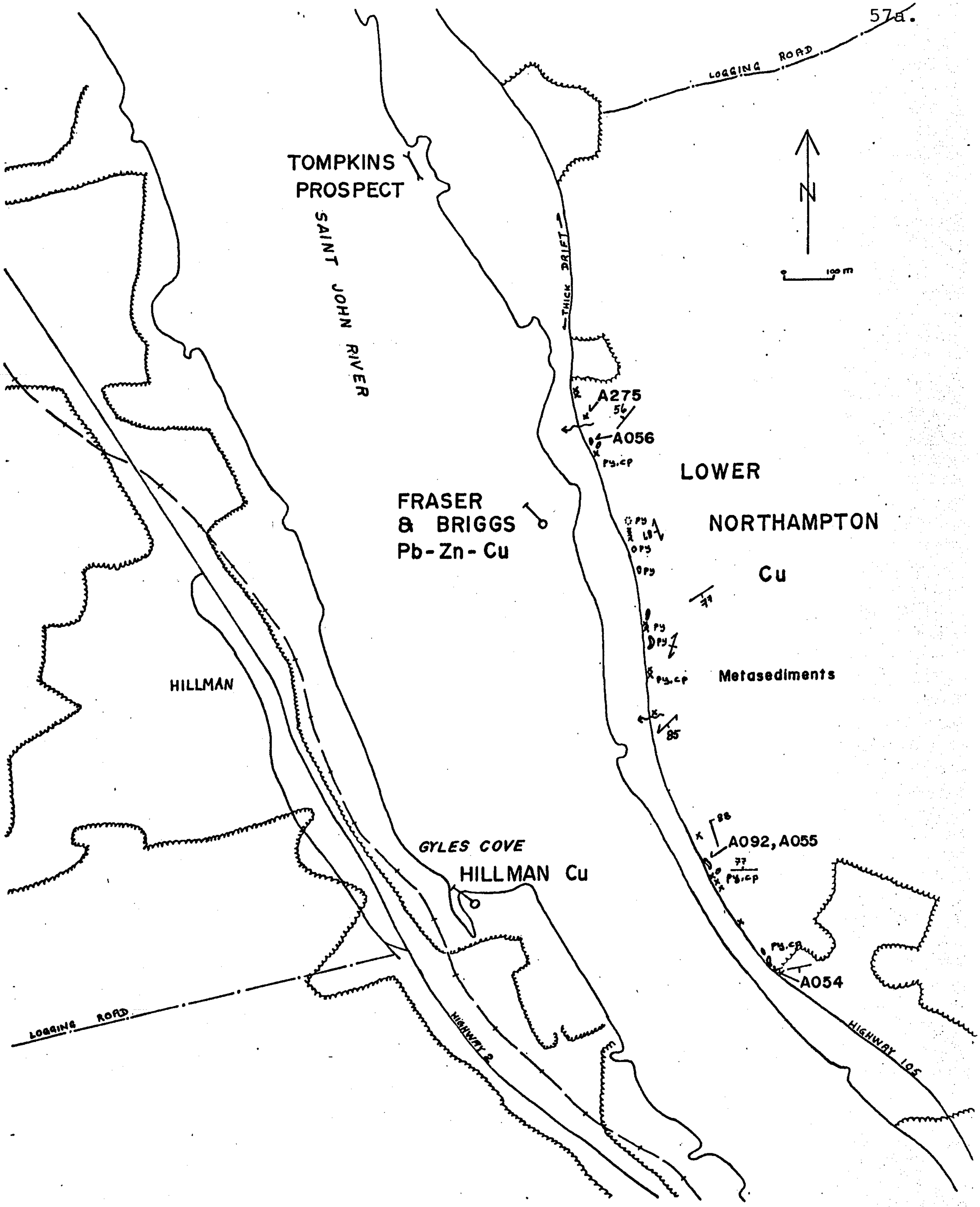


Figure 8.18: Lower Northampton Copper, Tompkins Prospect, Fraser and Briggs Pb-Zn-Cu, and Hillman Copper.

Geology

The occurrences are in a sequence of interbedded Cambro-Ordovician quartz wackes and argillites. The quartz wackes are medium green, fine to medium grained and well bedded in units from several centimeters to several metres thick. The argillites are finely laminated, medium grey to green with well developed northeasterly cleavage. These rocks are commonly silicified with abundant quartz stringers and veins to 10 cm wide. They are slightly carbonatized on fractures and chloritized adjacent to quartz stringers and veins. Argillites have small amounts of sericite developed on some fractures. In places the rocks are cut by up to 40 cm wide northeast trending shear zones with 2 cm wide mylonitic cores.

Mineralization

Pyrite is the predominant sulphide present and it is most abundant (up to 5%) in the highly silicified rocks. Some fine grained pyrite is disseminated in the metasediments, however it is most abundant as fracture coatings and fillings. Where the rocks are carbonatized, a few specks of very fine galena occur on fractures.

Geochemistry

Three samples of pyritized, silicified quartz wacke were analysed: A054 contains 5% pyrite but no carbonate, A056 contains carbonate but only traces of pyrite and A092 is carbonatized and contains 5% pyrite. All three are anomalous in Ag (0.9, 1.3, 3.3ppm). A054 and A092 are also anomalous in Cu (350 and 210ppm); and As (5.8 and 9.2ppm); A056 is above normal in Pb (77ppm), also A092 is anomalous in Au (15ppb), Mo (9ppm), Pb (384ppm) and Bi (16ppm).

A 40 cm wide shear zone (A055) adjacent to A092 is highly silicified and carbonatized. It contains 10% pyrite and anomalous Au (10ppb), Cu (220ppm), As (9.0ppm), Mo (9ppm), Ag (1.3ppm), Sb (3ppm), Pb (52ppm) and Bi (4ppm). Note that these are a similar suite of elements to those occurring in the adjacent quartz wacke (A092).

An argillite sample with no apparent mineralization, but with sericite on cleavage planes (A275) shows increases in As (8.6ppm) and Ag (1.0ppm).

Style of mineralization

Sulphides occur as:

1. disseminations on fractures; and
2. disseminations in shear zones and the adjacent wall rock.

Generally anomalous amounts of Au, Cu, As, Mo, Ag, Pb and Bi can be found in the shear zones.

19. Riceville (Figure 8.19)

Alternate names

Meductic property of Chaleur Metals

Commodity

Copper (?)

Location

UTM 614080mN 5095600mN
Lat: 46°00'23" Long:67°31'37"

History of exploration

~~10~~ Ten claims were staked in the Riceville area by Chaleur Metals. A geochemical soil survey using a dithizone field test on samples taken at a two foot depth by hand auger resulted in defining eight small anomalous areas (O'Donnell, 1955). Geological mapping discovered the chalcopyrite (O'Donnell and Hirschi, 1955) which constitutes this occurrence.

Access

The occurrence is in a roadside outcrop at the intersection of the Benton and Porter Settlement roads 0.6 km from Highway 2.

Geology

The Cambro-Ordovician metasediments exposed in the outcrops are light to medium green, fine to medium grained quartz wacke interbedded with 40-60 cm thick beds of light green, weathering red, sandy siltstone. The lithologies strike uniformly northeast and dip steeply to the northwest. In places the rocks are silicified with milky white, quartz stringers and vuggy veins to 5 cm wide. The rock adjacent to the quartz veins is highly chloritized.

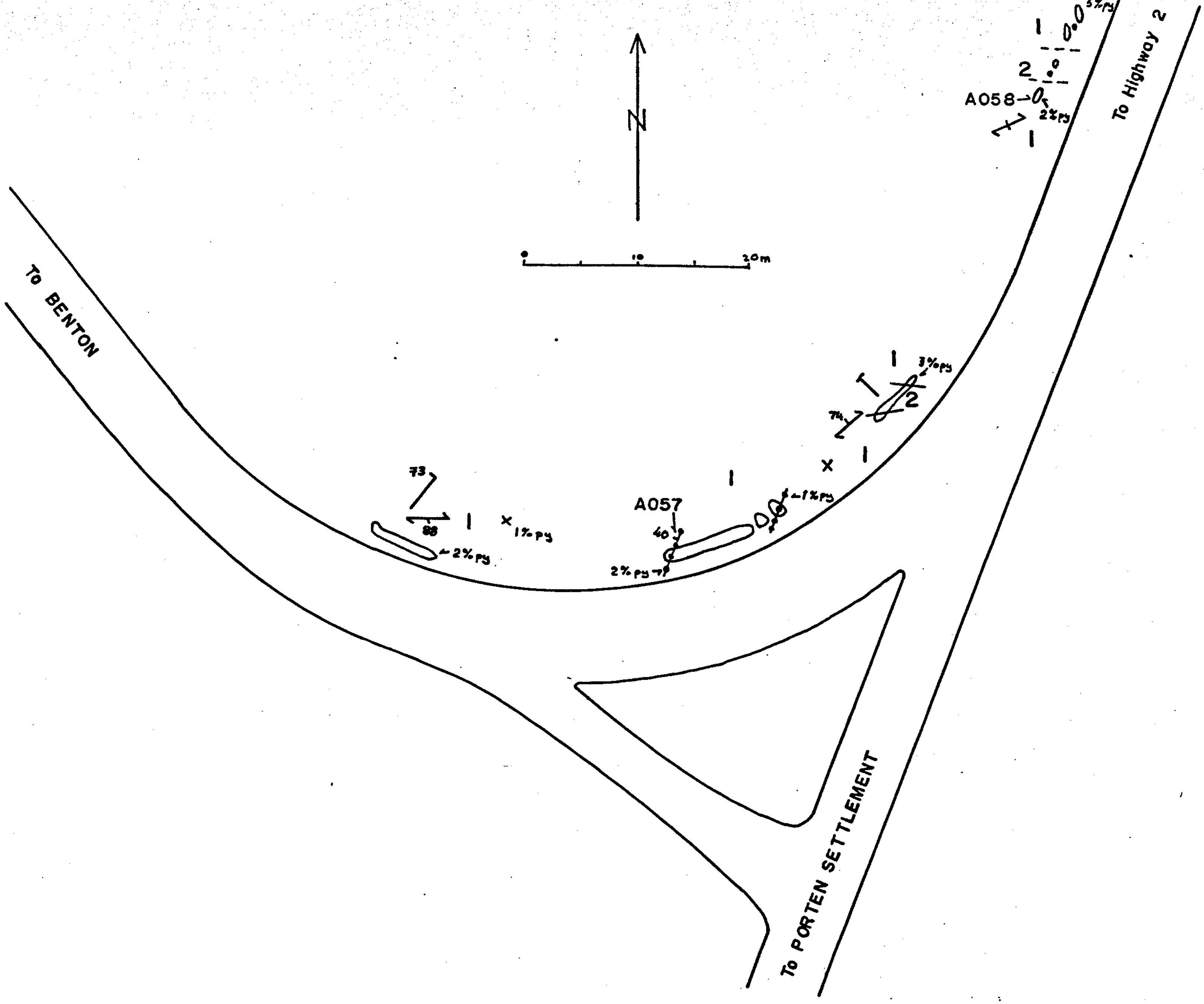


Figure 8.19: Riceville Copper (1:quartz wacke, 2:siltstone).

Mineralization

Up to 5% pyrite occurs mainly as coatings on fractures in silicified metasedimentary rocks and disseminated in quartz veins and in the adjacent wall rock.

Geochemistry

Two samples have been analyzed from this site. A057 is from a 5 cm vuggy quartz vein including some wall rock with 2% disseminated pyrite; it contains anomalous As (32ppm), Ag (1.2ppm), Pb (124ppm) and Bi (2ppm). A058 is from a rusty weathering, silicified quartz wacke with 5% disseminated sulphides; it contains anomalous As (24ppm).

Style of mineralization

Two styles of sulphide (pyrite) mineralization occur here:

1. fracture fillings in silicified metasediments; and
2. disseminated sulphides in quartz veins and the adjacent wall rock.

No copper mineralization was found at this site.

20. Benton Pyrite (Figure 8.20)

Alternate names

Benton copper

Commodity

Copper (?)

Location

UTM 608100mE 5095750mN
Lat:46°00'33" Long:67°36'14"

History of exploration

This occurrence was found and reported by Venugopal (1979) while mapping the area for the New Brunswick Department of Natural Resources.

Access

A road cut on the east side of a logging road near the crest of a steep hill 750 m north from the Caldwell Road is the site of this occurrence.

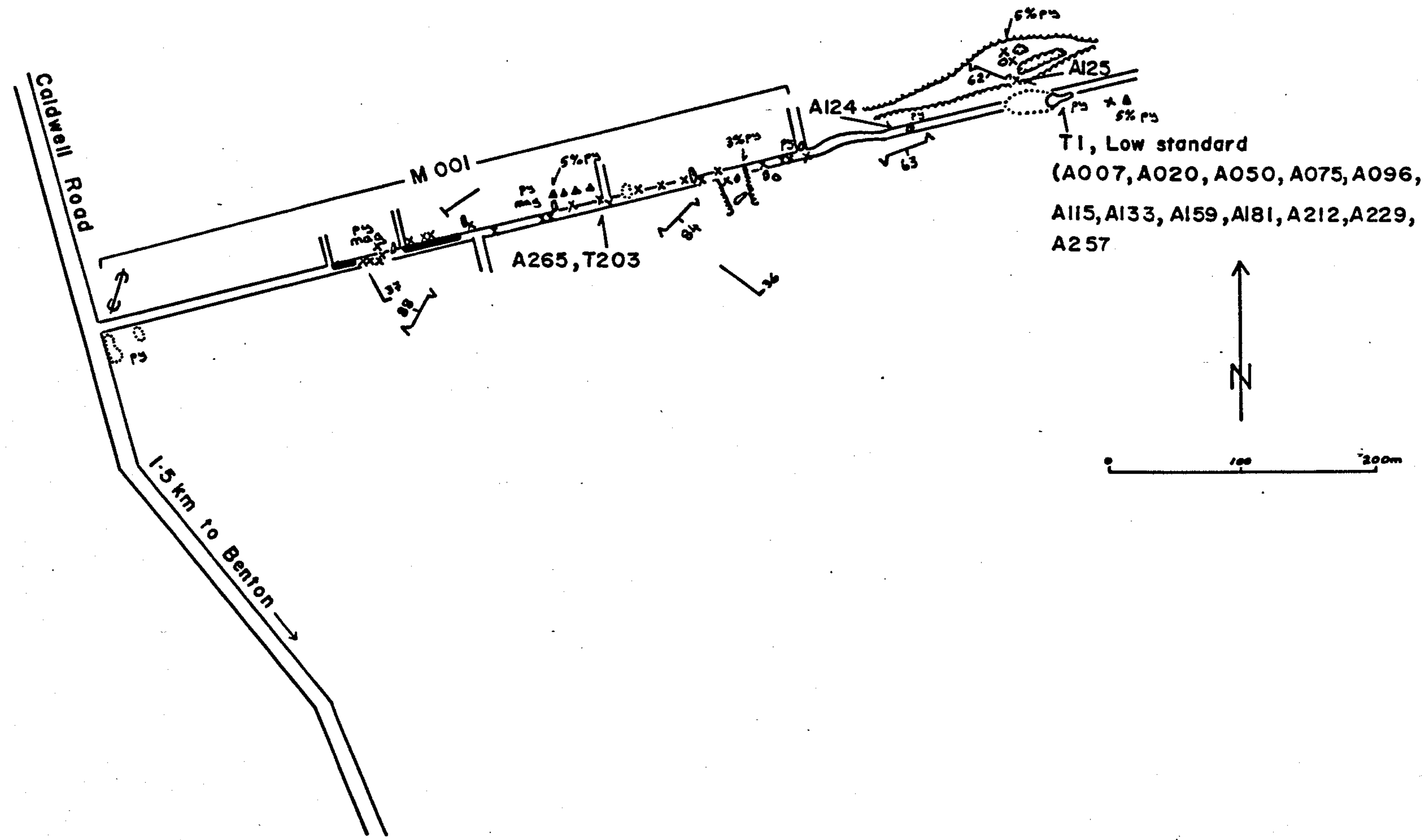


Figure 8.20: Benton Pyrite (▬ :diabase dyke).

Geology

The area is underlain by plagioclase porphyritic granite of the Benton Stock as described in thin sections T1 and T203 (Appendix I) along the road the granite is cut by a 203 m wide east northeasterly trending shear zone. In general, the granite exhibits moderate propylitization and moderate pervasive silicification of the shear zone.

Mineralization

The plagioclase porphyritic granite, as exposed along the logging road, generally contains traces of disseminated fine grained pyrite and magnetite. At the occurrence, the rock contains 2% fine to medium grained euhedral to subhedral pyrite on fractures and disseminated in the rock. Granite float 25 m north of the occurrence contains up to 5% fine, disseminated pyrite.

Venugopal (pers. comm.) described the chalcopyrite as occurring in small spots on fractures.

Geochemistry

A large sample was taken from the occurrence outcrop for use as a low gold field standard. A standard was prepared by breaking the bulk sample into 2 cm diameter fragments, mixing fragments thoroughly and splitting it into sub-samples. Twelve of these sub-samples (A007, A020, A050, A075, A096, A115, A133, A159, A181, A212, A229, A257) have been analyzed. A thin section (T1, Appendix I) also has been examined. The only element that is anomalous in most samples is Ag (average 1.3ppm). One sample, A057 contains 55ppb Au, all others have <1ppb Au. Cu has an average of 22ppm and a high of 120ppm.

Two other samples have been analyzed from this area: A124 is from the shear zone and it is anomalous only in Ag (1.5ppm). A125 is from near the shear zone and it contains 4% pyrite in disseminated clots. It is anomalous only in Ag (1.4ppm).

Note also that the sample M001 is a composite sample taken along the logging road and it is anomalous only in Ag (1.6ppm). A265 which is low in all elements tested is representative of unmineralized granites. It is the same as sample T203 from which a thin section was made (Appendix I).

Style of mineralization

Sulphide mineralization at this site is of two styles:

1. traces of fine disseminated pyrite in granite; and

2. up to 2% pyrite on fractures in sheared granite.

The presence of copper minerals at this location has not been confirmed.

21. Lilly Brook Cu-Mo

Alternate names

Johnson Brook Mo Cu

Commodity

Copper (?), Molybdenum (?)

Location

UTM 610670mE 5099600mN
Lat: 46°02'35" Long:67°34'13"

History of exploration

This area was staked by F.C. Tompkins in 1970, (Geosleuth Mineral Exploration Services, pers. comm.) but no assessment work was filed. The molybdenite occurrence was reported by Venugopal's field assistant and is shown on his map (Venugopal, 1981). Searches by Venugopal and Hattie in 1985 did not find molybdenite, but Venugopal did find a few grains of chalcopyrite (Geosleuth Mineral Exploration Services, Pers. Comm.). Analyses of samples collected by Geosleuth Mineral Exploration Services contained background contents of all metals analysed including Cu, Pb, Zn and Mo.

Access

The area of interest is 600 m up Lilly Brook from the abandoned CPR bridge. It can only be reached on foot.

Geology

Outcrops of medium grey quartz wacke of the Cambro-Ordovician sequence crop out along Lilly Brook in the area of the occurrence. The rock is moderately carbonatized and silicified and slightly chloritized and sericitized. The mineralization supposedly occurs in an area of quartz-calcite vein stockworks. The veins are generally less than 2 mm thick. Some other outcrops in the general area, are of highly fractured to brecciated quartz wacke with fractures filled with quartz. A fine grained amygdaloidal mafic dyke outcrops 130 m southeast of the occurrence. It is moderately chloritized and slightly silicified, but contains no sulphides.

Mineralization

Traces of pyrite are present in quartz-calcite veins and on fractures. Chalcopyrite and molybdenite are reported from this area.

Geochemistry

Two samples, A230 of the quartz-calcite stockworks, and A191 of the mafic dyke have been analysed. Both samples contain above normal Ag (1.0, 0.7ppm), A230 also contains 48ppm Pb and the dyke (A191) has 8ppm Sb and 6ppm U in it. All other elements are at background levels.

Style of mineralization

The only type of sulphide mineralization observed here is pyrite disseminated on fractures and in the associated quartz or quartz-calcite veinlets.

The presence of molybdenite or chalcopyrite has not been confirmed. However alteration (silicification) in the many outcrops along the creek is an indication that Cu-Mo mineralization could be present.

22. Lilly Brook Copper

Alternate names

Commodity

Copper?

Location

UTM 611150mE 5099330mN
Lat: 46°02'28" Long:67°33'50"

History of exploration

This area was staked by F.C. Tompkins in 1970 (Geosleuth Mineral Exploration Services, pers. comm.) but assessment work was not recorded. In 1985 Venugopal (pers. comm.) found traces of chalcopyrite in this outcrop.

Access

The occurrence is in an outcrop on Lilly Brook just above the CPR abandoned railway bridge.

Geology

This site was not investigated. Rocks farther up stream are of Cambro-Ordovician quartz wacke, commonly highly silicified with quartz or quartz-calcite stockworks.

Mineralogy

Traces of chalcopyrite on fractures have been reported by Venugopal (pers. comm.).

Geochemistry

No analyses are available

Style of mineralization

Disseminated sulphide minerals on fractures in quartz wacke have been reported (Venugopal, pers. comm.).

23. Woodstock Copper-Lead

Commodity

Copper, Lead

Location

UTM 610000mE 5111300mN
Lat: 46°08'54" Long:67°34'34"

History of exploration

Bailey (1899) reported that, "In the town of Woodstock itself,.....in digging a sewer, about the year 1896, a quantity of ore, embracing several metallic sulphides, including copper sulphide and galena, was obtained to the amount, it is said, of 500 or 600lbs.". No records of further investigations exist.

Access

The exact location is unknown, however as best as can be determined from the historical records the site is under the community college at the south end of the bridge over the Meduxnekeag River in Woodstock (M. Connell, pers. comm.).

Geology

There are no outcrops near the occurrence. Most maps (Venugopal, 1981; Anderson, 1968) show the area to be underlain by Cambro-Ordovician metasediments. Two areas of Devonian intrusive rock, the North and South Woodstock Stocks lie to the north and south of Woodstock and occur within 1.2 km of the occurrence.

Mineralization

Chalcopyrite and galena was reported by Bailey (1899).

Geochemistry

No analyses were recorded

Style of mineralization

No records exist concerning the style of mineralization.

24. Wetmore Copper

Alternate names

Silvermaque Woodstock

Commodity

Copper

Location

UTM 610480mE 517100mN
Lat: 46°06'39" Long:67°34'15"

History of exploration

The ground was staked by Silvermaque Mining Limited and optioned to Imperial Oil Enterprises in 1969. Imperial Oil Enterprises drilled a hole to the north of the occurrence and intersected chalcopyrite bearing quartz veins in hornfels and quartz monzonite (MacEachern, 1971a).

The occurrence lies on the Woodstock Indian Reserve No.23. A program to evaluate the mineral potential of the reserve did not extend to the Saint John River where the occurrence is located. The program conducted by Indian and Northern Affairs, Canada, involved preliminary evaluation (Resource Associates Ltd., 1972),geophysical ground surveys (horizontal loop and very low frequency electromagnetic and magnetic reconnaissance soil geochemistry for Au, Cu, Pb, Zn and U (Causse, 1983, 1984), detailed soil (B-horizon) geochemistry (Au, Cu, Pb, Zn and U and others), radiometric mapping (Causse, 1985) and 1445 feet of diamond drilling (Beardy, 1986) in shales.

The preliminary geophysical surveys (Causse, 1983) were conducted along the boundaries of the reserve. The magnetic survey identified several weak (100) anomalies and an area of high magnetic relief to the west of the CPR line. The electromagnetic surveys outlined several weak anomalies some of which were coincident with the magnetic anomalies. The soil geochemical surveys (Causse 1984, 1985) produced three coincident Au and base metal anomalies, two of which were coincident with magnetic anomalies. The results of the radiometric survey were not encouraging. The soil geochemical anomalies were drilled. The holes intersected quartz wacke, argillites and one 5-foot band of red micaceous slate. 21 samples selected on their sulphide contents were analysed for Au and 20 trace elements. The best results obtained were 15ppb Au, 1400ppm Zn, 6.7ppm Sb, 33ppm As, and 690ppm Ba.

Access

The occurrence is on the west side of the Saint John River at the Woodstock Indian Reserve No. 23. It is approximately 50 m east of Highway 2.

Geology

The showing consists of several large (to 60 cm diameter) sub angular boulders of white vein quartz and of plagioclase quartz porphyritic tonalite, as well as an abundance of cobble and pebble sized clasts of the same lithologies. This material occurs on the beach with assorted human refuse including cement blocks. The small bluff at the top of the beach is formed in 0.6 to 1 m of lacustrine silt overlying 10+ cm of glaciofluvial sand and pebble gravel.

There are no outcrops on this part of the Indian Reserve. To the south, by the church, there is an outcrop of argillite. To the north the Imperial Oil Enterprises diamond drill hole (No. 8) intersected 24 ft of overburden before entering diabase (MacEachern, 1971a).

Mineralization

The plagioclase quartz porphyritic tonalite float contains up to 2% sulphides, including pyrite and chalcopyrite, disseminated throughout. The quartz vein float contain up to 5% chalcopyrite and malachite.

Geochemistry

Samples of chalcopyrite bearing tonalite (A112) and quartz vein (A113) have been analysed. Both contain anomalous Cu (3200, 910ppm); the tonalite is also weakly anomalous in Se (3ppm) and Mo (7ppm), and the quartz vein in Bi (8ppm).

Style of mineralization

The sulphides occur as disseminations and on fractures in plagioclase quartz porphyritic tonalite and quartz veins.

The large boulders appear out of context with respect to the glaciofluvial pebble gravels and it is thought that the boulders may have been dumped here along with the other human refuse. However inquiries at the Indian Reserve indicated that "the boulders have always been there" (Randolph Paul, pers. comm.).

8.2.4 Vein-Lead

The deposits are characterized by quartz-calcite veins in Cambro-Ordovician metasedimentary rocks. The metasedimentary rocks are commonly chloritized, carbonatized and bleached. Galena occurs as disseminations and on fractures within the quartz-calcite veins. Sphalerite, where present, is associated with galena. Chalcopyrite occurs both within the veins and on fractures in the wallrock adjacent to the veins. Pyrite is associated with galena and chalcopyrite and it is also present on fractures and disseminated in the wall rock.

25. Britton Mine (Figure 8.25)

Alternate names

Shaw and Brittain Mine
Brittan Mine
Briton Mine

Commodity

Lead, Silver

Location

UTM 612610mE 5117320mN
Lat: 46°12'07" Long:67°32'26"

History of exploration

Prior to 1890, during a particularly dry summer, Messrs. Shaw and Britton who lived on either side of a small creek, dynamited the creek bed to form a catchment basin. They reported that, "The rock was full of native silver and gold". A company or syndicate was formed and mining commenced with the sinking of a 180-foot shaft. They shipped 3 or 4 car loads to Swansee England, 1 or 2 to Mapleton, Quebec and one to Nova Scotia (McCallum, 1941b).

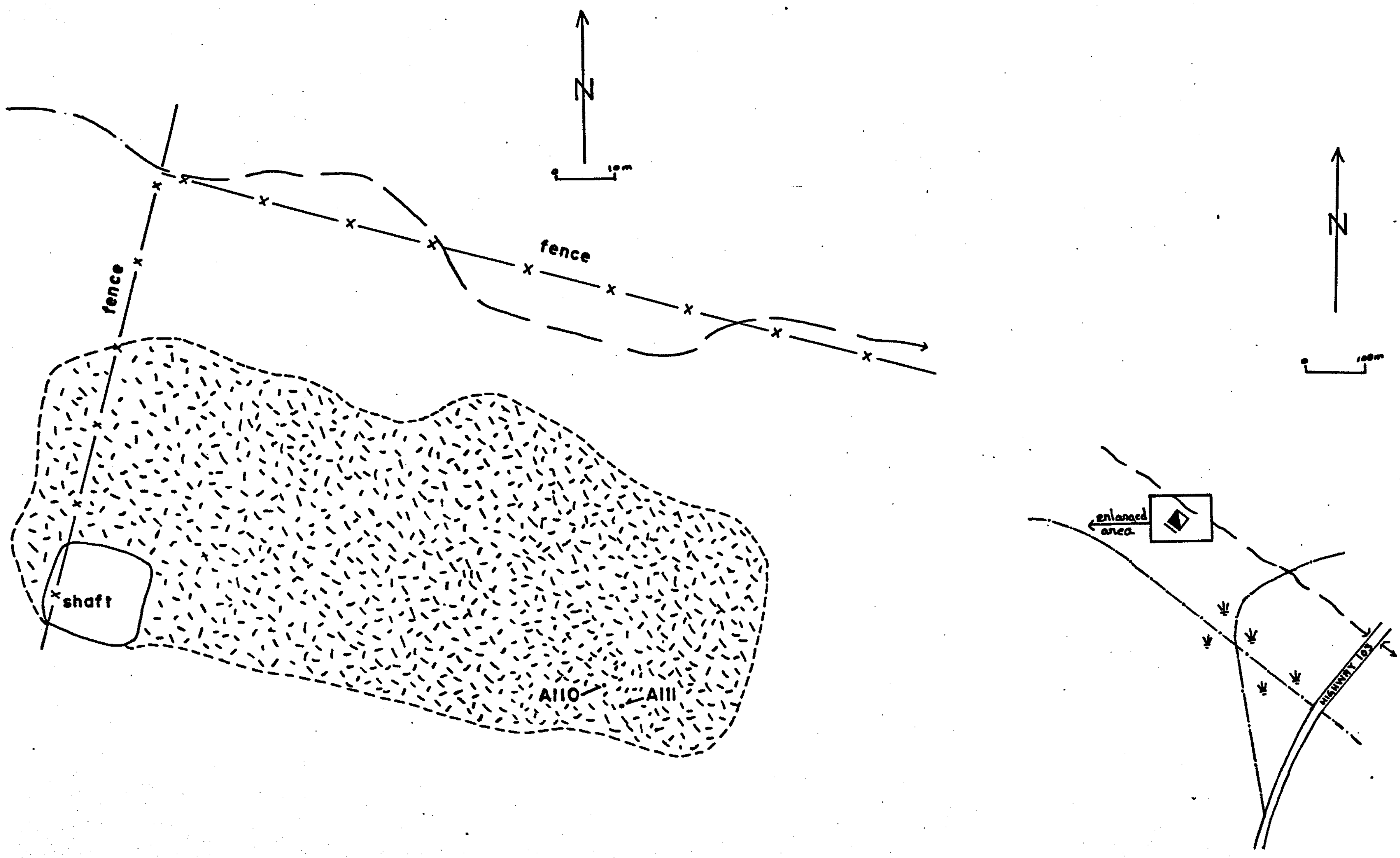


Figure 8.25: Britton Mine.

By 1891, development work was proceeding (Ingall, 1893), but Selwyn (1892) described it as "fruitless efforts" based on several assays of picked specimens. During the winter of 1892 - 1893, operations were suspended (Selwyn, 1895).

Brummell (Selwyn, 1892) reported that in 1890-1891 the shaft was 150 feet deep with 25-foot drifts at the 50-, 100-, 137- and 144-foot levels. The manager claimed to have a four-foot vein at the 144-foot level.

William Parks (1908a,b) drilled a 200-foot hole near the shaft in 1908 but saw nothing of economic interest. Sidwell (1954a) reported that another hole 450 feet deep was drilled around 1920. In 1927, the property was owned by H.G. Noble of Woodstock and optioned to N.A. Timmins Incorporated.

In 1953, Coppercliff Consolidated Mining Corporation staked 18 claims around the Britton Mine and transferred them to Stratmat Limited (Sidwell, 1954a). Only Au, Pb, Ag and Cu could be staked as other mineral rights belonged to the owner. The assessment work filed includes geological mapping, magnetic and electromagnetic surveys and diamond drilling of one hole (182 feet) into an electromagnetic anomaly. Some chalcopyrite occurred erratically in a 10-foot thick (Mississipian?) quartzite, but no analyses are given.

The property was held by Maritime Resource Research Limited (Fredericton) in 1986, but initial prospecting was not encouraging and the ground was dropped.

Access

The shaft is accessible by walking 30 m northeast of a farm road, 120 m northwest from Highway 103. The shaft is 25 m southwest of the creek.

Geology

The 1908 borehole records mention 6 to 14-foot layers of feldspar, feldspar and quartz, and slate (Parks, 1908b). Anderson (1955, 1967) and Venugopal (1981) show the area to be underlain by Cambro-Ordovician metasediments, near the contact with Mississippian sediments. The main lithologies on the waste pile at the shaft are light greenish grey, fine grained quartz wacke and argillite of the Cambro-Ordovician sequence. Most pieces are only slightly altered, but some are moderately silicified and chloritized. Several pieces of breccia containing angular fragments of dark green, chloritized, fine grained quartz wacke in a quartz-calcite matrix were found. Pieces of vein quartz, the supposed host of the "ore" zone, are scarce. One piece that was found is of white milky quartz which had been fractured and healed with clear, glassy quartz. The quartz vein contains traces of calcite on fractures.

Mineralization

Well mineralized samples are rare. The slightly altered quartz wacke contains traces of goethite (probably after pyrite) either disseminated throughout or concentrated on fractures. The breccia contains traces of pyrite in both the quartz wacke clasts and in the milky quartz + calcite matrix. Quartz + calcite vein material contains up to 1% pyrite and galena.

Geochemistry

Two samples of the best mineralized material have been analysed. A110 is of quartz vein with 1% sulphides including visible pyrite, and galena. It contains anomalous Zn (350ppm), As (14ppm), Cd (7ppm), Sb (19ppm),and Pb (1526ppm). A111 is of breccia with quartz + calcite matrix and traces of pyrite; it contains only low anomalous Sb (2ppm). It is surprising that for a supposedly rich, argentiferous galena mine, silver is undetected at less than 0.5ppm.

Analyses reported in the literature are as follows:

	Au	Pb	Ag	Cu
Ingall (1893):				
144ft level	3¼dwts	283lbs	4½oz	9lbs
(2240lbs=1ton)	(4964ppb)	(10.6%)	(125.5ppm)	(0.4%)
144ft level	$0.58	11.4%	$4.62	–
(2000lbs=1ton)	(900ppb)			
elsewhere in mine	4¼dwts	23lbs	Tc	Tc
(2240lbs=1ton)	(6505ppb)	(1.0%)		
Wright (1949b):				
Sample 49-34	0.01oz/ton	–	–	–
Anderson (1968)	(B.L. Shaw and K.E. Shaw, pers. comm.):			
ore	trace	2.5%	4.5oz/t	–
Prince(1987):	<0.01g/t	6-127ppm	<0.1-0.3ppm	25-155ppm

Style of mineralization

Most references describe this occurrence as a vein type of deposit, although McCallum (1941b) mentioned the presence of some sheared material. The mineralization observed during this study was mainly sulphide-bearing quartz veins.

Reported production from this mine varies from five car loads (MacCallum, 1941b) to $250,000 worth of silver (Anderson, 1955; after B.L. Shaw and K.E. Shaw,pers. comm). It is suggested in the literature that the deposit actually was very small but of high grade. The explanation for the lack of mineralized waste being that all sulphide bearing material was mined and shipped.

26. Wright Brook (Figure 8.26)

Commodity

Lead, Zinc, Copper, Silver

Location

UTM 612550mE 5110580mN
Lat: 46°08'29" Long:67°32'33"

History of exploration

The earliest record of this occurrence is a map dated May 14th, 1926 on which is shown the "exposed vein" and an irregular north-northeasterly trending, 6400 feet long line marked "outcrop of metal bearing lode". The plane table survey by Wright and Perry (1931) shows the main pit with several north-south diabase dykes nearby.

According to Anderson (1968) the pit, which constitutes the main showing, and some diamond drilling were completed in 1949. There is no record of this or any other work being completed on this occurrence.

Access

The Wright Brook occurrence is a pit at the crest of the valley wall on the south side of Wright Brook, 350 m from where the Brook crosses the Kilmarnock Settlement Road. It is approximately 90 m south of the Kilmarnock Road from a point 1.85 km southeast along the road from Highway 105.

The second, or eastern, occurrence is in Wright Brook, immediately behind a cabin 60 m southwest from Kilmarnock Settlement Road.

Geology

Rocks exposed in the area are northwesterly striking, west dipping, Cambro-Ordovician quartz wacke and interbedded argillite. At the pit, the quartz wacke is dark green becoming lighter toward the mineralized vein. Generally the rock is slightly chloritized and silicified but towards the mineralized vein, the alteration increases dramatically. At 4 m from the vein (A101) the rock is highly carbonatized, with 1 - 2 cm wide masses of calcite; it is also highly chloritized. At 3 m from the vein (A102) carbonatization and chloritization decreases to

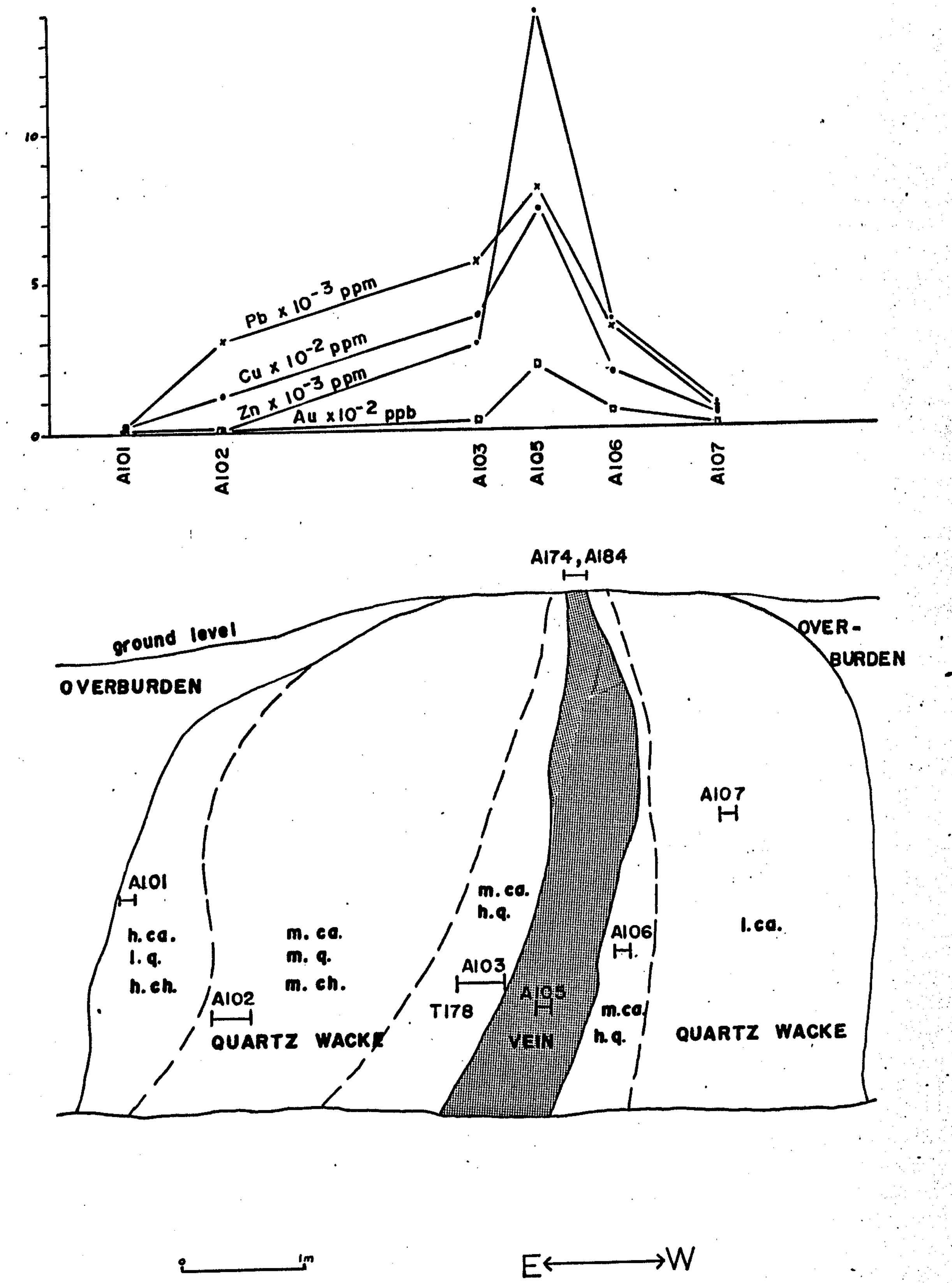


Figure 8.26: Wright Brook -south wall of pit at western occurrence (ca:carbonatization, q:silicification, ch:chloritization, h:high, m:moderate, l:low).

moderate, the former occurring as 2 - 3 cm wide calcite veins and silicification increases with 20% vertical quartz veinlets. At 1 m from the vein (A103) the quartz wacke is highly silicified and moderately carbonatized with quartz and quartz-carbonate stockworks. The mineralized vein (A105) is 40-60 cm wide and occurs on a fault or shear at 175°T dipping steeply east. It is composed of white quartz with up to 25% sulphides. It is highly carbonatized at the hanging wall. The quartz wacke on the footwall (A107) is only slightly carbonatized but locally contains up to 10% sulphides (A106) where highly silicified.

The eastern occurrence is exposed in the bed of Wright Brook and in several large blocks nearby. All rocks at the occurrence are of medium greenish grey, moderately chloritized quartz wacke. In places the rock is highly silicified with abundant 2-3 cm quartz veinlets. Carbonatization is not apparent.

Mineralization

The mineralization at the main occurrence is zoned as follows: 4 m from the vein (A101): traces of pyrite occurs as disseminated, 1 mm cubes. 3 m from the vein (A102): traces of pyrite with 1% galena are associated with calcite veins. 1 m from vein (A103): 1% fine grained pyrite is disseminated in quartz wacke and in quartz and quartz-calcite veins; 1% galena and trace of chalcopyrite, both fine grained, are disseminated in the quartz-calcite veins. The weathered core of the vein (A105) has up to 25% sulphides consisting of about 10% pyrite, 10% galena, 3 - 4% sphalerite and 7% chalcopyrite. In the silicified foot wall (A106) there are 10% sulphides made up of variable amounts of pyrite, galena, chalcopyrite and sphalerite in the quartz veins. The unsilicified foot wall (A107) has traces of disseminated pyrite. A polished section (T178;Appendix I) of the vein contains 2% sphalerite, 1% galena, 1% chalcopyrite, minor pyrite and traces of rutile.

At the eastern occurrence up to 2% pyrite occurs as disseminations in the quartz wacke associated with rutile and goethite. The veins (polished section T182; Appendix I) contain up to 25% sulphides composed of pyrite, chalcopyrite and covellite. Some of the pyrite has been altered to goethite and hematite.

Geochemistry

The zonation of mineralogy at the pit is evident in the geochemistry. Pb varies from 20ppm 4m from the vein (A101) to a maximum of 8350ppm in the vein (A105) and decreases to 445ppm in "unmineralized" foot wall (A107). Other elements from the wall rock samples show similar variations with the maximum values always in the vein (A105) as shown in the following table and in Figure 8.26.

Sample No.	Au*	Cu	Zn	As	Mo	Ag	Cd	Sb	Pb	Bi
A 101	<1	38	140	30	2	1.0	<1	<1	20	<1
A 102	<1	110	75	3.7	<1	1.0	<1	<1	3180	<1
A 103	32	390	2900	40	2	0.7	29	2	5776	<1
A 105	220	760	14000	300	34	2.4	115	5	8350	3
A 106	53	190	3400	52	15	1.0	27	2	3722	<1
A 107	6	52	500	3.4	<1	0.8	2	<1	445	<1

*Au in ppb, all other elements in ppm

A 50 cm chip sample taken across the width of the vein exposed in a surface trench on top of the pit (A174) contains 91ppb Au, 1700ppm Cu, 13000ppm Zn, 86ppm As, 2ppm Se, 16ppm Mo, 3.0ppm Ag, 33ppm Cd, 6ppm Sb, 2ppm Te, 690ppm Pb and 6ppm Bi. A grab sample from the same location (A184) contains 49ppb Au, 600ppm Cu, 940ppm Zn, 44ppm As, 19ppm Mo, 0.8ppm Ag, 12ppm Cd,4ppm Sb, 5150ppm Pb and 2ppm Bi.

Two mineralized boulders at the eastern occurrence were sampled, one was analysed in duplicate as samples A108, A116, the other as A109. They contain an average of 843ppm Cu, 360ppm Zn, 2.2ppm, Ag, 2ppm Cd, 290ppm Pb and 3ppm Bi. Other elements are at background levels.

A rusty red weathering green slate, exposed nearby on the Kilmarnock Settlement Road (A260) contains anomalous As (8.6ppm), Ag (1.2ppm), and Cd (7ppm). Other analyses reported in the literature, presumably from the pit area are:

	Au	Cu	Zn	Pb
Wright (1939b):	0.01oz/ton	0.47%	3.51%	1.46%

Style of mineralization

The wright Brook occurrence is a north-south trending, steeply dipping sulphide-bearing quartz vein hosted in quartz wacke. The metallization, including Au, Cu, Zn, Ag, Pb with associated As, Cd, Mo, Sb and Bi, is directly related to the degree of veining. Highest metal contents occur in the vein and decrease away from it.

27. Dominion No. 1 (Figure 8.27)

Commodity

Lead, Zinc, Copper

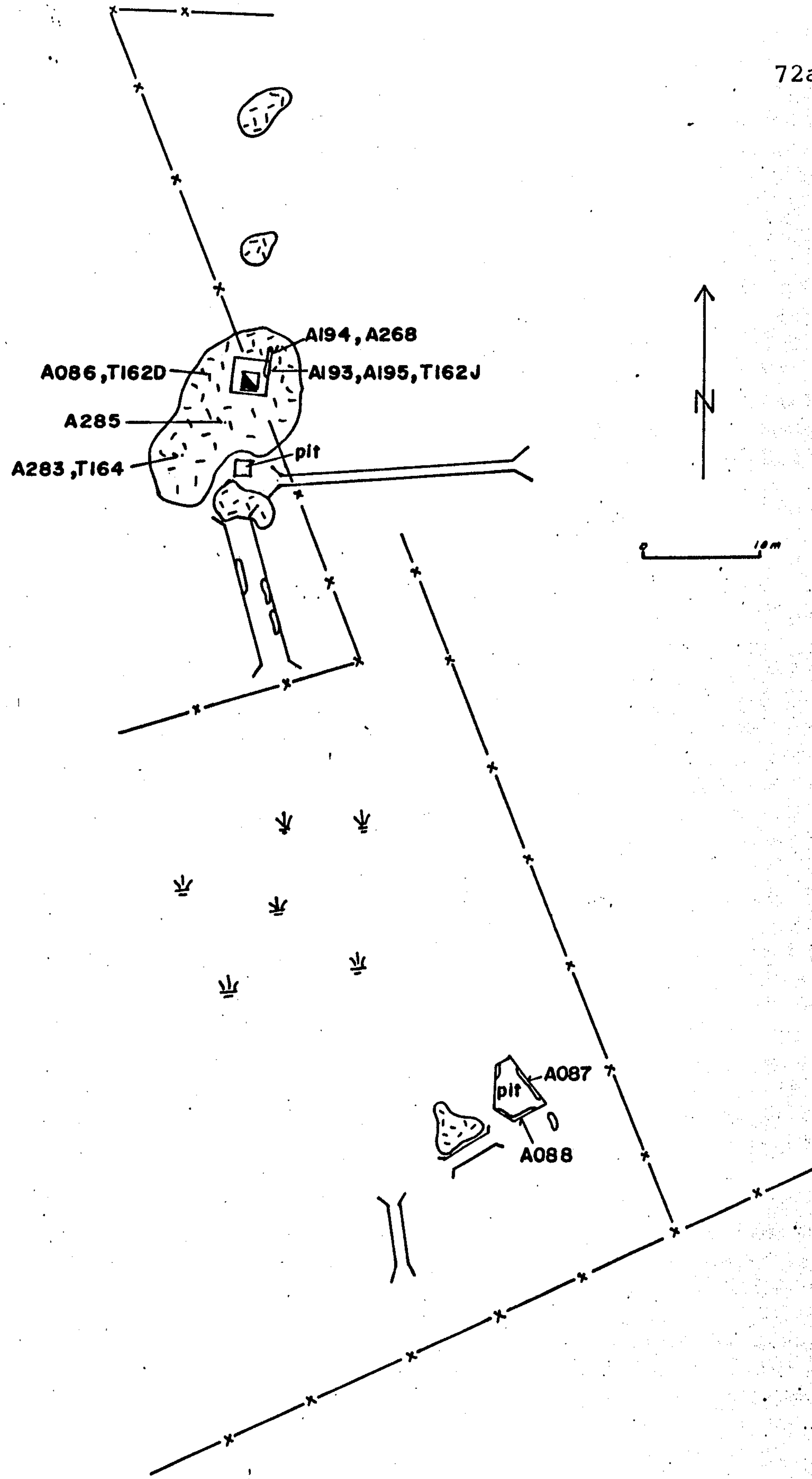


Figure 8.27: Dominion No.1.

Location

UTM 611650mE 5108850mN
Lat: 46°07'33" Long:67°33'18"

History of exploration

The occurrence was discovered by John McClement and Edward Greer of Woodstock, the same year (1905-1907) that they discovered the Cobbler-Sexton (Greer, 1939). A syndicate, headed by H.G. Noble of Woodstock was formed and by 1926, a pit 12 feet deep, a shaft 20 feet deep and some surface trenching had been completed. In 1926 the property was visited by Claudet (1926b) of the Canadian Pacific Railway, who recommended surface stripping. This was partially completed by the end of the year with the discovery of the vein, at the contact of the slate and quartzites, 60 feet and 150 feet from the shaft.

In late 1926, the property was optioned to N.A Timmins (1938) Limited and a contract was given to deepen the shaft to 100 feet (Pare, 1942b). The shaft was abandoned at 56 feet because of disappointing results and unsatisfactory performance of the contractor (Pare, 1942b; McMullen, 1927).

A survey of the workings (Wright and Perry, 1931) in 1931 shows the shaft, pit, and some 250 feet of trenches.

In 1939, the property was acquired by Hatfield-Kyle Ltd. Two X-ray diamond drill holes were drilled and the shaft was de-watered (Wright, 1940). A 422 pound sample from the shaft was submitted to Ore Dressing and Metallurgical Laboratories (1940) and the ore was determined as being amenable to concentration by floatation.

In 1948, Kayrand Mining and Development Corporation Ltd. optioned the property and completed trenching, stripping and a 10-hole program of diamond drilling .

In 1968, Falconbridge Nickel Mines Ltd. held a large block of claims which included the Dominion No.1 occurrence (Lockhart, 1969). The subsequent magnetometer survey (Lockhart, 1970a) had a northerly trending fabric near this occurrence. A vertical loop electromagnetic survey across the occurrence obtained a good response with high and low frequencies which were interpreted as a shallow, narrow, vertically-dipping mineralized zone (Lockhart, 1971a). Geological mapping and soil (B-horizon) geochemistry was completed, the latter showED an anomaly in copper and zinc of limited extent and magnitude over and near the OCCURRENCE (Lockhart, 1971b). No further work was done over this part of the claims even though the area was again staked by Omni Mines (Buchanan, 1974).

Recently 4 claims covering the Dominion No. 1 occurrence were staked by R.A. Mann (1985) in February 1983. Detailed soil (B-horizon) geochemistry (Cu, Pb, Zn, Ag, Au) was completed over the occurrence by Noranda Exploration Company Limited. The zinc results, and to a lesser extent the Ag and Cu results indicateD a north-trending zone with a probable strike length of 800 m. The claims have since been dropped. When visited in 1986 the shaft was blocked at the 9 meter level and was flooded; several trenches are still evident.

Access

The workings are accessible by means of a farm road which leaves Highway 105, 4.2 km south from the Grafton bridge. The shaft is located on the south side of a field 300 m behind the last farm house.

Geology

The mineralized zone as described by Wright (1940) from examination of the shaft occurs in a quartz vein developed in a fault. The fault on which considerable movement has taken place strikes north and dips 70° southwest and is confined to argillite except near the top of the shaft where it has juxtaposed the quartz wacke and argillite. The sediments strike 020°T and dip 70° northwest, opposite to that of the fault.

Both the quartz wacke and argillite are exposed at the head of the shaft; the contact is highly mineralized and silicified. The argillite is medium greenish grey, very finely laminated and is highly fractured. The quartz wacke is light to medium green, medium grained and weathers brownish grey. Both rocks are bleached, chloritized, carbonatized and silicified.

In the trenches to the south, only the quartz wacke is exposed. It is finer grained than at the shaft, and is highly silicified by stockworks of 1 - 8 mm quartz veinlets. Generally it is not carbonatized, but where quartz-calcite veins are present, sulphide minerals (mainly up to 2% pyrite) are present.

Mineralization

According to Wright (1940) the quantity of mineralization varies considerably within the vein and breccia zones along the fault. The mineralized zone is from 12 to 48 inches wide with an average of 36 inches, and widens considerably in the argillite.

Three sample have been examined in polished section: T162D (analysed as A086) is from the waste pile and is of a quartz vein with massive sulphides. It contains 60% pyrite, 25% sphalerite, 10% chalcopyrite and 5% galena. Sample T162J (analysed as A195) is a quartz vein from the contact of the argillite and quartz wacke at the head of the shaft. It contains 10-15% pyrite, 1-2% sphalerite, 1% galena and traces of chalcopyrite. T164 (analysed as A283) is a sample of quartz-calcite vein in quartz wacke. The vein contains 15% sphalerite, 5% galena, 4% pyrite and 1% chalcopyrite.

In 1940 six polished sections were prepared from the bulk sample taken from the bottom of the shaft, and examined by the Ore Dressing and Metallurgical Laboratories (1940). They reported that the gangue is greyish white quartz with considerable included carbonate. The metallic minerals present, in order of abundance, were: sphalerite, pyrite, galena and chalcopyrite. The report noted that the sphalerite is the dark, iron rich, variety.

Geochemistry

Nine samples including one duplicate, have been analysed from this occurrence. Sulphide-rich quartz vein samples selected from the waste pile (A086, A283) contain an average of 14ppb Au, 343ppm Cu, 9,130ppm Zn, 2.9ppm Ag, 36ppm Cd, 4630ppm Pb and 4ppm Bi. A193 and A195 are of mineralized vein material from the head of the shaft. The former contains 2% sulphides and anomalous Cu (470ppm), Mo (7ppm), Ag (0.7ppm), Pb(188ppm) and Bi (2ppm); the latter contains 15% sulphides and anomalous Cu (10000ppm), Ag (2.0ppm), Cd (68ppm), W (5ppm), Pb (17405ppm) and Bi (9ppm). Argillite from the shaft (A268, A194 duplicate) and from the waste pile (A285) contains anomalous (average) Zn (340ppm), Ag (1.1ppm), and Pb (147ppm). The quartz wacke with 2% quartz-calcite veins from the trenches 55m to the south of the shaft (A087, A080) are anomalous in Zn (up to 270ppm) and Pb (up to 122ppm).

Other analyses reported in the literature are:

	Au oz/t	Ag oz/t	Cu %	Pb %	Zn %
G-241 (J.T. Donald, 1926):	0.01	0.30	0.69	11.99	17.61
G-1918 (J.T. Donald, 1926):	0.005	0.445	-	15.11	18.58
G-78 (J.T. Donald,1926):	0.02	0.74	1.06	10.59	9.12
Selected samples from dump: Bishop and Wright (1939):	0.01	-	2	12.5	15.26
	-	-	0.29	18.22	-
	0.02	-	7.2	-	-
Pare (1942b): Sample from Noble:	0.003	(.39)	-	6.97	8.9
3'9" channel sample of vein in shaft @ 26' depth:	Trace	(.05)	-	1.71	3.24
Claudet (1926) across 3',in shaft at 15' depth:	Trace	0.2	0.4	7.14	5.58
Wright(1939b,1940) and Kyle (1939b:)	0.10	5.00	3.44	1.57	8.00
12lbs of vein from shaft: Wright (1940): fair sample from dump:	0.0001	-	7.2	18.2	15.2
Ore Dressing and Metallurgical Laboratories (1940) 422 lbs sample:	0.005	1.00	0.57	5.16	7.53
National Mineral Inventory files Kayrand Mining and Development Corp. from dump:	Trace	Trace	-	16.61	19.40
3000 ft from shaft:	-	-	-	3.78	1.13

Style of mineralization

Lead and zinc with associated copper and silver metallization is present in quartz-calcite veins and breccia zones on a northerly-trending fault cutting Cambro-Ordovician argillite. Sulphide minerals (galena, sphalerite with chalcopyrite) are restricted to the vein and their distribution within the vein is highly varied. Gold values are low (<1 to 14ppb).

28. Frazer and Briggs Pb-Zn-Cu (Figure 8.18)

Alternate names

Lower Northampton Zn, Pb, Cu

Commodity

Lead, Zinc, Copper

Location

UTM 613800mE 5097840mN
Lat: 46°01'35" Long:67°31'48"

History of exploration

In the early 1950s A.A. Fraser and M.A. Briggs of Plaster Rock, N.B. staked claims and completed surface prospecting, trenching and diamond drilling. They optioned the claims to I.C. Stairs of Meductic who intended to carry out geophysical work but was unsuccessful in his first attempt because of power line interference (Stairs, 1955). There is no record of further work on these claims.

Access

The mineral occurrence was intersected in a drill hole. Any surface workings in the area would now be flooded by Mactaquac head pond.

Geology

The log of drill hole no. 2 records 18 feet of overburden, overlying 94 feet of grey quartzite (Stairs, 1955). The quartzite is the Cambro-Ordovician quartz wacke probably similar to that exposed nearby along Highway 105 as described above (see 18. Lower Northampton Copper).

Mineralization

The upper part of the quartzite (18-52 feet) contains scattered stringers of sphalerite, galena and chalcopyrite; below 52 feet some small specks of pyrite and galena were reported (Stairs, 1955).

Geochemistry

No analyses were reported, Stairs (1955) considered the mineralization of no commercial value.

Style of mineralization

The drill hole log describes the mineralization as stringers. From other occurrences nearby, this can be interpreted as sulphide bearing quartz veinlets or fracture fillings.

29. Tompkins Prospect (Figure 8.18)

Commodity

Lead, Zinc

Location

UTM 613520mE 5098570mN
Lat: 46°01'59" Long:67°32'01"

History of exploration

The area was staked about 1965 by F. Carvell Tompkins of Lower Woodstock. Surface prospecting and trenching revealed sphalerite, galena and chalcopyrite mineralization in quartz veins (Tompkins, 1965). The occurrence was drilled in 1967 (Bugle, 1967). No further work was done although the deposit was "rich" (Tompkins, pers. comm.).

Access

The trenches are now flooded by Mactaquac head pond.

Geology

There are no records on the geology of the occurrence, however it is presumed to be in Cambro-Ordovician metasediments.

Mineralization

Tompkins (1965) map shows three mineralized outcrops, one of which are noted as containing Cu-Pb. The trench by the Saint John River was noted as containing Cu-Pb-Zn. The first drill hole intersected "ore" containing Cu, Pb, Zn and Ag from 40-80 feet deep and was finished in "ore" (Bugle, 1967). Tompkins (pers. comm.) remembers the mineralization as occurring in "heavy quartz" (Bugle, 1967).

Geochemistry

The Bugle (1967) reports that surface samples taken prior to drilling contained 8.2% Zn, 4.2% pB, 0.5% Cu and 0.72 oz/ton Ag.

Style of mineralization

The lead, zinc and associated copper, silver and pyrite mineralization is in quartz veins (Tompkins, pers. comm.) probably hosted in Cambro-Ordovician metasediments.

30. Lilly Brook Lead

Alternate names

Johnson Brook Pb

Commodity

Lead

Location

UTM 610980mE 5099400mN
Lat:46°02'28" Long:67°33'59"

History of exploration

The only record of this occurrence is a sketch map by Potter (1967c).

Access

The occurrence is accessible by an overgrown road. It is located 245 m west of the CPR (abandoned) bridge over Lilly Brook and is 90 m south of Lilly Brook (Potter, 1967c).

Geology

There are no outcrops at the location shown on Potter's map. A nearby float sample (A232) is of medium grey, weathering beige, Cambro-Ordovician quartz wacke. The rock is bleached and is cut by numerous 1-2 mm wide quartz-calcite stringers containing traces of pyrite. Approximately 100 m south is an outcrop (A233) of a fine grained mafic dyke which is chloritized and silicified with 1 mm quartz stringers and contains 5% disseminated fine pyrite. Outcrops along Lilly Brook are of quartz wacke and argillite which strike northeasterly and dip steeply west. In places (A231, A232) the quartz wacke is cut by numerous 1 mm quartz stringers. Calcite stringers containing traces of pyrite are also present.

Mineralization

Pyrite in calcite veins and disseminated in the mafic dyke was the only sulphide mineral seen . Geosleuth Mineral Exploration Services, Ltd. (pers. comm.) reported traces of pyrite in brecciated quartz wacke with quartz stringers and calcite fracture fillings adjacent to an amygdaloidal basalt outcrop along Lilly Brook. Potter (1967c) reported the occurrence of galena.

Geochemistry

Trace metals in the three samples submitted (A231, A232, A233) are low. Ag (1.1ppm) is anomalous in the mafic dyke (A233).

Style of mineralization

- Two styles of mineralization are present:

1. disseminated pyrite in mafic dykes; and
2. pyrite in calcite veins in quartz wacke.

Neither lead nor any other base metal mineralization has been confirmed at this site.

31. Grafton Pyrite (Figure 8.31)

Alternate names

Grafton lead

Commodity

Copper, Lead, Gold(?)

Location

UTM 610700mE 5110000mN
Lat: 46°08'11" Long: 67°34'01"

History of exploration

Venugopal (1981) described in detail the three intrusive breccia dykes that occur in this road cut. In Phase I of this project, the site was visited and a pyrite bearing breccia zone was located (Geosleuth Mineral Exploration Services). Because of the variable alteration exhibited by the rocks in this road cut, it was studied in some detail in the field by R. Thomas and minor galena was found.

Access

The occurrence is in a road cut on the east side of Highway 105, 3.2 km south of the Grafton Bridge

Geology

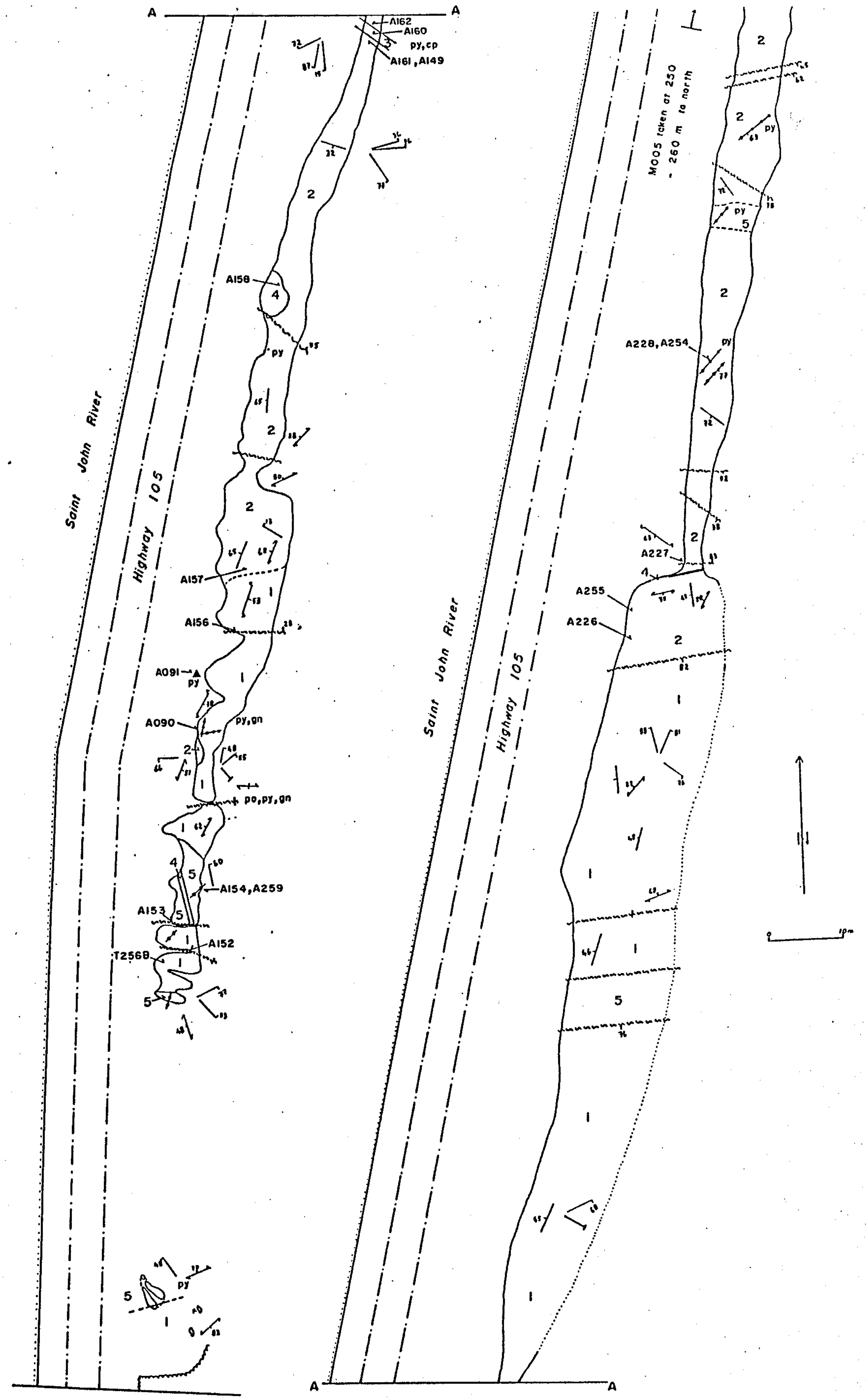


Figure 8.31: Grafton Pyrite (1:predominantly quartz wacke, 2:predominantly argillite, 3:porphyritic tonalite, 4:intrusive breccia, 5:brecciated metasediments).

The rock exposed in the road cut is Cambro-Ordovician quartz wacke and argillite which strike north-northeasterly and dip steeply west. The quartz wacke is medium greenish grey, fine grained and bedded in units of a few centimeters to 2m thick. Thin section T256 (Appendix I) shows it to be made up predominantly of subrounded fine grained quartz (65%) and feldspar (15%). The argillites are medium to dark greenish grey, in units 20 to 50 cm thick, exhibiting a well developed cleavage.

The metasediments are cut in places by intrusive breccia dykes (as described by Venugopal, 1981) and one 2-3 cm wide dyke of highly chloritized fine grained porphyritic tonalite. The latter is composed of 5% rounded quartz eyes to 4 mm, 15% plagioclase laths to 3 mm, 70% very fine grained matrix, and 10% fine, disseminated pyrite. It is moderately silicified by 1-2 mm, subhorizontal quartz stringers. The argillite wall rock is schistose and brecciated for 20 cm on either side of the dyke; the quartz wacke wall rock is not significantly altered but in places the fractures in it are filled with 2 mm thick seams of massive pyrite.

The metasediments show variable alteration. In general the argillite is slightly altered to hornfels and both lithologies are chloritized and slightly carbonatized except at the north end of the road cut where the rocks are moderately carbonatized with calcite on fractures. Sericite may be present on fractures in argillite. In places the rock is silicified by 1 - 2mm quartz veinlets in subhorizontal arcuate zones. The intensity of silicification increases downwards and as it increases calcite veinlets are present. The abundance of sulphide minerals increases downwards and in some places, specks of galena and chalcopyrite occur in the most intensely altered rocks at the base of the road cut.

The rocks are commonly fractured and in places brecciated. Several shear zones up to 5 m wide, some with 2-10 cm mylonitic cores, are present in the section. The shear zones all dip steeply and strike east-west and north-south, the latter direction being parallel to the road cut and the Saint John River.

Mineralization

Pyrite is disseminated or in blebs on fractures associated with quartz and calcite veinlets, in shear zones, in breccia zones, in intrusive breccias, in the tonalite dyke and the adjacent wallrock. Traces of galena and chalcopyrite occur as fine, disseminated grains in calcite veinlets only in the most intensely silicified rocks.

Geochemistry

Argillites were sampled at four sites: A255 is of relatively unaltered, unmineralized argillite; it is slightly anomalous in Ag (1.3ppm), Sn (6ppm), Sb (2ppm) and W (5ppm). A157 is of slightly silicified and sericitized argillite with no visible pyrite but with some rusty weathering patches; it contains anomalous As (46ppm), Ag (2.4ppm), and slightly anomalous Cd (2ppm), Sn (8ppm), Sb (4ppm), and U (6ppm). A228 and A254 (duplicate) are of very rusty weathering slightly silicified, argillite with traces of pyrite as scattered 1 mm seams on fractures; they contain anomalous (average) Cu (620ppm), As (23ppm) and Se (13ppm) and low anomalous Au (5ppb), Ag (0.7ppm), Sb (4ppm) and Bi (3ppm). A226 is of highly silicified, moderately sericitized and carbonatized argillite with 5% pyrite associated with quartz and calcite veins; it contains anomalous Au (14ppb), As (1300ppm), Ag (1.1ppm) and Sb (19ppm).

Silicified quartz wacke with 2-5% coarse pyrite (A090 contains anomalous Cu (300ppm), As (28ppm), Ag (1.1ppm), Sb (13ppm) and Pb (40ppm). A sample of a breccia dyke with 10-20% coarse pyrite at the same site (A091) contains anomalous Cu (280ppm), As (22ppm), Ag (0.8ppm), Sb (2ppm), W (7ppm) and Bi (7ppm). A 4 m diameter, intrusive breccia pipe (A158) with traces of pyrite contains anomalous Pb (187ppm) and slightly anomalous Au (6ppb), As (7ppm), Ag (1.5ppm), Cd (2ppm) and Sb (3ppm).

A sheared to brecciated quartz wacke composed of angular fragments of quartz wacke in a calcite matrix with traces of pyrite (A227) contains anomalous Mn (5900ppm). The mylonitic core of a shear zone comprised of 50% vein quartz (A156) is anomalous in Li (72ppm), As (40ppm), Ag (1.0ppm), Cd (2ppm), Sb (3ppm), and Pb (57ppm). A highly chloritized, moderately sericitized shear zone in quartz wacke with traces of pyrite (A152) contains anomalous Au (7ppb), Li (160ppm), V (402ppm), As (76ppm), Ag (1.8ppm), Cd (2ppm), Sn (7ppm), Sb (7ppm) and U (6ppm). A quartz vein with no visible sulphides, in a shear zone 1 m to the north (A153) contains anomalous As (210ppm), Pb (70ppm) and Sb (4ppm). An adjacent quartz vein in the quartz wacke (A154, A259 duplicate) contains traces of pyrite and anomalous (average) Au (8ppb), As (20ppm), Ag (1.2ppm), Sn (11ppm), Sb (3ppm), W (5ppm) and Bi (3ppm).

The porphyritic tonalite dyke (A160) contains anomalous Au (19ppb), V (493ppm), Cu (260ppm), As (9.8ppm), Sb (2ppm), Te (33ppm), W (7ppm) and Bi (122ppm). The highly chloritized and silicified schistose argillite wall rock (A149, A161 duplicate) contains anomalous (average) Au (9ppb), V (448ppm), Cu (210ppm), As (16ppm), Se (1.5ppm), Ag (1.2ppm), Te (10ppm), W (10ppm) and Bi (42ppm). The relatively unaltered quartz wacke wallrock with

2 mm seams of massive pyrite on fractures (A162) contains anomalous Au (94ppb), Co (79ppm), Ni (90ppm), Cu (520ppm), As (160ppm), Se (12ppm), Ag (1.6ppm), Cd (2ppm), Sb (6ppm), Te (3ppm), W (16ppm), and Bi (12ppm).

Style of mineralization

The types of pyrite mineralization present are:

1. pyrite-bearing fracture fillings in argillites with associated silicification and carbonatization containing anomalous As, Ag, and Sb with variably anomalous Au, Cu, Se and Bi;
2. disseminated pyrite in intrusive breccias containing low anomalous values in one or more of the following; Au, Cu, As, and Pb;
3. disseminated pyrite in shear zones and associated quartz veins containing anomalous As with variably anomalous Au, Li, V, Ag, Cd, Sn, Sb, W, Bi, Pb and U; and
4. disseminated pyrite in porphyritic tonalite dykes and on fractures in adjacent wall rock containing anomalous Au, V, Cu, As, Te, and Bi with weakly variably anomalous Au, Sb, Co, Ni, Se, Cd and W.

The highest Au values from the Grafton pyrite occurrence are derived from the tonalite dykes and pyrite filled fractures in the adjacent wallrock.

8.2.5. Vein-Gold

All known gold occurrences in the area are in quartz veins. Two are along the Saint John River and they are associated with the Gibson Stock, the other is known from boulders associated with the southwest contact of the Benton Stock.

32. Upper Northampton Gold (Figure 8.32)

Commodity

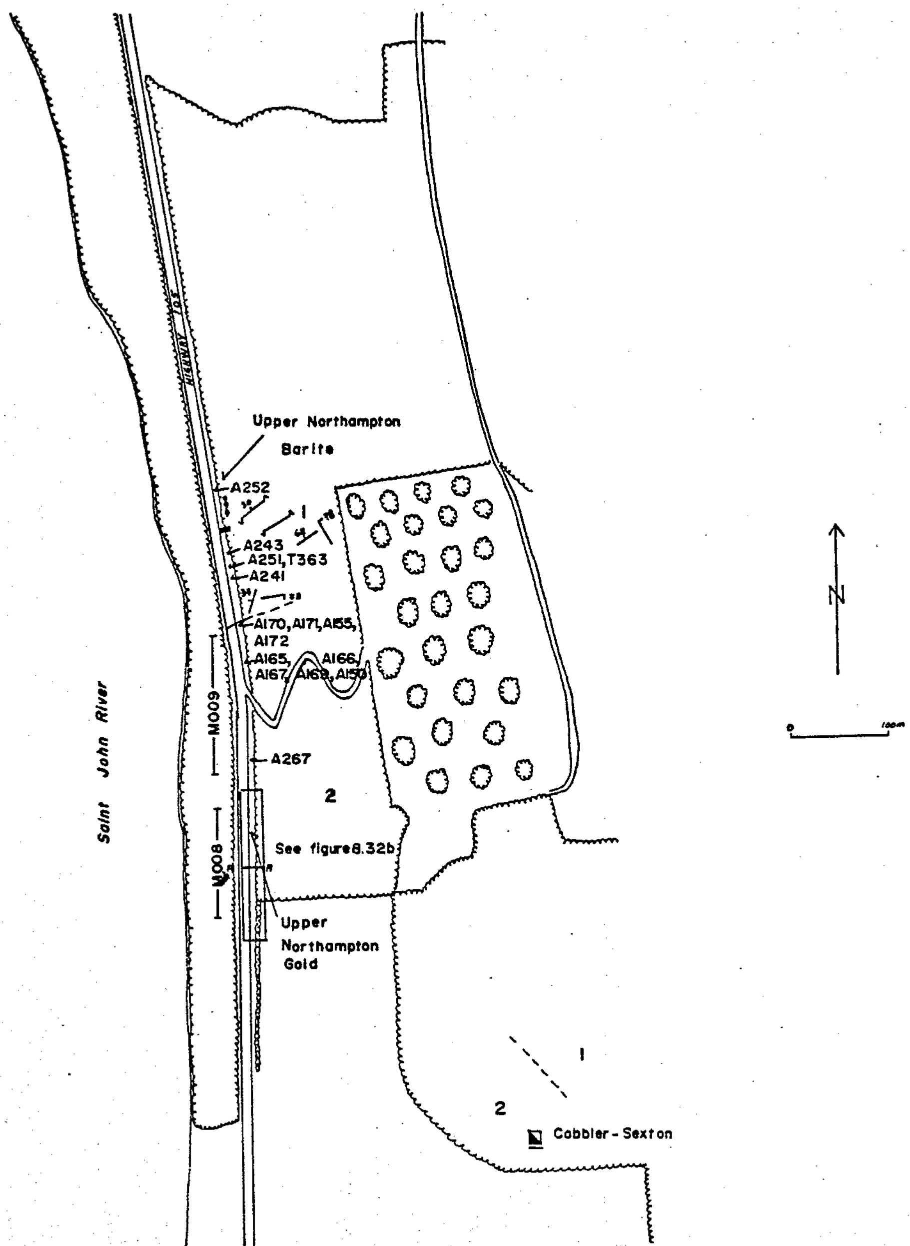
Gold (lead, copper, zinc)

Location

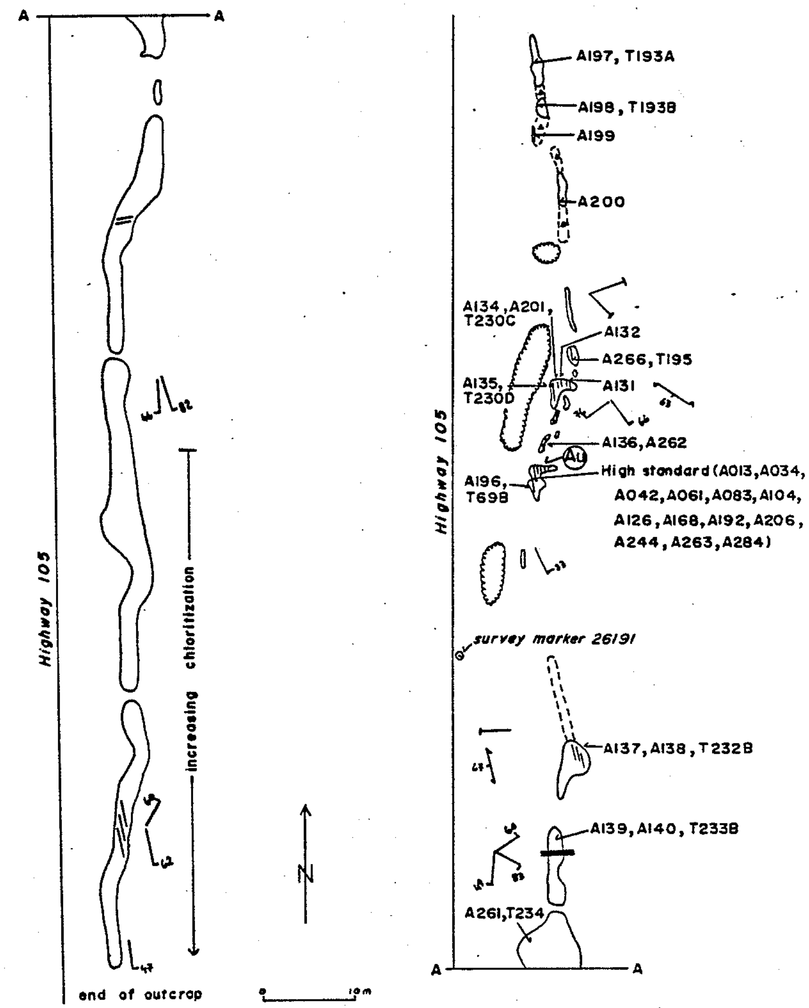
UTM 612210mE 5104820mN
Lat: 46°05'24" Long:67°32'57"

History of exploration

In the late 1960's and early 1979's this area was staked by Phelps Dodge Corporation of Canada, Limited, Falconbridge Nickel



a: General area (1:metasediments, 2:Gibson Stock, ▬:diabase dyke).



b: Detail (all outcrops of Gibson Stock, ▬:diabase dyke, ≡ quartz veins).

Figure 8.32: Upper Northampton Gold.

Mines, Ltd. and Omni Mines Limited but the reported assessment work did not cover this occurrence. The ground has recently (1986) been staked by Merton Steward of Douglastown, N.B. who has completed assessment work, but none is filed . Merton Steward (pers. comm.) identified this occurrence as containing good gold values.

Access

The occurrence is in a road cut on the east side of Highway 105, 8.5 km south of the Grafton Bridge. It is 30 m north and 15 m east of New Brunswick Department of Highways survey marker 26191.

Geology

The auriferous quartz veins form a 2 m wide zone striking 173°T, in quartz-plagioclase porphyritic tonalite. The latter has been described in the field as a quartz eye porphyry; it is medium greenish grey, weathers dark greenish grey, and is characterized by 10-20% rounded quartz eyes to 9 mm diameter. It has been described in thin section (T230D; Appendix I) in which intense propylitic alteration is evident. Mineralogically it is made up of 55% plagioclase, 30 % quartz, 10% chlorite (after biotite ?) and 5% opaques.

Veins of white milky quartz constitute 60% of the rock over the 2 m zone. Individual veins are 1-35 cm wide and can be followed for several meters before being covered by slumped rock debris. The veins are predominantly subparallell at 169°T and dipping 70°E. Some smaller veins (<2 cm wide) occur at 145°T and dipp 40°NE. The quartz veins occur in a shear zone.

This road cut affords a good cross-section through this part of the Gibson Stock and several phases of the stock as well as its contact with the Cambro-Ordovician sediments are exposed. Both the porphyritic tonalite and fine grained tonalite, are cut by an intrusive breccia of fine grained tonalite in medium grained porphyritic tonalite and their contacts are exposed 50 m to the north. These rocks have been described in section 7.2.5 and in thin sections T116, 116a, 192, 195, 230d, 234, 237, 360, 366 and 367 (Appendix I). A dyke of amygdaloidal basalt (T233B; Appendix I) intrudes the fine grained tonalite phase of the Gibson Stock, 75 m to the south.

Mineralization

The sulphide mineralization is concentrated in the quartz veins; 4% disseminated sulphides are present in the porphyritic tonalite adjacent to the vein (T230C) whereas up to 20% sulphides occur in the veins (T232B).

The mineralogy of the disseminated sulphides in the porphyritic tonalite, has been studied in four polished sections. T230C (Appendix I), which is representative of the wall rock 1-2 cm from the auriferous zone, contains 4% disseminated sulphides composed of 2.5% euhedral pyrite and 1.5% goethite after pyrite. Traces of rutile are disseminated through the section. Polished section T195 (Appendix I) is from a point 15 m north of the main auriferous vein, in plagioclase porphyritic tonalite (see thin section, T195; Appendix I) with abundant quartz veinlets oriented at 130°T. The tonalite contains 2% pyrite with traces of galena, chalcopyrite and pyrrhotite. Chalcopyrite and galena commonly occur as coatings or in fractures in pyrite. T193A (Appendix I) is of fine grained tonalite and contains 1% disseminated sulphides composed of equal amounts of pyrite and chalcopyrite; traces of goethite after pyrite and chalcopyrite, and traces of rutile are also present. T193C is of intrusive breccia composed of fragments of fine grained tonalite in a medium grained porphyritic tonalite matrix (see thin section T193B; Appendix I). The polished section is from the fine grained phase of the tonalite and contains 30% disseminated sulphides composed of pyrite, partially altered to goethite. Site T193 is approximately 20 m north of the auriferous gold vein outcrop.

The main gold bearing quartz vein contains pods with 15-20% sulphides. The sulphide-rich part of the vein (T69B), Appendix I) contains 15% coarsely disseminated sulphide as blebs up to 4 mm diameter, composed of 7% pyrite, 6% galena, 1% sphalerite, 1% chalcopyrite and traces of gold. Eleven grains of gold have been identified in polished sections occurring as free grains within the quartz gangue, as inclusions within pyrite, on pyrite grain boundaries and as an almost completely engulfed grain in galena in filling a fracture within pyrite.

Other quartz veins examined include: a 25 cm wide quartz vein, 25 m to the south (polished section T232B; Appendix I) containing 20% sulphides composed of pyrite with traces of chalcopyrite; a system of 0.1 - 5 cm quartz veins in plagioclase porphyritic tonalite, 15 m north of the auriferous vein outcrop contains 15% sulphides (polished section T195; Appendix I)composed of about 6.5% sphalerite, 2% chalcopyrite, 1% pyrite, 0.5% galena and traces of covellite.

Geochemistry

A bulk sample from the auriferous gold vein and wall rock was crushed to 2 cm blocks and sub-sampled for use as a high gold control sample. The sample was obtained from the side of the 2 m zone, away from thick quartz veins and obvious sulphide mineralization so that fairly homogeneous, representative sub-samples could be prepared. The sample was analysed 12 times as A013, A034, A042, A061, A0104, A126, A168, A192, A206, A244, A263 and A284 (Appendix II). The averages (and ranges) of the anomalous elements are: 1470ppb (50-8700ppb) Au, 175ppm (50-520ppm) Cu, 243ppm (55-1100ppm) Zn, 48ppm (17-82ppm) As, 0.8ppm (<0.5-3.2ppm) Ag, 1.3ppm (<1-7ppm) Cd, 2.4ppm (1-8ppm) Sb, 644ppm (<1-1550ppm) Pb and 1ppm (<1-3ppm) Bi. A sample of sulphide-rich quartz from the quartz vein (A196) that has been examined in polished section (T69B; Appendix I) has anomalous Au (6600ppb), Cu (4000ppm), Zn (1000ppm), As (86ppm), Se (2ppm), Ag (3.0ppm), Cd (9ppm), Sb (3ppm), Pb (11248ppm) and Bi (37ppm) in it.

Quartz veins 6 m north (A134, A201 duplicate), and 25 m south (A138) also are anomalous in gold (57, 57, 100ppb respectively) along with anomalous As (70, 70, 21ppm), and Bi (2, 2, 12ppm) with some Sb (3, 2, <1ppm), Mo (7, 14, 2ppm) and Pb (36, 88, 872ppm); Cu (250ppm) is anomalous in A138. A sample of quartz vein 24 m north (A199) is anomalous in V (497ppm), Co (75ppm), As (12ppm), Mo (5ppm), Pb (117ppm) and Bi (4ppm). Plagioclase porphyritic tonalite (A266) with abundant quartz veins containing up to 3% pyrite from 13 m north of A266 is anomalous in Cu (2200ppm), Zn (4500ppm), As (11ppm), Se (46ppm), Ag (4.9ppm), Cd (52ppm), Pb (3300ppm) and Bi (25ppm) but contains relatively low gold (7ppb).

The rock adjacent to the main auriferous zone was sampled as follows: A136 and A262 duplicate (1.6 m N, 0.3 m E) are of sheared fine grained tonalite with 2% pyrite; A135 (5.5 m N,0.3 m E) is of a highly chloritized inclusion of fine grained porphyritic tonalite in quartz-feldspar porphyritic tonalite; A132 (5.5 m N, 1.6 m E) is of quartz-feldspar porphyritic tonalite with abundant quartz-carbonate veinlets (<1 cm wide) containing traces of pyrite; and A131 (5.5 m N, 2.6 m E) is of highly chloritized, but unmineralized quartz-feldspar porphyritic tonalite. These samples are non auriferous (<1-2ppb) and have erratic, slightly anomalous amounts of V (190-439ppm), Cu (22-610ppm), As (2.8-70.0ppm), Se (<1-3ppm), Ag (<0.5 - 0.9ppm), Sb (<1 - 3ppm), Te (<1 - 2ppm), Pb (11 - 41ppm) and Bi (<1 - 7ppm). There appears to be an increase in Ba in tonalite nearest the vein (A135 - 330ppm Ba, A136 - 310ppm Ba) as compared to those farther away (A132 - 280ppm Ba, A131 - 110ppm Ba).

Also the wall rock (A137) adjacent to the vein system 25 m south (see A138 above) contains 490ppm Ba and weakly anomalous Ag (0.8ppm), Te (2ppm) and Bi (2ppm). For comparison moderately carbonatized porphyritic tonalite with no sulphides from 60m south of the main occurrence (A261) is low in all elements tested.

Composite samples of the quartz feldspar porphyritic tonalite over adjacent 3 m intervals (A165, A166, and A167-150 duplicate) 200 m north of the vein contain an average of 47ppm As, 21ppm Sb and 81ppm Pb. A selected sample of the most pyrite -rich material (A169) is anomalous in V (449ppm), Zn

(1300ppm), As (46ppm), Se (2ppm), Mo (11ppm), Ag (2ppm), Cd (13ppm), Te (8ppm), Pb (491ppm) and Bi (15ppm).

An intrusive breccia occurring 22 m to the north of the auriferous zone was sampled as follows : A197 is of medium grained porphyritic tonalite with numerous 1-4 mm quartz veinlets and 10% sulphides; A198 and A200 are of medium grained porphyritic tonalite and fine grained tonalite; A200 contains up to 30% disseminated sulphides. The samples are anomalous in V (580, 487, 519ppm) and Pb (141, 79, 39ppm). A197 is also anomalous in Au (86ppb) and Mo (17ppm) and A200 in As (12ppm).

An amygdaloidal basalt dyke (A140) 38 m to the south of the occurrence contains slightly anomalous Li (71ppm), V (725ppm), and Sb (4ppm) whereas the adjacent quartz-feldspar porphyritic tonalite (A139) contains low metal value.

The contact of the quartz-feldspar porphyritic tonalite and the quartz wacke also was sampled. A170 is of the tonalite at the contact; A171 - A155 duplicate is of the bleached quartz wacke at the contact; and A172 is of quartz wacke at the limit of bleaching. The quartz wacke at the limit of bleaching is enriched in Cu (180ppm), As (56ppm), Se (3ppm) and Ag (1.6ppm) as compared to the samples adjacent to the contact (A170, A171-A155) which contain respectively 61, 36,78ppm Cu, 1.4, 7.2, 12.0ppm As and 1.0, 1.2, 1.4ppm Ag.

Style of mineralization

The gold is confined to quartz veins probably in a north trending shear zone. The gold mineralization is associated primarily with As, Pb, and Bi and in part with Cu, Zn, Ag, Sb, Mo and Cd. The gold occurs as free gold in the quartz gangue, as inclusions in pyrite, along pyrite grain boundaries and engulfed in galena in fractures in pyrite.

33. Saint John River Gold

Alternate names

River Showing
Dominion No. 1 - River Showing

Commodity

Gold (?), Copper (?), Lead (?)

Location

UTM 611460mE 5106750mN
Lat: 46°06'26" Long:67°33'30"

History of exploration

There is no good documentation concerning this occurrence. In 1907 McClement and Greer examined a galena-bearing vein at this location prior to ascending Patchell's Mountain where they discovered Cobbler-Sexton (Greer, 1939) occurrence. Wright and Perry (1931) showed the location of the River Showing and one analysis is given (Wright, 1939b). Goodwin (1928) stated that gold has been reported from a quartz vein with pyrite and chalcopyrite on the Saint John River opposite Bulls Creek. Silvermaque Mines Ltd. staked this area and optioned it to Imperial Oil Enterprises Ltd. in 1969. A limited induced polarization (MacEachern, 1970) and soil (B-horizon) geochemical (Cu) (MacEachern, 1971a) produced anomalies which were later drilled (MacEachern, 1971b). The results of the drilling were discouraging, nothing was analyzed and no further work was done. Note that this work was performed on north-south lines parallel to, and to the east of the reported gold occurrence.

Access

The location of the occurrence on the east side of the Saint John River as shown by Wright and Perry (1931) is presently flooded by Mactaquac Head Pond.

Geology

There are no records of the geology of the occurrence other than it is in quartz veins in Gibson Stock just south of its contact with the metasediments. Rocks exposed along this part of the Saint John River are of plagioclase - quartz porphyritic granodiorite and quartz- plagioclase porphyritic granodiorite as described in thin sections T366 and T367 (Appendix I). Slight propylitic alteration is apparent in these samples.

Mineralization

The presence of galena (Greer, 1939) chalcopyrite, pyrite and native gold (Goodwin, 1928) are recorded in quartz veins.

Geochemistry

Wright (1939b) records the following analysis of an undescribed sample: 0.05 (oz/ton) Au, 5.44% Cu, 0.59 (%) Zn and trace of Pb.

Style of mineralization

Free gold with associated Cu, Zn and possible Pb in quartz veins. The veins are in the Gibson stock (granodiorite) near its contact with the metasediments. This occurrence is similar to the Upper Northampton Gold occurrence.

34. Oak Mountain Sb-(Au) (Figure 8.34)

Alternate names

Oak Mountain Gold

Commodity

Antimony, (gold), (silver), (copper), (arsenic), (lead), (zinc)

Location

UTM 604700mE 5096000mN
Lat: 46°00'41" Long:67°38'54"

History of exploration

The earliest documentation of this occurrence was by Anderson (1955) who described his unsuccessful efforts to locate the gold bearing quartz vein boulders, and Moorehouse (1955) who indicated quartz boulders on his geological map. The site was visited and described by Sabina (1967). Some trenching has been done at various places but there are no records of what was found. At present the site has been staked by F. Carwell Tompkins.

Access

The occurrence is on the northeast side of Oak Mountain. It is accessible on foot from the road through the community of Oak Mountain; the main boulder field is approximately 225 m west of a point 480 m south on the road from the Canadian Pacific Railway crossing.

Geology

The occurrence consists of white, milky quartz vein boulders up to 1 m x 0.5 m that occur in fence rows, rock piles and generally scattered on the hillside. Some boulders are obviously mineralized, others appear barren. Some are sheared, others contain pieces of wall rock of quartz wacke, volcanic or chloritic masses.

There are several outcrops and two pits at the base of the slope that show the plagioclase porphyritic granodioritic phase of the Benton Stock as described in Section 7.2.5 and in thin section T273B (Appendix I). Quartz wacke and intermediate volcanic boulders and cobbles are abundant on the hillside. Rare cobbles and boulders of conglomerate and argillite are also present.

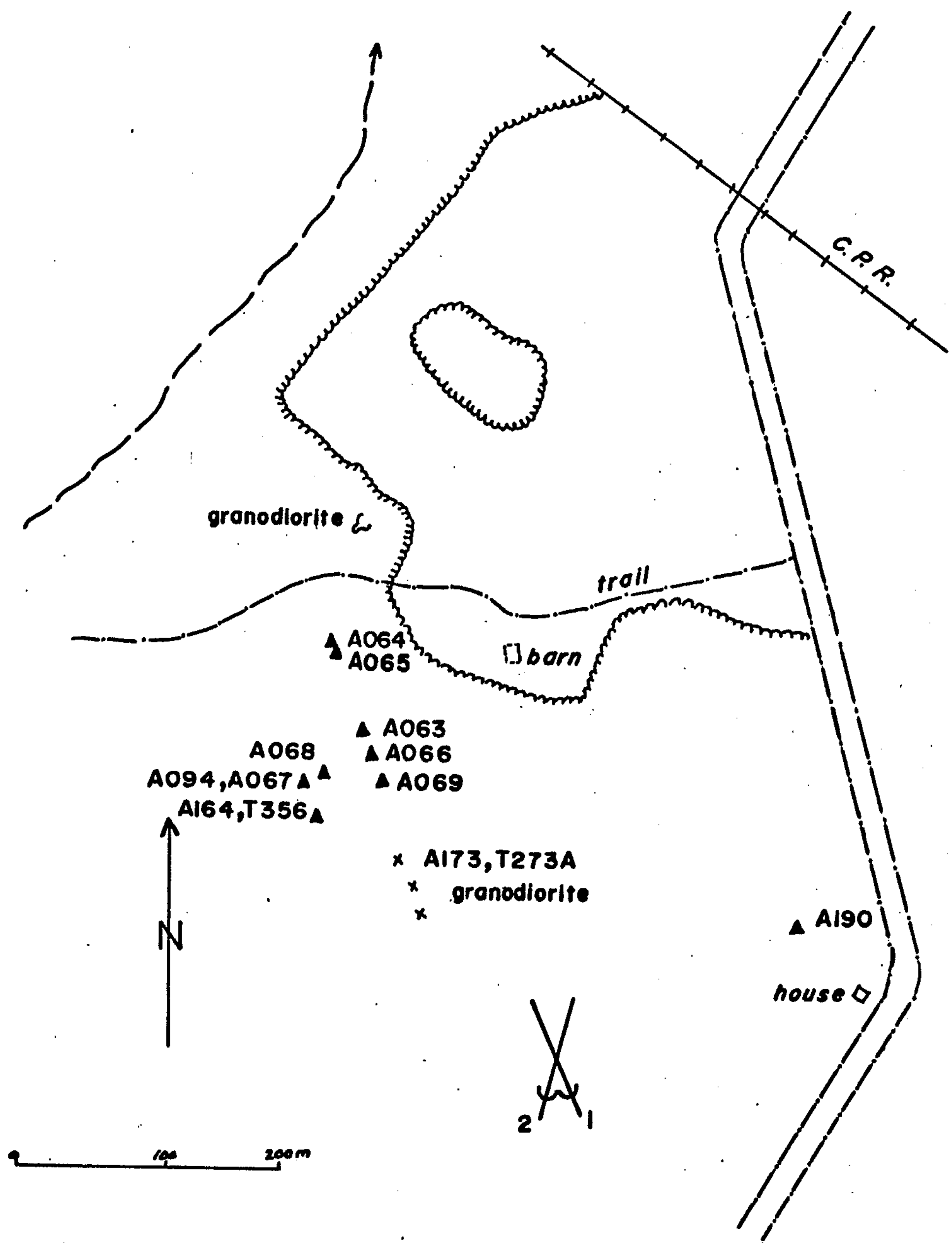


Figure 8.34: Oak Mountain (Au) Sb.

The source of the boulders has not been located. Ice flow during the Millville/Dungarvon phase of the last glaciation was from the north-northwest (Rampton and Paradis, 1981) implying that the source lies in this direction.

Mineralogy

Several boulders have iron stains on fractures, others contain traces of pyrite. A polished section of a well mineralized boulder (T356; Appendix I)) contains 25% sulphides composed of 20% tetrahedrite, 2.5% sphalerite, 2.5% goethite replacing tetrahedrite and traces of covellite and chalcopyrite. A yellow crusty coating lining some cavities in the quartz vein has been identified as bindheimite by X-Ray diffraction.

Geochemistry

A variety of different types of quartz vein boulders have been analysed geochemically. A brief description of the boulders is given in Appendix III.

Of the ten boulders analysed, all contain anomalous Sb (2-19600ppm), and three contain anomalous Au (7-180ppb). The highest gold content (180ppb) is from a boulder (A063) of vein quartz with chloritic inclusions and traces of malachite. Another (A164, 94ppb Au) contains tetrahedrite in 2 cm wide bands and as 1 cm diameter cavity fillings. Sample A190 (3ppb Au) consists of highly fractured vein quartz with traces of malachite and supposedly contains a silvery mineral (Tompkins, pers. comm.). This sample similar in its metal content except for gold to A063 and A164 in that they all (A063, A164, A190) contain very high Sb (6939, 19600, 143000ppm respectively) associated with anomalous Cu (5700, 4900, 1000ppm), Zn (1800, 760, 440ppm), As (140, 150, 40ppm), Se (2, 8, 7ppm), Ag (68, 79, 5ppm), Cd (44, 73, 49ppm), Pb (755, 9600, 3830ppm) and Bi (5, 14, 15ppm). These boulders if assumed to originate from the same source, outline a fan 70 m wide, at the up-ice end, by 350 m long. The other boulders that have been sampled would generally lie within this fan.

Other boulders anomalous in Au (A064-7ppb and A069-10ppb) also are anomalous in As (100 and 110ppm respectively), Sb (16 and 86ppm respectively) and Pb (208 and 77ppm respectively).

The sample of plagioclase porphyritic granodiorite (A173) is low in trace elements.

Style of mineralization

Antimony as tetrahedrite with associated Au, Cu, Zn, As, Se, Ag, Cd, Pb and Bi occurs as seams and cavity fillings in white milky quartz veins. The veins are at least 15 cm wide and occur near the contact of the Benton Stock probably in metasediments (chloritic masses). The Sb-Au-Ag-Cu-As-Pb mineralization is not necessarily associated with abundant pyrite (see A064; Appendix III). However many of the quartz boulders do contain limonite after pyrite, other secondary minerals include malachite and bindheimite.

The quartz vein boulders are most abundant on the northwest part of the fan. In this area of approximately 100 m² there is an average of one quartz vein boulder per 25 m². It is presumed that the bedrock source is not far to the northwest of this locale, but more detailed boulder prospecting is required.

8.2.6 Vein - Barite

Barite veins occur at two locations in the area; South Newbridge and Upper Northampton Barite. Barium analyses from this project show only two other anomalous areas, Dugan Road East (A014) and Oak Mountain Fe-Mn (A180 and A182) which contain 1600, 1300 and 1300ppm Ba respectively.

35. South Newbrige

Alternate names

Phillips Creek Barite

Commodity

Barite, Lead

Location

UTM 613900mE 5112900mN
Lat: 46°09'45" Long:67°31'29"

History of exploration

While mapping the surficial deposits in the area Lee (1962, pers. comm.) investigated a southeasterly trending airphoto lineament. He dug a pit in the till over the lineament and collected about 501 bs of barite in pieces up to 6 inches in diameter (Lord, 1958).

The area was staked by Moneta-Dome (Moneta Porcupine Mines Ltd.) in January, 1959. The work recorded (Richardson, 1959) included 300 ft of bulldozer trenching to expose the vein and 46 stream sediment samples collected over the surrounding area to determine the extent of mineralization. The results did not warrant further work.

Access

The trench has filled in and a stream now flows through it. The location is 800 m down a farm road from a point 3.7 km east along Highway 585 from its intersection with Highway 105.

Geology

The area is underlain by Cambro-Ordovician metasediments, described by Richardson (1959) from the trench as fine grained quartzite, siltstone and shale. They strike northeast and dip vertically.

Mineralization

A 30-60 m wide barite vein, oriented subparallel to the metasediments was exposed for 4.6 m in the trench. The northeast end of the vein bent sharply and pinched out; the south west end was not uncovered because of deep overburden (Richardson, 1959). Some 34 m to the south-southeast a 60 cm wide depression in bedrock in the trench contained abundant rounded fragments of barite. The barite is white and contains minor galena and malachite.

Geochemistry

There are no records of analyses of samples from the trench. In places stream sediment samples from the surrounding area were anomalous particularly in zinc (Richardson, 1959). The ranges of values for the 46 samples were: Cu, 7 to 59ppm; Pb, <15 to 60ppm; and Zinc <10 to 280ppm. Richardson (1959) reported that the area between the barite vein and the brook contains high lead, but that it does not persist down the brook.

Lord (1958) reported that the barite as seen from Lee's overburden sample is of good paint grade. A sample of highly chloritized quartz wacke with numerous quartz veinlets and a fracture coated with barite (A089) contains 1600ppm Ba, 15ppbAu, 65ppm Cu, 7ppm As, 0.7ppm Ag and 3176ppm Pb.

Style of mineralization

This is a barite vein occurrence in quartz wacke with associated galena and anomalous Au.

36. Upper Northampton - Barite (Figure 8.36)

Commodity

Barite, Lead, Silver

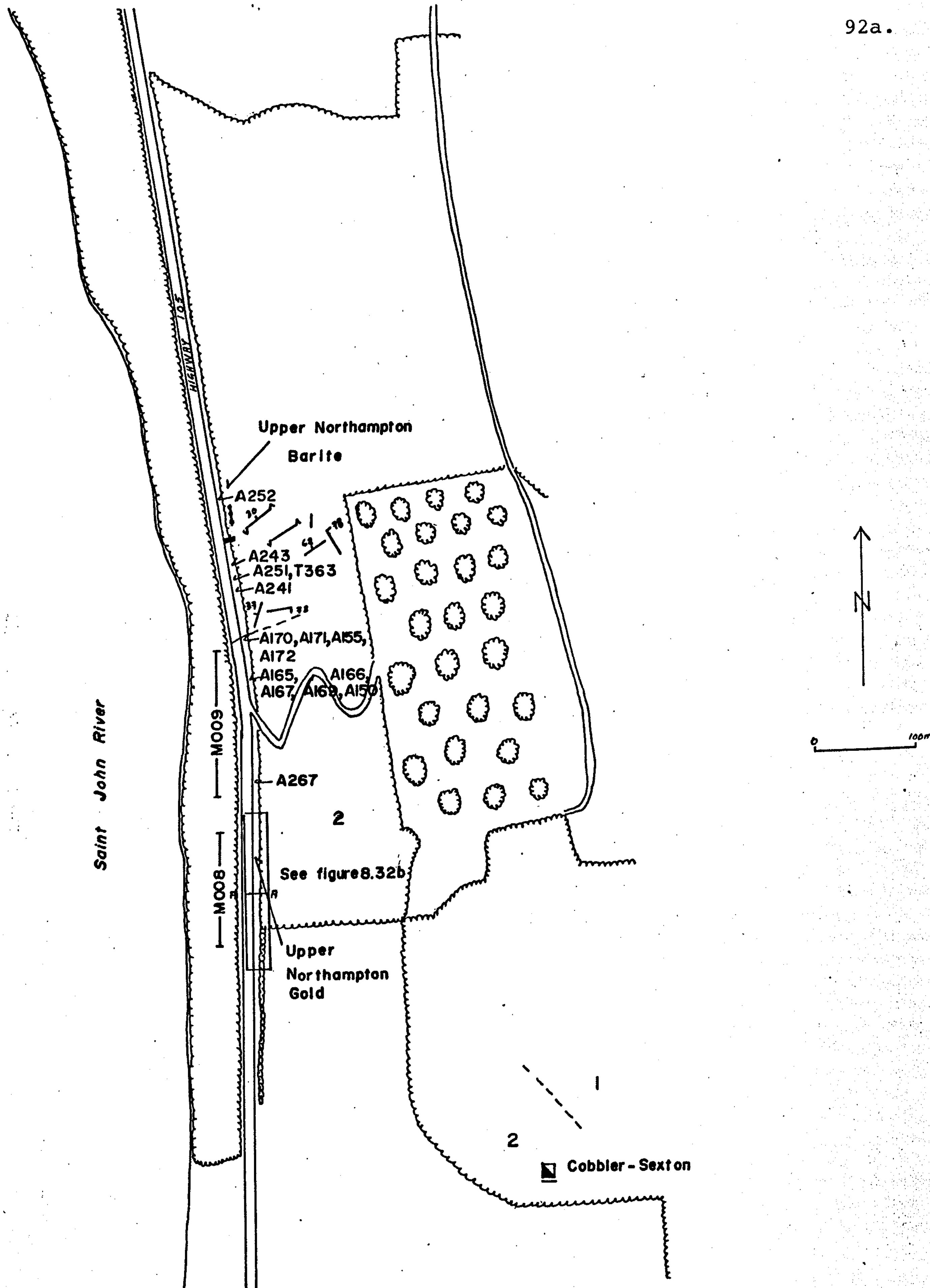


Figure 8.36: Upper Northampton Barite(1:metasediments, 2:Gibson Stock, :diabase dyke)

Location

UTM 612130mE 5105200mN
Lat:46°05'36" Long: 67°32'59"

History of exploration

The occurrence was first recorded by Take (1974) and was examined by Geosleuth Exploration Services (pers. comm.) as Phase I of this study. Although the area has been staked by several exploration companies there is no record of these barite veins in the assessment files.

Access

The occurrence is in a road cut on the east side of Highway 105, 8.1 km south of the Grafton Bridge. It is approximately 400 m north of the Upper Northampton Gold occurrence.

Geology

The occurrence is in a sequence of Cambro-Ordovician metasediments consisting of interbedded quartz wackes, siltstones and argillites trending northeasterly and dipping steeply to the northwest. The rocks are pyritized and chloritized hornfels with local zones of bleaching, silicification and carbonatization. In general the rocks become more altered toward the south and the contact with the Gibson Stock. Shears occur throughout the section and are subparallel to the bedding. The rocks are generally highly fractured.

Mineralization

Several barite veins occur over a 20 m length of this road cut. They are of variable thickness and length, generally following vertical fractures striking 175°T. They are predominantly hosted in quartz wacke. A cobble of quartz feldspar porphyritic tonalite found in till some 200 m to the south contains abundant quartz veinlets and is coated on one side with barite.

Geochemistry

The barite vein in the quartz wacke (A252) contains anomalous Ba (20000ppm), and Ag (1.8ppm). The barite-tonalite boulder (A267) contains anomalous Ba (19000ppm), Au (11ppb), Cu (440ppm), As (8ppm), Se (25ppm), Ag (8.4ppm), Sb (5ppm), Te (4ppm), Pb (1470ppm) and Bi (25ppm).

Three rusty weathering highly fractured, parts of the road cut were sampled: A241 is siltstone with abundant quartz veinlets and contains 12Øppm Cu, 1.2ppm Ag and 47ppm Pb, A243 is quartz wacke and A251 is siltstone and they contain anomalous Ag (2.1, 1Ø.9ppm) and weakly anomalous Cu (62, 61ppm), As (7.2, 8.5ppm), Se (4, 3ppm).

Style of mineralization

In this occurrence barite veins are present as 1-5 cm fracture fillings in metasediments, the veins and fractures contain anomalous Ag. Barite veins may also occur in quartz feldspar porphyritic tonalite. A cobble from this type of barium mineralization contains anomalous Au, Cu, As, Se, Ag, Sb, Te, Pb and Bi.

8.2.7 Iron and Manganese

Three iron manganese occurrences lie within the study area. One occurrence, Peabody Farm, consists of hematitic slate boulders probably derived from similar Silurian stata to the northwest. The other two are in slates containing manganese oxides on fractures and quartz veins. These latter two occurrences are being studied by Geosleuth Mineral Exploration Services (Hattie and Connell, 1986) and will be discussed in detail in their final report. These occurrences were examined as part of this project to determine if they are related to the other metal deposits in the Woodstock Area.

37. Wickham (Figure 8.37)

Commodity

Iron, manganese

Location

UTM 6Ø312ØmE 5Ø995ØØmN
Lat: 46°Ø2'35" Long:67°4Ø'Ø3"

History of exploration

The first reference to this particular occurrence was by Anderson (1955). There are no assessment reports dealing with it even though some exploration work in the form of stripping and bulk sampling of the outcrop has occurred. The outcrop was examined by Geosleuth Exploration Services Ltd. (pers. comm.) as part of Phase I of the Miramichi Metallogenic study.

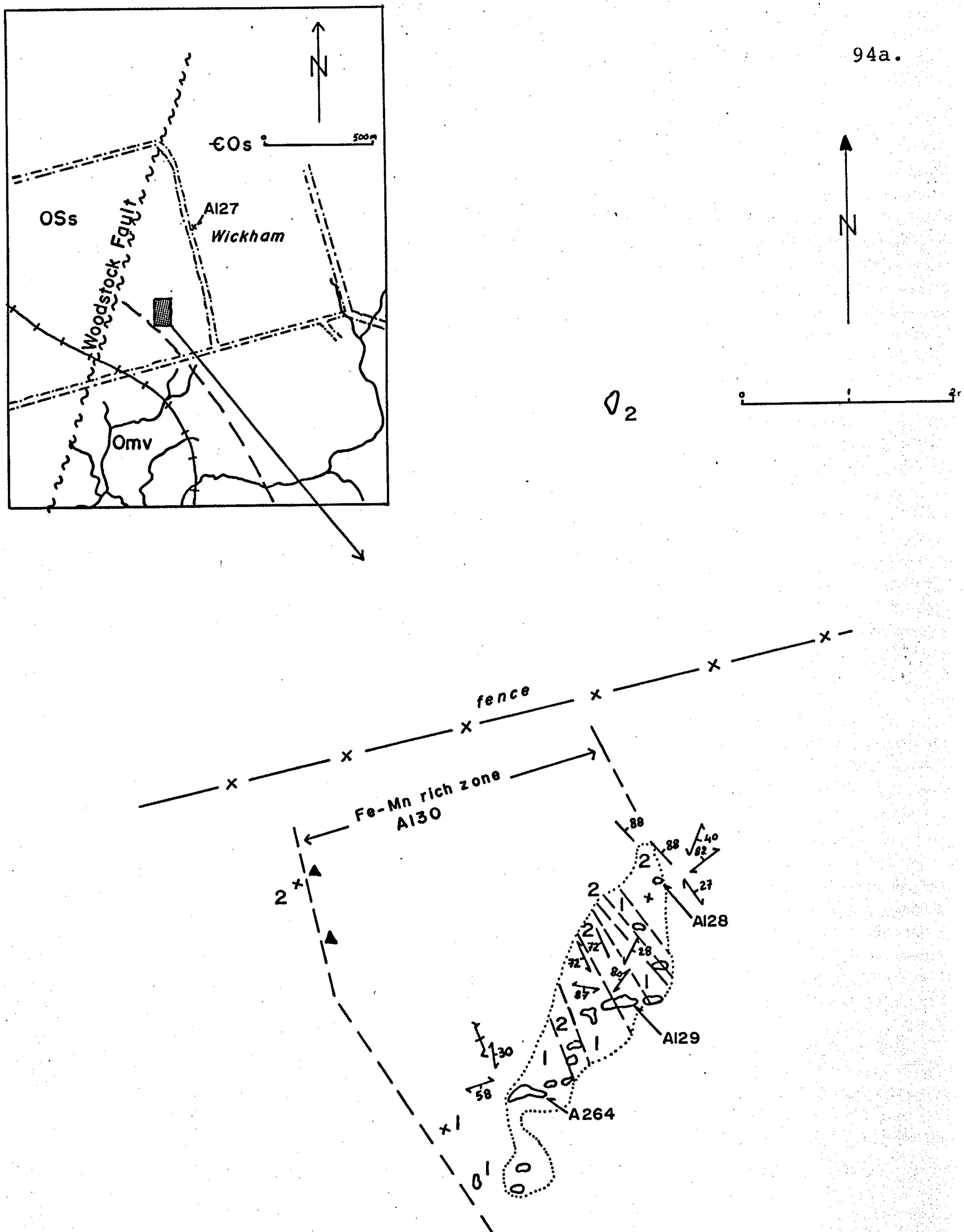


Figure 8.37: Wickham Fe-Mn (1:sandstone, 2:slate and siltstone).

Access

The area is accessible on foot only. It is 180 m west from a point 200 m north along a side road from its intersection with the Dugan Road.

Geology

The occurrence is in interbedded, dark grey, very fine grained slate, siltstone and very fine grained sandstone. Fine laminations were observed in places indicating that the sediments strike northwest-southeast and dip steeply to the west. The rocks are highly fractured and are deeply oxidized with much secondary manganese oxides present on the fractures.

The locality is within 300 m of a north-northeast airphoto lineament that is believed to be the Woodstock Fault. Between the occurrence and the fault are outcrops of light green quartz wacke; to the northeast are outcrops of amygdaloidal basalt which Anderson (1968) show to be part of a mafic intrusive unit.

Mineralization

The main form of manganese observed at the occurrence is a secondary manganese hydroxide coating on fractures and partly to completely impregnating the rock between the fractures. In places, red iron weathering products (limonite-goethite) and erythrite are present on fractures.

Traces of very fine pyrite occur disseminated in, or as thin (<1 mm) lenses on fractures. A few 1-5 mm quartz stringers are present particularly in the coarser units.

Geochemistry

Four samples were taken from the occurrence as follows: A128 - highly fractured slate at the edge of the exposure; A129 - contains traces of pyrite; A264 - contains quartz stringers; and A130 is a composite chip sample from the outcrop. These samples contain 6, 8, 6 and 5ppb Au respectively. A264 contains 37000ppm Mn, 97000ppm Fe, 114ppm Co, 73ppm Ni, 82ppm Cu, 24ppm As, 6ppm Sb and 100ppm Pb. Metals in the other samples average the following: 128ppm Li, 24000ppm Mn, 21333ppm Fe, 210ppm Co, 111ppm Ni, 88ppm Cu, 93ppm As, 4.7ppm Mo, 1.1ppm Ag, 14ppm Sb, 7ppm W and 86ppm Pb. Apart from Fe and Mn the samples are considered to be highly anomalous in Co, Sb and As.

The amygdaloidal basalt (A127) contains 1200ppm Mn, 140000ppm Fe, 110ppm Cu and 475ppm V.

Other analyses reported by Anderson (1966), (J.T. Donald assay No. 2942, July 10, 1952) and 9.65% Fe and 2.08%Mn

Style of mineralization

This deposit appears to be an enrichment of iron and manganese on fractures in fine grained sediments. The Cambro-Ordovician rocks along the Dugan Road to the east (see occurrences 13 and 14) are also marked by manganese staining on the fractures, although not to this intensity. Note that some of the rocks from the Dugan Road East occurrence also contains anomalous Li, Mn, As, Mo, Ag, Sb, and W, a similar suite of elements except for Co, Fe, and Pb as are found at Wickham.

The deposit could therefore be derived from enrichment by weathering of the hornfels in argillites found near the contact of the Benton Stock. The weathering could be contemporaneous with the supergene enrichment on Connell Mountain

38. Oak Mountain Iron-Manganese

Commodity

Iron, Manganese

Location

UTM 603300mE 5095400mN
Lat: 46°00'22" Long:67°39'56"

History of exploration

This occurrence has been known since the late 1800's (Bailey, 1884). In late 1954 the property was staked by American Metals Company Ltd. A soil geochemical survey (Cu, Zn) produced scattered anomalies but these were not pursued (Hackey, 1956). The property was mapped geologically by Moorhouse (1955) and an electromagnetic survey was completed which identified a conductive zone. Six trenches were dug by bulldozer on the conductive zone and it was determined that the conductors were related to the dark, sheared, argillaceous sediments; two were related to sedimentary - intrusive or sedimentary - volcanic contacts as well (Hackey, 1956). A gravity survey was completed but because no significant excess mass was revealed, no further work was recommended (Benlow, 1956).

The occurrence was examined by Geosleuth Mineral Exploration Services as part of Phase I of the study of the Metallogeny of the Miramichi Zone (Connell and Hattie, 1985) and is being studied in more detail in the follow-up study (Hattie and Connell, 1986).

Access

The occurrence lies between Spruce Peak and the main peak of Oak Mountain. It is accessible by walking 100 m from the end of a farm road which runs 1.4 km west from the road south from Oak Mountain (village) at a point 1 km south of the railway crossing.

Geology

The occurrence is a 60 m thick unit of fairly uniform maroon, hematitic slates, trending northeast and dipping steeply southeast. In places chert lenses, 1 x 3 cm are present. The unit is bounded on the west by chloritized mafic volcanics and tuffs and on the southeast by basalt flows. All rocks are of Ordovician age (Venugopal, 1979).

At one location veins of white comb quartz from 3 cm to 40 cm wide by 2.5 m long occur in the maroon slates. They are oriented north-south and dip steeply west. The slate wall rock is bleached for 3 cm adjacent to the veins.

Mineralization

There is no reported sulphide mineralization associated with the maroon slates.

Geochemistry

A composite sample (A182) made up of pieces collected from the available outcrops is considered to represent the average composition of the maroon slates. It contains anomalous Au (26ppb), V (416ppm), Mn (1600ppm), Fe (260000ppm), Co (100ppm), Ni (116ppm), As (72ppm), Mo (8ppm), Ag (2.0ppm), Sn (9ppm), Sb (27ppm), Te (3ppm), W (12ppm), Pb (172ppm) and Ba (1300ppm). The maroon slate with minor iron and manganese stain on the cleavage (A175) contains only 1600ppm Mn and 26000ppm Fe but it is anomalous in Li (63ppm), V (547ppm), Co (103ppm), As (100ppm), Mo (12ppm), Ag (2.2ppm), Cd (2ppm), Sn (6ppm), Sb (36ppm), Te (3ppm), W (13ppm), Pb (243ppm), Bi (2ppm) and Ba (1000ppm).

The bleached slate adjacent to the quartz veins (A180) contains 17000ppm Mn and 170000ppm Fe and it is anomalous in Au (15ppb), Li (75ppm), V (500ppm), Co (130ppm), Ni (163ppm), Cu (200ppm), Zn (230ppm), As (8.3ppm), Mo (6ppm), Ag (2.4ppm), Cd (2ppm), Sn (7ppm), Sb (9ppm), Te (3ppm) and Ba (1300ppm). Compared to the "average" composition (A182), of the maroon slates, the bleached zone contains less As, Sb, W and Pb and more Li, Co, Ni, Cu and Zn. The quartz veins (A179) contain anomalous Au (43ppb), Mn (12000ppm), Co (75ppm), Ni (78ppm), Cu (180ppm), As (28ppm), Mo (6ppm), Ag (1.5ppm), Sb (12ppm), Te (3ppm), W (6ppm), Pb (53ppm) and Bi (2ppm). The quartz veins therefore appear to be enriched in Au, and Cu relative to composite sample A182.

The mafic tuff unit to the northwest (A258) contains anomalous Mn (9700ppm), Cu (140ppm), As (70ppm) and Sb (4ppm).

Other analyses reported from this Fe-Mn occurrence are: Hoffman (1906); shale with thin seams of quartz; 16.50% Fe_2O_3 (11.55% Fe).

Style of mineralization

This is a lean iron formation in hematitic slate. Elevated contents of elements such as Co, Ni, V and Cr would suggest derivation from a mafic rock. Metallogenitically the enrichments of such elements as Au, Li, As, Ag, Sb, W, Pb, and Ba appear to be related to rocks close to the Benton granite contact (eg 13 - Dugan Road and 37 - Wickham). Quartz veining in the slates with associated geochemical anomalous Au, Cu, Zn, As, Sb and Pb values may indicate some hydrothermal activity in the area similar to that indicated by the quartz vein boulders at Oak Mountain.

39. Peabody Farm

Commodity

Iron

Location

UTM 609850mE 5108650mN
Lat: 46°07'32" Long:67°34'40"

History of exploration

A brief description of this occurrence is given by Bailey (1899). No further work is recorded in the literature.

Access

The exact location of this occurrence is unknown. Bailey (1899) described it as being on the Peabody Farm, which is located on Peabody Brook, 2.5 km south of Woodstock along Highway 103. Mrs. Barbara Peabody (pers. comm.) cannot remember any reference locally to this occurrence.

Geology

Bailey (1899) described loose blocks of hematite scattered over the ground. The surficial materials between the Canadian Pacific Railway and the Saint John River are glaciofluvial and fluvial sands and fine gravels (Lee, 1962; Rampton and Paradis, 1981). It is possible that the blocks are erratics from the glacial till which occurs to the west of the railway.

Mineralization

Bailey (1899) described blocks of hematite, there are no further descriptions.

Geochemistry

No analysis are reported from this occurrence.

Style of mineralization

Bailey (1899) proposes two origins and therefore styles of mineralization for these boulders:

1. because he feels that the area is stratigraphically similar to Oak Mountain, they could be derived from a local source similar to the Oak Mountain iron-manganese occurrence; or
2. they could be glacially transported from the Silurian iron deposits at Jacksontown, 9 km up ice from Peabody farm.

Lacking further information, the latter appears most likely.

9.Ø METALLOGENESIS

9.1 Porphyry Copper

The Gibson Stock is an epizonal multiple intrusion of tonalite, trondhjemite and granodiorite. the porphyry copper deposits are associated with the tonalite and trondhjemite phases of the intrusion which are located in the northern part of the Gibson Stock. Texturally the rocks range from fine grained to porphyritic. some phases contain resorbed quartz phenocrysts to 7 mm diameter. Generally the granodioritic rocks occur in the Bulls Creek area, tonalites predominate in the north-central part and trohdhjemites and tonalites are present in the Connell Mountain Area.

Intrusive breccias are of minor importance. Small pipe like features to 3 mm diameter and tabular bodies up to 4Ø cm thick occur along Highway 1Ø5, both within the Gibson Stock and in the Cambro-Ordovician rocks.

The porphyry copper deposits are marked by an area of extensive phyllic alteration which includes the Connell Mountain area (occurrences 1, 2), and extends southwestward to include the other porphyry copper occurrences (eg. 3, 4, 5, 6). Phyllic alteration is also present at Bulls Creek No. 2 (occurrence 10) and in the South Woodstock Stock. Phyllic alteration is evident in the Gibson Stock as pervasive sericitization of the rock. Fine grained sericite has overgrown chloritized ferromagnesian minerals and plagioclase is altered to very fine grained sericite and epidote overgrowths with, in places, fine grained clinozoisite poikiloblasts. Intensive silicification as quartz stringers and stockworks and pyritization as disseminations and fracture fillings, accompany the sericitization.

The metasedimentary rocks within the zone of phyllic alteration exhibit sericitization, silicification and pyritization similar to but not as well developed as that found in the adjacent Gibson Stock.

Zones of propylitic alteration surround the zone of phyllic alteration in the Gibson Stock and in the North Woodstock Stock. Propylitic alteration is marked by extensive chloritization and epidotization of ferromagnesian minerals and plagioclase. Carbonatization is locally important and may be more common in fresher rocks at depth. Sericitization of plagioclase, silicification and pyritization are locally present but are not intensive or ubiquitous. The propylitic alteration within the metasedimentary rocks includes chloritization and carbonatization with minor epidotization and sericitization. Silicification and pyritization are only locally present.

Potassic alteration has not been identified either by this study or by Lockhart (1971d). However selinite is present in the lower parts of some drill holes (W-70-2, 43'; W-70-4, W-70-6, 69'-159'; W-70-8, 81') Lockhart, 1971c, d).

Argillic alteration was not identified and is not a common feature of Appalachian porphyry copper systems (Hollister et al, 1974). A hornfels zone and pyrite shell are associated with the Gibson Stock, however the extent of these zones beyond the phyllic zone has not been mapped.

Chalcopyrite is the dominant copper mineral in the mineralized Gibson Stock and adjacent metasedimentary rocks. It occurs mainly as fracture fillings but locally it is disseminated as blebs in intergranular spaces in both the intrusive and metasedimentary rocks. Lockhart (1971c) has shown that the copper content of the mineralized Gibson Stock is twice that of the adjacent mineralized metasedimentary rocks. Pyrite is generally present as fracture fillings and it is disseminated locally. Pyrrhotite is present in some parts of Connell Mountain (occurrence 1), Smart Farm (occurrence 5) and Upper Northampton

Copper (occurrence 6). Traces of bornite and molybdenite are reported from quartz veins on Connell Mountain (occurrence 1) (Lockhart, 1971d) and traces of sphalerite have been found at Connell Brook (Occurrence 3) and Smart Farm (occurrence 5).

A zone of supergene enrichment is outlined for the Connell Mountain area by the presence of covellite, chalcocite and cuprite (Lockhart, 1971d). The depth of weathering is from 3 to 10 m.

The copper mineralization in the porphyry deposits is accompanied by increases in As, Ag, Sn, and W. Anomalous amounts of Zn, Se, Mo, Sb, Pb and Bi are locally present particularly at Connell Mountain (occurrence 1) and to some degree at Smart Farm (occurrence 5); Au is locally anomalous at both sites.

Porphyry copper style mineralization is present in the northern part of the Gibson Stock. The most mineralized part so far discovered is Connell Mountain, with lesser mineralization occurring to the southwest within the zone of phyllic alteration.

9.2 Vein-Type and/or Porphyry Affiliate-Copper

Nine occurrences have been classified as vein-type and/or porphyry affiliate-copper. Significant mineralization was not confirmed at the two Dugan Road occurrences (13, 14). The remainder are near the contact of the Gibson Stock and the Cambro-Ordovician metasediments or are within the metasediments within 1 km of the contact. They are all to the southwest of the porphyry copper deposits.

The mineralized zones comprise quartz veins, up to 1 m wide, and associated silicified shear and breccia zones. They have northerly to northeasterly trends, and commonly are hosted in more than one lithology. The host rocks include fine grained tonalite and plagioclase-quartz porphyritic tonalite (occurrence 12), granodiorite (occurrence 10, 16), quartz wacke (occurrence 9, 10, 11, 12, 15) and argillite (occurrence 8).

The deposits lie within the propylitic alteration zone of the porphyry copper system (Figure 10.1). Additionally the metasedimentary rocks are generally bleached and carbonatized on fractures. Silicification is restricted to the mineralized zones.

Pyrite and chalcopyrite are disseminated in quartz veins, quartz breccias and silicified shear zones and as fracture fillings in the wall rock. Lesser amounts of sphalerite, galena, arsenopyrite, pyrrhotite, covellite, cubanite and cuprite are present in some occurrences. Mineralization, in all cases is predominantly in the quartz veins, quartz matrix of breccias, and quartz filling of fractures. The mineralization has not substantially invaded the wall rock.

Copper metallization is associated with geochemical enrichments in Au, Zn, As, Ag, Sb, Pb and Bi. Anomalous quantities of Mo, Sn, and W are present in some occurrences.

Vein and/or porphyry affiliate copper deposits are late stage mineralization as indicated by the variety of rocks in which the veins are hosted. The northerly to northeasterly trend of the veins indicate a regional structural association with the subparallel Woodstock Fault. The trace element assemblage is similar to that found in the porphyry copper deposits of the district.

9.3 Fracture Filling - Copper

Copper mineralization was confirmed at only two of the eight occurrences classified as fracture filling - copper. One (occurrence 24) contains chalcopyrite filled fractures in porphyritic tonalite boulders; the source of these boulders is unknown. The other occurrence (18) is of disseminated pyrite with traces of chalcopyrite and galena on fractures and in shears in Cambro-Ordovician quartz wackes and argillites. The rocks are silicified, carbonatized and slightly chloritized and sericitized. The minor copper metallization is accompanied by anomalous As, Mo, Ag, Pb and Bi. Probably the metals were deposited from hydrothermal solutions emanating either from the Gibson Stock porphyry copper system or from a deeper, more local intrusion.

9.4 Vein - Lead

The vein-lead deposits that were examined all lie in the Cambro-Ordovician metasediments 1 to 8 km north of the Gibson Stock. The two occurrences (28, 29) not examined lie to the south of the Gibson Stock and probably are similar, but may be related to a deeper intrusion in that area. Lead mineralization was not confirmed at one occurrence (30). The above three occurrences have not been included in the following description.

The quartz veins are up to 1.3 m wide and occur in north to northeasterly trending faults or shear zones. The veins are hosted in quartz wacke, siltstone or argillite which are commonly brecciated to sheared with quartz filling the interstices and fractures.

Silicification and carbonatization as fracture fillings of the host rock adjacent to the veins is prominent at most locations. Carbonatization of the mineralized quartz veins and wide spread bleaching of the host rock is also common. Chloritization of the host rock is variable.

Sulphide minerals occur as fracture fillings in the veins and to a lesser degree in the wall rock. Galena is the only lead mineral present. It is associated with pyrite, sphalerite and chalcopyrite except at the Britton Mine (occurrence 25).

Pb and associated Cu, Zn and Ag are present at all occurrences other than the Britton Mine (occurrence 25) and Au, As, Mo, Cd and Bi are present in anomalous concentrations at some occurrences.

Spatially the vein-lead deposits are peripheral to the vein-copper deposits. The veins are principally in faults and shear zones and were probably deposited from hydrothermal systems related to the Gibson Stock. The north to northeasterly trend of the mineralized structures is parallel to the Woodstock Fault which may indicate a common tectonic control.

9.5 Vein - Gold

Little is known concerning the geological setting of the Oak Mountain Gold occurrence (34) because the source of the boulders was not found. Gold occurs in quartz veins that probably formed in Cambro-Ordovician metasediments near the contact of the Benton Stock. Tetrahedrite with chalcopyrite, sphalerite and covellite occur as fracture and cavity fillings in the quartz boulders. The Sb metallization is accompanied by anomalous Au, Cu, As, Se, Ag, Cd, Pb and Bi.

The Upper Northampton Gold (occurrence 32) and the Saint John River Gold (occurrence 33) are believed to be similar. They occur on the east side of the Saint John River within the Gibson Stock. The Upper Northampton Gold is a north trending vein system developed within porphyritic tonalite. Individual veins are from 1 to 35 cm wide and form a system 2 m wide which can be followed for 30 m along strike. The occurrence lies within the propylitic alteration zone of the Gibson Stock porphyry copper system. Silicification is the only alteration directly associated with the gold mineralization.

At Upper Northampton Gold, free gold is associated with pyrite, chalcopyrite, galena, sphalerite and pyrrhotite. Geochemically the gold is associated with enrichments in Cu, Zn, As, Ag, Cd, Sb, Pb and Bi.

The Upper Northampton Gold and Saint John River Gold occurrences are late stage vein deposits emplaced in dilation zones by hydrothermal solutions possibly related to the Gibson Stock porphyry copper system. The genesis of the Oak Mountain Gold is unknown but it is hosted in quartz veins cutting the metasedimentary rocks in the periphery of the Benton Stock. Sb enrichment appears to be peculiar to this particular geological setting (eg Wickham and Dugan Road).

9.6 Vein - Barite

The vein-barite deposits of the area are hosted in Cambro-Ordovician sediments. The veins are from 1 to 50 cm wide and are oblique to bedding. The wall rocks exhibit minor alteration to hornfels, bleaching, silicification and carbonatization. The barite veins have associated pyrite or galena and anomalous Ag, Pb, As with variable anomalous values in Cu, Se, Sb, Te, and Bi.

The veins are epigenetic fracture fillings possibly formed by hydrothermal solutions related to the Gibson Stock.

9.7 Iron and Manganese

The Oak Mountain (38) and Wickham Fe-Mn occurrences are located in the southwest part of the area, in Ordovician and Cambro-Ordovician metasediments respectively. The former is a strata-controlled deposit in maroon hematitic slates. The latter occurs in highly fractured argillites, siltstones and very fine grained sandstones that have been enriched by weathering processes. Both deposits contain anomalous Li, Co, Ni, As, Mo, Ag, Sb, W, and Pb and variable anomalous V, Cu, Zn, Sn, Te and Ba associated with the Fe and Mn.

Both deposits contain small areas of silicification in the form of quartz stringers and veins. Pyrite is present on fractures at Wickham. The silicified zone at Oak Mountain Fe-Mn contains anomalous Au, Mn, Co, Cu, As, Mo, Ag, Sb, Te, W, Pb and Bi an assemblage similar to that at Oak Mountain Gold and possibly indicating regional hydrothermal activity.

The Peabody Farm occurrence (39) was not investigated. It is reported to consist of hematitic boulders possibly derived from the Silurian deposits to the northwest or from a local source, similar to the Oak Mountain Fe-Mn occurrence.

10.0 DISCUSSION

The present study is highlighted by a porphyry copper system related to the porphyritic intrusion of the Gibson Stock. The system appears to be of the "classic" type as described by Guilbert and Lowell (1974) and McMillan and Panteleyev (1980). The centre of the system as presently known is on Connell Mountain as first identified by A.W. Lockhart (1976). It is marked by extensive chalcopyrite-pyrite-pyrrhotite mineralization in a zone of phyllic alteration.

Phyllic alteration and porphyry copper mineralization occur in a zone some 2000 m wide by 3000 m long to the southwest of Connell Mountain (Figure 10.1). They are surrounded by a 2500 m wide zone of propylitic alteration. The eastern limit of these zones is not defined. Vein-gold and vein-copper deposits occur within the propylitic alteration zone to the southwest of the porphyry copper deposits. Vein-lead deposits occur to the northwest of the porphyry copper deposits within and exterior to the zone of propylitic alteration.

Phyllic alteration has also been identified in the South Woodstock Stock and propylitic alteration in the North Woodstock Stock. Other intrusions may also be present both at surface (eg. Sharp's Mountain, Kilmarnock Settlement) or at depth. Such intrusions could explain the mineralization in the Lower Northampton area (occurrences 17, 18, 28, 29) and the different geochemistry of the Britton Mine (25).

Stream sediment geochemistry (Austria, 1980 a, b) reflects the porphyry copper system as outlined above. Cu (>30ppm) and Mo (>3ppm) (Figure 10.2) are regionally higher in sediments from streams draining the phyllic alteration zone of the Gibson Stock. Zinc (>125ppm) shows the same general pattern (Figure 10.3) as well as regional increases to the north and west peripheral to the stock. Pb (Figure 10.4) is also highest in the periphery of the stock especially to the west and north. These patterns define metal zoning typical of many porphyry copper districts. The high Pb area to the north of the Gibson Stock incorporates most of the know galena occurrences in that area. On a more regional scale it can be seen that Pb values

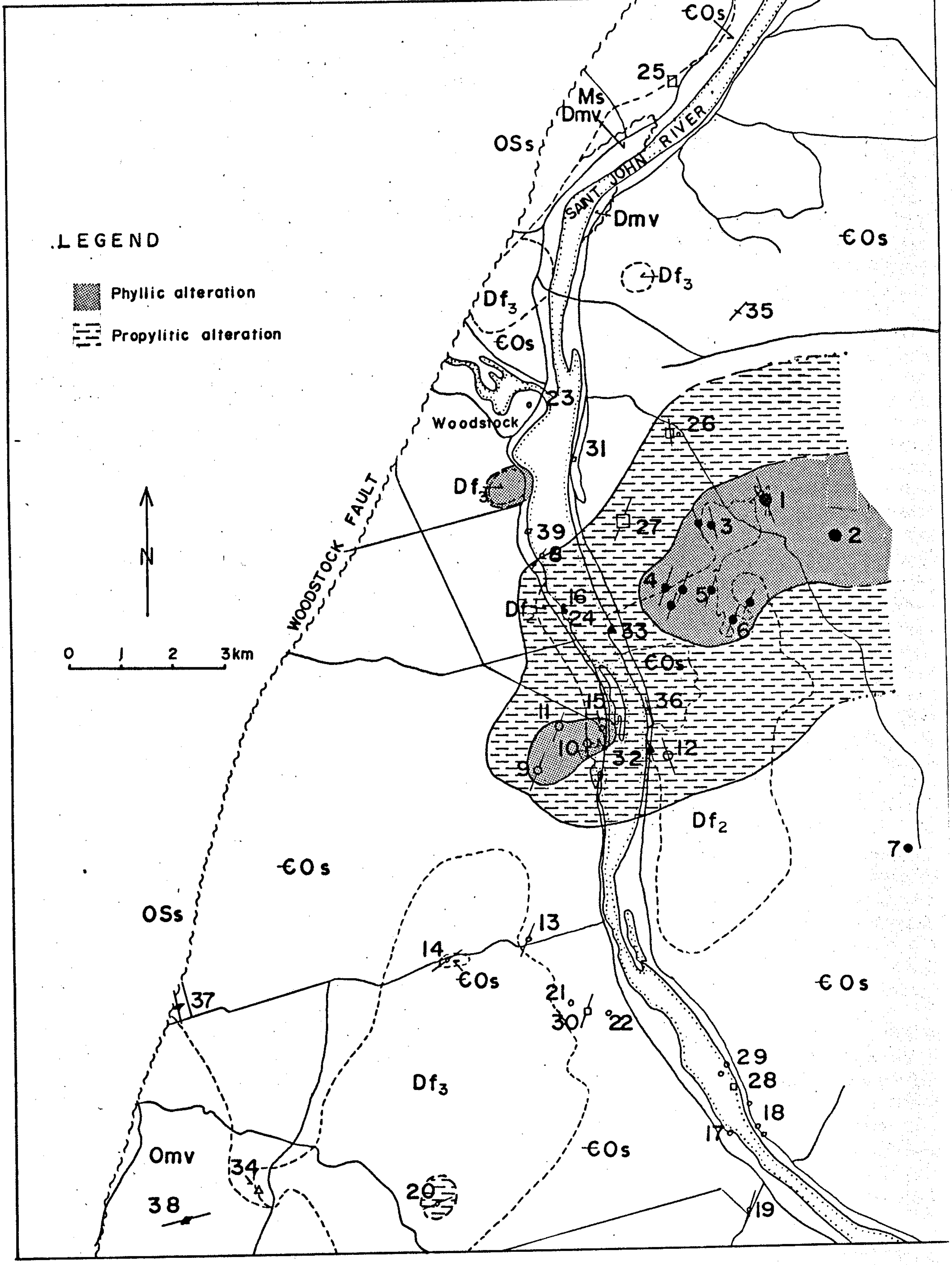


Figure 10.1: Regional distribution of phyllic and propylitic alteration (for basemap legend see Map 1).

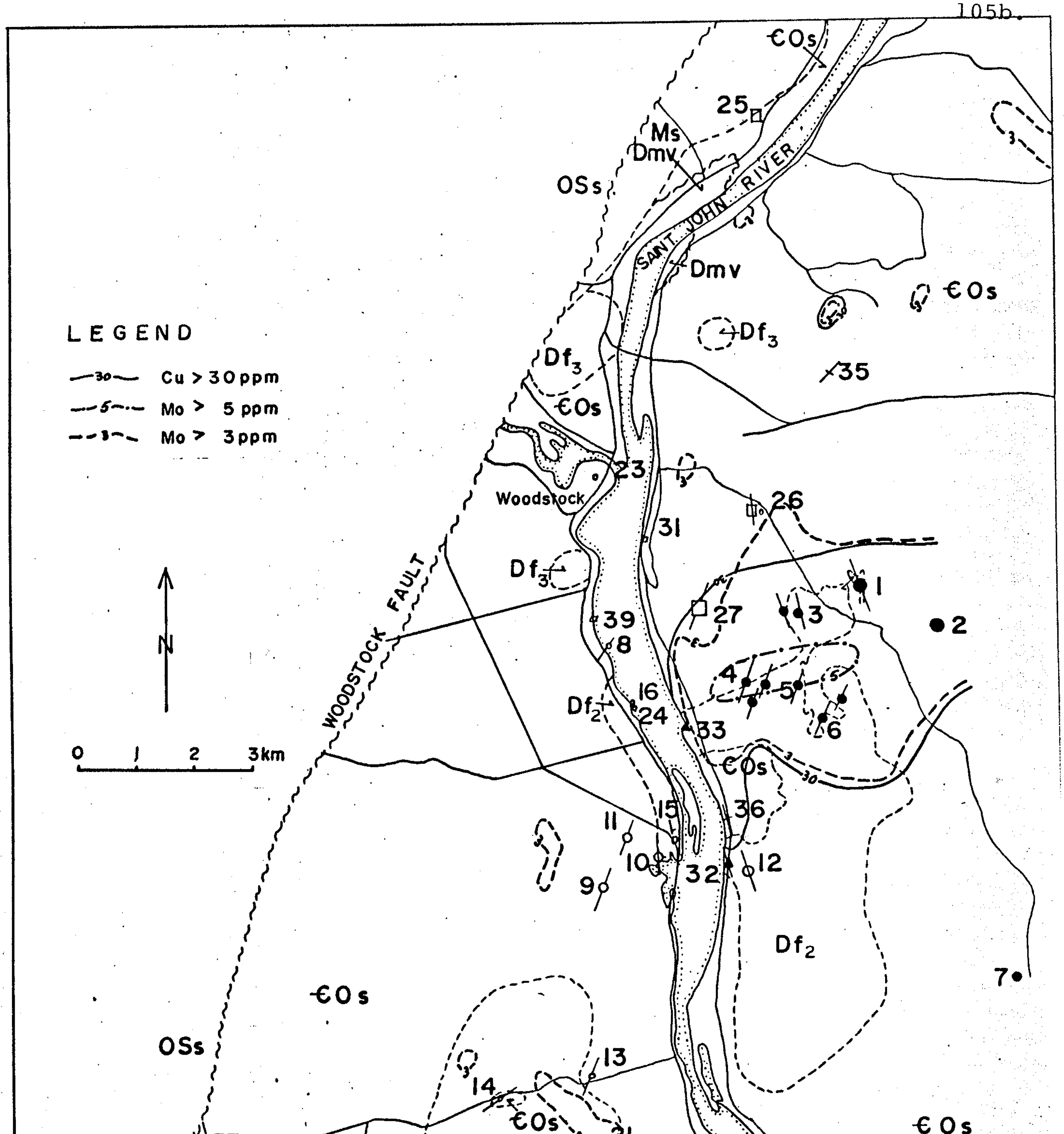


Figure 10.2: Regional distribution of Cu and Mo in stream sediments (for basemap legend see Map 1).

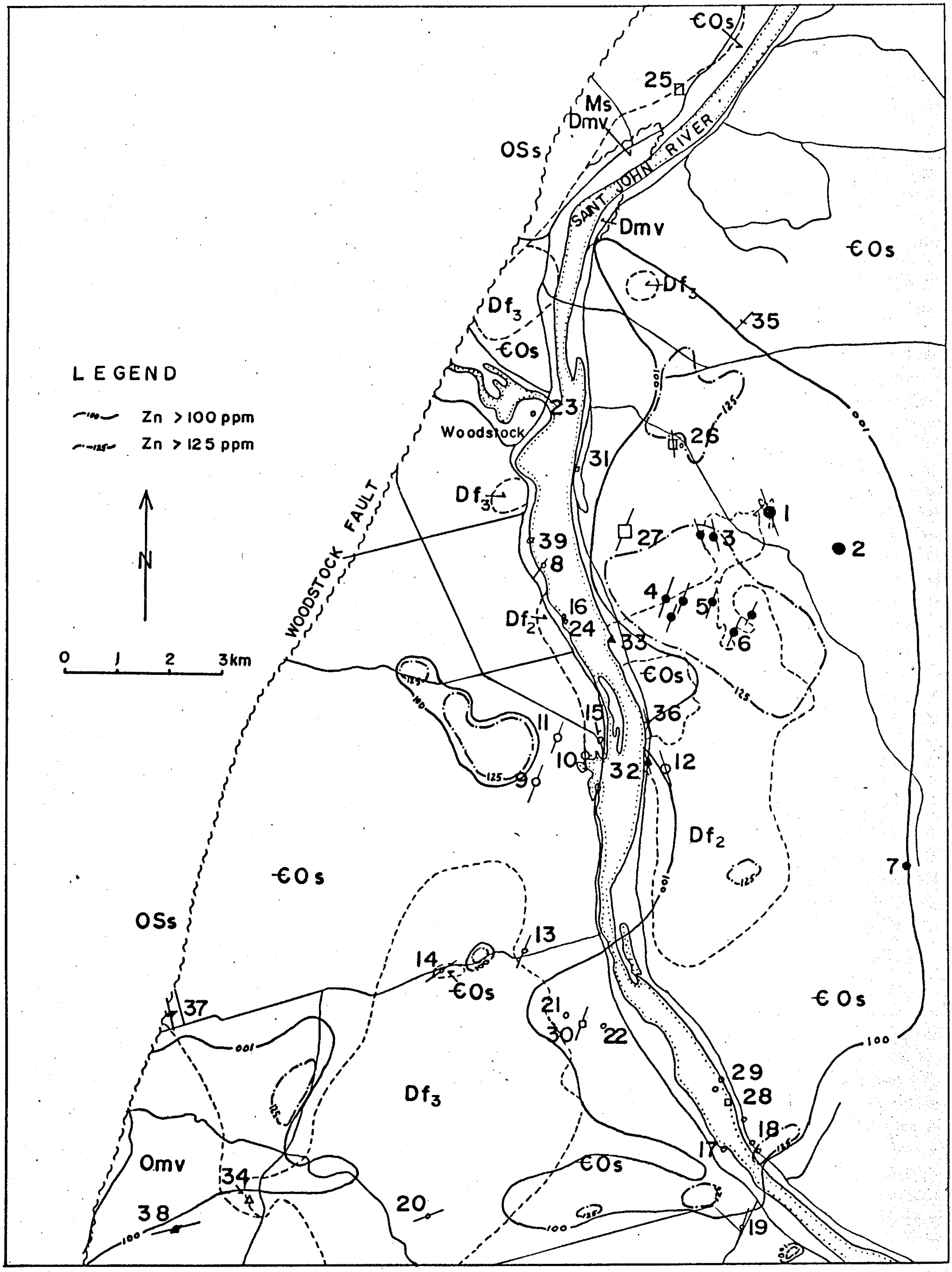


Figure 10.3: Regional distribution of Zn in stream sediments (for basemap legend see Map 1).

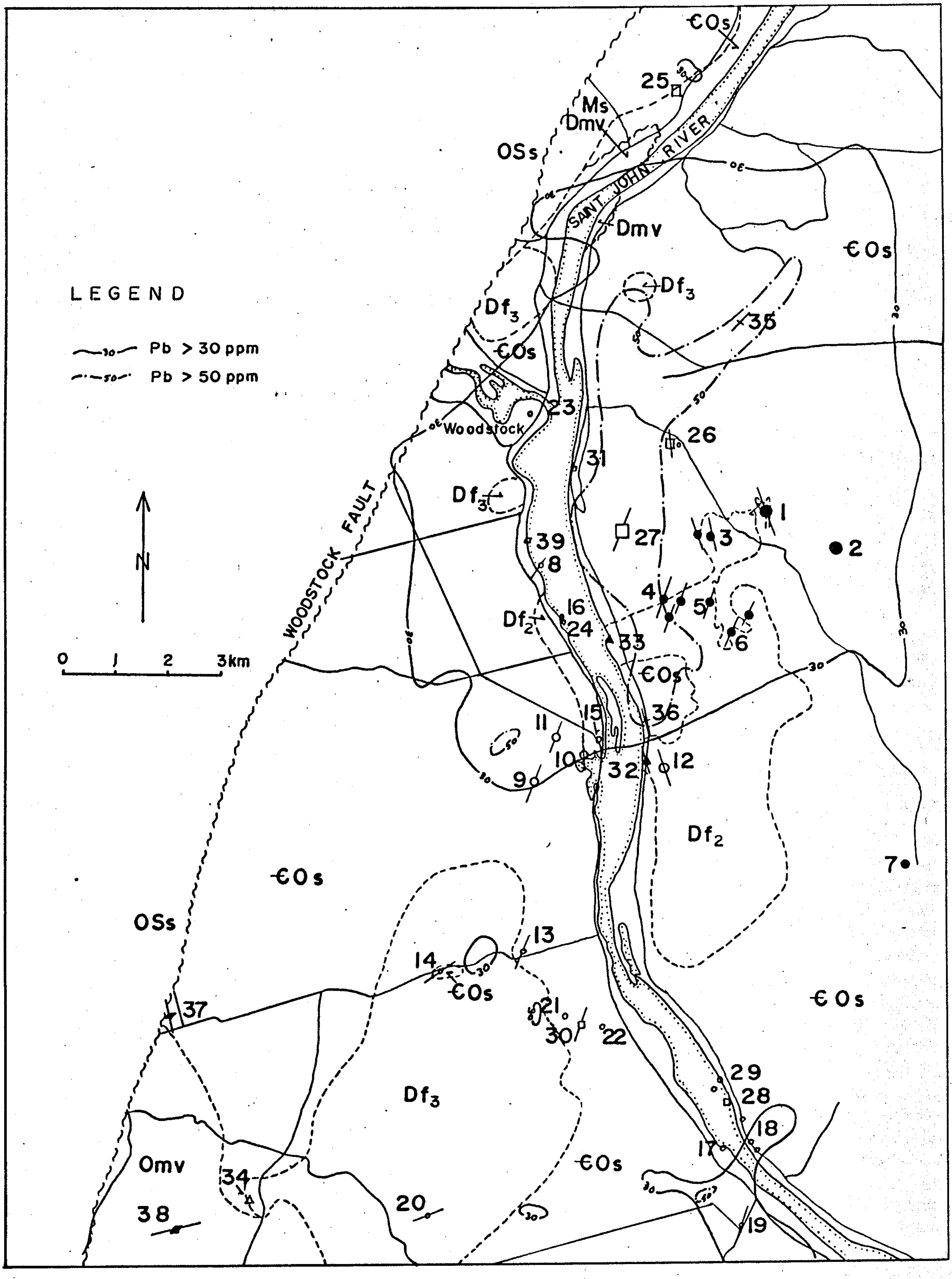


Figure 10.4: Regional distribution of Pb in stream sediments (for basemap legend see Map 1).

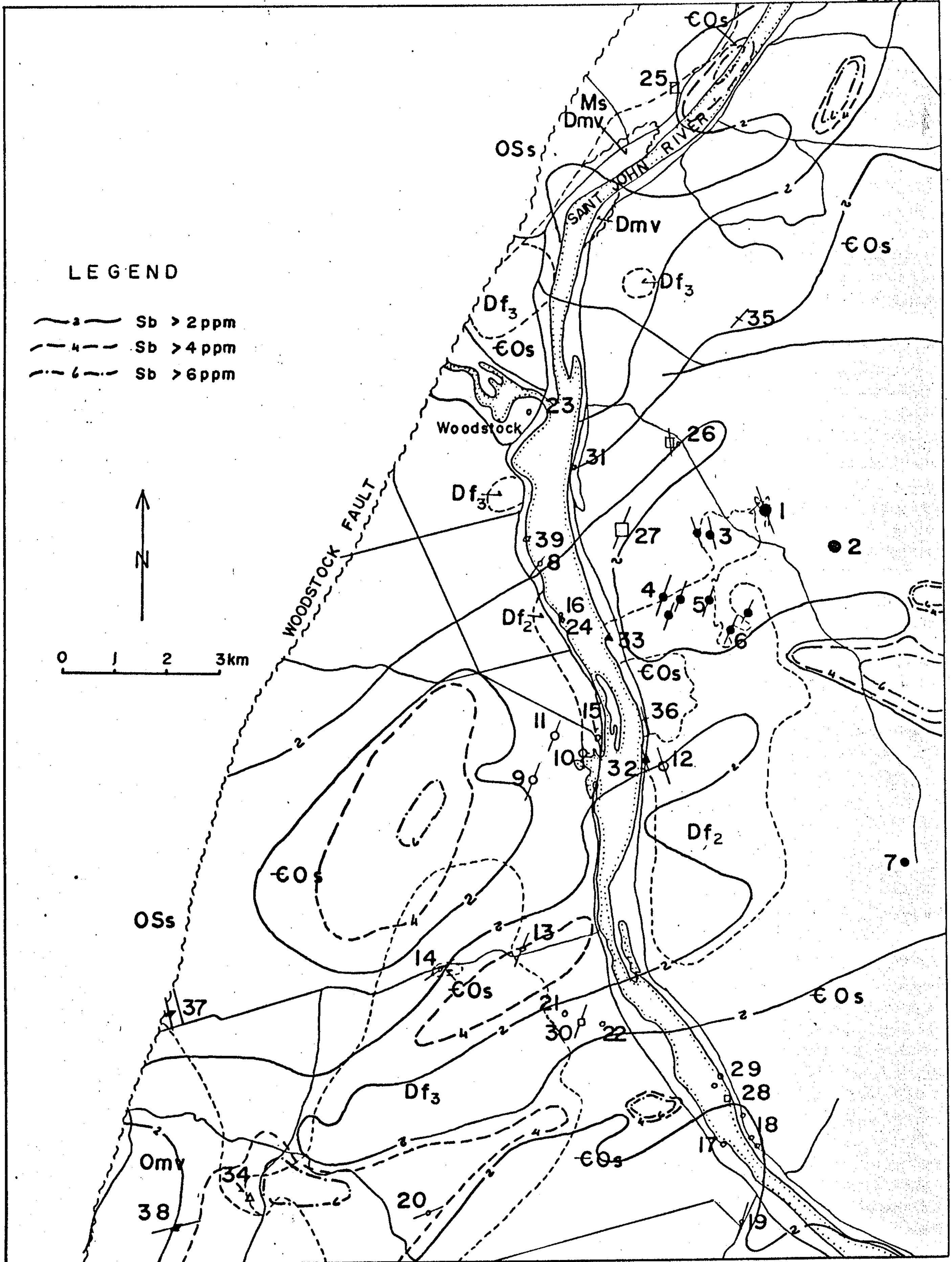


Figure 10.5: Regional distribution of Sb in stream sediments (for basemap legend see Map 1).

greater than 30ppm (Figure 10.4) are in most of the northern part of the area whereas zinc greater than 100ppm extends a considerable distance farther to the south. Zinc is also greater than 100ppm in the Oak Mountain area where it may reflect the presence of mafic volcanics and/or Zn mineralization associated with Sb-Au quartz veins in that area. Compilation of the Sb (Figure 10.5) stream sediment data shows concentration in the periphery of the Benton Stock. This is substantiated by the presence of antimony minerals at Oak Mountain and geochemical anomalous Sb geochemical values at other sites in the area (eg. Wickham and Dugan Road) near the Benton Stock. The stream sediment geochemical results suggest more Sb occurrences are likely present in the metasediments in the periphery of the Benton Stock.

The main structural controls for sulphide mineralization in the porphyry copper system trend northerly to northeasterly. This is subparallel to the Woodstock Fault and implies a common tectonic relationship between the fault and the porphyry copper system. Also the regional stream sediment geochemistry patterns for Sb indicate northeasterly trends in the vicinity of the Benton Stock.

The Woodstock area contains several Devonian Stocks which have some similarities in that they are in part porphyritic, felsic in composition, epizonal, elongated north-south and low in Rb. However there are several marked differences between the Gibson and Benton Stocks in particular that should be emphasized.

1. Porphyry copper mineralization is associated with only the northern part of the Gibson Stock as indicated not only by the distribution of the known mineral occurrences but also by the stream sediment geochemistry.

2. The Benton Stock contains more Ba and Sb than the Gibson Stock. This is apparent from the lithogeochemistry, from the regional geochemical patterns for Sb in the stream sediments (Figure 10.5) and from the known mineral occurrences (No. 13, 14, 34, 37, 38).

3. The Connell Mountain phase of the Gibson Stock contains more F than the Benton Stock which in turn contains more than the rest of the Gibson Stock.

4. Whereas the Gibson, Benton and North Woodstock Stocks contain low levels of Rb compared to Sr and Ba, the South Woodstock and Sharp's Mountain Stocks contain low levels of Sr compared to Rb and Ba.

11.0 SUGGESTIONS FOR FURTHER WORK

The genetic relationship between the various stocks in the Woodstock Area is not known, nor are the various phases of the Gibson and Benton Stocks adequately mapped. Detailed geological mapping (1:1000 scale) could identify specific areas for further mineral exploration and possibly show relationships between the various pulses of intrusion within the Gibson Stock and certain mineral occurrences.

The limits of mineralized zones and associated alteration are not defined to the east of Connell Mountain. More areas of mineralization, complimentary to that seen to the west of Connell Mountain, may be present to the east. Because of extensive drift cover boulder prospecting and till geochemistry may be required in order to evaluate the mineral potential of these areas.

Auriferous parts of the porphyry copper system on Connell Mountain have been identified; the geochemical data would indicate that the potential for large tonnage auriferous porphyry copper deposits is not favourable. However gold vein type deposits are present and warrant further exploration. An effective exploration approach would be systematic detailed near surface till sampling and geochemical gold analysis of the -63 μ fraction. Undiscovered Sb - Au vein deposits probably occur in the metasedimentary rock peripheral to the Benton Stock. Other felsic stocks in the area such as the Sharp's Mountain and South Woodstock stocks contain anomalous Au and As, the latter also exhibits phyllic alteration. Hence these stocks as well as the north Woodstock Stock and Kilmarnock Settlement area would be targets that merit evaluation.

In addition to detailed geological mapping, effective exploration technique to screen favourable targets in this area would be systematic till geochemistry and gold analysis of the -63μ fraction. Initially, the near surface tills could be sampled at 1 kilometer centers. As an aid to geological mapping of the area an airborne gradiometer survey would be an asset.

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Wright, W.J. and Perry, S.C., 1931: Plan of prospects near Woodstock, New Brunswick; New Brunswick Department of Natural Resources, MP 31-8.

APPENDIX I

PETROGRAPHIC AND MINERALOGRAPHIC REPORTS

by

J. A. AYER

INDEX FOR APPENDIX I

Page

NOTES REGARDING PETROLOGY OF WOODSOTCK THIN SECTIONS

1. All the stocks are high level porphyritic intrusions. The Benton and Bull Creek are granitic to granodioritic. The Gibson and Connell Mountain intrusions are largely devoid of alkali feldspar and range from tonalitic to trondhjemitic in composition.

Note all granitoid compositions are based on the Streckeisen classification scheme.

Streckeisen, A. 1976: To each plutonic rock its proper Name. Earth-Science Reviews, Vol.12, p.1-33.

2. Most of intrusive rocks examined are pervasively altered within the propylitic zone. Some of the samples from Connell Mountain and Bull Creek extend into the phyllic zone. I have found little evidence of any potassic alteration with the possible exception of a small quartz vein in sample No. 159. No hydro biotite was observed in any of the specimens. To test for possible potassic alterations future samples should include good sulphide-bearing quartz veins from the phyllic zone and then I can determine if a potassic selvage is present around these veins similar to the type in the Highland Valley deposits in B.C.

3. The samples which we indicated as chloritic (ie 128 and 68B) do not appear unusually rich in chlorite in thin sections, so I really can't verify if the dykes are responsible for chloritization or not. Also chloritization appears to be pervasive accompanying propylitic alteration.

BENTON STOCK - Comments

Thin sections of 4 specimens from this intrusion were examined (sample nos. 1, 4, 203 and 273B). The composition of these samples ranges from granite to granodiorite. All samples are plagioclase porphyritic in a fine to medium-grained groundmass with granophyric intergrowth of groundmass quartz and feldspar.

These textures indicate intrusion at a relatively high level in the crust (ie. an epizonal intrusion). Additionally, the granophyric textured groundmass may indicate the source material for this intrusion is a late differentiate from a more mafic parent magma.

Alterations in the 4 samples is variable. Sample No.1 is essentially unaltered. Sample nos. 4 and 273B are pervasively altered within the propylitic zone. Sample No. 4 is moderately altered and sample No. 273B has more intense alterations. Plagioclase crystals are altered to sericite overgrowths with increasing epidote content at higher intensities. Ferromagnesium minerals are partially to totally chloritized with increasing chlorite content at higher intensities.

T-1

Rock Name Plagioclase porphyritic granite

Mineralogy

Kspar	35%	m.g. (up to 2mm) subhedral
Quartz	30%	m.g. (up to 2mm) anhedral
Plagioclase	25%	m.g. (up to 3mm) subhedral,glomeroporphyritic
Biotite	8%	f.g. (up to 1mm) subhedral
Opaques	2%	f.g. (up to Ø.6mm) subhedral to euhedral
Apatite	tr	f.g. (up to Ø.1mm) euhedral

Texture Porphyritic to glomeroporphyritic plagioclase in a m.g. subhedral-granular groundmass.

Description Plagioclase crystals are of albite composition and moderately altered to v.f.g. overgrowths of sericite. Locally several phenocrysts are attached together in a glomeroporphyritic texture. Kspar crystals have minor exsolved plagioclase in a perthitic intergrowth. Quartz and Kspar crystals commonly have granophyric intergrowths with each other and locally inclusions of f.g. plagioclase. Biotite crystals are moderately altered to overgrowths of f.g. chlorite, sphene and epidote. Opaques consist of pyrite crystals rimmed by v.f.g. hematite and oxides now totally altered to leucoxene.

T-4

Rock Name Plagioclase porphyritc granite

Mineralogy

Plagioclase	30%	m.g. (up to 3mm) euhedral to subhedral
Quartz	30%	f.g. to m.g. (up to 2mm) anhedral
Kspar	30%	f.g. (up to 1mm) subhedral
Biotite	8%	f.g. (up to 1mm) subhedral
Epidote	2%	f.g. (up to 0.5mm) subhedral
Sphene	tr	f.g. (up to 0.5mm) subhedral
Opaques	tr	f.g. (up to 0.2mm) subhedral

Texture Medium-grained porphyritic to glomeroporphyritic plagioclase in a f.g. granophyric groundmass of intergrown quartz, plagioclase and Kspar.

Description Plagioclase crystals are strongly altered to overgrowths of v.f.g. sericite and epidote with moderately altered rims. Quartz and Kspar occur as granophyric intergrowths with minor f.g. inclusions of plagioclase. Biotite is almost completely altered to overgrowths of f.g. chlorite, sphene and epidote. Opaques are moderately altered to leucoxene.

T-2Ø3

Rock Name: Plagioclase porphyritic granite

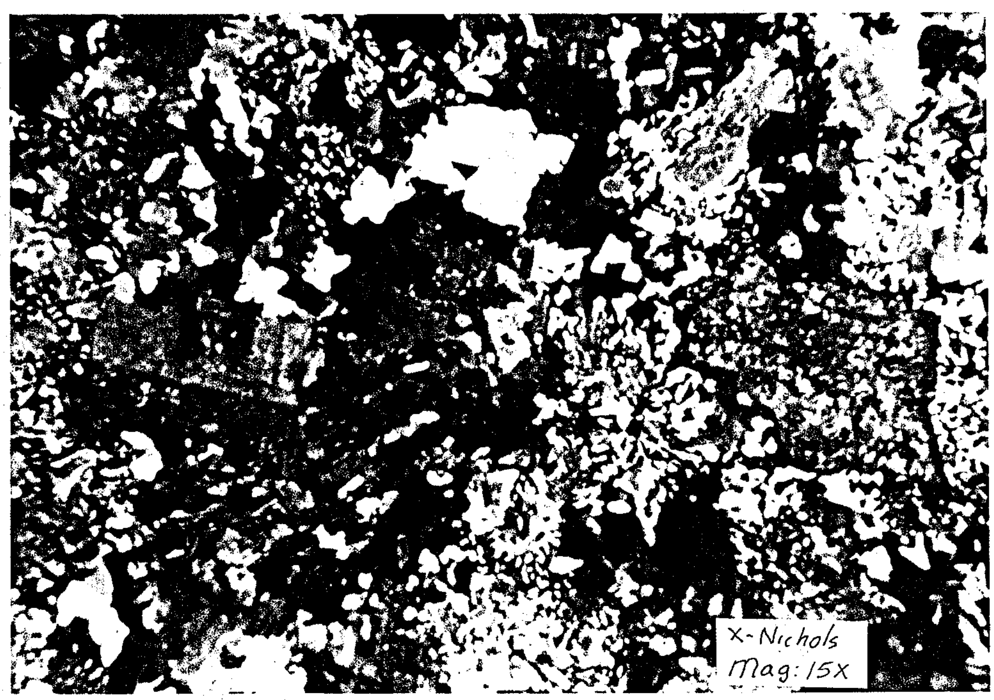
Mineralogy:

Plagioclase	4Ø%	f.g. to m.g. (up to 5mm), subhedral
Quartz	25%	f.g. (up to 1mm), anhedral
Kspar	25%	f.g. (up to 1mm), subhedral
Hornblende	5%	f.g. (up to 1mm), subhedral
Biotite	5%	f.g. (up to Ø.5mm), subhedral
Epidote	tr	f.g. (up to Ø.5mm), subhedral
Opaques	tr	f.g. (up to Ø.2mm), subhedral

Texture: Medium-grained plagioclase phenocrysts in a fine-grained groundmass of granophyric intergrowths of quartz and Kspar, with fine grained plagioclase.

Detailed Description: Plagioclase phenocrysts are of andesine composition and are slightly to moderately altered to overgrowths of very fine-grained sericite and epidote. Quartz and Kspar occur as separate crystals in the groundmass and as granophyric intergrowths. Hornblende (?) is totally replaced by chlorite, epidote and opaques. Biotite is partially to totally altered to chlorite and sphene. Opaques are unaltered oxides.

Interpretation: A high level intrusion (i.e. porphyritic and granophyric) of granite composition. Alteration is relatively moderate propylitization consisting of sericitization and epidotization of plagioclase and chloritization of ferromagnesium minerals.



T-273B

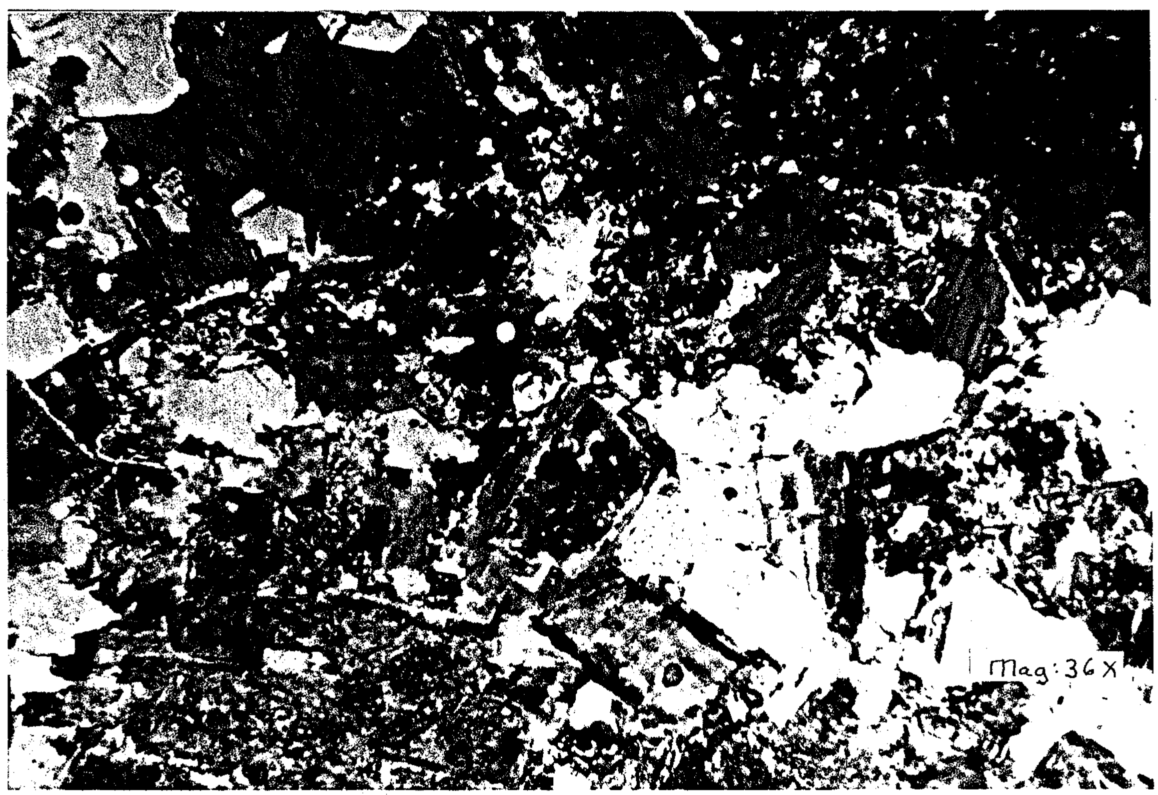
Rock Name Plagioclase porphyritic granodiorite

Mineralogy

Plagioclase	45%	m.g. (up to 2mm) subhedral
Hornblende	25%	f.g. to m.g.(up to 2mm) subhedral to euhedral
Quartz	15%	f.g. (up to 1mm) anhedral
Kspar	10%	f.g. (up to 1mm) subhedral
Opaques	3%	f.g. (up to 0.5mm) subhedral
Epidote	2%	f.g. (up to 0.5mm) subhedral

Texture Medium grained plagioclase phenocrysts in a f.g. granophyric groundmass.

Description Plagioclase crystals are intensely altered to v.f.g. overgrowths of epidote, chlorite, sericite and carbonate. Hornblende is weakly to intensely altered to chlorite, epidote and locally carbonate. The quartz and Kspar occur as granophyric intergrowths with minor f.g. plagioclase inclusions. Opaques are moderately altered to leucoxene.



GIBSON STOCK - **Comments**

Thin sections of 16 speciments from this intrusion were examined (nos. 103, 116, 116A, 125, 128, 129. 159, 192B, 193B, 195, 230D, 234, 237, 360, 366 and 367). The composition of the samples ranges from granodiorite to tonalite with one trondhjemite sample.

It is not known what intrusive relationship exists between the granodiorites (nos. 366, 367) and the tonalites. Two phases of tonalite are present in the samples. An earlier fine-grained equigranular tonalite occurs in samples 103,116A, 159 and 193B intruded by porphyritic tonalite (nos. 116, 116A, 125, 128, 129, 193B, 195, 230D, 234, 237 and 360). The fine-grained equigranular tonalites (and the trondhjenite-sample no. 192B) all have a peculiar subophitic texture with fine-grained subhedral to euhedral early plagioclase crystals partially to totally included in anhedral quartz. The porphyritic tonalites and granodiorites consist of medium-grained plagioclase ± quartz ± hornblende phenocrysts in a fine-grained subhedral-granular groundmass of feldspar, quartz and ferromagnesium minerals. All the above textures are indicative of rapid cooling as the result of intrusion at a relatively high level in the crust (ie. epizonal).

All the examined samples show varying degrees of pervasive propylitic alteration. This is characterized by sericitization and/or epidotization of plagioclase and chloritization of ferromagnesium minerals. The most intense propylitic alteration occurs in samples 234, 237 and 360, where primary hornblende crystals are now totally replaced by f.g. chlorite ± epidote ± sphene ± quartz ± carbonate ± sericite. In addition, sample no. 237 may extend into the phyllic zone as indicated by numerous thin fractures filled with sericite and f.g. sericite overgrowths on altered hornblende.

T-103

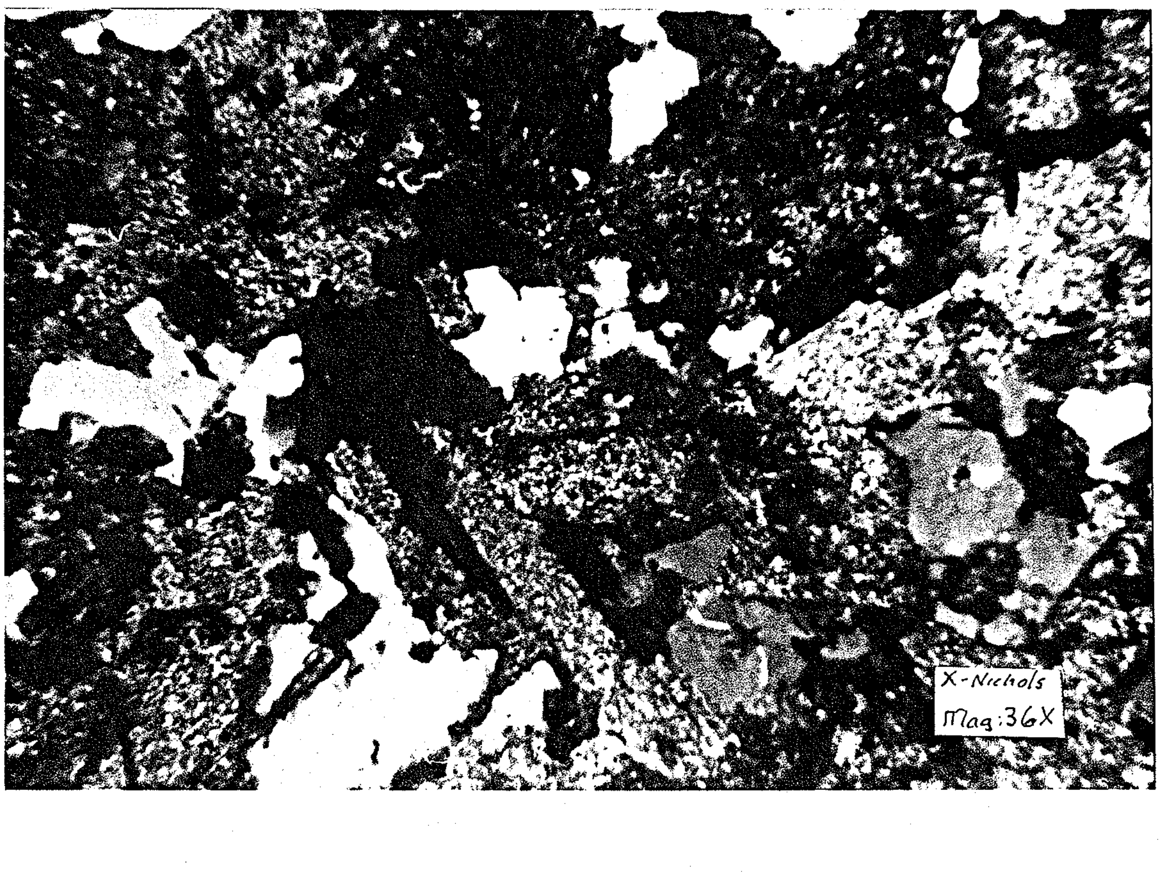
Rock Name Fine-grained tonalite

Mineralogy

Plagioclase	60%	f.g. (up to 1mm) euhedral to subhedral
Quartz	20%	f.g. (up to 1mm) euhedral to anhedral
Chlorite	15%	f.g. (up to 0.5mm) subhedral
Opaques	5%	f.g. (up to 0.1mm) euhedral
Carbonate	tr	f.g. (up to 0.5mm) subhedral

Texture Fine grained plagioclase laths partially to totally included in f.g. anhedral quartz in a subophitic texture.

Description Plagiolcase is moderately altered to v.f.g. sericite and minor v.f.g. epidote overgrowths. Chlorite contains numerous v.f.g. inclusions of sphene and locally f.g. epidote and probably replaces biotite. Opaques are magnetite which is essentially unaltered.



T-116

Rock Name Plagioclase-quartz-hornblende porphyritic tonalite

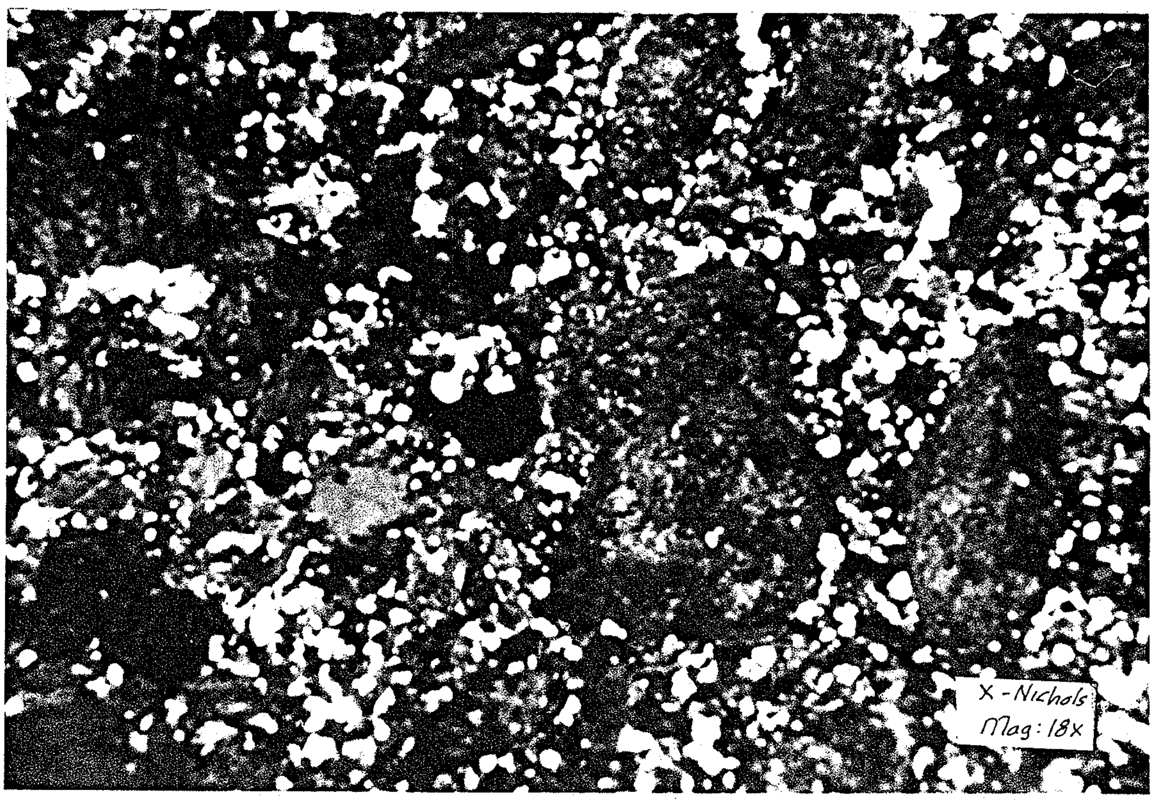
Mineralogy

Plagioclase	50%	f.g. to m.g. (up to 3mm) euhedral
Quartz	30%	f.g. to m.g. (up to 5mm)subhedral to anhedral
Hornblende	10%	f.g. to m.g. (up to 5mm) euhedral
Chlorite	10%	f.g. (up to 0.5mm) subhedral
Epidote	tr	f.g. (up to 0.5mm) subhedral
Sphene	tr	f.g. (up to 0.5mm) subhedral
Opaques	tr	f.g. (up to 0.5mm) subhedral
Zircon	tr	f.g. (up to 0.1mm) euhedral

Texture Medium grained phenocrysts of plagioclase, quartz and hornblende in a f.g. subhedral granular groundmass.

Description Plagioclase is strongly altered to v.f.g. to f.g. sericite and epidote. Hornblende crystals are moderately altered to chlorite, epidote and quartz. Chlorite totally replaces biotite and has f.g. inclusions of sphene and epidote. Opaques are pyrite with rims altered to hematite.

Several irregular-shaped diorite inclusions are present up to 5mm in diameter. They consist of abundant partially chloritized actinolite with f.g. epidotized plagioclase, sphene and minor quartz.



T-116A

Specimen consists of f.g. tonalite, intruded by porphyritic tonalite.

Rock Name Fine-grained tonalite

Mineralogy

Plagioclase	63%	f.g. (up to 1mm) euhedral
Quartz	20%	f.g. to m.g. (up to 1.5mm) anhedral
Chlorite	10%	f.g. (up to 0.5mm) subhedral
Epidote	5%	f.g. (up to 0.2mm) subhedral
Sphene	2%	f.g. (up to 0.2mm) subhedral

Texture Fine-grained plagioclase laths totally to partially included in anhedral quartz crystals.

Description Plagiolcase slightly altered to f.g. epidote overgrowths. Chlorite totally replaces primary biotite and has f.g. inclusions of epidote and sphene.

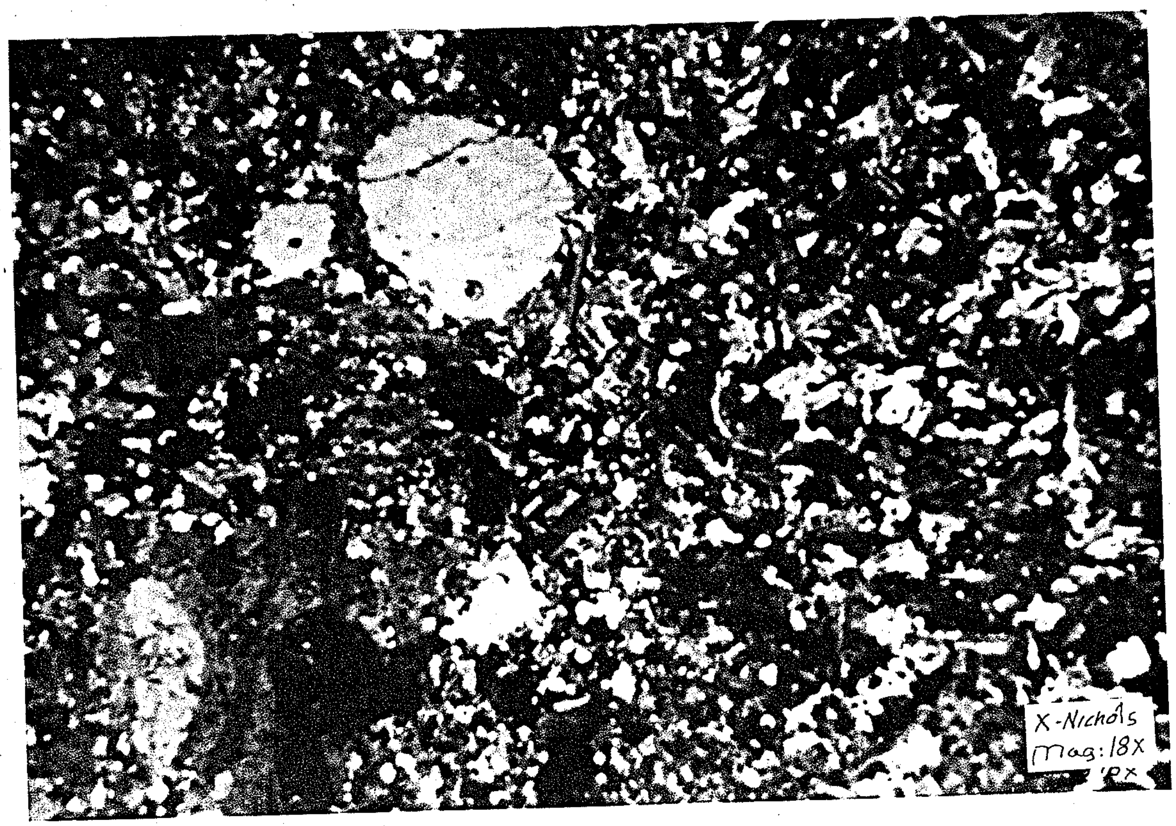
Rock Name Plagioclase-hornblende-quartz porphyritic tonalite

Mineralogy

Plagiolcase	55%	m.g. (up to 2mm) euhedral phenocrysts and f.g. subhedral in groundmass
Quartz	30%	m.g. (up to 2mm) subhedral phenocrysts and f.g. anhedral in groundmass
Hornblende	15%	f.g. to m.g. (up to 2mm) euhedral
Sphene	tr	f.g. (up to 0.2mm) subhedral
Epidote	tr	f.g. (up to 0.2mm) subhedral

Texture Medium-grained plagioclase, hornblende and quartz phenocrysts in a f.g. subhedral granular groundmass.

Description Plagioclase is strongly altered to v.f.g. sericite and f.g. epidote overgrowths. Quartz phenocrysts are strongly resorbed. Hornblende is moderately to strongly altered to actinolite, chlorite, quartz and epidote.


X-Nichols
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T-125

Rock Name Plagioclase-quartz-hornblende porphyritic tonalite

Mineralogy

Plagioclase	55%	m.g. (up to 2mm) euhedral phenocrysts and f.g. subhedral in groundmass
Quartz	30%	m.g. (up to 5mm) subhedral phenocrysts and f.g. anhedral in groundmass
Hornblende	10%	f.g. to m.g. (up to 3mm) euhedral
Opaques	3%	f.g. (up to 0.4mm) subhedral
Epidote	2%	f.g. (up to 0.5mm) subhedral

Texture Medium-grained phenocrysts of plagioclase, quartz and hornblende in a f.g. subhedral-granular groundmass.

Description Plagioclase is moderately altered to v.f.g. sericite and epidote. Oscillatory zoning is locally preserved. Quartz phenocrysts are strongly resorbed and contain f.g. plagioclase inclusions. Hornblende is totally replaced by f.g. chlorite, quartz, and epidote with inclusions of f.g. sulfides. Opaques are predominantly f.g. pyrite.

Thin fractures up to 0.2mm wide have mylonitized wallrock and infillings of v.f.g. epidote and chlorite. Offsets occur along these fractures up to about 2mm long.

T-128

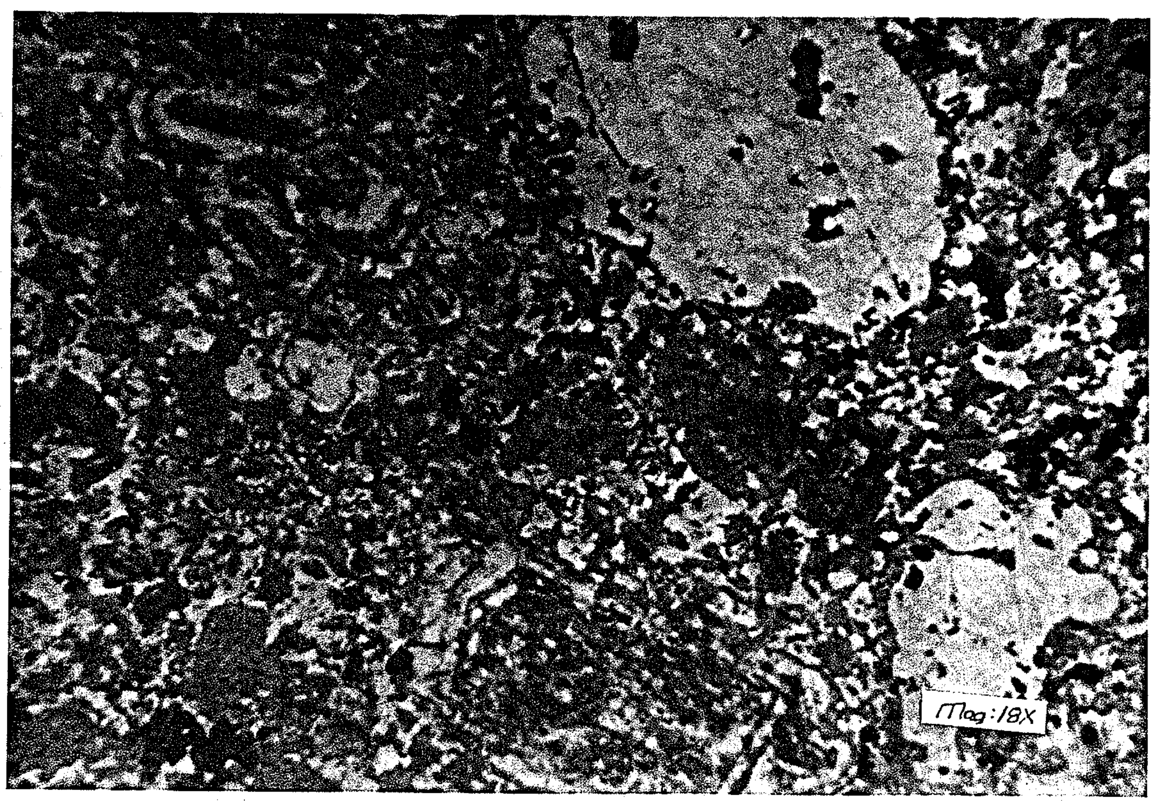
Rock Name Plagioclase-hornblende-quartz porphyritic tonalite

Mineralogy

Plagioclase	55%	f.g. to m.g.(up to 2mm) euhedral to subhedral
Quartz	25%	m.g. (up to 5mm) subhedral phenocrysts and f.g. anhedral in the groundmass
Hornblende	20%	f.g. to m.g.(up to 2mm) euhedral to subhedral
Opaques	tr	f.g. (up to 0.5mm) euhedral to subhedral
Apatite	tr	f.g. (up to 0.1mm) euhedral

Texture Medium-grained plagioclase, hornblende and quartz phenocrysts in a f.g. subhedral granular groundmass.

Description Plagioclase crystals have preserved oscillatory zoning which ranges from essentially unaltered andesine to strongly altered v.f.g. to f.g. overgrowths of sericite and epidote. Quartz phenocrysts have minor resorption and plagioclase and hornblende inclusions. Hornblende crystals are variably altered to actinolite, chlorite and epidote. Opaques are pyrite with minor alteration to hematite around rims and fractures.



T-129

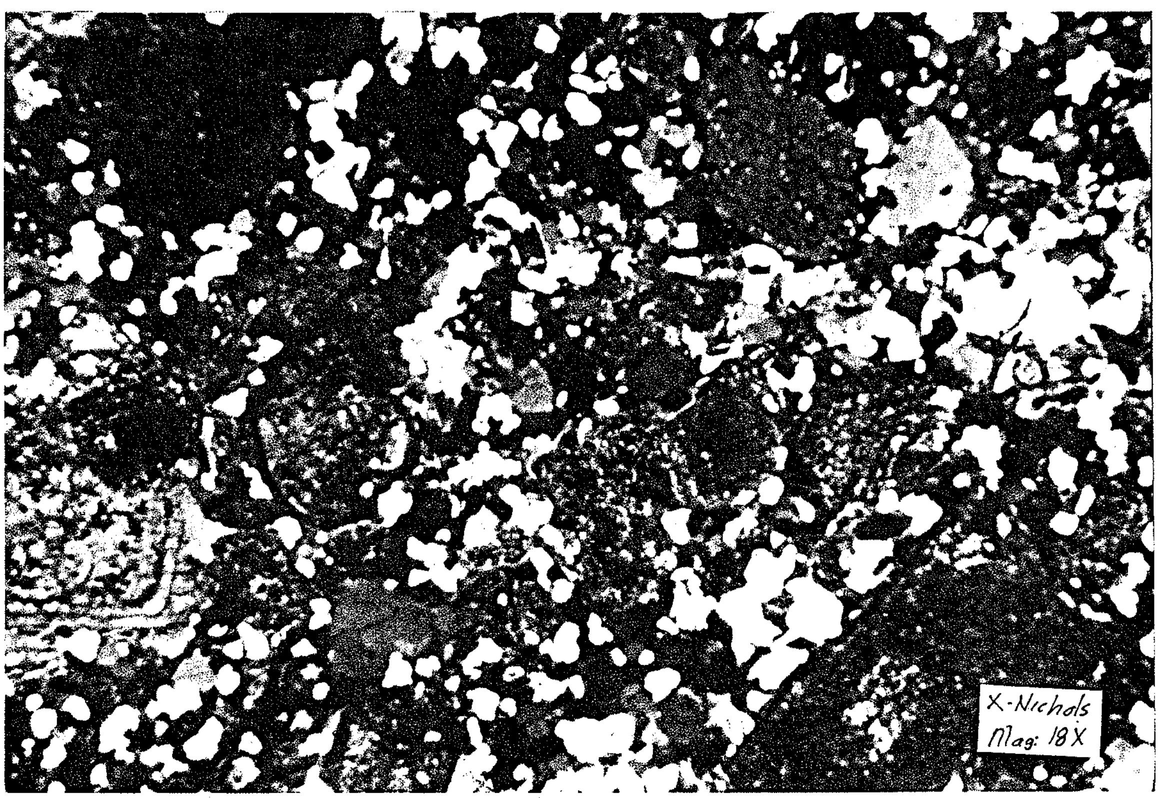
Rock Name Plagioclase-quartz porphyritic tonalite

Mineralogy

Plagioclase	60%	f.g. to m.g. (up to 2mm) euhedral
Quartz	25%	f.g. to m.g. (up to 2mm) anhedral
Chlorite	10%	f.g. (up to 1mm) subhedral
Opaques	5%	f.g. (up to 0.5mm) euhedral to subhedral
Epidote	tr	f.g. (up to 0.2mm) subhedral
Zircon	tr	f.g. (up to 0.1mm) euhedral

Texture Medium-grained phenocrysts of plagiolcase and minor quartz in a f.g. subhedral-granular groundmass.

Description Plagioclase phenocrysts are oscillatory zoned and strongly altered to v.f.g. sericite and epidote with some relatively unaltered portions of andesine composition. Quartz phenocrysts are strongly resorbed and contain f.g. inclusions of plagioclase. Chlorite crystals contain f.g. epidote and are probably alteration of earlier biotite crystals. Opaques are predominantly pyrite locally slightly altered to hematite.



T-144

Rock Name Highly sericitized fine-grained intrusive or sediment

Mineralogy

Sericite	40%	v.f.g. (up to 0.1mm) subhedral,lepidioblastic
Quartz	25%	f.g. (up to 1.0mm) anhedral
Chlorite	20%	v.f.g. (up to 0.1mm) subhedral,lepidoblastic
Plagioclase	13%	f.g. (up to 0.2mm) anhedral
Opaques	2%	v.f.g. (up to 0.5mm) subhedral

Texture Fine-grained anhedral and highly resorbed or corroded quartz crystals in a fine-grained groundmass of lepidoblastic randomly oriented sericite and chlorite with granoblastic quartz and feldspar.

Description Quartz crystal borders are typically intergrown with recrystallized micas in the groundmass. Plagioclase crystals are granoblastic and moderately altered to overgrowths of very fine-grained sericite and epidote. Sericite occurs in randomly oriented lepidoblastic sprays throughout the groundmass. This texture is similar to that seen in phyllitic alteration zones in the intrusives. Chlorite is also recrystallized in randomly oriented subhedral lepidoplastic crystals in the groundmass.

Interpretation A highly altered and recrytallized rock within the phyllic alteration zone. Rock may be fine-grained intrusive or sediment?

Alteration products are sericite, chlorite and possibly quartz.

T-159

Rock Name Tonalite

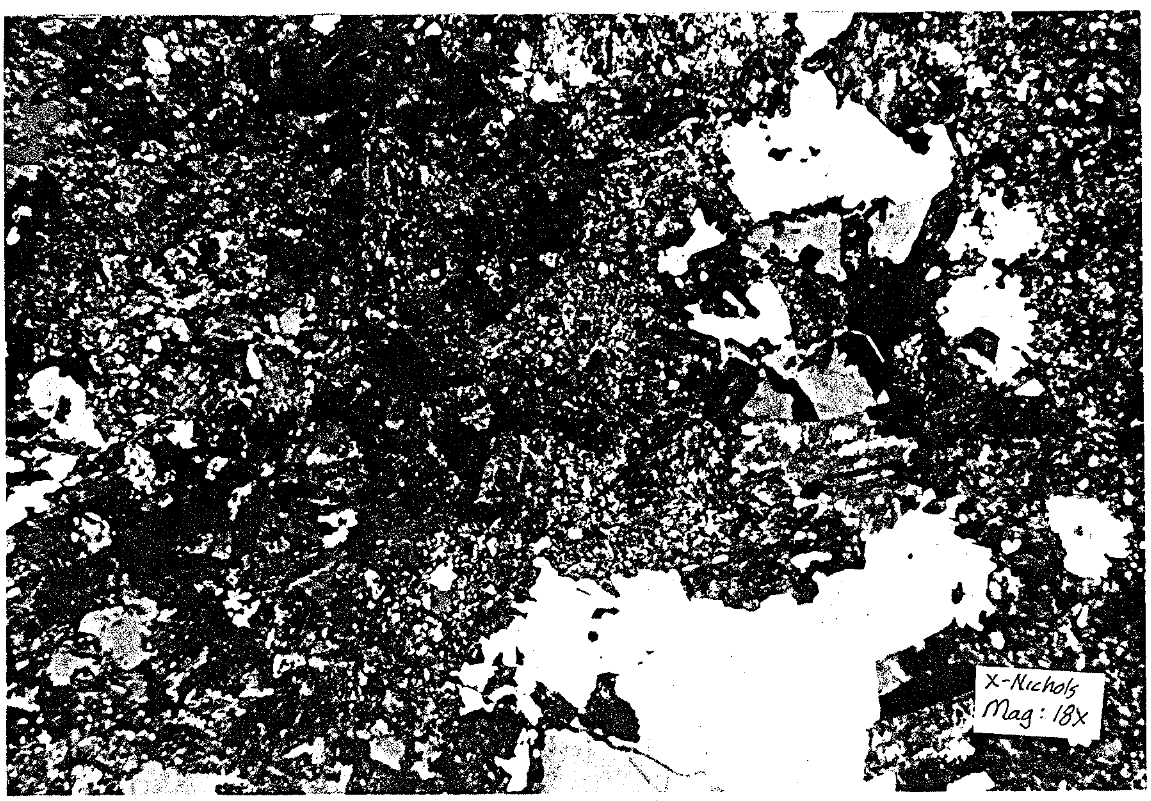
Mineralogy

Plagioclase	55%	f.g. to m.g.(up to 2mm) euhedral to subhedral
Quartz	20%	f.g. to m.g.(up to 2mm) subhedral to anhedral
Biotite	15%	f.g. (up to 1mm) subhedral
Hornblende	10%	f.g. (up to 1mm) euhderal to subhedral
Epidote	tr	f.g. (up to Ø.5mm) subhedral
Opaques	tr	f.g. (up to Ø.2mm) euhedral

Texture M.g. to f.g. plagioclase laths partially to totally subophitically included in subhedral to anhedral f.g. to m.g. quartz.

Description Plagioclase is strongly altered to v.f.g. to f.g. sericite and epidote. Biotite crystals are completely altered to chlorite and epidote. Hornblende is slightly to strongly altered to chlorite and epidote.

An intermittent quartz vein consisting of irregular shaped m.g. quartz and f.g. subhedral Kspar occurs in the central part of the slide.



T-192B

Rock Name Trondjhemite

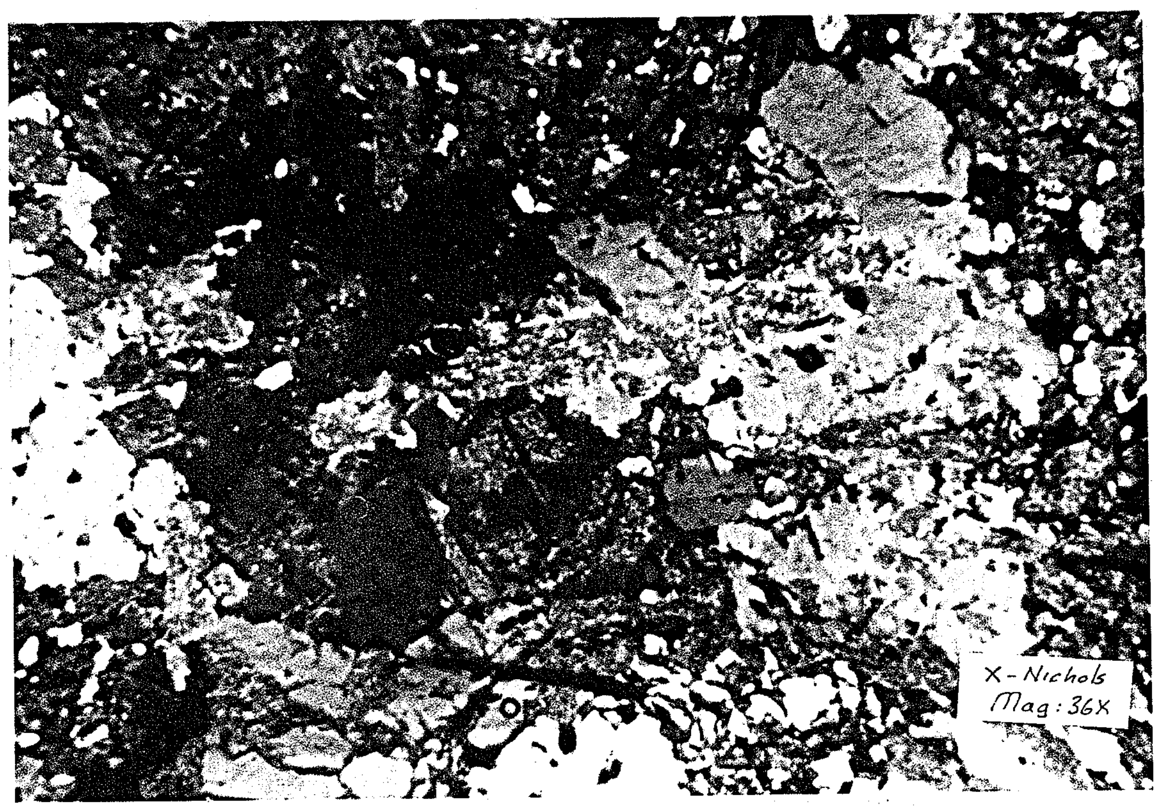
Mineralogy

Plagioclase	45%	f.g. (up to 1mm) subhedral
Quartz	40%	f.g. to m.g. (up to 3mm) anhedral
Chlorite	15%	f.g. to m.g.(up to 4mm) euhedral to subhedral
Opaques	tr	v.f.g. (up to Ø.1mm) subhedral

Texture Subophitic with f.g. to m.g. quartz crystals totally to partially including f.g. plagioclase laths.

Description Plagioclase strongly altered to v.f.g. sericite overgrowths. Quartz crystals are large (up to 3mm) and include numerous f.g. plagioclase laths. Some quartz cores have granophyric intergrowths of f.g. plagioclase. Chlorite replaces primary hornblende and biotite and has v.f.g. epidote and opaque inclusions.

Quartz veins up to 2mm wide cut the rock and are infilled with m.g. anhedral quartz and f.g. chlorite.



T-193B

Rock consist of an intrusive breccia with fragments of f.g. tonalite in a matrix of m.g. porphyritic tonalite.

<u>Rock Name</u> Fine-grained tonalite

<u>Mineralogy</u>

Plagioclase	50%	f.g. to m.g. (up to 2mm) subhedral
Hornblende	20%	f.g. (up to 0.5mm) euhedral
Quartz	20%	f.g. (up to 1mm) anhedral
Opaques	5%	f.g. (up to 0.2mm) subhedral
Chlorite	5%	f.g. (up to 0.5mm) subhedral

<u>Texture</u> Rare plagioclase phenocrysts and abundant f.g. plagioclase laths and hornblende crystals partially to totally included in f.g. anhedral quartz in a subophitic texture.

<u>Description</u> Plagioclase crystals are strongly altered to v.f.g. to f.g. sericite and v.f.g. epidote. Hornblende crystals are unaltered. Chlorite is probably after biotite and contains v.f.g. sphene and epidote inclusions. Opaques are predominatly pyrite and are unaltered. Subordinate oxides are partially to totally altered to leucoxene.

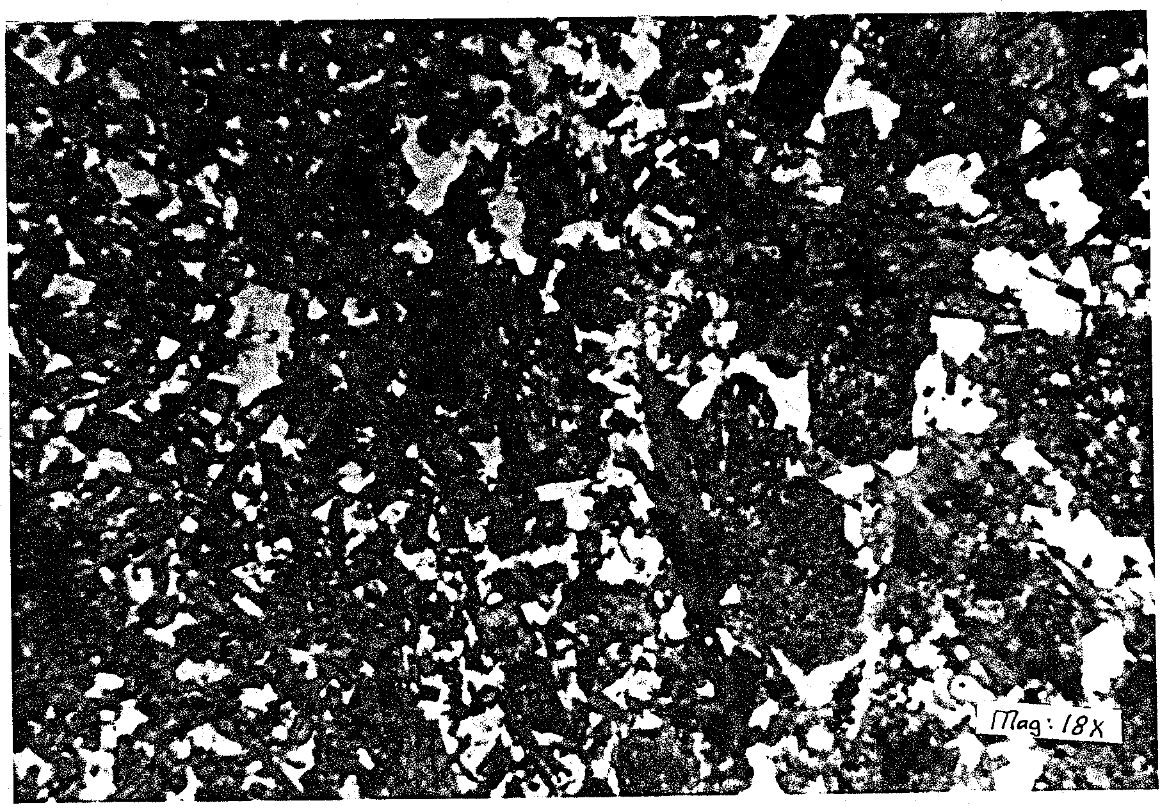
<u>Rock Name</u> Plagioclase-hornblende-quartz pophyritic tonalite

<u>Mineralogy</u>

Plagioclase	55%	m.g. (up to 3mm) euhedral phenocrysts and f.g. subhedral in groundmass
Quartz	20%	f.g. to m.g. (up to 2mm) anhedral
Hornblende	20%	f.g. to m.g. (up to 5mm) euhedral
Chlorite	5%	f.g. (up to 1mm) subhedral
Opaques	tr	f.g. (up to 0.2mm) subhedral
Epidote	tr	f.g. (up to 0.2mm) subhedral

<u>Texture</u> Medium grained phenocrysts of plagioclase, hornblende and quartz in a f.g. to m.g. subhedral granular groundmass.

<u>Description</u> Plagioclase crystals are locally oscillatory zoned. Alteration of zoned crystals is variable with certain bands altered to sericite and others to sericite and epidote. Quartz crystals have inclusions of plagioclase and hornblende. Hornblende is slightly altered to chlorite. Chlorite crystals have v.f.g. to f.g. epidote inclusions and are probably alteration of primary biotite. Opaques consist of pyrite with rims altered to hematite.


Mag: 18X

T-195

Rock Name Plagioclase porphyritic tonalite

Mineralogy

Plagioclase	50%	f.g. to m.g.(up to 2mm) euhedral to subhedral
Quartz	30%	f.g. (up to 1mm) anhedral
Chlorite	15%	f.g. (up to 0.5mm) subhedral
Opaques	5%	f.g. (up to 0.5mm) euhedral
Epidote	tr	v.f.g. (up to 0.1mm) subhedral
Carbonate	tr	v.f.g. (up to 0.1mm) subhedral

Texture Occasional m.g. plagioclase phenocrysts in a f.g. groundmass of subophitic included plagioclase laths in anhedral quartz.

Description Plagioclase is strongly altered to v.f.g. to f.g. sericite. Chlorite probably replaces primary ferromagnesiam minerals (ie biotite and/or hornblende). Opaques consist of predominantly pyrite which is unaltered and subordinate oxides strongly altered to leucoxene.

A 5mm quartz vein occurs at one end of the slide in a zone of mylonitized tonalite extending 1 to 2mm on either side of the vein. Quartz in the vein is subhedral with its long axes perpendicular to the vein boundaries. Fine grained pyrite occurs in the vein and concentrated along vein boundaries.

T-230D

Rock Name: Quartz-plagioclase porphyritic tonalite

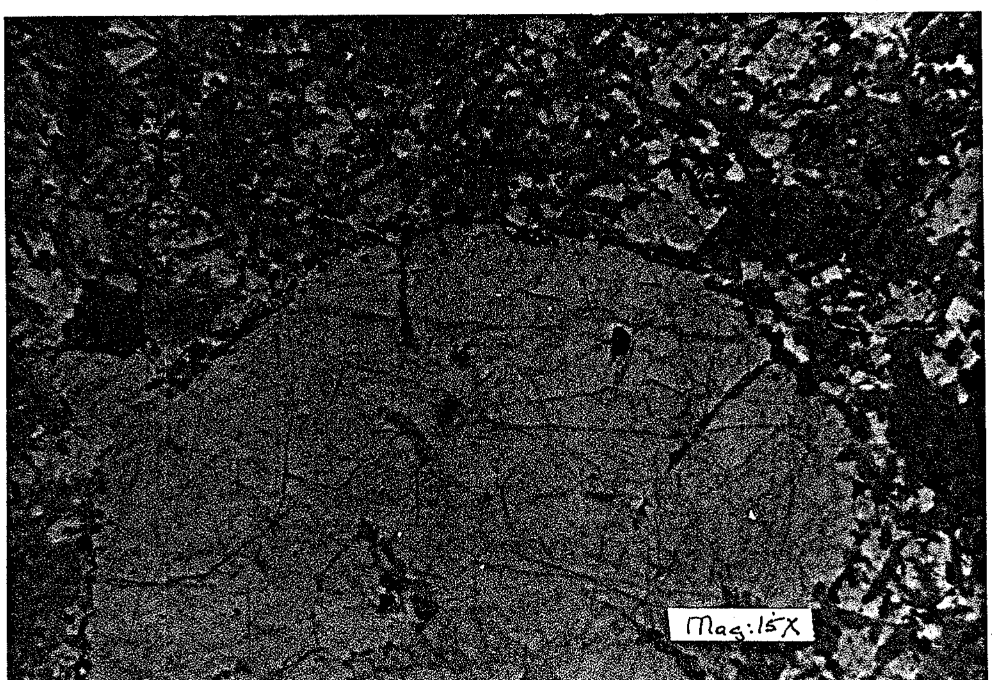
Mineralogy:

Plagioclase	55%	f.g. to m.g. (up to 2mm), subhedral
Quartz	30%	f.g. (up to 7mm), subhedral phenocrysts and f.g. anhedral in groundmass
Chlorite	10%	f.g. (up to 1mm), subhedral
Opaques	5%	f.g. (up to 1mm), anhedral

Texture: Occassional medium to coarse grained quartz and plagioclase phenocrysts in a fine-grained groundmass of subophitically intergrown quartz and plagioclase.

Detailed Description: Plagioclase crystals are intensely altered to v.f.g. to f.g. sericite. Quartz phenocyrsts have strongly resorbed borders. Groundmass quartz crystals are anhedral and up to 1mm with numerous partially to totally included finer-grained subhedral plagioclase crystals. Chlorite cyrstals locally have f.g. sphene inclusions and are probably alteration products of biotite. Opaques are very fine grained in the groundmass locally altered to leucoxene and hematite and as fine-grained dissemianted anhedral sulphide crystals.

Interpretation: A high level intrusion (i.e. porphyritic in a fine-grained groundmass) of tonalitic composition. Alteration is intense propylitization with strong sericitization of plagioclase and complete chloritization of ferromagnesium minerals.



T-234

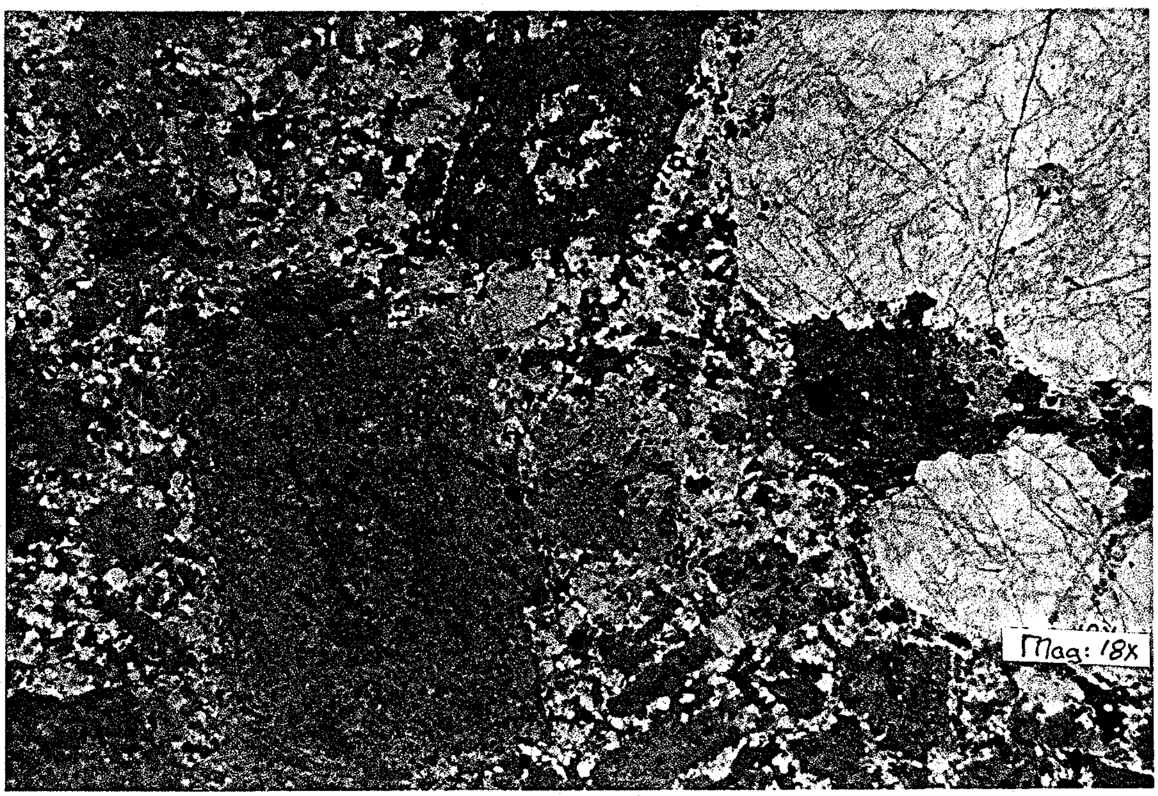
Rock Name Plagioclase-quartz-hornblende porphyritic tonalite

Mineralogy

Plagioclase	50%	m.g. (up to 3mm) euhedral phenocrysts and f.g. subhedral in groundmass
Quartz	30%	c.g. (up to 1cm) subhedral phenocrysts and f.g. anhedral in groundmass
Hornblende	10%	f.g. to m.g.(up to 4mm) subhedral to euhedral
Chlorite	10%	f.g. (up to 0.5mm) subhedral
Opaques	tr	f.g. (up to 0.5mm) subhedral

Texture Medium-grained phenocrysts of plagioclase, quartz and hornblende in a f.g. subhedral granular groundmass.

Description Plagioclase is strongly altered to v.f.g. sericite and v.f.g. to f.g. epidote. Quartz phenocrysts have strongly resorbed borders. Hornblende pseudomorphs are now totally replaced by f.g. chlorite, epidote, quartz and carbonate. Fine-grained chlorite in the ground mass contains v.f.g. epidote and sphene inclusions and is probably after biotite. Opaques are oxides partially altered to leucoxene.



T-237

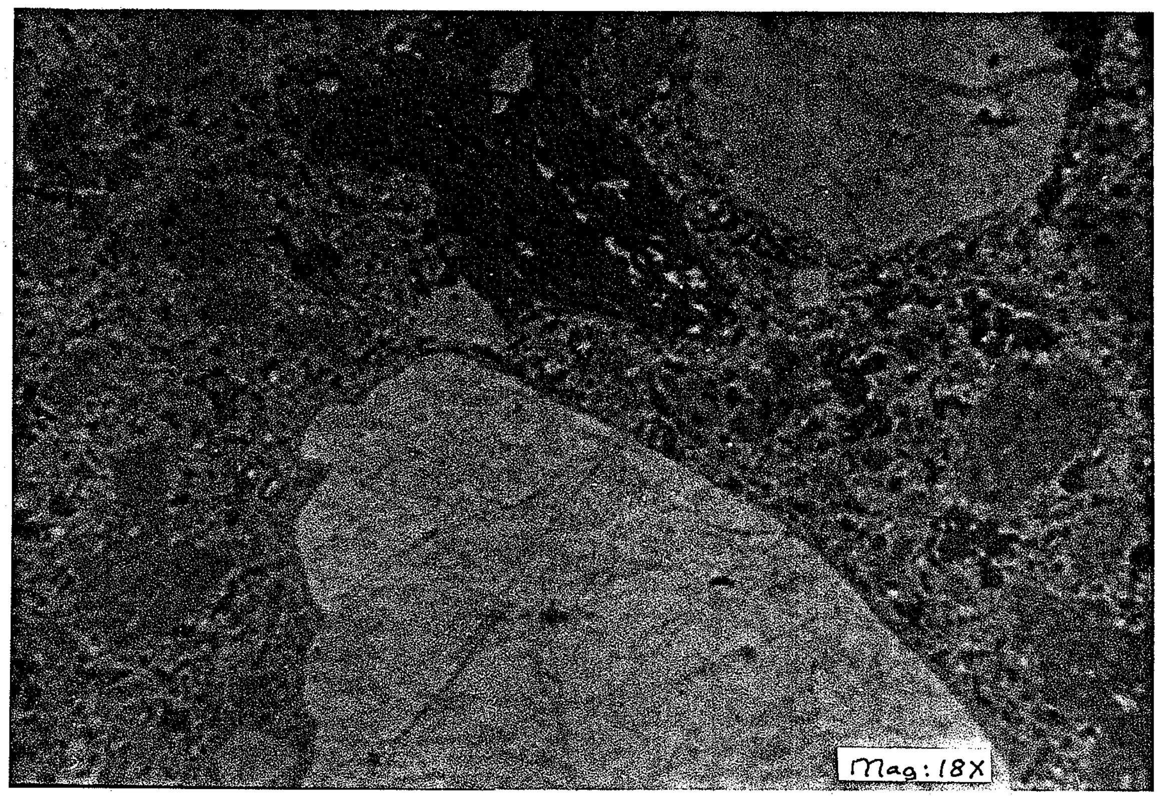
Rock Name Quartz-plagioclase-hornblende porphyritic tonalite

Mineralogy

Plagioclase	55%	m.g. (up to 2mm) euhedral phenocrysts and f.g. subhedral to anhedral in groundmass
Quartz	30%	m.g. to c.g.(up to 1cm) subhedral phenocrysts and F.g. anhedral in groundmass
Hornblende	15%	f.g. to m.g.(up to 2mm) euhedral to subhedral
Opaques	tr	f.g. (up to Ø.5mm) subhedral to euhedral
Epidote	tr	f.g. (up to Ø.1mm) subhedral

Texture Coarse to medium-grained quartz, plagioclase and hornblende phenocrysts in a f.g. subhedral-granular groundmass.

Description Plagiolcase crystals are moderately to strongly altered to sericite and chlorite. Quartz phenocrysts are strongly resorbed with rare inclusions of f.g. plagioclase. Hornblende peudomorphs are now totally altered to f.g. chlorite, sericite, quartz and carbonate. Chlorite in the goundmass may be altered hornblende and/or biotite. Opaques consist of unaltered pyrite and oxides altered to leucoxene.



T-360

Rock Name Plagioclase-quartz-hornblende porphyritic tonalite

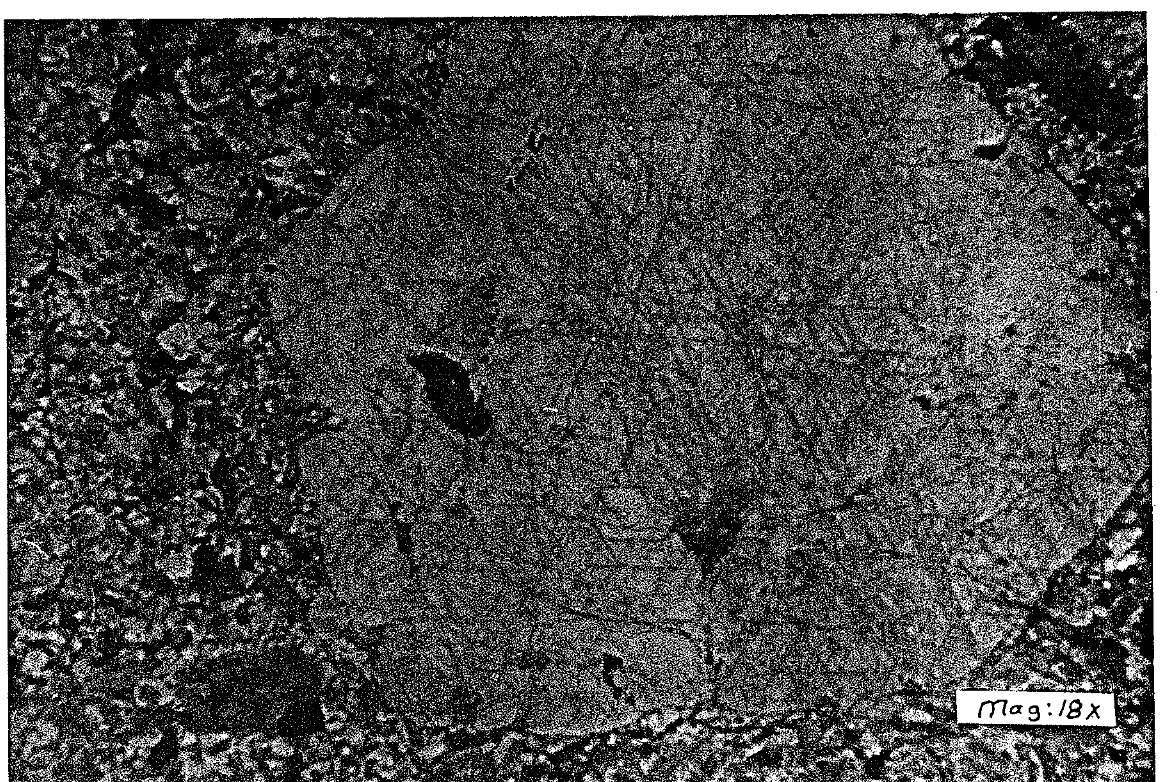
Mineralogy

Plagioclase	50%	m.g. (up to 2mm) subhedral phenocrysts and f.g. subhedral in groundmass
Quartz	30%	m.g. (up to 5mm) euhedral to subhedral phenocrysts and f.g. anhedral in groundmass
Chlorite	15%	f.g. (up to 0.5mm) subhedral
Hornblende	5%	f.g. to m.g. (up to 2mm) subhedral
Opaques	tr	f.g. (up to 0.2mm) euhedral
Sericite	tr	v.f.g. (up to 0.1mm) subhedral

Texture Medium-grained plagioclase, quartz and hornblende phenocrysts in a f.g. subhedral-granular groundmass.

Description Plagioclase crystals are moderately altered to overgrowths of v.f.g. sericite and minor epidote. Quartz phenocrysts have slightly resorbed borders and f.g. inclusions of plagioclase. Hornblende pseudomorphs are now totally replaced by f.g. chlorite, epidote, sphene and sericite. Chlorite in the groundmass contain v.f.g. inclusions of sphene and is probably an alteration production of biotite. Opaques consist of pyrite moderately altered with hematite and oxides strongly altered to leucoxene.

Numerous very thin fractures cut the rock. These are filled with v.f.g. sericite and hematized opaques.



T-366

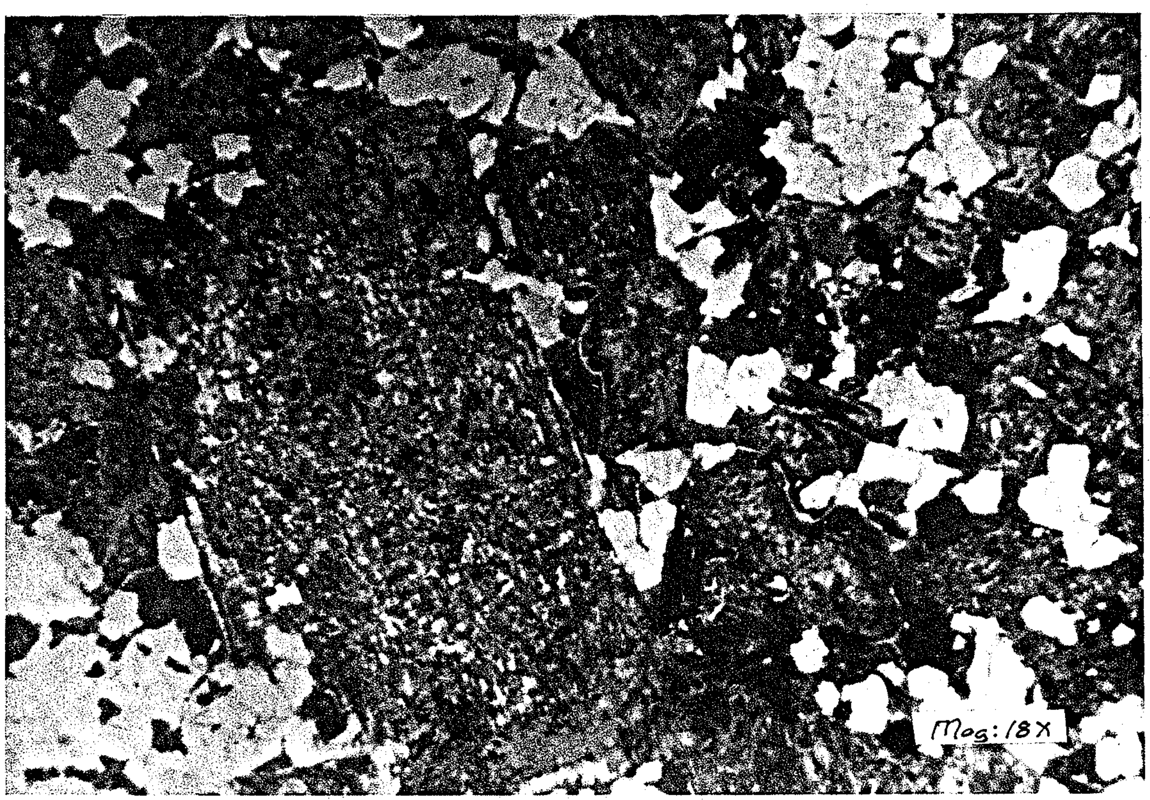
Rock Name Plagioclase-quartz porphyritic granodiorite

Mineralogy

Plagioclase	40%	f.g. to m.g. (up to 5mm) euhedral
Quartz	30%	f.g. to m.g. (up to 5mm) anhedral
Kspar	15%	f.g. (up to 1mm) subhedral
Hornblende	7%	f.g. (up to 1mm) euhedral
Chlorite	7%	f.g. (up to 1mm) subhedral
Opaques	1%	f.g. (up to 0.5mm) euhedral
Epidote	tr	f.g. (up to 0.1mm) subhedral

Texture Medium-grained plagioclase and quartz phenocrysts in a f.g. equigranular subhedral-granular groundmass.

Description Plagioclase is moderately altered to v.f.g. overgrowths of sericite and epidote. Quartz phenocrysts are strongly resorbed and contain f.g. inclusions of plagioclase. Kspar crystals are perthitic with exsolved plagioclase. Hornblende crystals are essentially unaltered. Chlorite contains f.g. epidote and sphene inclusions and is probably alteration of primary biotite. Opaques are magnetite variably altered to leucoxene.



T-367

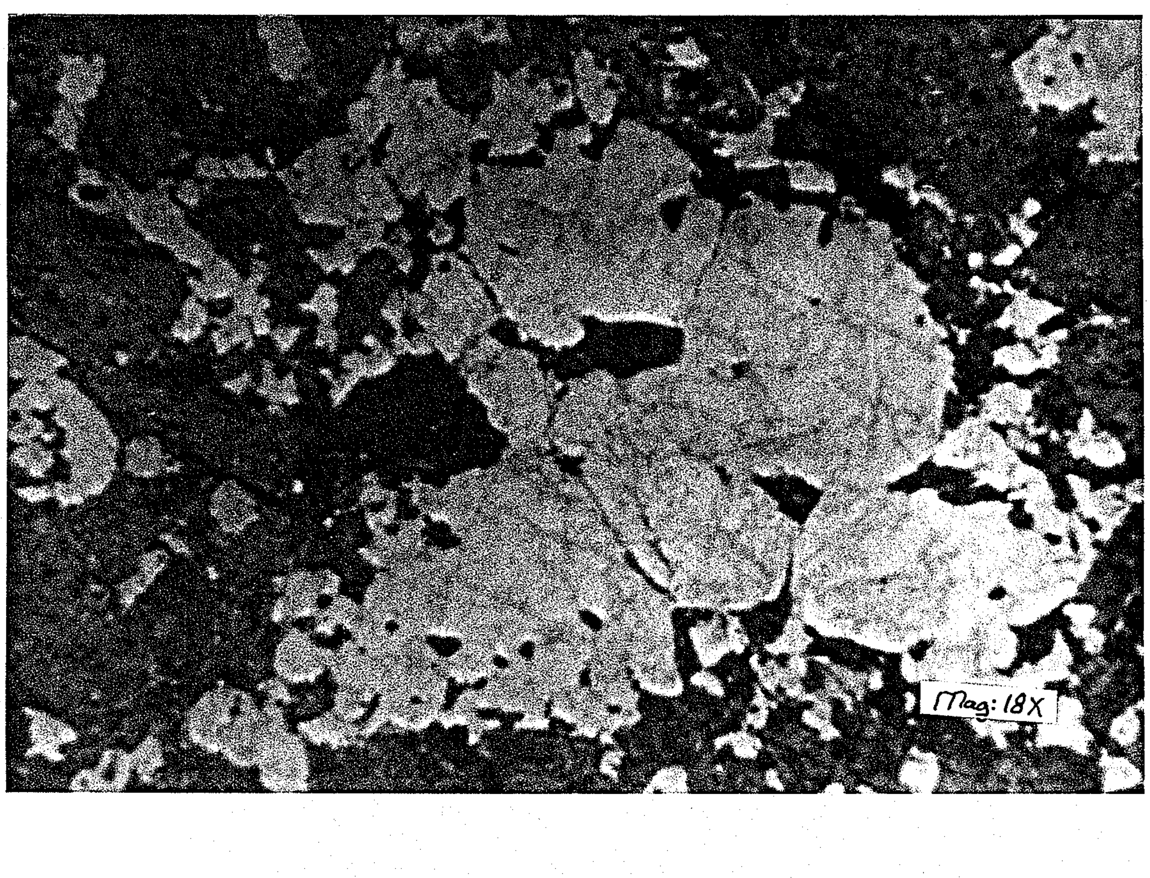
Rock Name Quartz-plagioclase porphyritic granodiorite

Mineralogy

Plagioclase	40%	m.g. (up to 3mm) euhedral to subhedral
Quartz	25%	m.g. to c.g. (up to 7mm) anhedral
Hornblende	15%	f.g. to m.g. (up to 2mm) euhedral
Chlorite	10%	f.g. (up to 1mm) subhedral
Kspar	8%	f.g. (up to 1mm) subhedral
Opaques	2%	f.g. (up to 0.5mm) subhedral to euhedral
Sphene	tr	v.f.g

Texture Medium to coarse-grained quartz phenocrysts and rare plagioclase phenocrysts in a f.g. to m.g. subhedral-granular groundmass.

Description Plagioclase crystals are moderately altered to v.f.g. sericite and epidote overgrowths. Quartz phenocrysts are very irregularly shaped (very strongly resorbed?) with inclusions of plagioclase, Kspar and hornblende. Hornblende crystals are essentially unaltered. Chlorite is probably after biotite and has f.g. to v.f.g. inclusions of sphene and epidote. Opaques consist predominantly of magnetite strongly altered to chlorite and leucoxene and minor sulfides which are essentially unaltered.



BULL CREEK STOCK

The 6 slides of Bull Creek intrusive (nos. 40A, 40C, 369, 370B, 370C and 376) indicate a range of composition from granite to granodiorite. The granodiorites are medium-grained with a slight tendency to have quartz phenocrysts. The granites are fine-grained and equigranular.

The overall textural appearance of these rocks would indicate a epizonal or high level intrusion.

Alteration of the granodiorites is moderate within the propylitic zone. This alteration is pervasive and consist of moderate sericitization and epidotization of plagioclase and moderate to intense chloritization and epidotization of ferromagnesium minerals. The granites appear to be more intensely altered within the phyllic zone. This is indicated by growth of f.g. radiating sericite clusters. Plagioclases are only slightly epidotized and sericitized and ferromagnesium minerals are totally altered to chlorite. The sericite appears to be overgrowing chloritized biotites thus indicating that the phyllic alteration is superimposed on an earlier propylitic alteration.

T-40A (1)

Rock Name: Granodiorite

Mineralogy:

Plagioclase	40%	f.g. to m.g. (up to 2mm), subhedral
Quartz	30%	f.g. to m.g. (up to 4mm), anhedral
Chlorite	20%	f.g. (up to 1mm),subhedral
Kspar	5%	f.g. (up to 1mm), subhedral
Opaques	5%	f.g. (up to 0.5mm), subhedral to anhedral

Texture: Medium-grained subhedral granular

Detailed Description: Plagioclase crystals are strongly altered to v.f.g. sericite. Anhedral quartz crystals include, and are intergranular to, subhedral plagioclase and Kspar indicating the quartz was later in the crystallization sequence. Chloritized mafic crystals include fine to very fine grained quartz, epidote, opaques and sphene overgrowths and have crystal pseudomorphic outlines indicating replacement of hornblende and biotite. Opaques are dominantly disseminated sulphides with minor alteration to hematite.

One end of the slide is a sulphide bearing vein with a higher concentration of m.g. anhedral quartz and feldspar totally altered to f.g. radiating lepidoblastic sericite.

A vein up to about 0.5mm consisting of f.g. subhedral carbonate appears to cross cut the above vein and does not contain any sulphide or alterations.

Interpretation: A medium-grained, subhedral-granular granodiorite intrusive with intense propylitic alteration consisting of sericitization of plagioclase and chloritization of ferromagnesium minerals.

A vein of silicification and disseminated sulphides cuts the rock with more intense alteration consisting of f.g. radiating sericite overgrowths totally replacing plagioclase. This appears to be locallized alteration to phyllic conditions associated with the vein.


X-NICHOLS
Mag: 15X

T-40C

Rock Name: Granodiorite

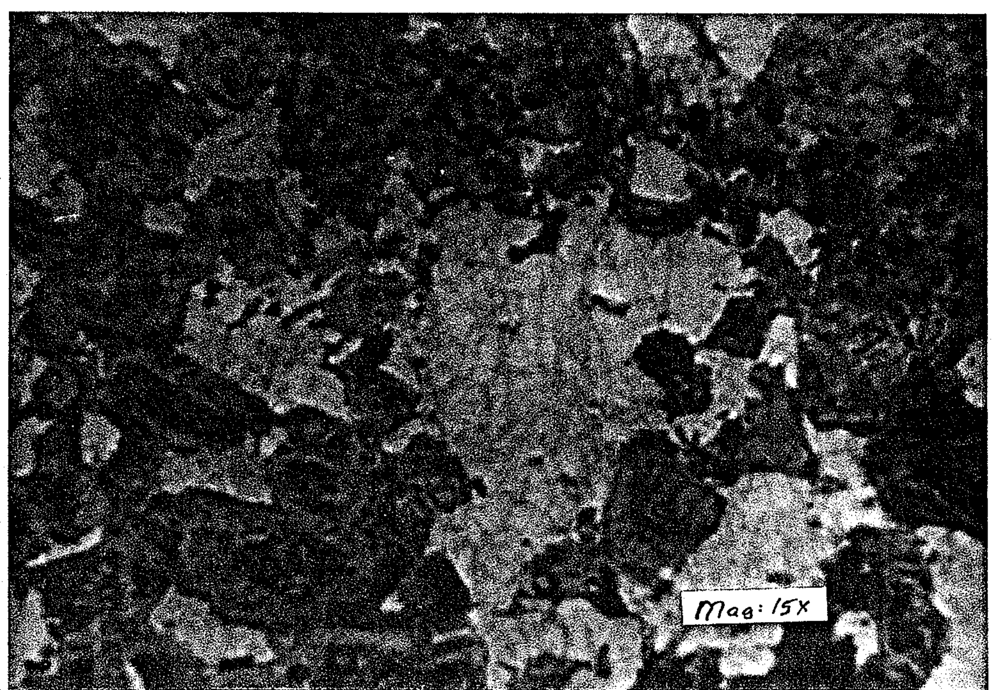
Mineralogy:

Plagioclase	45%	f.g. to m.g. (up to 5mm), subhedral to anhedral
Quartz	30%	f.g. to m.g. (up to 5mm), anhedral
Kspar	10%	f.g. (up to 1mm), subhedral
Biotite (?)	10%	f.g. (up to 1mm), subhedral to anhedral
Hornblende	5%	f.g. to m.g. (up to 2mm), subhedral to anhedral
Epidote	tr	f.g. (up to 1mm), subhedral
Opaque	tr	f.g. (up to 0.4mm), subhedral

Texture: Medium-grained subhedral-granular

Detailed Description: Plagioclase crystals are moderately altered to overgrowths of v.f.g. sericite and epidote. Locally crystals exhibit compositional zoning indicated by cores with more intense alteration. Large quartz crystals commonly include smaller plagioclase and Kspar crystals indicating a relatively late crystallization. Kspar (locally) partially to totally includes plagioclase crystals. Hornblende is partially altered to chlorite and epidote. Biotite (?) is totally replaced by chlorite with v.f.g. sphene overgrowths. Opaques are predominantly sulphides partially altered to hematite.

Interpretation: Granodiorite with early crystallization of plagioclase and mafic minerals followed by Kspar and then quartz. Alteration is consistent with the propylitic zone and consists of moderate sericitization and epidotization of plagioclase and moderate to intense chloritization of hornblende and biotite.



T-369

Rock Name Granodiorite

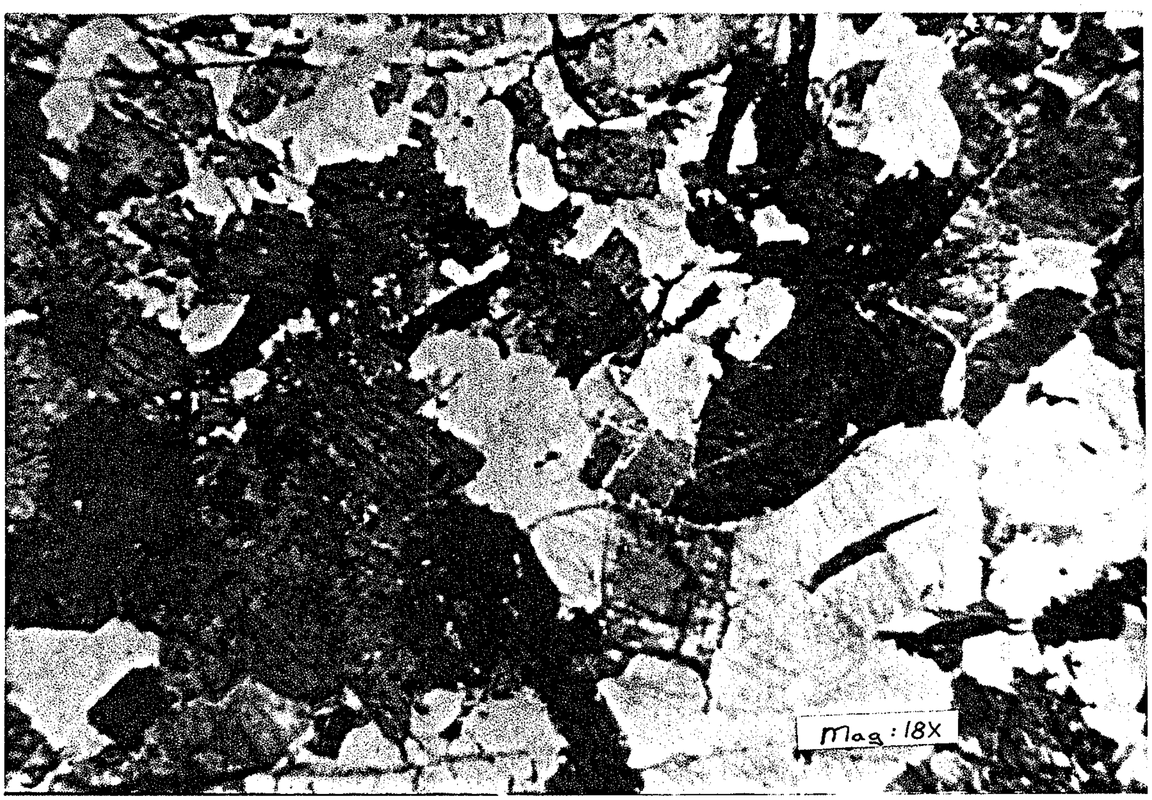
Mineralogy

Plagioclase	35%	f.g. to m.g. (up to 2mm)euhedral to subhedral
Quartz	35%	f.g. to m.g.(up to 5mm) subhedral to anhedral
Kspar	15%	f.g. to m.g. (up to 2mm) subhedral
Hornblende	8%	f.g. to m.g. (up to 2mm) euhedral
Biotite	7%	f.g. to m.g. (up to 2mm) subhedral
Opaques	tr	f.g. (up to Ø.5mm) euhedral

Texture Medium grained subhedral granular and equigranular

Description Plagioclase is moderately altered to v.f.g. sericite and minor epidote. Hornblende is typically only weakly altered to chlorite along cleavage and fractures. Biotite (?) is totally altered to chlorite, epidote, and sphene.

Thin veinlets (up to 1mm) cut the rock and are filled with v.f.g. carbonate and/or chlorite.



T-370B

Note: Slide consists of v.f.g. argillite intruded by f.g. granite with a zone of mylonitization at the contact.

Rock Name Granite

Mineralogy

Quartz	30%	f.g. (up to 1mm) anhedral
Plagioclase	30%	f.g. (up to 1mm) subhedral
Kspar	30%	f.g. (up to 1mm) subhedral
Biotite	5%	f.g. (up to 0.5mm) subhedral
Sericite	5%	f.g. (up to 0.2mm) subhedral
Opaques	tr	f.g. (up to 0.1mm) subhedral

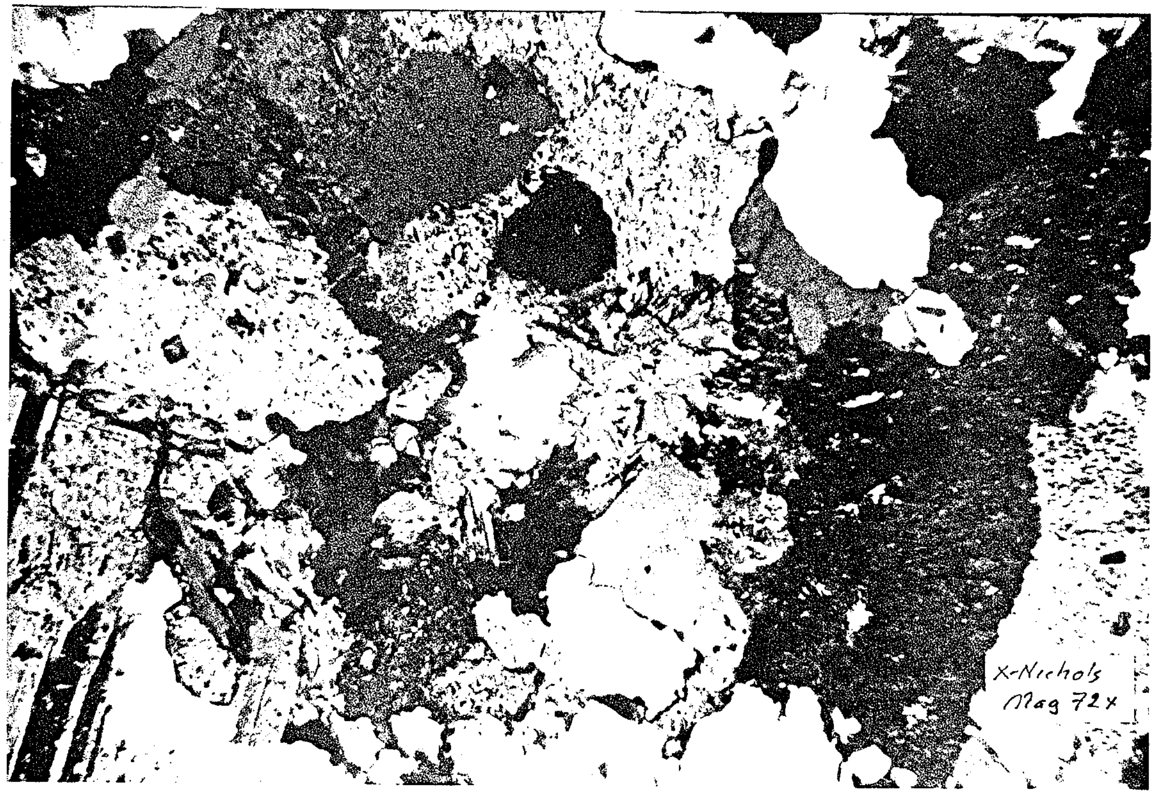
Texture Fine grained subhedral-granular and equigranular

Description Plagioclase crystals are of oligocene composition and are slightly altered to v.f.g. epidote and minor sericite. Kspar crystals are also slightly altered to v.f.g. epidote and minor sericite. Feldspars are difficult to distinguish in thin section as a result of similar alteration. Biotite is totally altered to chlorite with minor v.f.g. hematized opaques. Opaques are sulphides moderately altered to hematite.

Rock Name Argillite

Mineralogy, Texture and Description V.f.g. silt sized grains of quartz, feldspar and opaques (up to 0.1mm) in a v.f.g. sericite rich matrix. Rounded f.g. porphyroblasts (up to 1mm) consist predominantly of v.f.g. sericite. These porphyroblasts have locally overgrown the argillitic groundmass, and are progressively elogated and flattened towards the contact with the granite.

A 5mm wide layer of mylonitization occurs between the granite and argillite. This zone is marked by a decrease in grain size of the granite and increased sericitization of feldspars and increased chlorite content and oxidization of opaques to hematite.


X-Nichols
Mag 72X


X-Nichols
Mag: 18X

T-370C

Note Two rocks occur in the slide, a f.g. granite with an inclusion of v.f.g. argillite on one side of the slide.

Rock Name Granite

Mineralogy

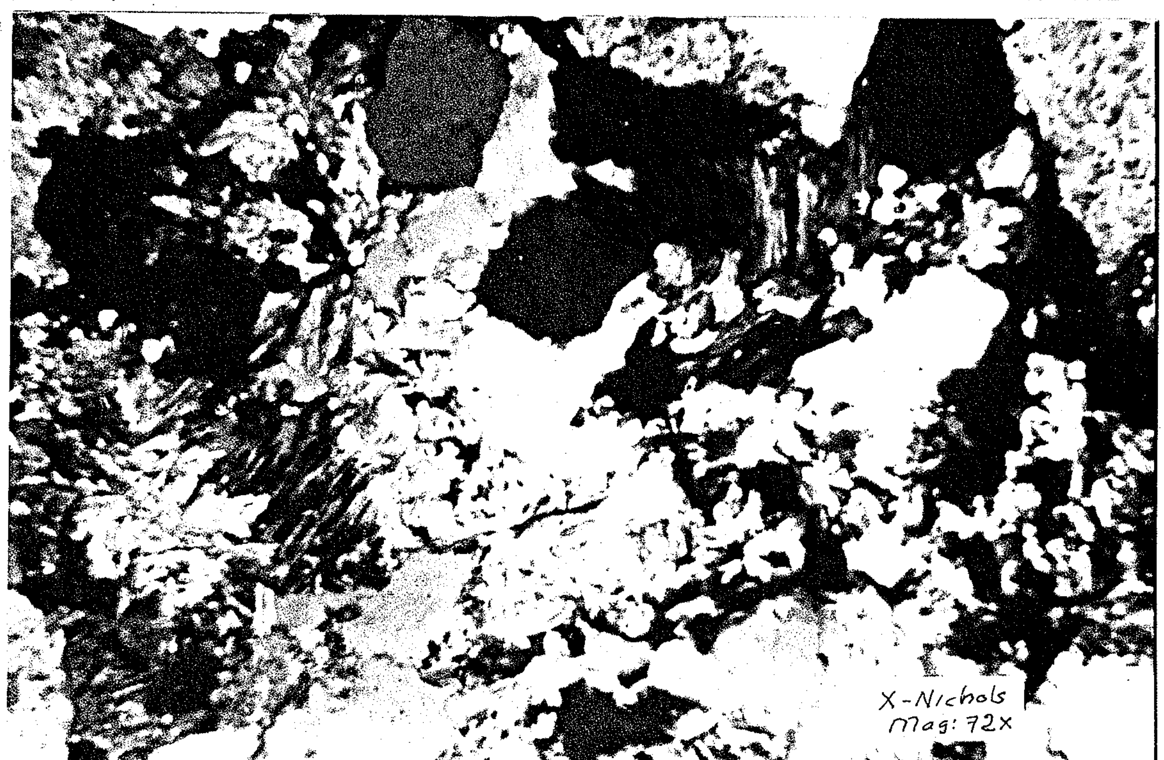
Quartz	35%	f.g. to m.g. (up to 2mm) anhedral
Kspar	30%	f.g. (up to 1mm) subhedral
Plagioclase	25%	f.g. (up to 1mm) subhedral
Sericite	5%	f.g. (up to 0.5mm) subhedral to euhedral
Biotite	5%	f.g. (up to 1mm) subhedral
Opaques	tr	f.g. (up to 0.2mm) subhedral

Texture Fine grained subhedral-granular and equigranular

Description Plagioclase and Kspar crystals are slightly altered to v.f.g. overgrowths of sericite and epidote and because of their similar alteration they are difficult to distinguish in thin section. Biotite crystals are totally altered to chlorite and hematized opaques. Sericite occurs as clusters of f.g. radiating subhedral crystals locally replacing chloritized biotite crystals.

Rock Name Argillite

Mineralogy, Texture and Description The argillite consists of v.f.g. recrystallized granoblastic quartz, feldspar and chlorite. Fine grained subhedral biotite porphyroblasts (up to 0.5mm) are totally replaced by chlorite and hematized opaques. Biotite porphyroblasts are most abundant at the contact with the granite.



T-376

Rock Name Quartz porphyritic granodiorite

Mineralogy

Plagioclase	40%	f.g. to m.g.(up to 3mm) euhedral to subhedral
Quartz	25%	m.g. to c.g.(up to 1cm) subhedral phenocrysts and f.g. anhedral in the groundmass
Kspar	15%	f.g. to m.g. (up to 2mm) subhedral
Hornblende	10%	f.g. to m.g. (up to 2mm) euhedral
Biotite	10%	f.g. (up to 1mm) subhedral
Opaques	tr	f.g. (up to 0.2mm) euhedral

Texture M.g. to c.g. quartz phenocrysts in a m.g. subhedral-granular groundmass.

Description Plagioclase is moderately altered to sericite with localized patches of epidote and carbonate. Quartz phenocrysts are moderately resorbed and have f.g. inclusions of plagioclase, Kspar and ferromagnesium minerals. Hornblende is moderately to intensely altered to chlorite, carbonate and epidote. Biotite is moderately to intensely altered to chlorite, sphene and epidote. Opaques are magnetite moderately altered leucoxene and unaltered pyrite.

Note One corner of the slide contains a 1cm inclusion of f.g. tonalite. It consists of f.g. plagioclase (65%) chloritized and epidotized ferromagnesium minerals (25%) and quartz (10%). The plagioclase is andesine in composition and only moderately altered to v.f.g. sericite and localized patches of f.g. epidote.

Connell Mountain Intrusion - Comments

These thin sections (Nos. 62A, 125, 129, 159, 249 and 280) were examined from this intrusion. The composition of the samples ranges from tonalite to trondhjemite. All samples are deficient in alkali feldspar. Most samples are plagiolcase ± quartz ±hornblende porphyritic.

The porphyritic nature in a fine-grained groundmass indicates an epizonal intrusion at a relative high level in the crust.

The two trondhjemites (Nos 249 and 280) are both pervasively altered within the phyllic zone. This is primarly indicated by f.g. sericite overgrowths on chloritized ferromagnesium minerals. The plagioclase is variably altered to v.f.g. sericite and epidote overgrowths (similar to that found in the propylitic zone) but in one sample (No. 280) it is also locally totally overgrown by f.g. clinozoisite poikiloblasts. Typically zones of sulfide concentrations are very altered to the extent of texture destruction. It is also possible that the increase quartz content of these 2 samples (relative to the tonalites) is due to silicification rather than a primary compositional variation in the intrusion.

T-62A

Rock Name: Plagioclase-quartz porphyritic tonalite

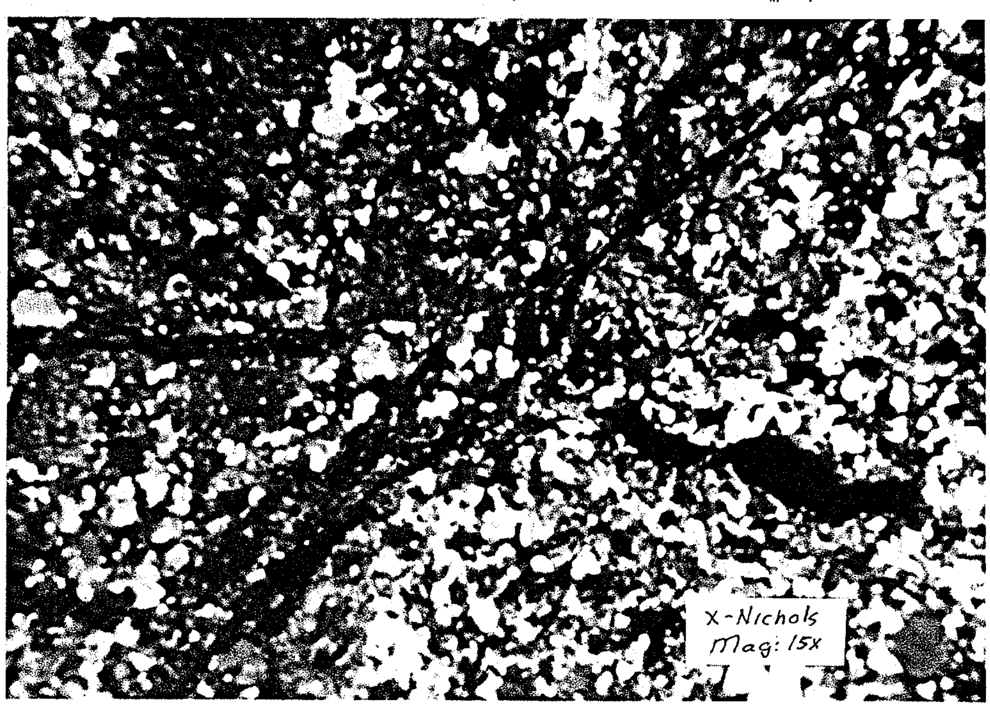
Mineralogy:

Plagioclase	60%	f.g. to m.g. (up to 2mm), subhedral
Quartz	20%	f.g. to m.g. (up to 4mm), anhedral
Chlorite	10%	f.g. (up to 1mm), subhedral
Sericite	5%	f.g. (up to 0.5mm), subhedral
Opaques	5%	f.g. (up to 0.2mm), subhedral

Texture: Medium-grained phenocrysts of plagioclase and quartz in a fine-grained groundmass of subhedral-granular plagioclase, quartz and micas. Cut by numerous thin zones of mylonitization with introduced chlorite and sulphides.

Detailed Descriptions: Plagioclase crystals are strongly altered to very fine-grained overgrowths of sericite and minor epidote. Two varieties of chlorite occur; the predominant one has grey interference colours and pseudomorphs an earlier biotite and/or hornblende crystals. The second has anomalous blue birefringence and occurs in clusters of very fine-grained crystals typically closely associated with mylonitized zones. Sericite occurs as partial to total overgrowths of the grey birefringent chlorite. Sulphides are also closely associated with zone of mylonitization and thin fractures. They are partially to totally altered to hematite.

Interpretation: A plagioclase and quartz porphyritic tonalite which has been pervasively altered to phyllic conditions with strong sericitization of plagioclase and replacement of secondary chlorite by sericite. The rock has also been mylonitized with introduction of chlorite and sulphides strongly oxidized to hematite.



T-249

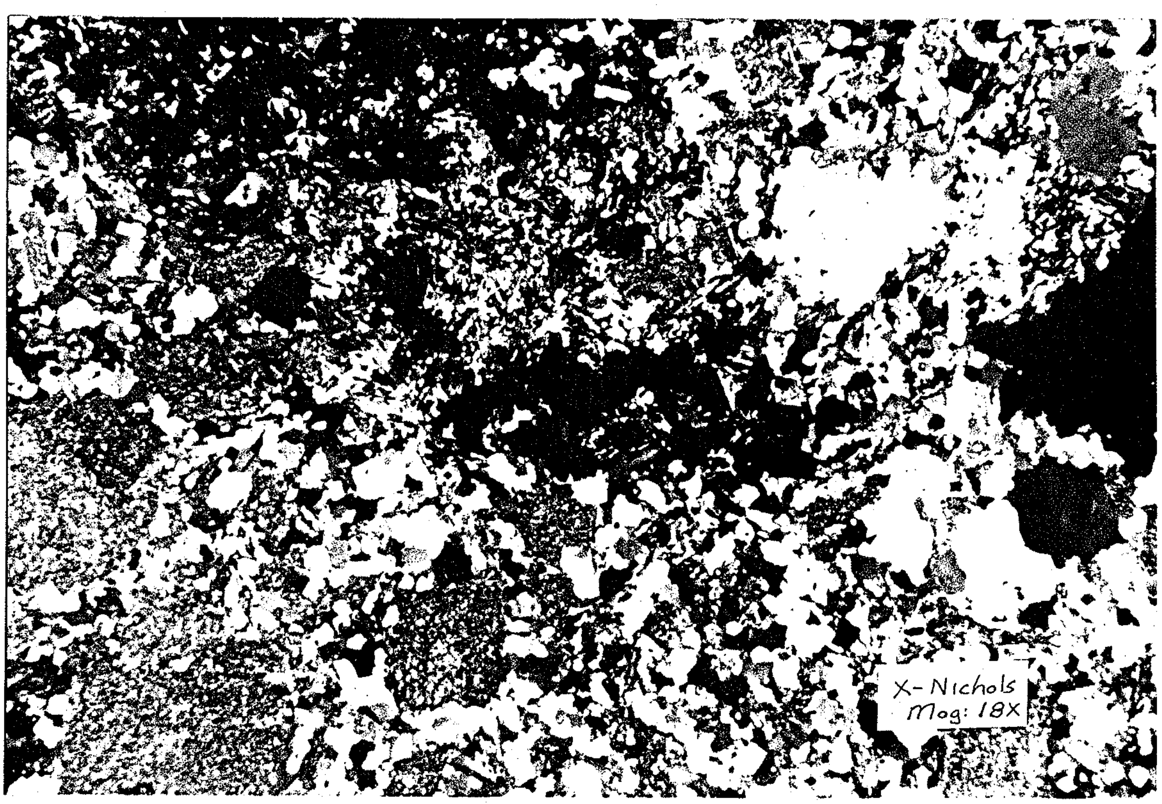
Rock Name Plagioclase-quartz porphyritic trondhjemite

Mineralogy

Quartz	50%	m.g. (up to 5mm) subhedral phenocrysts and f.g. anhedral in groundmass
Plagioclase	30%	m.g. (up to 4mm) euhedral phenocrysts and f.g. subhedral in groundmass
Chlorite	15%	f.g. (up to 1mm) subhedral
Sericite	3%	f.g. (up to Ø.2mm) subhedral
Opaques	2%	f.g. (up to Ø.2mm) euhedral to subhedral

Texture M.g. plagioclase and occasional quartz phenocrysts in a f.g. subhedral granular groundmass .

Description Plagioclase cyrstals are strongly altered to v.f.g. sericite and minor epidote. Quartz phenocrysts have strongly resorbed grain boundaries and f.g. inclusion of plagioclase. Chlorite cyrstals are probably alteration of biotites. Sericite is typically associated with the chlorite crystals. In some parts of the rock are concentrations of f.g. pyrite surrounded by texture destructive concentrations of f.g. chlorite, sericite and quartz. Opaques consist predominantly of sulphides moderately altered to hematite.



T-280

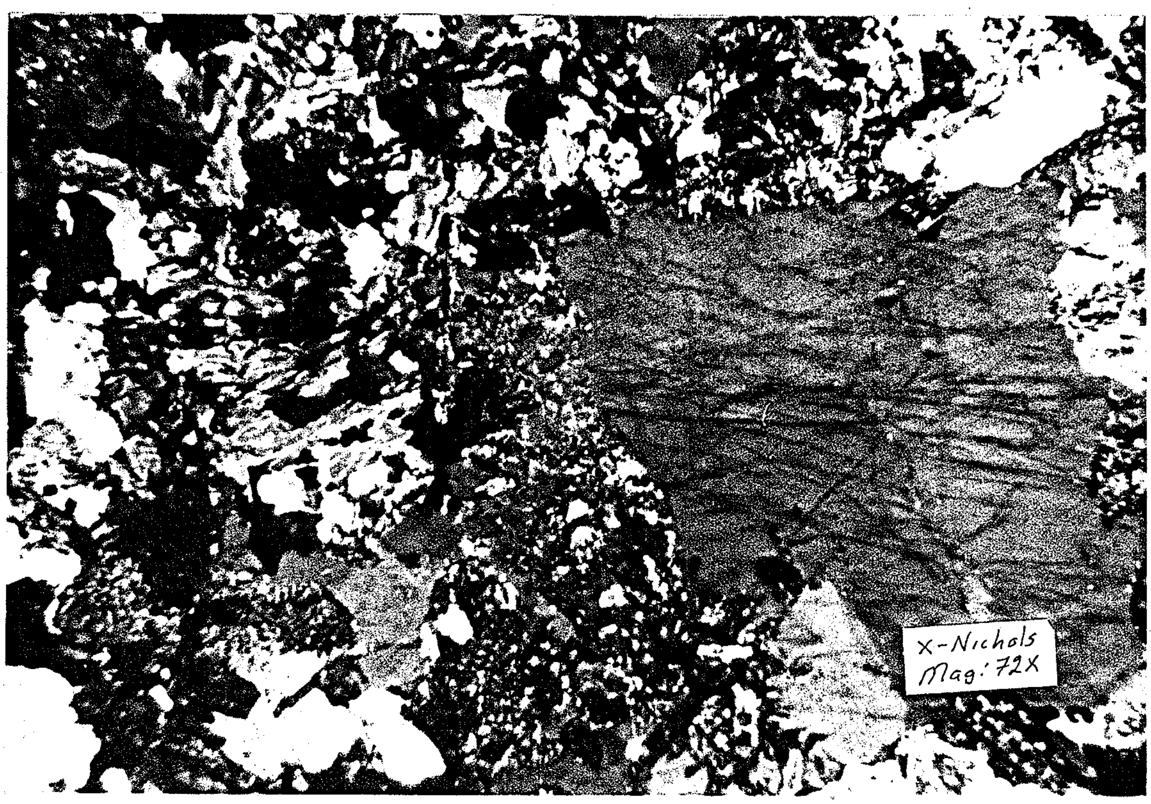
Rock Name Plagioclase porphyritic trondhjemite

Mineralogy

Quartz	40%	f.g. to m.g. (up to 2mm) anhedral
Plagioclase	30%	f.g. to m.g.(up to 3mm) euhedral to subhedral
Clinozoisite(?)	10%	f.g. (up to 1mm) anhedral poikiloblastic
Chlorite	10%	f.g. (up to 0.5mm) subhedral
Opaques	8%	f.g. Up to 0.3mm) euhedral to anhedral
Sericite	2%	f.g. (up to 0.2mm) subhedral to euhedral
Epidote	tr	f.g. (up to 0.2mm) subhedral

Texture Rare m.g. plagioclase phenocrysts in a groundmass of m.g. to f.g. plagioclase laths partially to totally included in m.g. to f.g. quartz crystals.

Description Plagioclase is intensely altered to v.f.g. to f.g. sericite and minor epidote. Locally plagioclase crystals are totally overgrown by poikiloblasts of f.g. clinozoisite. Quartz crystals locally have cores with granophyric intergrowths of feldspar. Chlorite is probably an alteration of biotite and is locally overgorwn by f.g. sericite. Opaques are predominantly sulphides. In areas of sulphide concentrations the rock is msot altered with abundant clinozoisite, sericite and epidote.



North Woodstock Stock

Sample No. 16

Rock Name: Plagioclase - quartz porphyritic quartz diorite

Mineralogy:
Phenocrysts - 27%

Plagioclase	20%	f.g. to m.g. (0.5 to 2.0mm), euhedral to subhedral
Altered mafics	5%	f.g. to m.g. (0.1 to 2.0mm), subhedral
Quartz	2%	f.g. (0.1 to 0.5mm), subhedral

Groundmass - 73%

Plagioclase	50%	f.g. (0.1 to 0.3mm), subhedral
Quartz	10%	f.g. (0.1 to 0.3mm), anhedral
Chlorite	5%	v.f.g. (0.01 to 0.1mm), subhedral
Epidote	5%	v.f.g. (0.01 to 0.1mm), subhedral
Sphene	3%	v.f.g. (0.01 to 0.1mm), subhedral
Opaques	tr	v.f.g. to f.g. (0.01 to 0.3mm), subhedral to euhedral

Texture: Fine to medium - grained phenocrysts of plagioclase, altered mafics and quartz in a fine - grained subhedral granular groundmass.

Detailed Descriptions: Plagioclase crystals are moderately altered to overgrowths of very fine - grained epidote and sericite. Mafic phenocrysts are now totally altered to overgrowths of very fine - grained chlorite with minor epidote, sphene, and carbonate. Quartz phenocrysts are very strongly resorbed. The groundmass consists of plagioclase and quartz in subhedral - granular intergrowths with minor chlorite, epidote, sphene and opaques. Opaques are strongly altered to leucoxene.

Interpretation: A porphyritic intrusion emplaced at a relatively high level (i.e. epizonal) as indicated by the fine grain size of the groundmass.

Alteration consists of moderate epidotization and sericitization of plagioclase and strong chloritization of the original ferromagnesium minerals (probably hornblende and/ or biotite). This assemblage indicates hydrothermal alterations to propylitic conditions.

The similarity of compositions (i.e. K.Spar depleted) and the hydrothermal alteration of this stock would suggest it is genetically related to the Gibson stock.

South Woodstock Stock

Sample No. 1

Rock Name: Quartz - plagioclase porphyry

Mineralogy:
Phenocrysts 35%

Quartz	15%	f.g. to m.g. (0.1mm to 2.0mm), euhedral to subhedral
Plagioclase	15%	f.g. to m.g. (0.1mm to 2.0mm), euhedral to subhedral
Altered mafics	5%	f.g. (0.1mm to 0.5mm), subhedral

Groundmass 65%

Quartz feldspar	35%	v.f.g. (less than 0.01mm), anhedral
Chlorite	15%	v.f.g. (less than 0.01mm), subhedral
Sericite	15%	v.f.g. (less than 0.01mm), subhedral
Opaques	tr%	v.f.g. (0.01 to 0.1mm),euhedral
Carbonate	tr%	v.f.g. to f.g. (0.01 to 0.2mm), subhedral

Texture: Fine to medium - grained quartz, plagioclase and altered mafic phenocrysts in a very fine - grained groundmass. Irregular - shaped miarolitic cavities (up to 1cm - best seen in hand specimen) are filled with f.g. carbonate.

Detailed Description: Quartz phenocrysts are euhedral with square outlines indicating they were originally Beta quartz crystals. Plagioclase crystals are very strongly altered to overgrowths of very fine to fine - grained sericite with minor carbonate and chlorite. Mafic phenocrysts are now totally altered to very fine - grained chlorite and sericite. Some of these have cores overgrown by fine - grained sericite. The groundmass is very fine - grained and as such it is not possible to distinguish relative proportions of quartz and feldspar (also if K-spar is present or not - but I suspect it is not). Miarolitic cavities are up to 1cm (in hand specimen), are very irregular in shape, and are filled with f.g. subhedral carbonate.

Interpretation: A prophyritic intrusion emplaced at a relatively high level in the crust (i.e. epizonal) as evidenced by a very fine - grained groundmass and miarolitic cavities. It is probably relatively poor in K_2O and thus of tonalitic or trondhjemitic composition. A very high degree of alteration (sericitization) of plagioclase and mafic phenocrysts and late over growths of sericite on altered mafics indicate hydrothermal alteration has achieved phyllic conditions.

The degree of alteration and probably similarity of composition (i.e. tonalitic) would indicate a genetic relationship of this stock to the Gibson stock. This could be as either an apophysis or from a similar parent magma source.

MAFIC DYKE ROCKS

T-233B

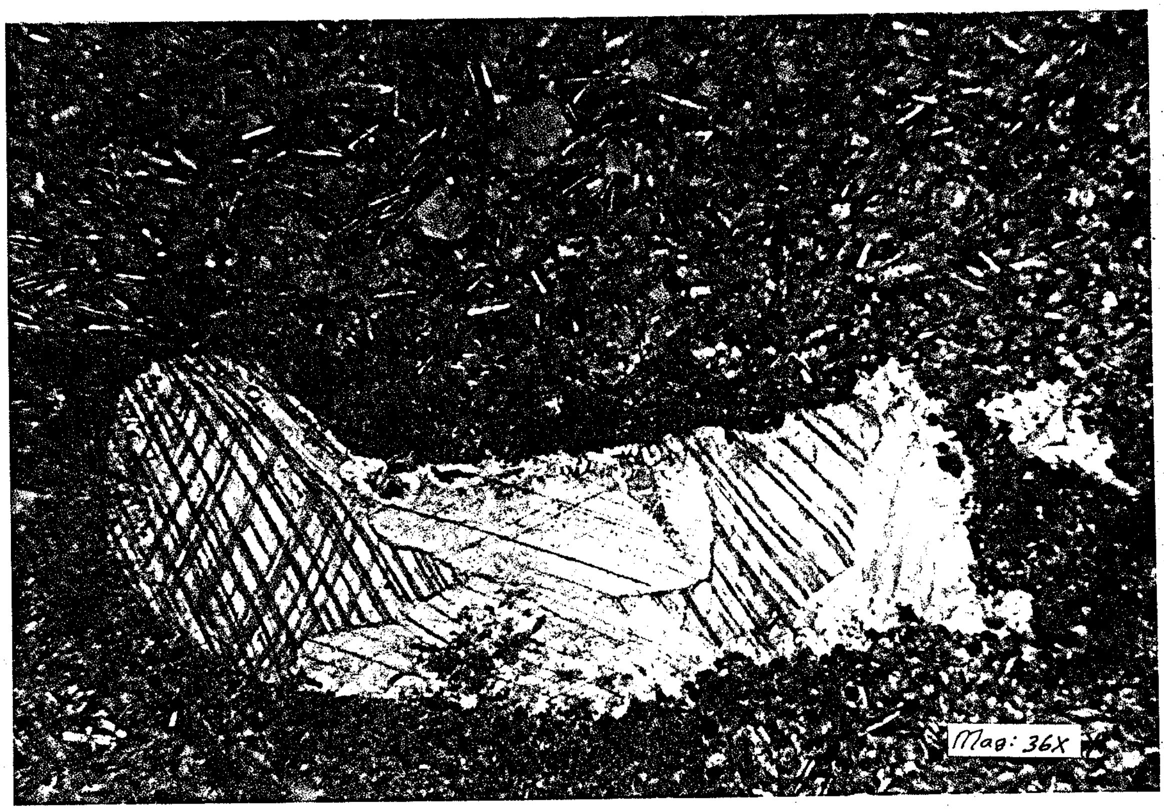
Rock Name Amygdaloidal basalt

Mineralogy

Plagioclase	30%	f.g. (up to 0.2mm) enhedral to subhedral moderately altered to v.f.g. sericite and epidote
Groundmass	65%	v.f.g. (up to 0.mm)chlorite, feldspar, epidote, carbonate and opaques
Amygdules	5%	0.5 to 3.0mm rounded vesicles filled with f.g. carbonate and chlorite

Texture Fine-grained plagioclase microlites randomly oriented in a pilotaxitic texture in a very fine-grained groundmass with rounded vesicles filled with carbonate and/or chlorite.

Interpretation A fine-grained amygdaloidal flow or feeder dyke of basaltic composition metamosphosed to lower greenschist facies.



T-338B

Rock Name Plagioclase porphyritic diabase

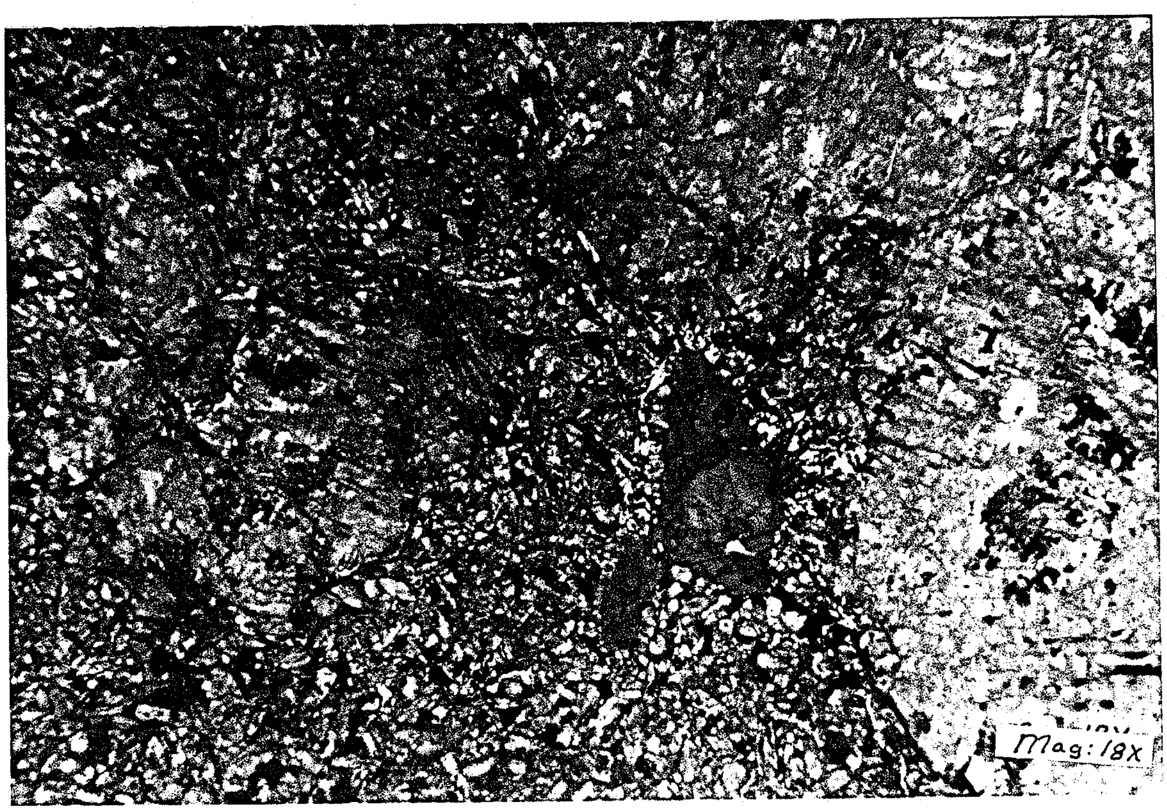
Mineralogy

Plagioclase	60%	m.g. to c.g.(up to 1cm) subhedral phenocrysts and f.g. subhedral to euhedral in the groundmass
Clinopyroxene	20%	f.g. (up to 1mm) subhedral
Chlorite	10%	f.g. (up to 0.2mm) subhedral
Opaques	10%	f.g. (up to 0.2mm) subhedral

Texture Medium to coarse-grained plagioclase phenocrysts in a diabasic textured groundmass consisting of f.g. plagioclase laths subophitically included in f.g. subhedral clinopyroxene crystals.

Description Plagioclase phenocrysts are strongly altered to v.f.g. to f.g. sericite and epidote. Groundmass plagioclase is of bytownite composition and only slightly altered to v.f.g. sericite and epidote. Clinopyroxene crystals are unaltered. Chlorite occurs as f.g. to m.g. pyroxene pseudomorphs (probably after orthopyroxene) and in the groundmass. Opaques are strongly altered to leucoxene.

Interpretation A mafic intrusion of diabasic composition and texture. The rock has experienced subgreenschist metamorphism sufficient to alter orthopyroxene but leave the clinopyroxene crystals unaffected.



T-308

Rock Name: Basalt

Mineralogy:

Plagioclase	50%	f.g. (up to 1mm), subhedral phenocrysts and v.f.g. subhedral in the groundmass
Clinopyroxene	25%	f.g. (up to 0.5mm), subhedral phenocrysts and v.f.g. subhedral in the groundmass
Orthopyroxene(?)	20%	f.g. (up to 0.5mm), subhedral phenocrysts and v.f.g. subhedral in the groundmass
Opaques	5%	f.g. (up to 0.2mm), subhedral sulphides and v.f.g. subhedral to anhedral oxides in the groundmass

Texture: About 20% fine-grain plagioclase and pyroxene phenocrysts in a very fine-grained groundmass. Lath-shaped plagioclase crystals are in subparallel trachytic textured alignment.

Detailed Description: Plagioclase crystal occur as phenocrysts and as fine-grained crystals intergrown with pyroxene in the groundmass. Plagioclase crystals are slightly altered with minor overgrowths of very fine-grained epidote. Clinopyroxene is essentially unaltered. The other mafic species, which is assumed to have been orthopyroxene, is now totally replaced by sperpentine and/or chlorite. Opaques occur as very fine-grained oxides intergrown in the matrix, and as fine-grained disseminated replacement sulphides.

Interpretation: Basaltic flow or dike subjected to sub green schists metamorphism sufficient to alter orthopyroxenes but leave clinopyroxene unaltered.

SEDIMENTARY LITHOLOGIES

Thin sections of 14 specimens of various sedimentary rocks were examined (Sample nos. 28, 49, 68B, 131, 135, 144, 156, 239, 256, 281, 324, 329, 363 and 370H).

Samples 256, 281 and 324 are quartz wackes with quartz sands predominanting over feldspar. In 256, rip-up clasts of argillite and siltstone are also present.

Samples 329 and 363 are both siltstones. In 329, quartz is most abundant and in 363 feldspar grains are more abundant.

Eight samples of argillite (sample nos. 28, 49, 68B, 131, 135, 144, 156, 239 and 370H) were examined. In some, minor silt-sized quartz and feldspar grains are present. All are very rich in v.f.g. micas (>50%).

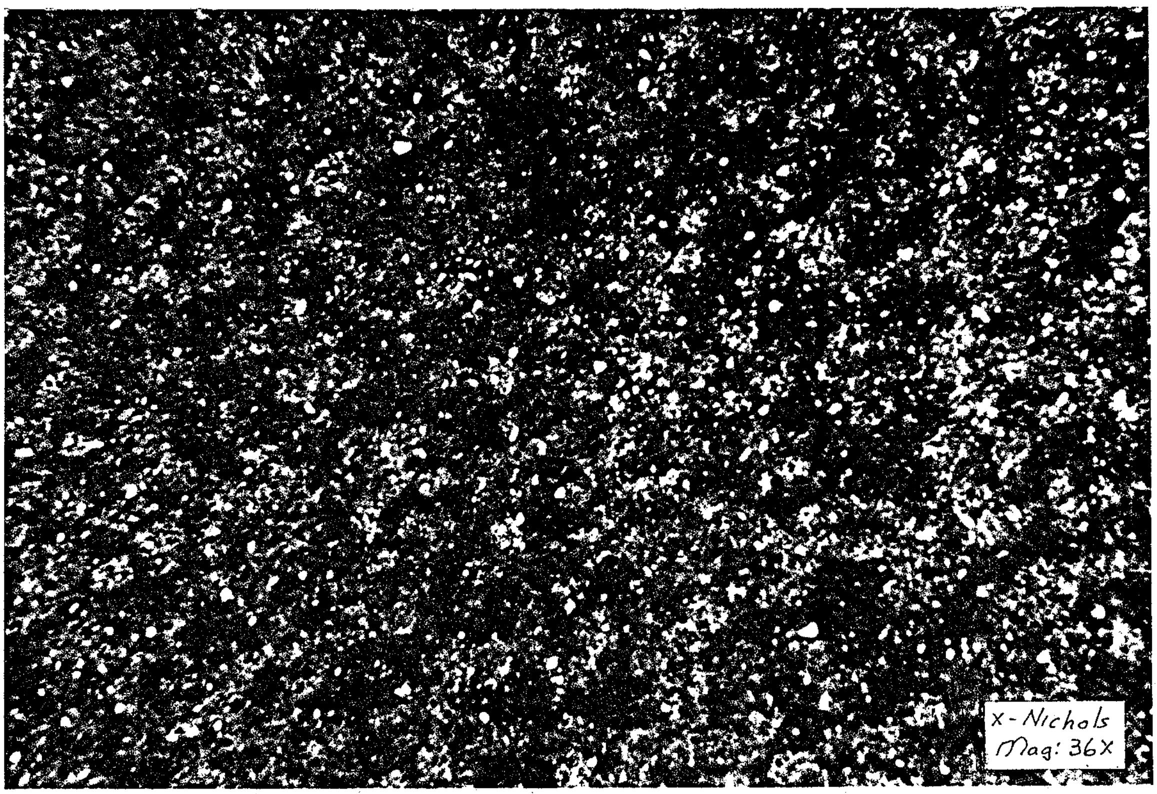
All these lithologies are consistent with sedimentary depositions in a submarine basin with wackes and siltstones deposited from turbidity currents and perhaps representing background sedimentation in the basin. A relatively quartz-rich source terrane is also evident.

All the argillites show some evidence of metamorphic recrystallization of micas. Some have porphyroblastic spots of concentrated sericite and all show a relatively random orientation of lepidoblastic recrystallized micas. These features are consistent with contact metamosphism due to heat supplied by granitic intrusion.

T-28

Rock Name Hornfelsed silty argillite

Mineralogy, Texture and Description About 20% subangular silt sized (up to 0.5mm) grains of quartz, feldspar and opaques in a v.f.g. chlorite-rich matrix. Numerous f.g. anhedral poikiloblasts (up to 0.2mm) consisting of concentrations of v.f.g. randomly oriented sericite occur throughout the rock.



T-49B

Rock Name: Brecciated and altered argillite

Mineralogy, Texture and Description: The rock consists of abundant, very fine-grained sericite intergrown with very fine-grained chlorite and minor feldspar and quartz. It has been intensely brecciated with highly angular sericitized fragments in a matrix of fine-grained quartz and carbonate. Locally angular vugs are filled with medium to coarse-grained carbonate.

In one portion of the slide the rock is rebrecciated with angular broken clasts of quartz and carbonate as well as argillite fragments. Up to about 10% very fine-grained sulphides have also been introduced. This zone of secondary brecciation and sulphidization is up to 2cm wide (in accompanying hand specimen).

Interpretation: A clay-rich sediment which has been contact metamorphosed and sericitized followed by brecciation and introduction of carbonate, quartz and sulphides.

The pervasive sericitization suggests alteration to phyllic conditions prior to the brecciation and addition of quartz and carbonate.

T-68B

Rock Name Hornfelsed argillite

Mineralogy, Texture and Description Rock consists of v.f.g. quartz-o-feldspathic grains with abundant v.f.g. chlorite, sericite and biotite in random orientation. This has been overgrown by numerous f.g. anhedral poikilablosts consisting of concentrations of v.f.g. randomly oriented sericite. Poikiloblosts are up to Ø.3mm.

One side of the slide is cut by a vein or dyke of f.g. quartz and plagioclase which is moderately mylonitized with localized concentration of sericite, chlorite and hematized sulphides.

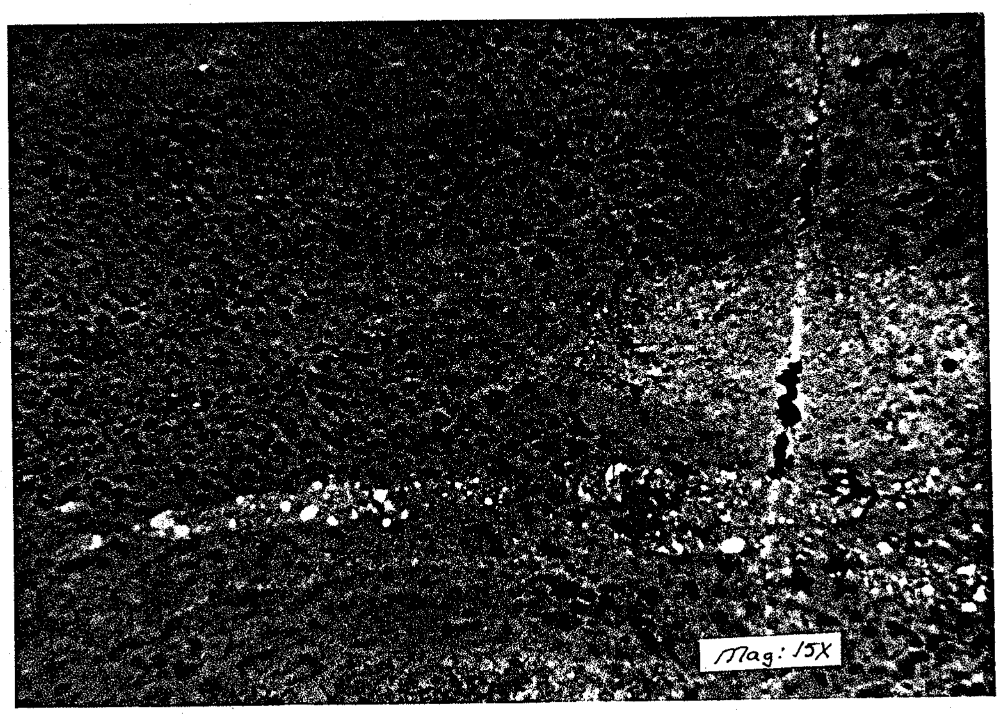
T-131

Rock Name: Spotted argillite

Mineralogy, Texture and Description: The rock consists of 30% f.g. prophyroblasts (up to 0.2mm) of v.f.g. chlorite in a v.f.g. groundmass of sericite, quartz, feldspar, chlorite and opaques. Locally silty lenses up to 0.5mm thick and several cm long occur with f.g. rounded quartz and feldspar sand grains (up to 0.2mm) in a v.f.g. argillaceous matrix.

A very thin vein (up to 0.1mm) cuts the rock. It consists of v.f.g. quartz, sericite, chlorite and locally opaques (sulphides). A selvage of bleaching up to 1mm thick surrounds the vein. This zone does not contain any chlorite spots.

Interpretation: Very fine-grained mudstone with silty lenses has been contact metamorphosed resulting in recrystallization of micas and the production of fine-grained chlorite porphyroblasts (spots). Subsequent brittle deformation has resulted in fracturing with fractures infilled with quartz, mica and sulphides.



T-135

Rock Name: Spotted argillite

Mineralogy, Texture, Description: Argillite consisting of very fine-grained sericite, chlorite, quartz, feldspar and opaques. Minor developments of fine-grained (up to Ø.2mm) porphyoblasts of very fine-grained chlorite. About 1 to 2% fine-grained (up to Ø.3mm) disseminated anhedral sulphide crystals.

A weak, irregular bedding is defined by variation in mica content. Beds range from Ø.5mm to 1cm thick.

A cross cutting fracture of up to Ø.2mm thick is filled with fine-grained sulphides and minor quartz. The sulphides are oxidized to hematite and a extremely fine-grained hematite coating occurs throughout the vein.

Interpretation: A clay-rich sediment which has been contact metamorphosed and cut by fractures bearing sulphides and quartz.

T-144

Rock Name Highly sericitized fine-grained intrusive or sediment

Mineralogy

Sericite	40%	v.f.g. (up to 0.1mm) subhedral,lepidioblastic
Quartz	25%	f.g. (up to 1.0mm) anhedral
Chlorite	20%	v.f.g. (up to 0.1mm) subhedral,lepidoblastic
Plagioclase	13%	f.g. (up to 0.2mm) anhedral
Opaques	2%	v.f.g. (up to 0.5mm) subhedral

Texture Fine-grained anhedral and highly resorbed or corroded quartz crystals in a fine-grained groundmass of lepidoblastic randomly oriented sericite and chlorite with granoblastic quartz and feldspar.

Description Quartz crystal borders are typically intergrown with recrystallized micas in the groundmass. Plagioclase crystals are granoblastic and moderately altered to overgrowths of very fine-grained sericite and epidote. Sericite occurs in randomly oriented lepidoblastic sprays throughout the groundmass. This texture is similar to that seen in phyllitic alteration zones in the intrusives. Chlorite is also recrystallized in randomly oriented subhedral lepidoplastic crystals in the groundmass.

Interpretation A highly altered and recrytallized rock within the phyllic alteration zone. Rock may be fine-grained intrusive or sediment?

Alteration products are sericite, chlorite and possibly quartz.

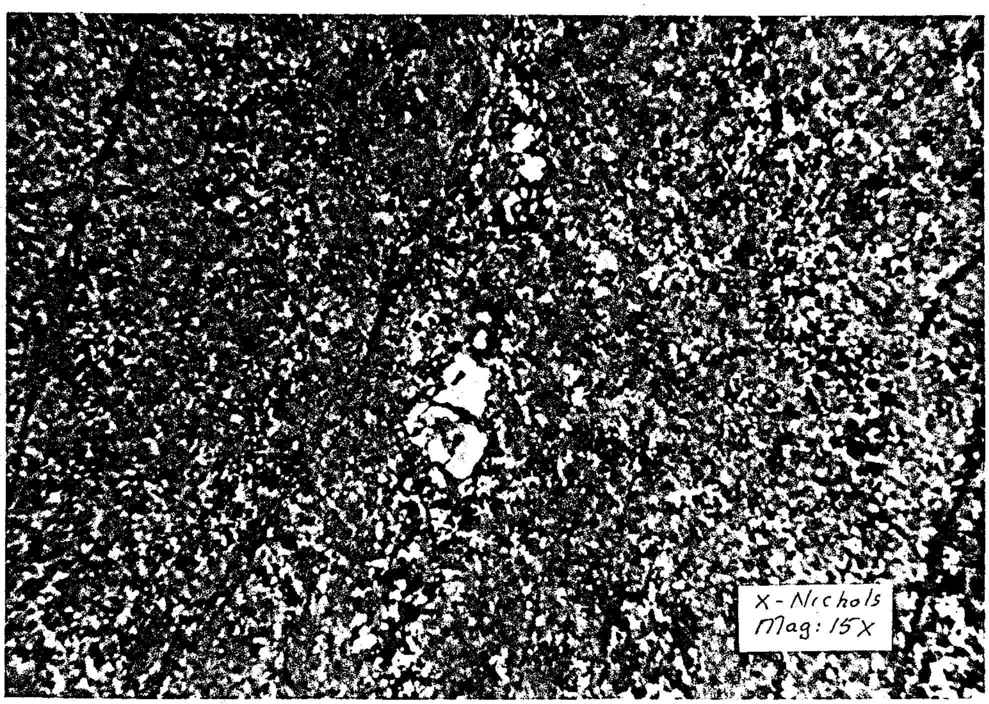
T-156

Rock Name: Spotted argillite

Mineralogy, Texture and Description: Abundant very fine-grained sericite intergrouwn with chlorite, quartz, and feldspar. Chlorite occurs in fine-grained concentrated spots (up to Ø.2mm). About 10% very fine-grained subhedral to anhedral sulphides occur disseminated throughout the slide with concentrations occurring along thin fractures and quartz veins.

The rock is cut by numerous thin fractures in two prominent directions. In and around the fractures are concentrations of very fine-grained sulphides. Locally the fractures contain fine-grained subhedral quartz (up to Ø.5mm) and fine-grained subhedral sericite (up to Ø.2mm) as well as sulphides.

Interpretation: A very fine-grained clay-rich sediment which has been contact metamorphosed resulting in the formation of sericite and fine-grained chlorite porphyroblasts (spots). Tectonism has resulted in abundant fractures with the introduction of sulphides, and quartz. The abundant very fine-grained sericite in the rock and fine-grained sericite associated with the quartz and sulphide veins are indicative of alteration within the phyllic zone.

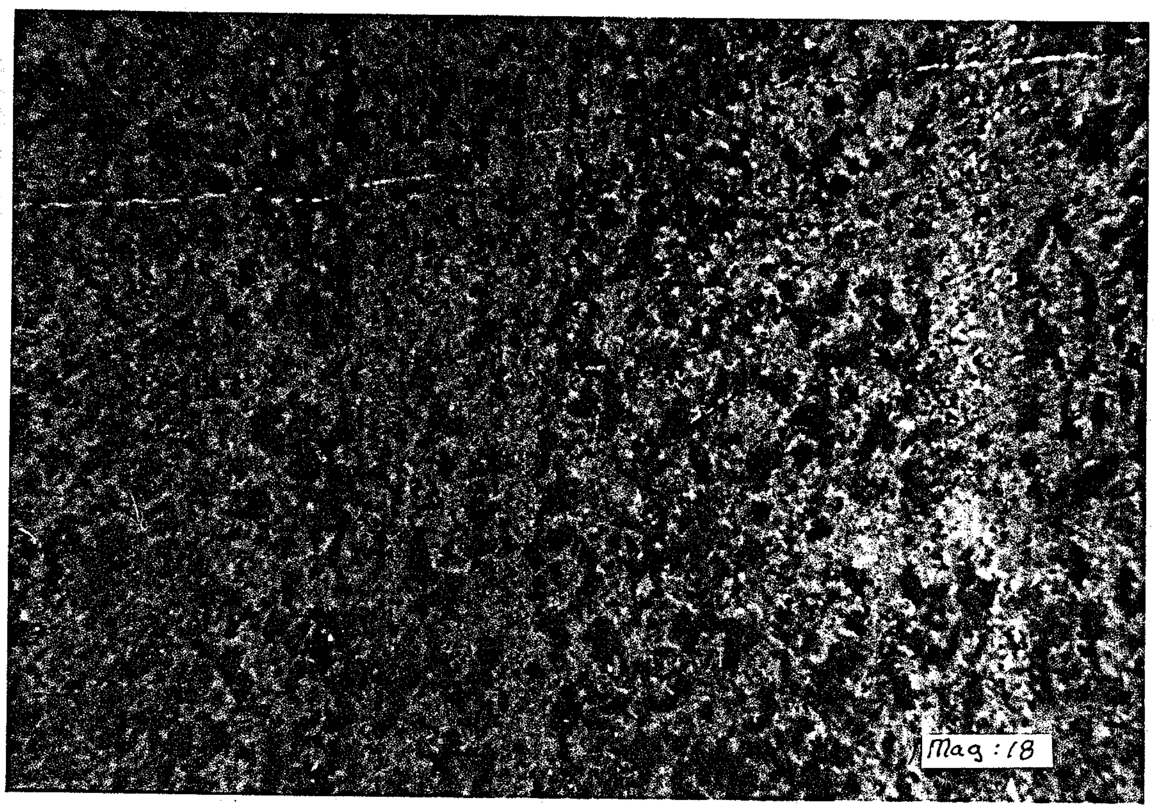


T-239

Rock Name Hornfelsed thinly laminated argillite

Mineralogy, Texture and Description Thin bedding laminations from Ø.3mm to 1.Øcm thick are defined by variations in mica content. Beds range from silty beds with v.f.g. quartz, feldspar and opaques with 2Ø to 3Ø% micas to argillite beds with 6Ø - 7Ø% micas. Micas consist of v.f.g. to f.g. sericite and chlorite randomly oriented. Recrystallized sericite crystals are subhedral poikiloblasts up to Ø.5mm, also randomly oriented in the matrix.

A quartz vein (up to Ø.2mm thick) consists of f.g. quartz, chlorite and pyrite.



T-256

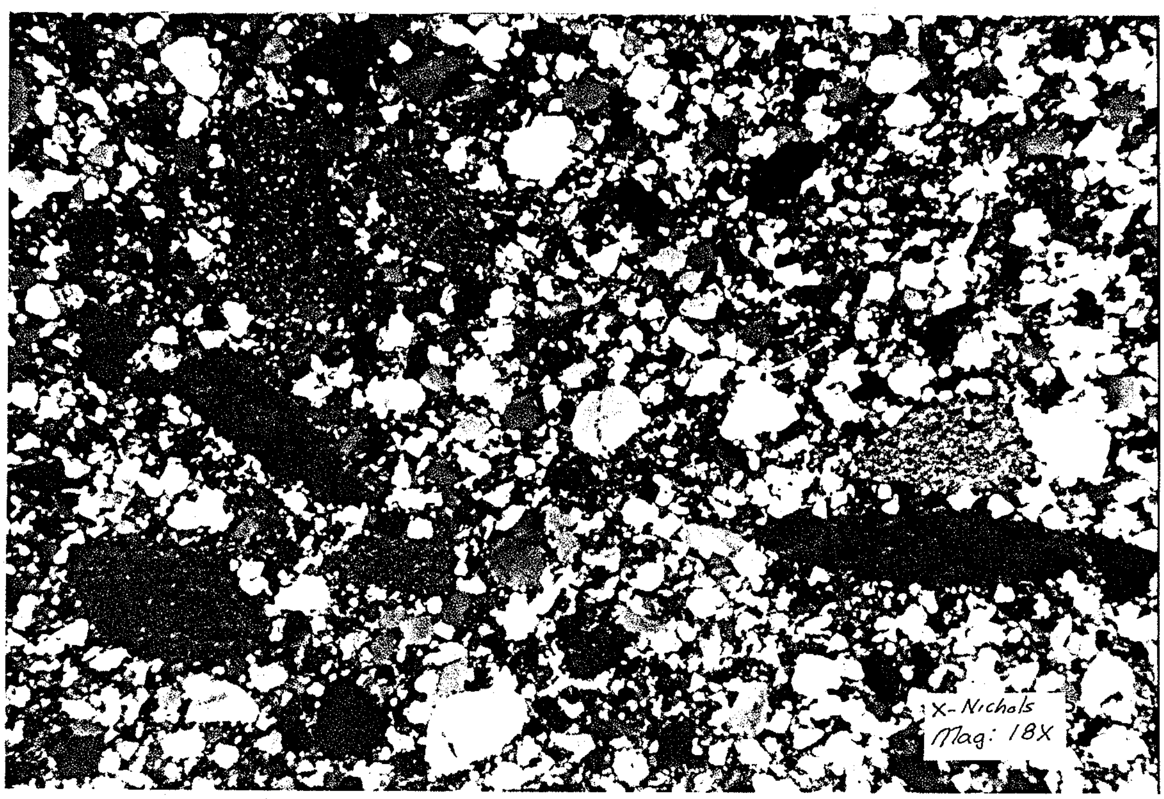
Rock Name Quartz wacke

Mineralogy

Frame work grains	70%	(>0.06mm)	
Quartz	60%	f.g. (up to 1mm), subrounded to subangular	
Feldspar	5%	f.g. (up to 0.5mm) subrounded to subangular	
Rock Fragments	5%	f.g. (up to 0.5mm) subangular	
Matrix	30%	(<0.06mm)	
Feldspar	10%	v.f.g. (up to 0.6mm)	subangular
Quartz	5%	v.f.g. (up to 0.6mm)	subangular
Chlorite	5%	v.f.g. (up to 0.6mm)	subangular
Opaques	5%	v.f.g. (up to 0.6mm)	subangular
Sericite	5%	v.f.g. (up to 0.6mm)	subhedral, lepiloblastic
Epidote	tr	v.f.g. (up to 0.6mm)	subangular
Zircon	tr	v.f.g. (up to 0.6mm)	subangular

Texture Subrounded to subangular quartz and feldspar sand grains and subangular rock fragments in about 30% matrix of silt sized quartz, feldspar, heavies and micas.

Description Quartz and feldspar grains are relatively well rounded. Lithic clasts are relatively angular rip-ups of argillite and siltstone. Minor subrounded cherty clasts are also locally present. Feldspar is more abundant than quartz in the matrix. Chlorite grains appear detrital while sericite is metamorphically recrystallized. Opaques are variably altered to leucoxene.



T-281

Rock Name: Quartz wacke

Mineralogy:

Framework Grains	80%	(>0.06mm)
Quartz	94%	f.g. (up to 1mm) subrounded to subangular
Feldspar	4%	f.g. (up to 0.5mm), subangular
Rock fragments	1%	f.g. (up to 0.5mm), subangular
Opaques	1%	f.g. (up to 0.2mm), subrounded
Matrix Grains	20%	(<0.06mm)
Quartz	40%	v.f.g. (up to 0.06mm), subangular
Feldspar	35%	v.f.g. (up to 0.06mm), subangular
Sericite	5%	v.f.g. (up to 0.06mm), subhedral
Chlorite	5%	v.f.g (up to 0.06mm), subangular
Opaques	5%	v.f.g. (up to 0.06mm), subrounded
Zircon	tr	v.f.g. (up to 0.02mm), subrounded
Apatite	tr	v.f.g (up to 0.02mm), subrounded

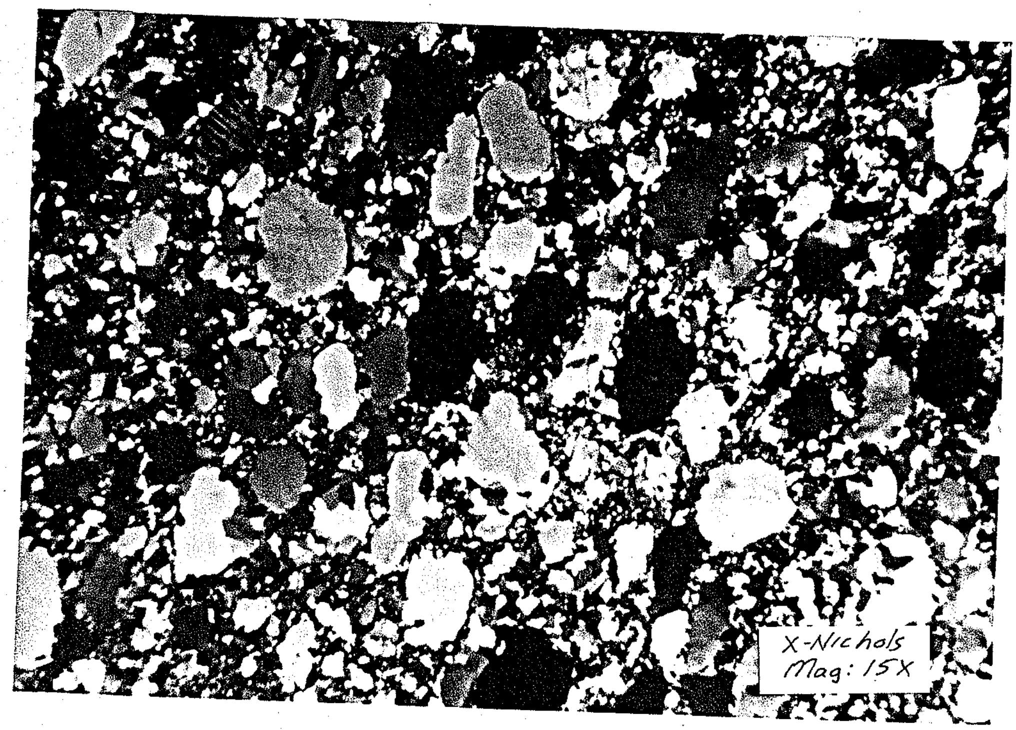
Texture: Subangular to subrounded quartz and minor feldspar and rock fragments sand sized grains in a quartz-feldspar-rich matrix.

Detailed Description: Quartz is the most abundant constituent of the rock. Most quartz grains are single crystals, but some are polycrystalline. Feldspar grains are smaller and about subequal amounts of Kspar and plagioclase are present. Occassional rock fragments are of very fine-grained siltstone. Chlorite in the matrix is subrounded to subangular and appears to be detrital. Sericite occurs as subhedral lepidoblastic recrystallizations. At one end of the slide sericite occurs in clusters which appear to have overgrown portions of the matrix. The sericite in these areas are similar in habit to the phyllic alteration sericite in the intrusives.

A thin mylonitized fracture (up to 0.5mm) cuts the rock. Fine grain chlorite and opaques have been introduced in this fracture and the opaques are extensively hematized.

Interpretations: A quartz rich wacke which might be considered a quartzite except for the relatively high proportions of silty matrix (i.e. 20%) and angularity of the quartz sands.

In one portion of the slide the matrix is locally overgrown by sericite in clusters similar in habit to that in the phyllic alteration zones in the intrusives.


X-Nichols
Mag: 15X

T-324

Rock Name Fine-grained quartz wacke

Mineralogy

Framework Grains	70%	(>Ø.6mm)
Quartz	60%	f.g. (up to Ø.4mm) subangular to subrounded
Feldspar	10%	f.g. (up to Ø.2mm) subangular to subrounded

Matrix: 30% (<Ø.Ø6mm)

Feldspar	15%	v.f.g. (up to Ø.Ø6mm) subangular
Quartz	5%	v.f.g. (up to Ø.Ø6mm) subangular
Opaques	5%	v.f.g. (up to Ø.Ø2mm) subangular
Sericite	3%	v.f.g. (up to Ø.Ø6mm) subhedral, lipidoblastic
Chlorite	1%	v.f.g. (up to Ø.Ø6mm) subangular
Epidote	1%	v.f.g (up to Ø.Ø6mm) subangular

Texture 70% sand size grains of subangular to subrounded quartz and feldspar supported in a 30% matrix of silt sized subangular feldspar, quartz, micas and heavies.

Description Feldspars are moderately altered to v.f.g. sericite and epidote overgrowths. Chlorite appears to be largely detrital while sericite appears to be metamorphically recrystallized.

Thin veins up to Ø.1mm wide are filled with v.f.g. quartz and chlorite.

T-329

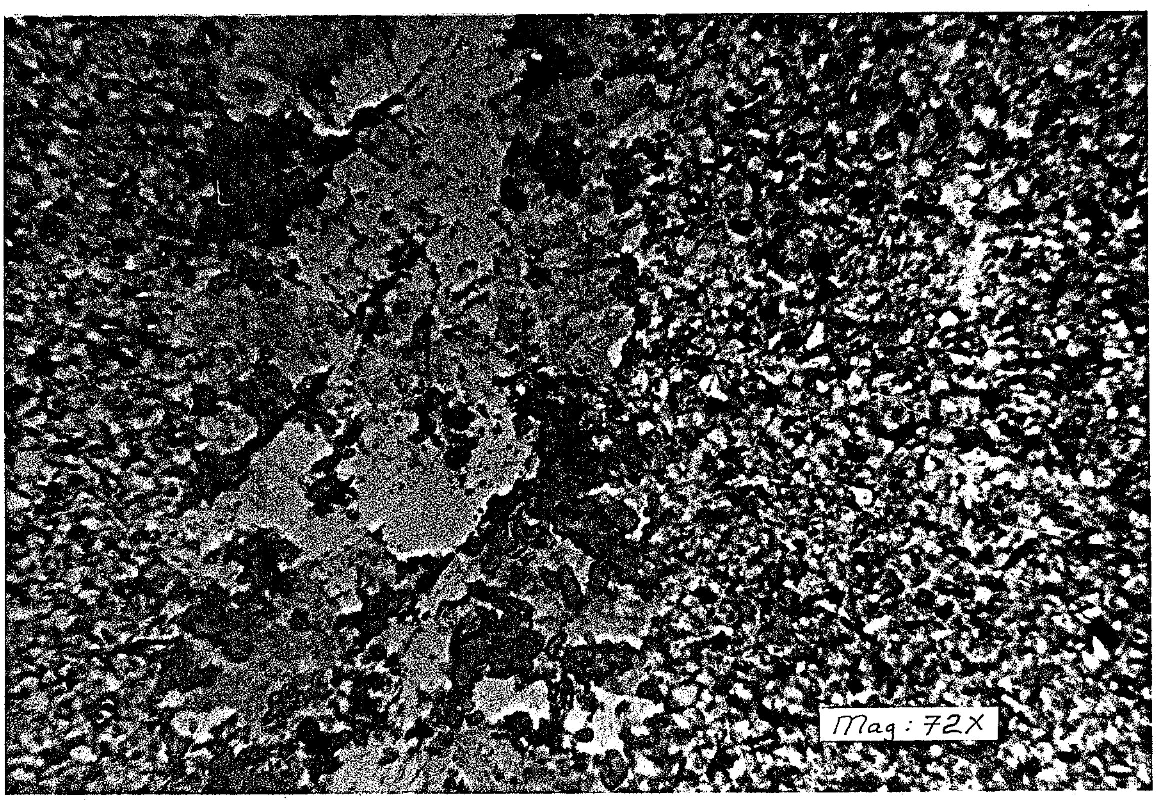
Rock Name Siltstone

Mineralogy

Quartz	75%	v.f.g. (up to Ø.1mm) subangular to subrounded
Feldspar	1Ø%	v.f.g. (up to Ø.Ø5mm) subangular to angular
Chlorite	5%	v.f.g. (up to Ø.Ø5mm) subangular
Opaques	5%	v.f.g. (up to Ø.Ø5mm) subangular
Sericite	5%	v.f.g. (up to Ø.1mm) subhedral, lepidoblastic

Texture Silt sized quartz, feldspar and opaques grains are subangular to angular and framework supported in a matrix of chlorite and sericite.

Description Thin laminations up to 1cm thick as defined by concentrations of heavies on the bedding planes (up to 1mm thick). These laminations outline an isoclinal fold in the central portion of the slide. There doesn't appear to be an axial planar cleavage developed in association with this fold.



T-363

Rock Name Siltstone

Mineralogy

Feldspar	50%	v.f.g. (up to 0.1mm)	angular to subangular
Quartz	35%	v.f.g. (up to 0.2mm)	subangular to angular
Chlorite	10%	v.f.g. (up to 0.05mm)	subangular
Sericite	5%	v.f.g. (up to 0.05mm)	subhedral, lepidoblastic
Opaques	tr	v.f.g. (up to 0.1mm)	euhedral to subhedral
Sphene	tr	v.f.g. (up to 0.05mm)	subangular
Apatite	tr	v.f.g. (up to 0.05mm)	subangular

Texture Subangular to angular silt-sized grains of quartz, feldspar and heavies in a small amount of matrix of v.f.g. chlorite and sericite.

Description Feldspar grains are moderately altered to v.f.g. overgrowths of sericite and epidote. Some micas, particularly chlorite appear to be detrital. Sericite appears to be metamorphically recrystallized in randomly oriented lepidoblastic crystals. Opaques consist predominantly of f.g. euhedral pyrite introduced after deposition of the sediment.

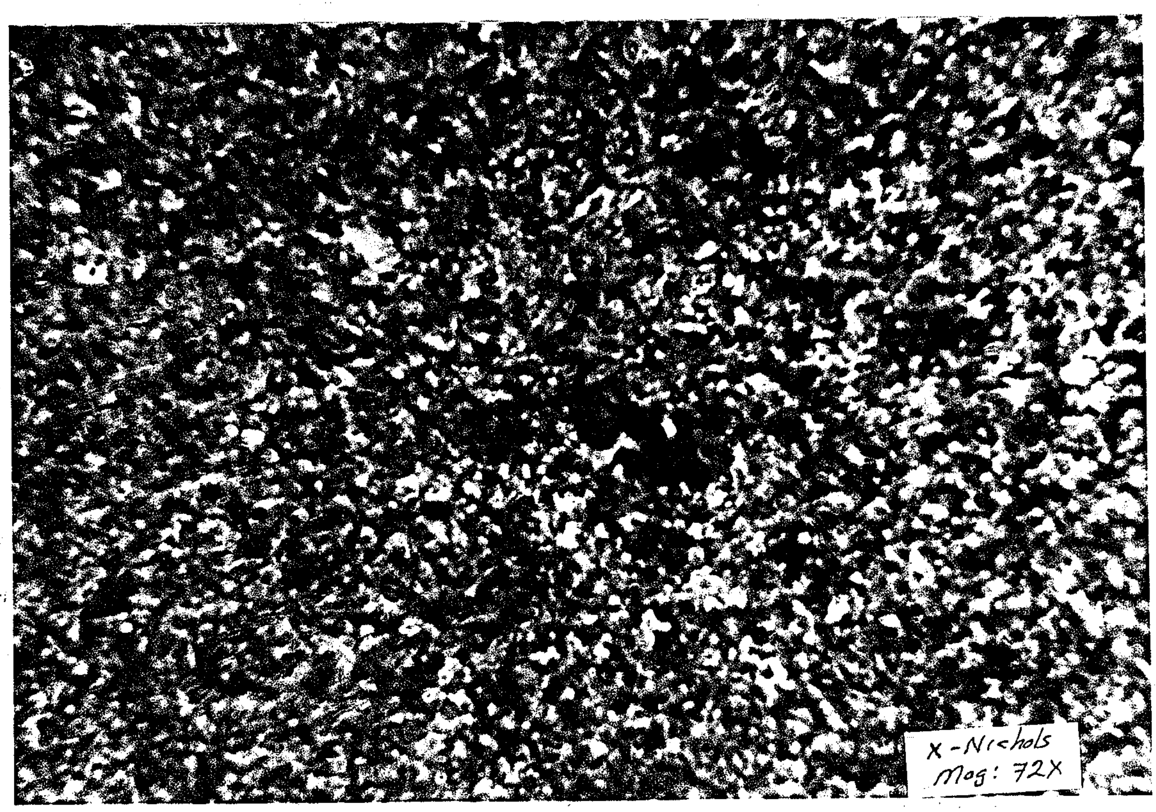
A 4mm quartz vein consisting of f.g. subhedral quartz oriented perpendicular to the vein walls, f.g. chlorite and pyrite cuts the rock. A bleached selvage extends up to 3mm on either side of the vein with chlorite depleted and redeposited in the host rock at the contact with the vein and within the vien.

T-370H

Rock Name Argillite

Mineralogy, Texture and Description Rare subrounded silt-size grains of quartz and feldspar in a matrix of abundant v.f.g. micas consisting of sericite, chlorite and biotite with subordinate quartz-o-feldspar material and heavies. The matrix is largely metamorphically recrystallized with anhedral granoblastic quartz and feldspar and subhedral lepidoblastic micas in random orientation.

Thin fractures (up to Ø.1mm thick) cut the rock and are filled with v.f.g. hematite and occasionally quartz.



MINERALOGRAPHIC DESCRIPTION

OF

POLISHED SECTIONS

WOODSTOCK PROJECT

by

J.A. Ayer

Dugan Road West

Sample T23

Vein with about 50% fine-grained sulphides in a sedimentary rock. The vein is up to 7mm wide and has a bleached selvage up to 3mm wide in the wallrock which has about 2% sulphides.

Vein Opaque Mineralogy: (50% sulphides)

Pyrite	99%	(note % as a total of the amount of opaques present)
Magnetite	tr	
Rutile	tr	
Covellite	tr	

Pyrite occurs as fine-grained (up to 0.2mm) euhedral to subhedral cubes with occasional very fine-grained inclusions of gangue and magnetite.

Magnetite crystals are very fine-grained (up to 0.03mm) subhedral and occur as inclusion in pyrite and as separate grains disseminated in the gangue.

Rutile crystals are very fine-grained (up to 0.03mm) and are subhedral to anhedral often intergrown in a skeletal habit with silicates.

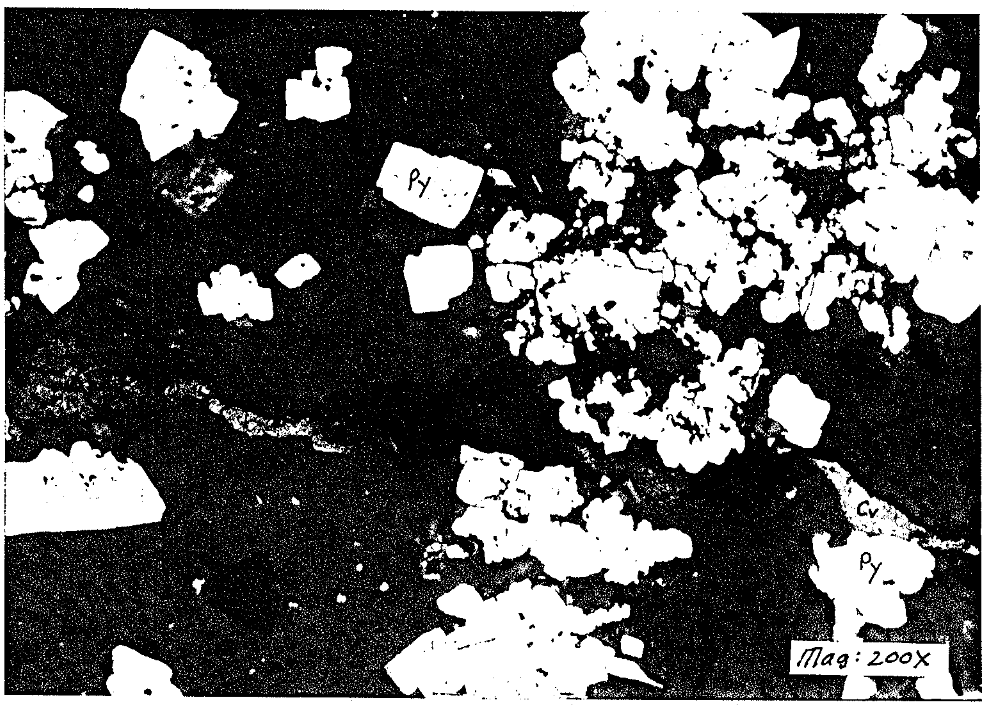
Covellite occurs as fine-grained anhedral masses (up to 0.3mm) restricted to infillings of vuggy fractures (photo R5, #23).

Wallrock Opaque Mineralogy (2% disseminated opaques)

Magnetite	70%
Rutile	30%

Magnetite is very fine-grained (up to 0.02mm) and subhedral.

Rutile is very fine-grained ,(up to 0.03mm) and anhedral occurring as skeletal intergrowths with gangue minerals.


Py
Cv
Py
Mag: 200X

Bull Creek No. 2

Sample T40A (1)

Sample with about 10% disseminated sulphides. Sample selected from a copper-rich portion of the rock.

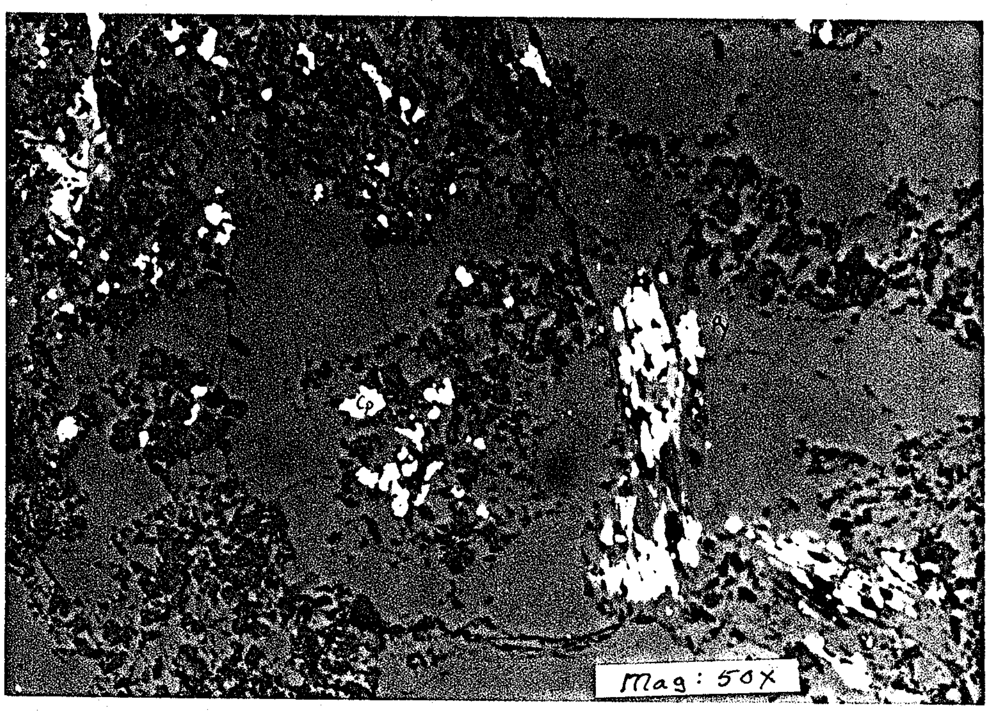
Modal Mineralogy (% expressed represents the proportion of the total amount of opaques present)

Chalcopyrite	90%
Rutile	5%
Pyrite	3%
Goethite	2%

Chalcopyrite is very fine to fine-grained (up to 0.2mm). It is anhedral and occurs in ragged and embayed grains in micaceous portions of the gangue and infilling irregular fractures in the gangue.

Rutile is very fine to fine-grained (up to 0.2mm). It is anhedral occurring as ragged ribbon shaped grains intergrown with micaceous minerals in the gangue which frequently contain chalcopyrite as well.

Pyrite is fine-grained and euhedral to subhedral (up to 0.3mm). Locally the pyrite grains are partially to totally replaced by overgrowths of goethite.



Bull Creek No. 2

Sample T40A (2) - Polished Thin Section

Sample of wallrock with about 4% disseminated sulphides. At one end of the slide is a more altered and copper-rich portion of the rock. It is this area which was selected for sample 40A (1), a regular polished section (i.e. not a thin section), described elsewhere.

Wallrock Modal Mineralogy

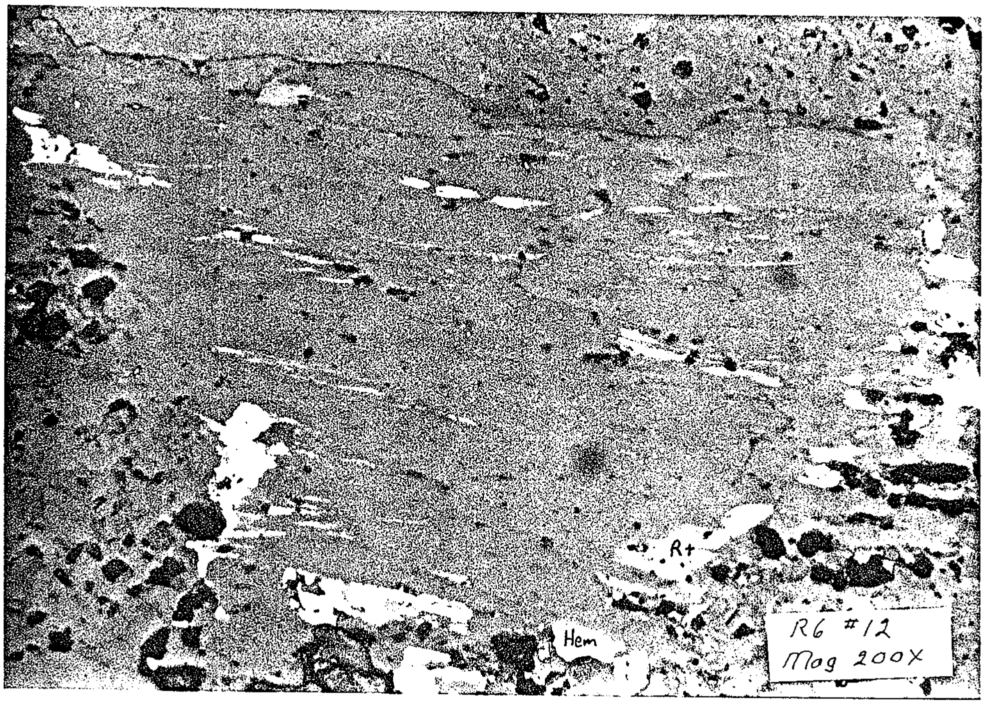
Pyrite	55%
Goethite	40%
Chalcopyrite	2%
Rutile	2%
Hematite	1%

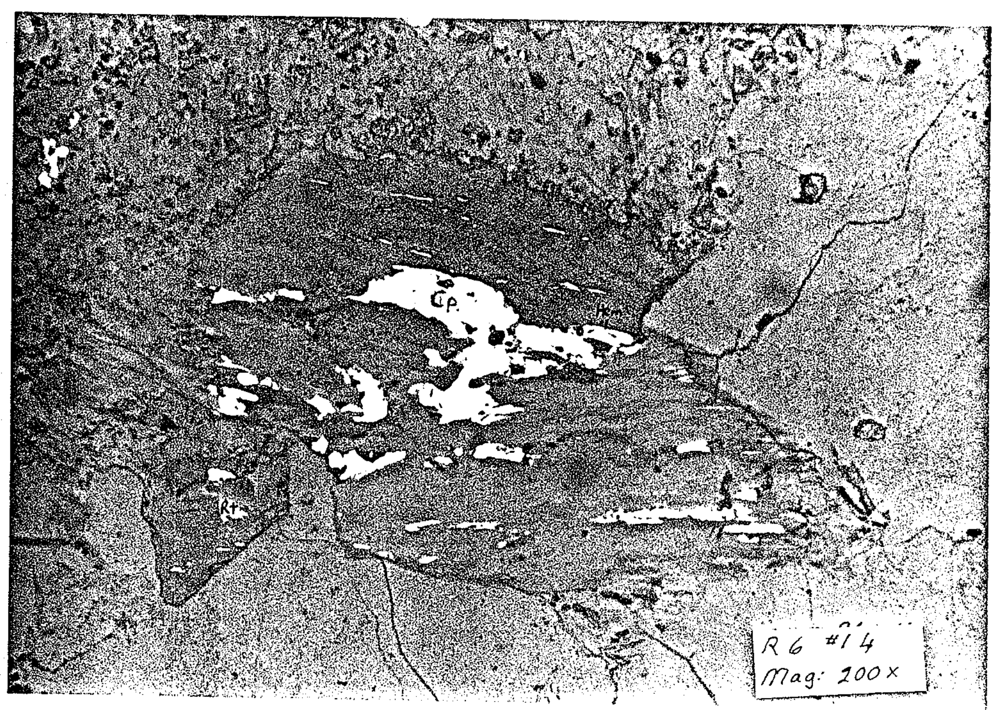
Pyrite is very fine to fine-grained (up to 0.5mm) and euhedral to subhedral with minor very fine-grained inclusions of gangue. It is typically partially to totally replaced by goethite pseudomorphs.

Chalcopyrite is very fine - to fine-grained (up to 0.2mm) and anhedral. It occurs typically as irregular shaped inclusions in micaceous gangue minerals (Photos R6, #14-16). Locally partially overgrown by goethite.

Rutile is very fine-grained (up to 0.1mm) and subhedral to anhedral. It typically occurs as inclusions with hematite in chloritized biotite crystals (Photo R6, #10-13).

Hematite is very fine-grained (up to 0.1mm) and anhedral to subhedral. It is typically intergrown with rutile as inclusions in chloritized biotite (Photo R6, #10-13).


Rt
Hem
R6 #12
Mag 200X


Cp.
Rt
R6 #14
Mag: 200x

Bull Creek No. 2

Sample T45

Vein sample with about 10% disseminated sulphides.

Modal Mineralogy

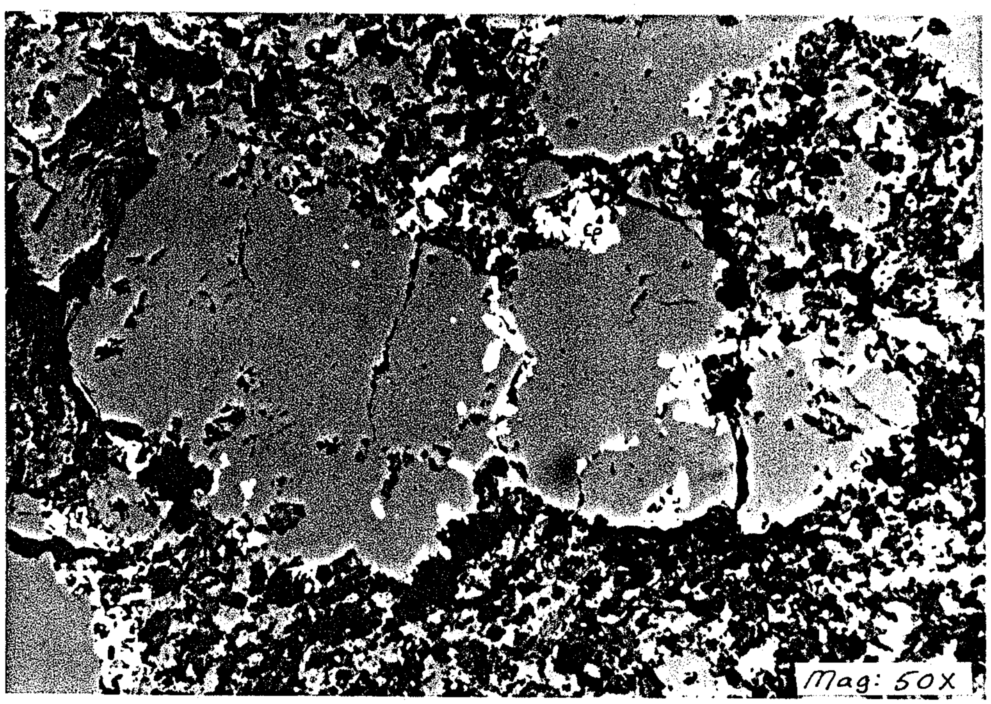
Chalcopyrite	95%	Goethite	tr
Hematite	3%	Covellite	tr
Pyrite	2%		

Chalcopyrite is fine-grained (up to Ø.7mm) occurring as subhedral to anhedral irregular shaped crystals or crystal aggregates. It commonly occurs as fracture fillings in and around large quartz crystals (Photo R5, #25).

Hematite is very fine to fine grained (up to Ø.2mm) and occurs as euhedral to subhedral bladed crystals disseminated in gangue.

Pyrite is fine-grained (up to Ø.1mm) and euhedral to anhedral. Some occur as euhedral cubes and others are very strongly embayed and corroded in outline. Both forms occur disseminated in the gangue.

Goethite and covellite occur locally as alteration of chalcopyrite in fractures and around grain borders.



Bull Creek No. 2

Sample T46

A sulphide vein up to 5mm wide cuts wallrock with about 15% disseminated sulphides.

Vein Mineralogy

Pyrite	50%	Sphalerite	tr
Chalcopyrite	30%	Cubanite (?)	tr
Arsenopyrite	20%	Covellite	tr

Pyrite is fine to medium grained (up to 2mm), euhedral and locally highly fractured with infillings of gangue and chalcopyrite (Photo R5, #26 & 27).

Chalcopyrite occurs in irregular shaped fine to medium grained anhedral aggregates. It surrounds and fills cracks in pyrite and arsenopyrite crystals (Photos R5, # 26 & 27). The chalcopyrite is typically highly pitted as is locally fractured with minor alteration to covellite.

Arsenopyrite is fine to medium grained (up to 4mm) and high fractured euhedral crystals with fractures infilled with gangue and chalcopyrite (Photo R5, #26). It locally occurs as finer inclusions in pyrite (Photo R5, #27).

Spahlerite is very fine-grained (up to 0.1mm) and subhedral. It typically occurs in larger chalcopyrite grains and has abundant very fine grained inclusions or exsolution of chalcopyrite oriented along cleavage traces.

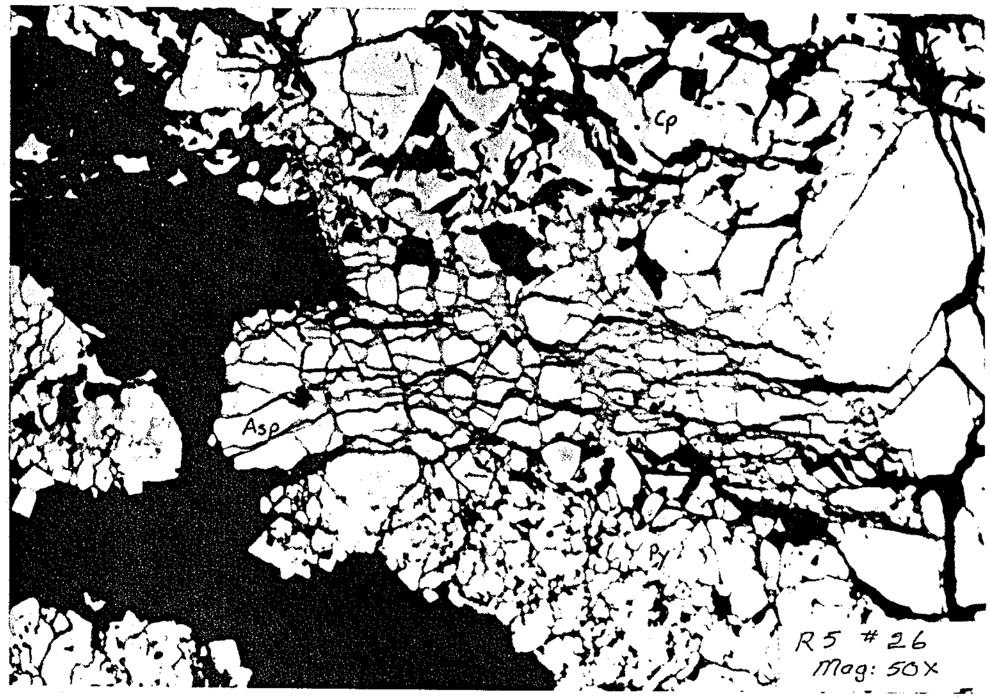
Cubanite (?) is very fine grained (up to 0.1mm) and subhedral. It occurs within larger chalcopyrite grains. It's optical properties are as follows; light grey-blue colour, moderate reflectance (30 to 35), distinct bireflectance, distinct anisotropism, and no internal reflectance. Grains are two small for X-ray determination.

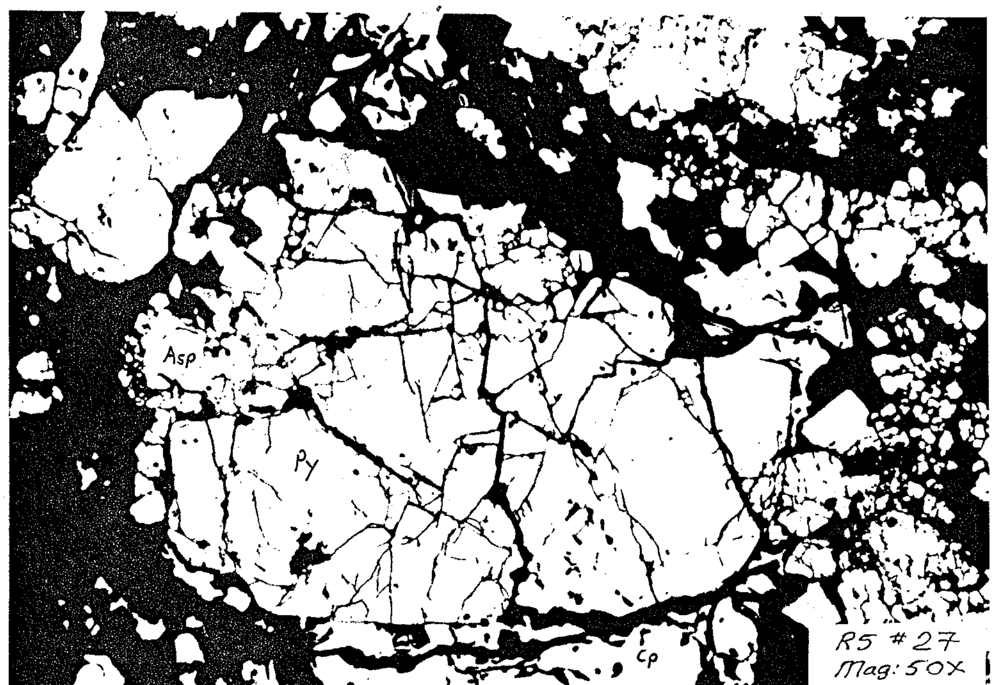
Wallrock Modal Mineralogy

Chalcopyrite	90%
Hematite	10%

Chalcopyrite is fine-grained (up to 0.5mm) and occurs in anhedral aggregates in fractures fillings or coating quartz crystals similar in habit to sample 45.

Hematite is very fine, to fine grained (up to 0.2mm) euhedral lath-shaped prismatic crystals disseminated throughout the gangue.


Cp
Asp
Py
R5 #26
Mag: 50X


Asp
Py
Cp
R5 #27
Mag: 50X

Bull Creek No. 3

Sample T47B

Vein sample consisting of about 5% disseminated sulphides locally in lath shaped grains up to 3mm in size showing no preferred orientation.

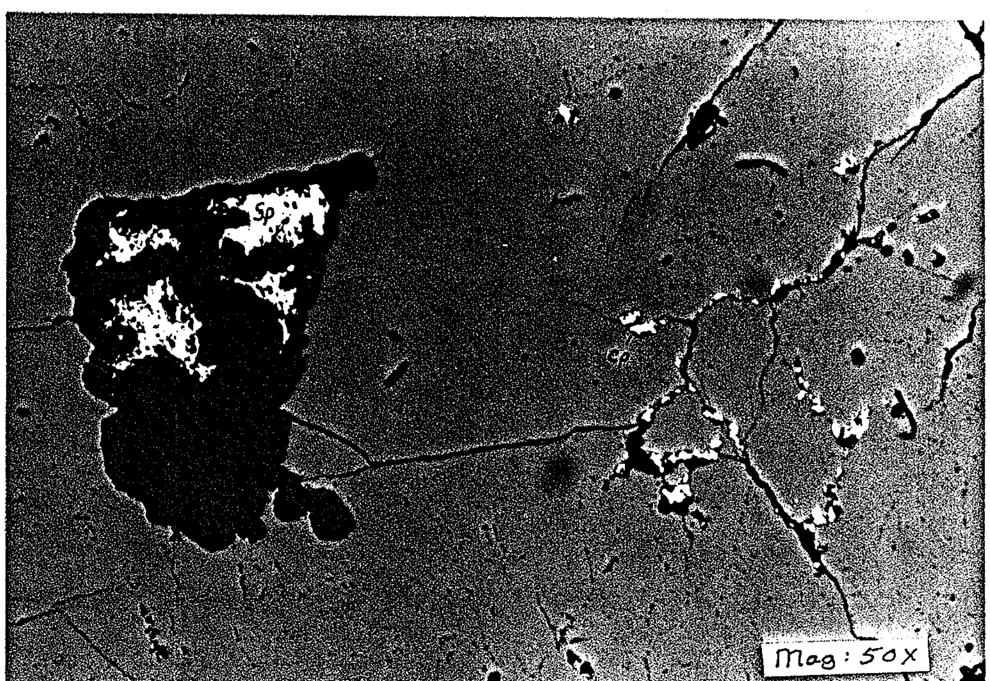
Modal Sulphide Mineralogy

Sphalerite	60%	Covellite	tr
Chalcopyrite	20%	Rutile	tr
Pyrite	15%	Goethite	tr
Galena	5%		

Sphalerite occurs in anhedral irregular grains up to 3mm in size recognized by internal reflections and ubiquitous chalcopyrite inclusions which in this case display no preferred orientation. Replacement by covellite along gangue filled seams running through sphalerite. Locally coated by chalcopyrite and commonly in contact with galena. Extensively pitted section. Pits may represent plucked spahlerite which would reflect a greater modal abundance (see photo R6, #22).

Chalcopyrite occurs as irregular anhedral grains up to 1mm in size. It commonly occurs as irregular discontinuous seams infilling fractures in the gangue and as small equant blebs in the gangue. Very common as un-oriented blebs in sphalerite. Coats sphalerite, galena and pyrite (see photo R6, #22).

Pyrite occurs as euhedral to anhedral inclusions up to 0.5mm in size. One grain coated by sphalerite, chalcopyrite and galena.



Bull Creek No. 1

Sample T51

Vein sample with disseminated to massive clots of sulphides.

Modal Mineralogy

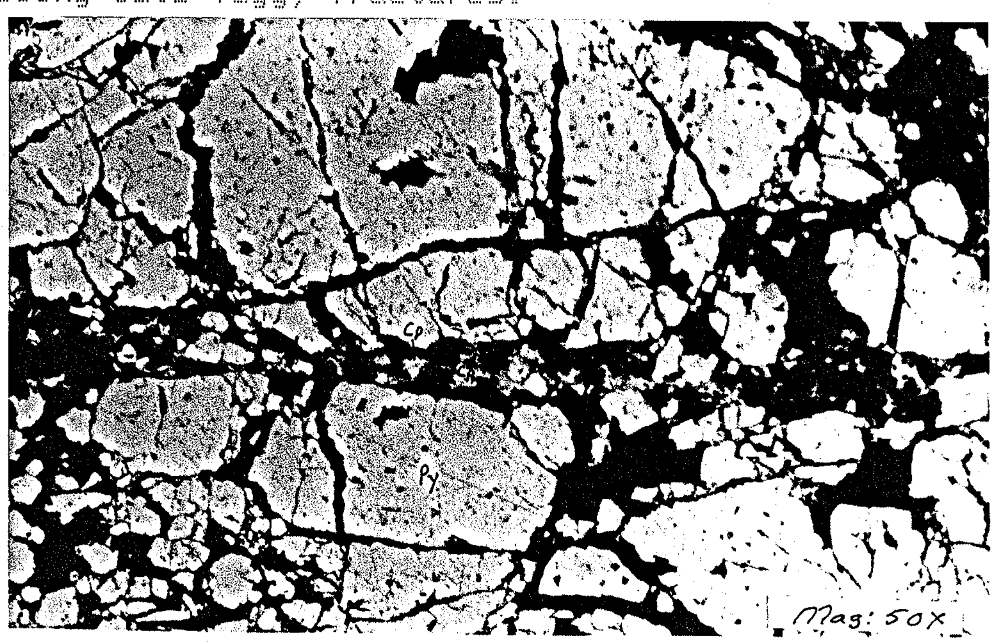
Pyrite	90%
Chalcopyrite	8%
Sphalerite	1%
Hematite	1%
Goethite	tr

Pyrite occurs as fine-grained to medium-grained (up to 1mm) euhedral to subhedral crystals as separate grains and irregular shaped aggregates up to 1.5cm in size. Crystals commonly contain very fine-grained inclusions of gangue hematite and chalcopyrite. Locally pyrite is highly fractured with infillings of gangue and chalcopyrite (Photo R5, #28).

Chalcopyrite, is very fine to fine grained anhedral grains (up to 0.2mm) as minor disseminations and fracture fillings throughout the section. In one area a lens of chalcopyrite is relatively concentrated up to about 1cm x 2mm wide. Chalcopyrite contains very fine grained to fine grained inclusions of gangue, pyrite and sphalerite.

Sphalerite is very fine grained (up to 0.1mm) and subhedral as disseminations in gangue and inclusions in chalcopyrite. Sphalerite typically contains abundant very fine grained inclusions or exsolution of chalcopyrite oriented along cleavage traces.

Hematite is very fine-grained (up to 0.1mm) and subhedral crystals disseminated in the gangue throughout the section. It also intergrown with goethite as fine-grained accumulations infilling late vuggy fractures.



Bull Creek No. 1

Sample T53

A vein sample with about 20% disseminations and stringers of sulphides.

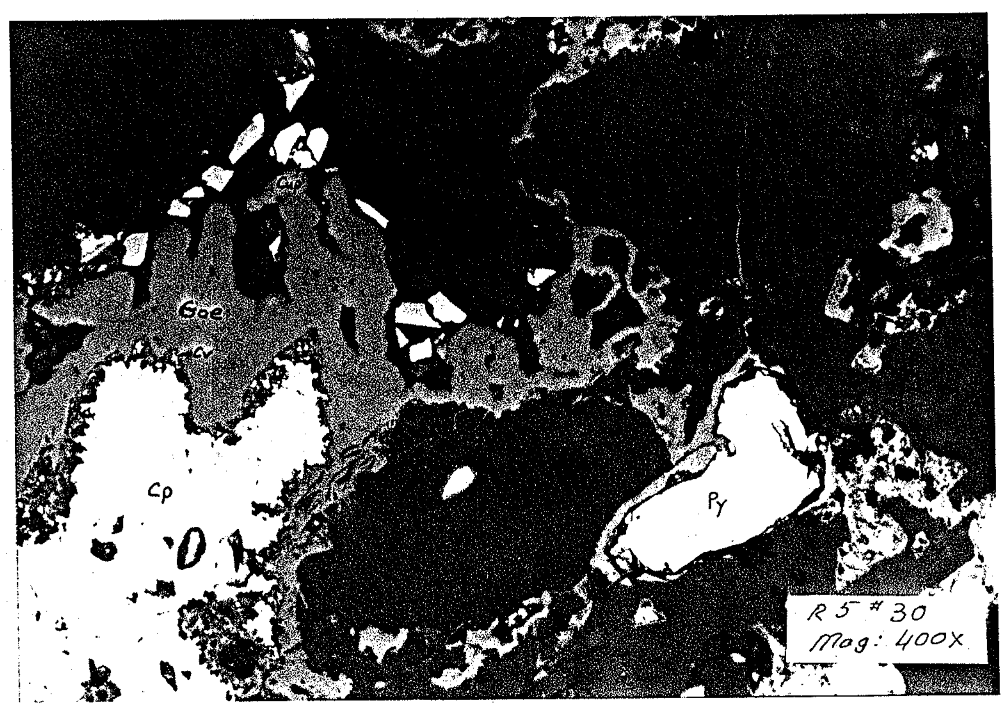
Modal Mineralogy

Chalcopyrite	85%
Goethite	10%
Pyrite	3%
Covellite	2%
Cuprite (?)	tr

Chalcopyrite occurs as fine to medium grained (up to 2mm) irregular-shaped blebs as fracture fillings and stringers commonly surrounding and coating rounded growths crystals (Photo R5, #29). The chalcopyrite is quite pitted and cut by fractures and veins with alteration to covellite and goethite (Photo R5, #29 & 30).

Pyrite occurs as fine-grained euhedral (up to 0.2mm). Locally fractured and partially to totally replaced by goethite (Photo R5, #30).

Very fine-grained euhedral to subhedral crystals (up to 0.02mm) of cuprite (?) occur locally in alteration rims around chalcopyrite grains (Photo R5, #30) or adjacent to vugs which are partially infilled with goethite. Due to the small size and X-ray determination was not possible. It has the following optical properties; light bluish grey colour, moderate reflectance (35-40), and strong internal reflectance which masks its aniotropism.



Connell Mountain

Sample T62A (Polished Thin Section)

Wall rock sample consisting of less than 2% sulphides and oxides in fine disseminations

Modal Mineralogy

Goethite	60%
Pyrite	35%
Chalcopyrite	3%
Hematite	2%
Covellite	tr

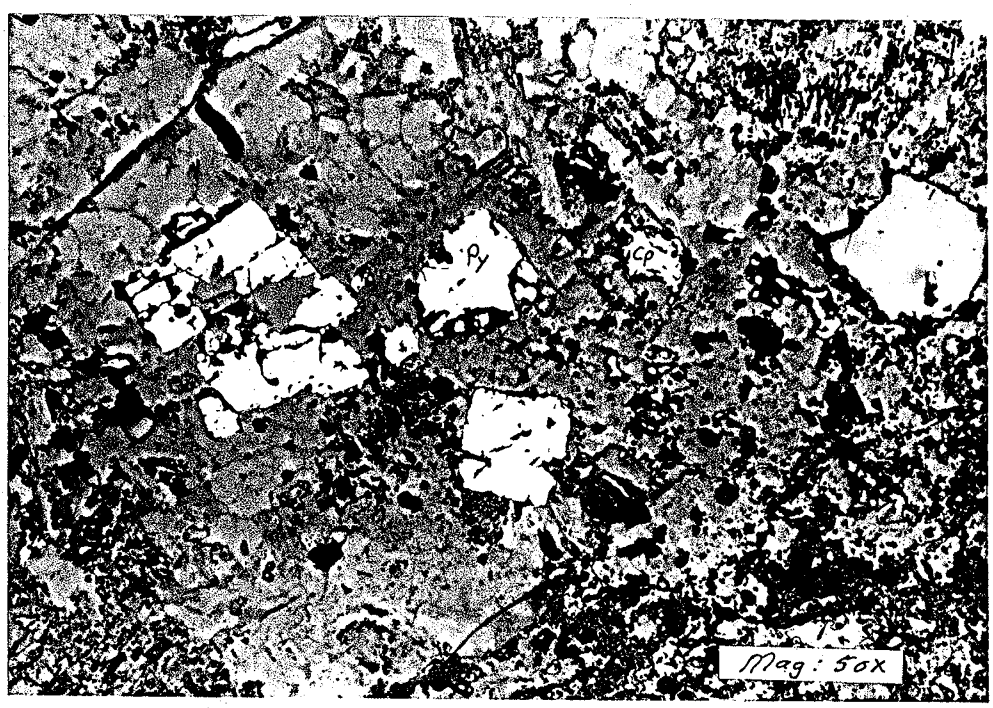
Goethite occurs as irregularly shaped colloform textured masses which replace pyrite, chalcopyrite and covellite. It also form irregular banded masses infilling fractures in the gangue. Typically the goethite surrounds pitted areas.

Pyrite occurs as euhedral to subhedral up to 0.5mm. They are locally fractured and replaced by goethite along grain boundaries.

Chalcopyrite occurs in irregular grains up to 0.2mm in size. It is commonly replaced by goethite and locally by covellite. Chalcopyrite also occurs as fine grained unaltered dissemination in the groundmass.

Hematite is locally intergrown with goethite and finely disseminated in the gangue.

Covellite replaces chalcopyrite along grain boundaries and is locally intergrown with goethite., It commonly occurs at the edges of pitted areas which are enveloped by goethite.



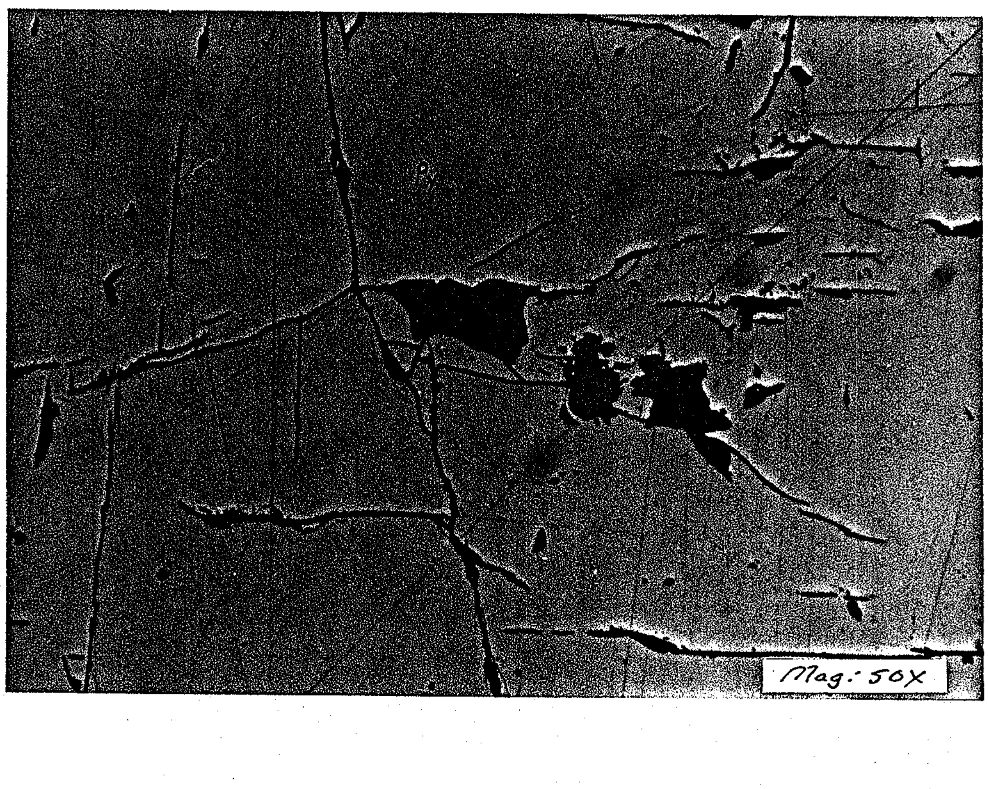
Connell Mountain

Sample T67A

Sample large pyrite cube.

Modal Mineralogy
Pyrite 100%
Hematite tr

Pyrite comprises virtually 100% of this sample possibly occurring as one grain. Minor oriented fractures occur probably reflecting cubic habit of pyrite. Trace amounts of hematite occur as inclusions in the pyrite as well as trace quantities of gangue.



Connell Mountain

Sample T67B

Vein sample consisting of about 5% sulphides; largest clot is of chalcopyrite and about 4mm in size.

Modal Sulphide Mineralogy

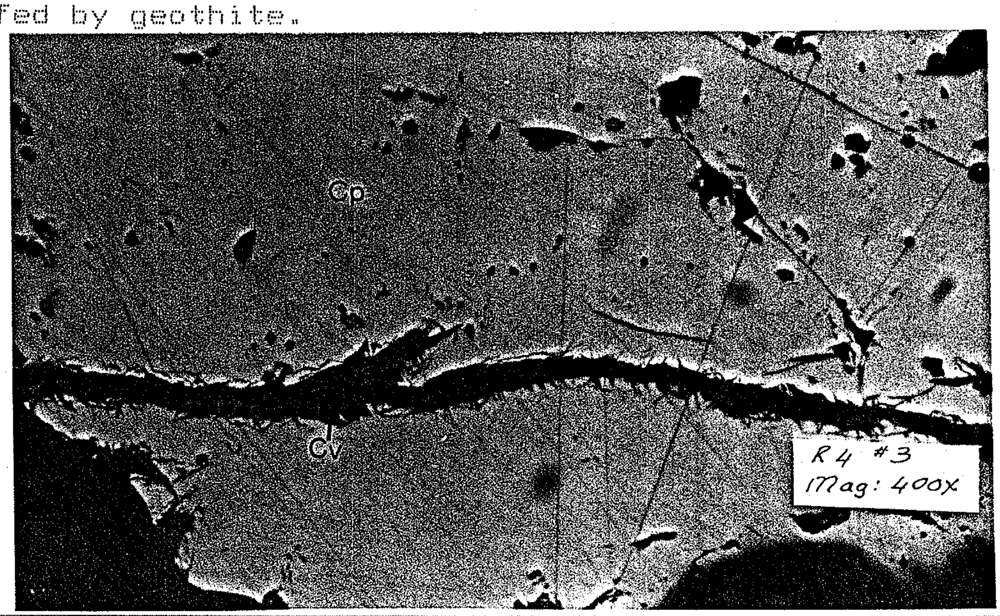
Chalcopyrite	85%	Pyrite	3%
Goethite	7%	Pyrrhotite	tr
Covellite	5%		

Chalcopyrite occurs as large anhedral irregular masses up to 4mm in size and as small irregular seams infilling fractures in the gangue. Small equant blebs are also present in the gangue. Large irregular masses may be infilling intergranular spaces. Covellite replaces chalcopyrite along grain boundaries and along fractures (Photo R4, #1-3). Goethite replacement is more extensive locally completely engulfing "islands" of chalcopyrite (Photo R4, #4 & 5). Rare pyrrhotite occurs as thin inclusions in the chalcopyrite.

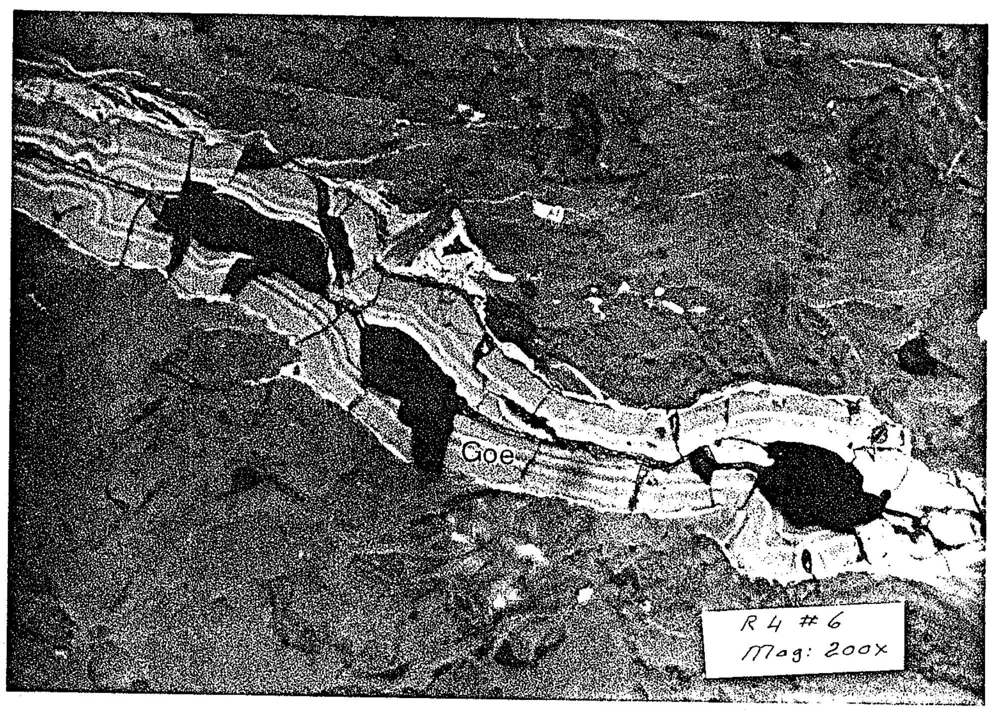
Pyrite occurs as euhedral to subhedral grains disseminated in the gangue. The grains are largely inclusion free and locally coated by chalcopyrite. Pyrite is rarely replaced by goethite along grain boundaries in this section.

Covellite is always associated with chalcopyrite and to a lesser extent goethite. It replaces chalcopyrite along grain boundaries and penetrating fractures. Locally classic replacement flame textures are developed. Covellite locally occurs within goethite.

Goethite replaces both chalcopyrite and covellite. It displays good banded to colloform textures particularly along infilled fractures in the gangue (Photo R4, #6 & 7). Extensive replacement isolates "islands" of chalcopyrite completely engulfed by geothite.




Cp
Goe
R4 #5
Mag: 200x


Goe
R4 #6
Mag: 200x

Upper Northampton Au

Sample T69B

Vein sample consisting of about 15% disseminated sulphide blebs up to 4mm in size showing no preferred orientation or spatial distribution.

Modal Mineralogy

Pyrite	50%	
Galena	40%	
Sphalerite	6%	
Chalcopyrite	4%	
Gold	tr	(11 separate grains)

Pyrite occurs as euhedral to subhedral up to 1.5mm in size, locally clustered in aggregates up to 3.5mm. Grains are generally inclusion free but may locally contain minor amounts of gangue, galena, chalcopyrite and gold (Photo R4); however these may actually be healed fractures within pyrite.

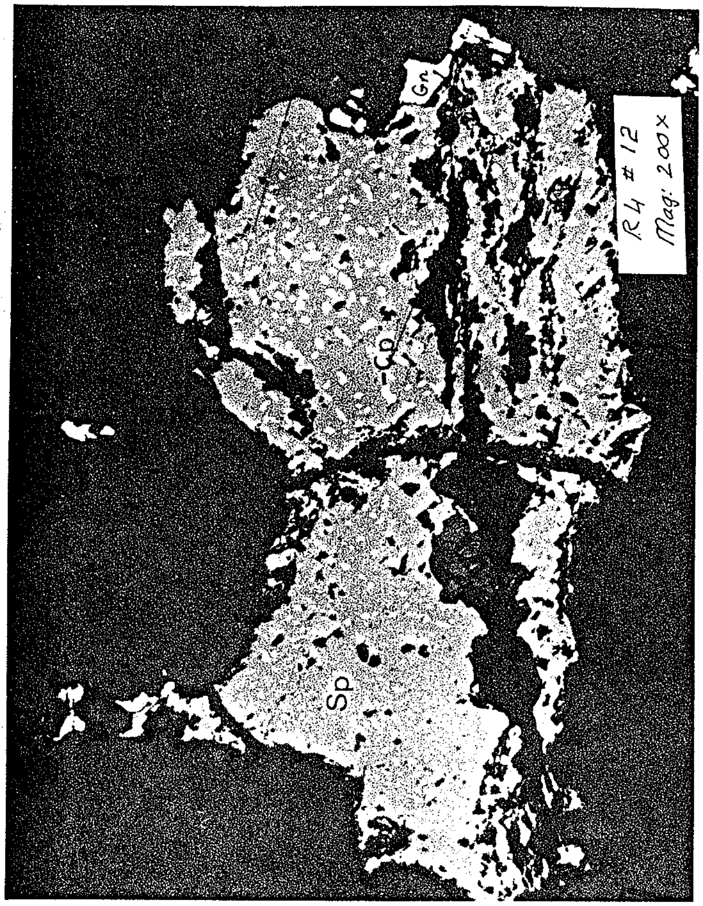
Galena occurs as irregular anhedral grains up to 2mm and aggregates up to 2.5mm. Diagnostic triangular pits are present in all larger grains reflecting perfect (100) cleavage. Tends to occur in fracture fillings within gangue and commonly coats pyrite or infills fractures within pyrite (Photo R4, #8-11). Locally coats spahlerite. Cleavage traces are commonly covered.

Sphalerite occurs as large anhedral clots up to 2mm in size. All grains contain ubiquitous small blebs and rods of chalcopyrite which locally display a distinctive preferred orientation. This texture is interpreted to results from either epitaxial growth of chalcopyrite during sphalerite formation or replacement of sphalerite via reaction with copper-rich fluids (Photo R4, #12 & 13).

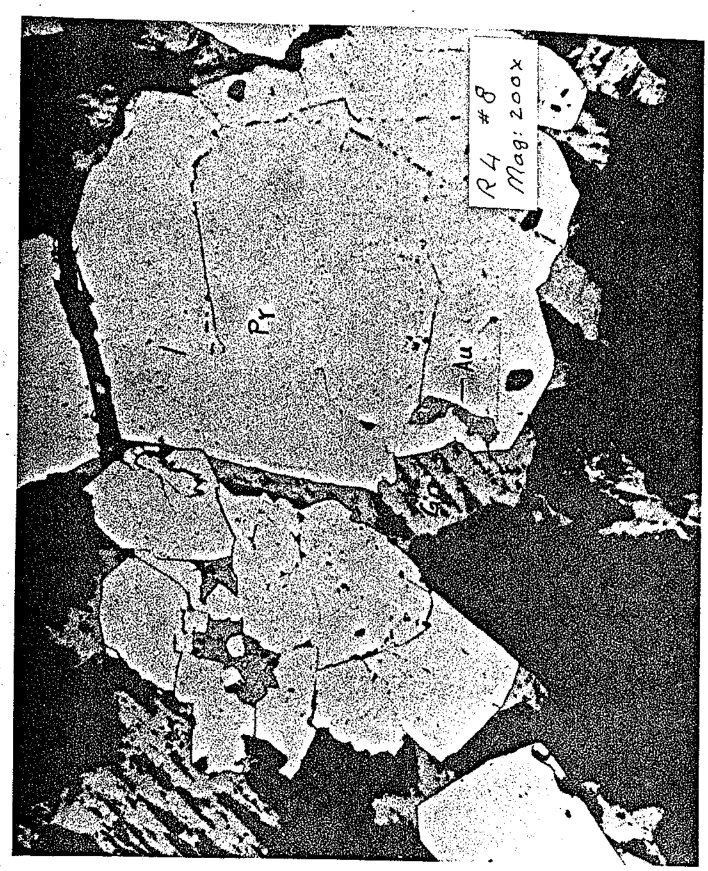
Chalcopyrite occurs in anhedral irregular grains up to 0.5mm in size. It is common as fracture fillings and small blebs within the gangue. Many small inclusions of chalcopyrite occur within the sphalerite. One inclusion of chalcopyrite was observed in pyrite.

Gold is very abundant within this sample as irregular grains and equant blebs up to 0.1mm in size. Eleven distinct grains of gold were identified in 4 modes of occurrence. These include:

1) Seven free grains within gangue (Photo R4, #14)
2) Two grains included within pyrite (Photo R4, #8 & 9)
3) One grain coating pyrite
4) One grain almost completely engulfed by galena infilling a fracture within pyrite (Photo R4, #10 & 11).


R4 #12
Mag: 200x
Gn
Cp
Sp


R4 #14
Mag: 400x
Au
Au


R4 #8
Mag: 200x
Py
Au
Gn


R4 #10
Mag: 200x
Au
Py
Gn

Cobbler Sexton

Sample T1Ø6

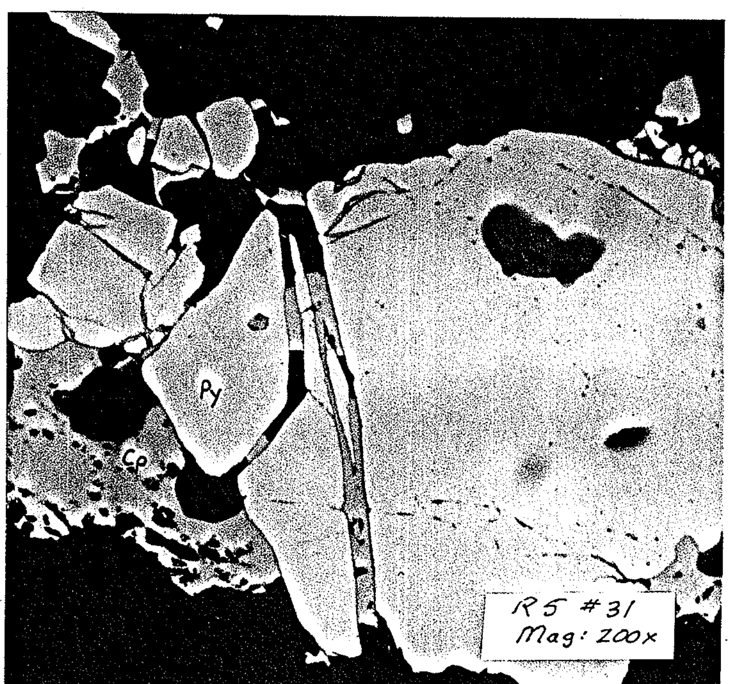
A vein sample with about 15% sulphides mostly as stringers of chalcopyrite.

Modal Mineralogy

Chalcopyrite	85%
Pyrite	15%

Chalcopyrite occurs as fine to medium grained (up to 3mm) anhedral crystals as fracture fillings and coarse irregular shaped aggregates up to 1cm in size. Chalcopyrite contain numerous pits and inclusions of gangue and pyrite.

Pyrite is very fine to fine grained and euhedral. Minor very fine grained inclusion of gangue are typically present. The pyrite euhedral are commonly associated in and around irregular veins in the gangue (Photo R5, #32). Locally pyrite is fractured with infillings of chalcopyrite and gangue (Photo R5, #31).



Cobbler Sexton

Sample T1Ø8

Wallrock sample with about 5% disseminated sulphides.

Modal Mineralogy

Pyrite	85%
Chalcopyrite	1Ø%
Hematite	3%
Rutile	2%

Pyrite is fine to medium grained (up to 4mm) euhedral crystals locally with very fine grained inclusions of gangue. Pyrite crystals are commonly highly fractured with minor dissaggregation into fragments of initially single crystals (Photo R5, #33).

Chalcopyrite is fine grained (up to Ø.3mm) anhedral irregular-shaped grains typically infilling fractures.

Hematite occurs as very fine grained (up to Ø.1mm) euhedral lath-shaped crystals disseminated throughout the gangue.

Rutile occurs as very fine grained subhedral crystals (up to Ø.1mm) disseminated throughout the gangue.

Cobbler Sexton

Sample T1Ø9

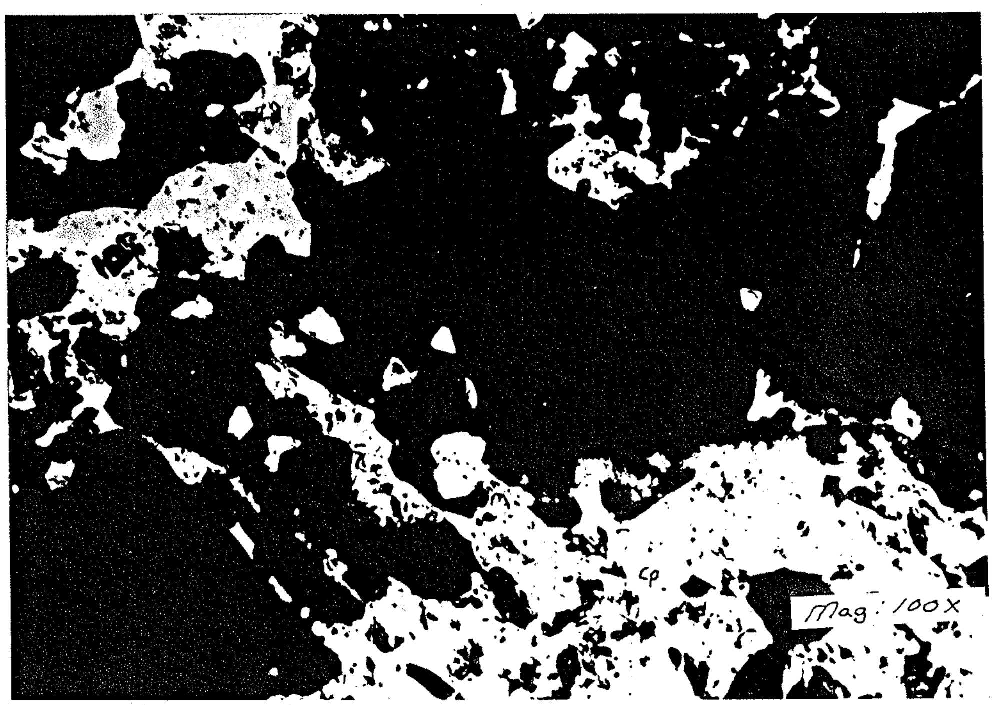
A vein sample with about 1Ø% disseminated to stringers of sulphides.

Modal Mineralogy

Chalcopyrite	8Ø%
Pyrite	2Ø%

Chalcopyrite occurs in fine to medium-grained (up to 4mm) anhedral grains with numerous inclusions of gangue (Photo R5, #34). Locally it occurs as fracture infillings and partially to totally surrounding rounded quartz crystals in the gangue (Photo R5, #34).

Pyrite is very fine to fine-grained euhedral crystals disseminated throughout the gangue. Locally pyrite is fractured with infillings of gangue and chalcopyrite.



Cobbler Sexton

Sample T113B

A sample of fine-grained wallrock with 1 to 2% finely disseminated oxides and cut by sulphide-rich veins.

Vein Modal Mineralogy

Pyrite	80%
Chalcopyrite	20%
Goethite	tr

Pyrite occurs as fine to medium grained euhedral crystals (up to 3mm) locally with abundant very fine-grained inclusions of gangue in sieve-texture pores to larger crystals. Pyrite is locally fractured with infillings of gangue.

Chalcopyrite occurs in fine grained anhedral blebs (up to 0.5mm) partially to totally surrounding rounded gangue minerals (Photo R5, #35).

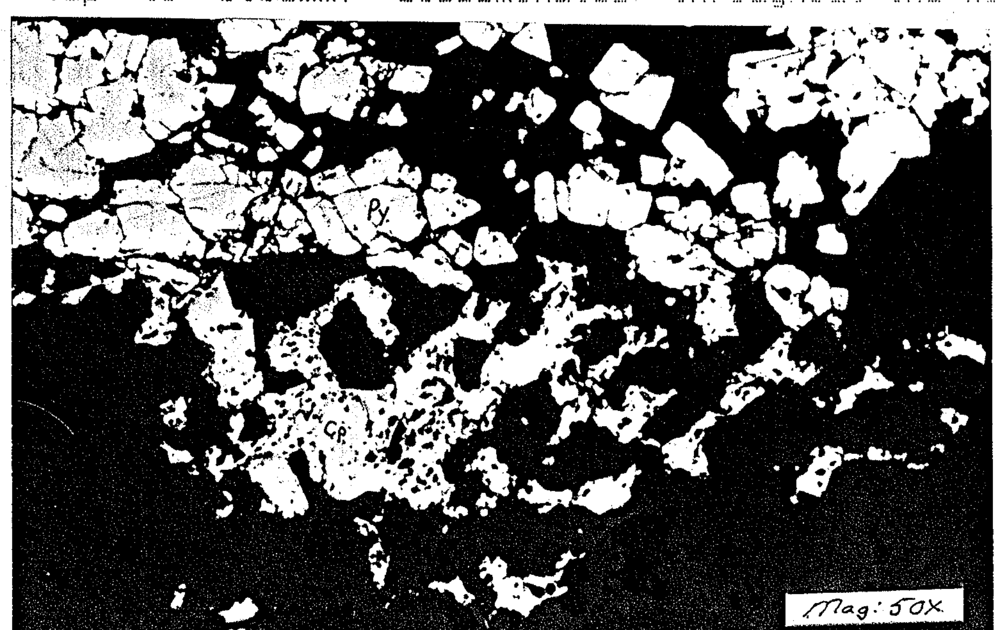
Goethite occurs as mamiliform infillings in a thin fracture in one portion of the section. Pyrite grains adjacent to the fracture are partially to totally replaced by goethite. Chalcopyrite adjacent to the fracture is partially to totally replaced by covellite and goethite bands.

Wallrock Modal Mineralogy

Hematite	70%
Rutile	30%

Hematite is very fine-grained (up to 0.05mm) subhedral to anhedral crystals disseminated throughout the wallrock gangue.

Rutile occurs as very fine-grained subhedral to euhedral crystals (up to 0.03mm) disseminated throughout the wallrock gangue.



Upper Northampton Cu

Sample T129

About 5% finely disseminated sulphides in wallrock.

Modal Mineralogy

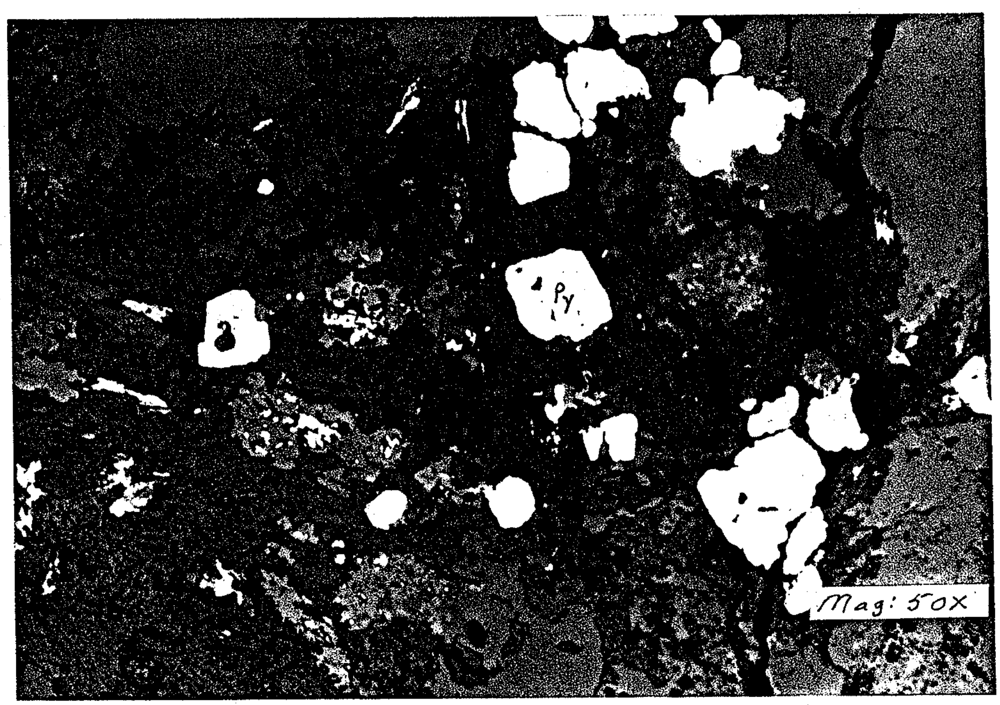
Pyrite	90%
Chalcopyrite	5%
Hematite	3%
Goethite	tr

Pyrite is fine-grained (up to 1mm) subhedral to enhedral crystals. Locally crystals have inclusions of gangue and hematite (Photo R5, #36).

Chalcopyrite occurs as very fine-grained anhedral irregular shaped blebs occurring as inclusions in gangue minerals (Photo R5, #36).

Hematite and rutile are typically intergrown in very fine-grained subhedral crystals disseminated throughout the gangue (Photo R5, #36).

On one side of the section a thin fracture (up to 0.5mm wide) is infilled with mammilliform goethite-hematite intergrowths and locally fine-grained masses of covellite. Pyrite grains adjacent to the vein are partially to totally replaced by goethite.



Upper Northampton Cu

Sample T134

Thin fracture controlled veinlets of sulphides in sediments.

Modal Sulphide Mineralogy

Pyrite	96%
Chalcopyrite	3%
Goethite	1%
Covellite	tr
Rutile	tr

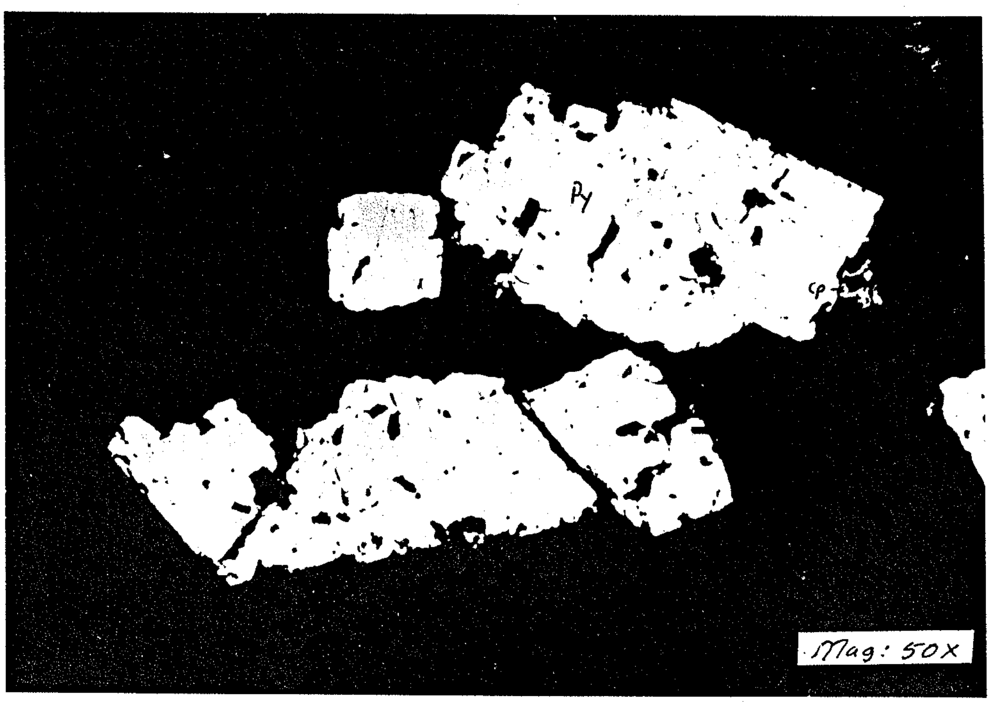
Pyrite typically occurs as coarse subhedral up to 1mm in size. It contains inclusions of gangue, chalcopyrite, pyrrhotite and rare composite inclusions of chalcopyrite and pyrrhotite. The pyrite is fractured and locally infilled by chalcopyrite which also locally coats the grains. Pyrite is replaced by goethite along fractures and grain boundaries.

Chalcopyrite forms irregular anhedral intergranular grains and locally infills fractures in the gangue. It also occurs as inclusions in pyrite, fracture infillings in pyrite and coatings on pyrite.

Goethite replaces pyrite along grain boundaries and fractures. It also replaces chalcopyrite along grain boundaries and occurs rarely as small grains in the gangue.

Covellite replaces chalcopyrite along grain boundaries and penetrating seams.

Rutile occurs as fine disseminations in the gangue.



Smart Farm

Sample T151

About 10% finely disseminated sulphides in wallrock.

Modal Mineralogy

Chalcopyrite	55%	Rutile	5%
Pyrrhotite	20%	Sphalerite	tr
Pyrite	20%	Molybdenite	tr

Chalcopyrite occurs as very fine-grained to fine-grained anhedral irregular-shaped grains partially to totally surrounding gangue crystals. it is commonly intergrown with pyrrhotite with a very similar habit (Photo R5, #18).

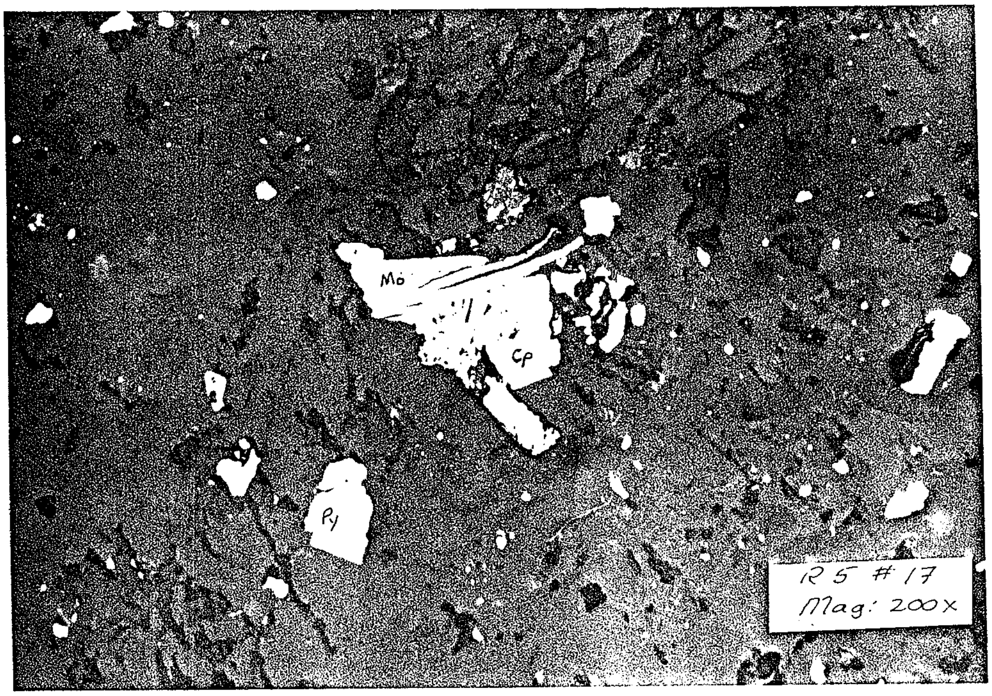
Pyrrhotite very fine to fine-grained anhedral crystals in irregular-shaped grains, commonly intergrown with chalcopyrite (Photo R5, #18).

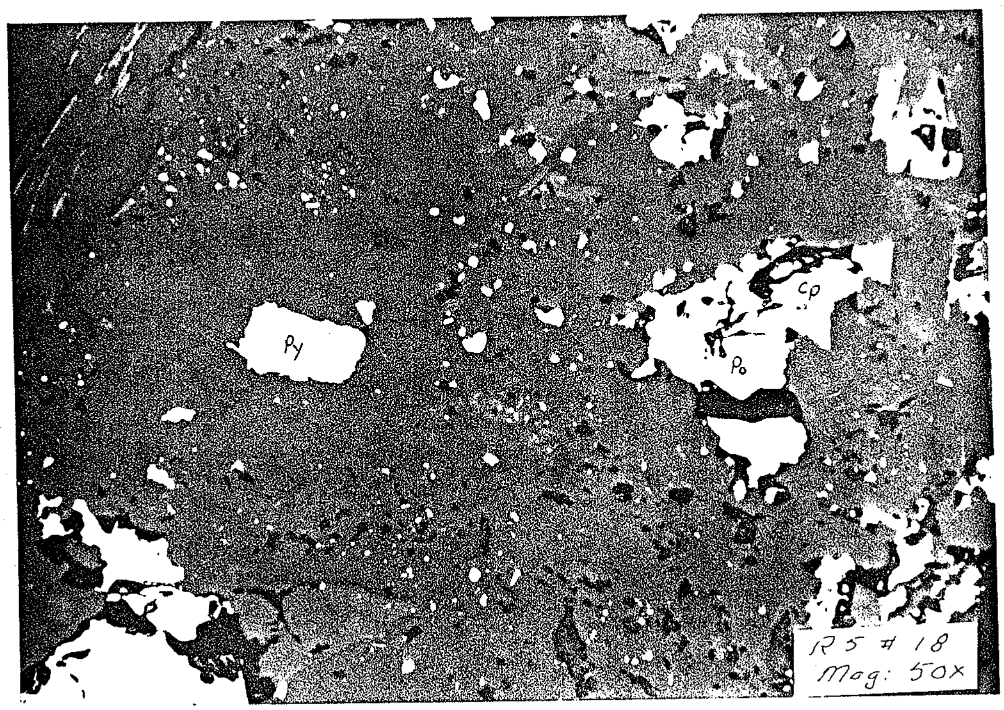
Pyrite is fine-grained, euhedral (up to 0.7mm) commonly with inclusion of very fine-grained gangue (Photo R5, #18).

Rutile is very fine-grained (up to 0.1mm) and subhedral. it occurs as prismatic shaped inclusions in micaceous gangue (Photo R5, #18).

Spahlerite is very fine-grained (up to 0.05mm) and anhedral to subhedral. It is commonly associated with chalcopyrite and/or pyrrhotite grains. Very fine-grained chalcopyrite inclusions or exsolutions occur along cleavage traces.

Molybdenite was only observed in one location in the section. It is very fine-grained (up to 0.05mm) and subhedral, occurring in tabular crystals with intergrowths of gangue (Photo R5, #16 & 17) and associated with chalcopyrite.


Mo
Cp
Py
R5 #17
Mag: 200x


Py
Cp
Po
R5 # 18
Mag: 50x

Dominion No. 1

Sample T162D

A vein sample of massive sulphides.

Modal Mineralogy

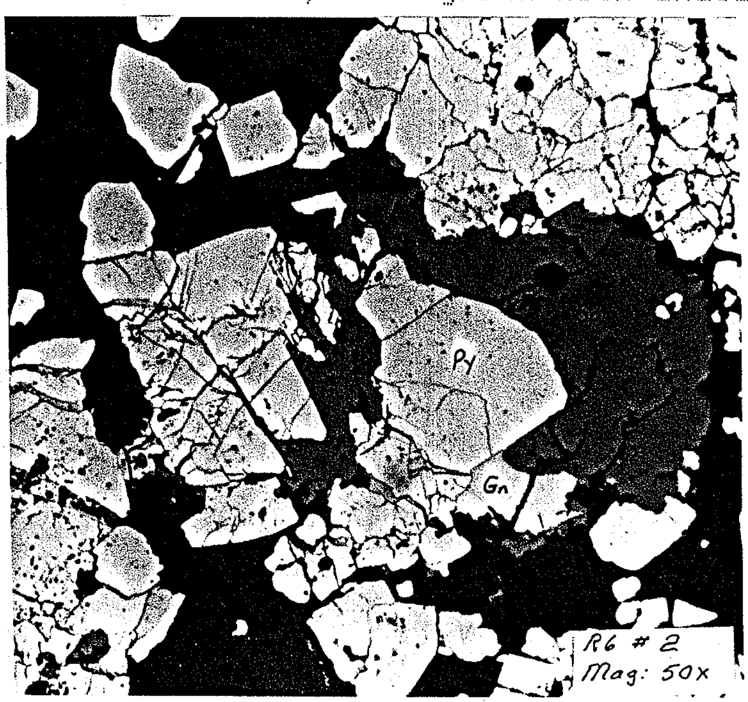
Pyrite	60%
Sphalerite	25%
Chalcopyrite	10%
Galena	5%

Pyrite is very fine-grained to medium-grained and euhedral. It locally contains abundant very fine-grained inclusions of gangue in sieve-textured cores and locally inclusions of chalcopyrite, sphalerite and galena. Some grains are extensively fractured with infillings of chalcopyrite, sphalerite, galena and gangue (Photo R6, #1, 2, & 3).

Sphalerite is fine to medium-grained (up to 4mm) and anhedral in rounded grains with finely embayed margins (Photo R6, #1, 2 & 3). Inclusions of pyrite chalcopyrite, galena and gangue are common. Grains are locally fractured with infillings of gangue (Photo R6, #3).

Chalcopyrite occurs in very fine to medium-grained anhedral irregular-shaped blebs (up to 2mm). It contains minor inclusions of pyrite, sphalerite, galena and gangue and locally occurs intergrown with galena (Photo R6, #3).

Galena occurs as very fine to fine-grained anhedral irregular shaped grains (up to 0.5mm). It is commonly closely associated with pyrite as coatings on fracture infillings and is commonly intergrown with chalcopyrite (Photo R6, #3).



R6 # 2
Mag: 50X

R6 # 3
Mag: 200X

Dominion No. 1

Sample T162J

Vein sample consisting of about 15% disseminated sulphides showing no preferred orientation.

Modal Sulphide Mineralogy

Pyrite	85%
Sphalerite	10%
Galena	5%
Chalcopyrite	tr
Rutile	tr

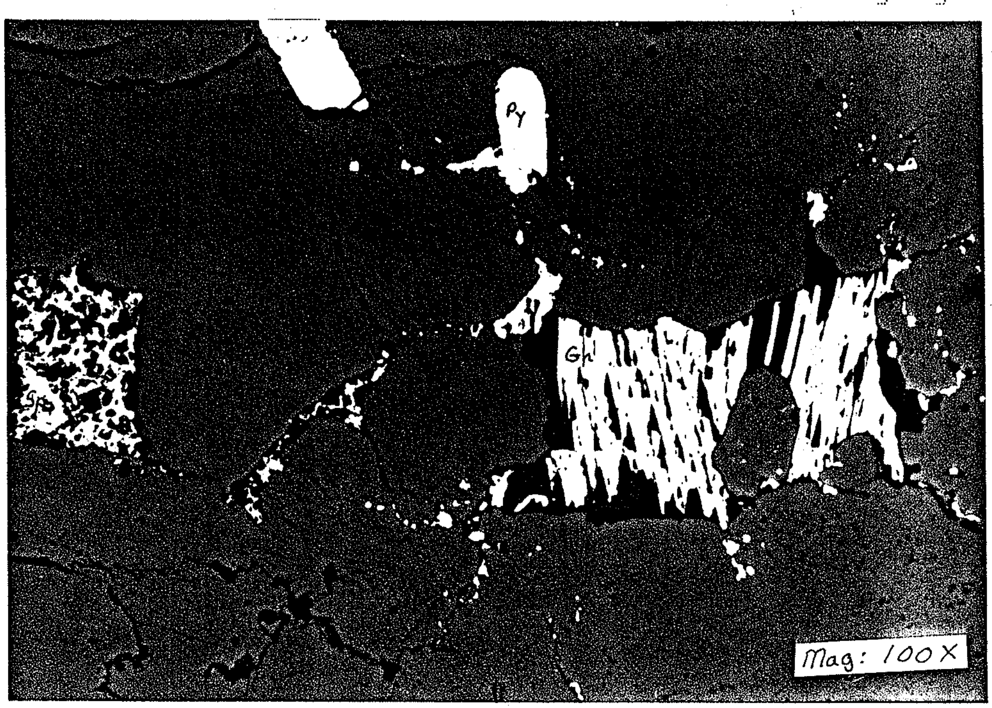
Pyrite occurs as euhedral, commonly fractured grains up to 3mm in size. It contains minor inclusions of gangue and galena. Sphalerite and galena coat the pyrite.

Sphalerite occurs as anhedral grains up to 1mm in size. It contains inclusions of chalcopyrite and is commonly in contact with galena and pyrite. Sphalerite also occurs as fracture infillings in the gangue (Photo R5, #15).

Galena occurs in irregular anhedral grains up to 1mm. It displays well developed triangular pits along cleavage traces. It occurs in contact with pyrite and sphalerite and infills irregular fractures in the gangue (Photo R5, #15). Galena also coats pyrite and occurs as inclusions within it.

Chalcopyrite occurs as tiny inclusions disseminated within sphalerite. It also occurs as small blebs and fracture fillings in the gangue.

Rutile occurs as fine disseminations in the gangue.



Dominion No. 1

Sample T164

Wall rock sample containing about 25% massive sulphides infilling a cross-cutting vein.

Modal Sulphide Mineralogy

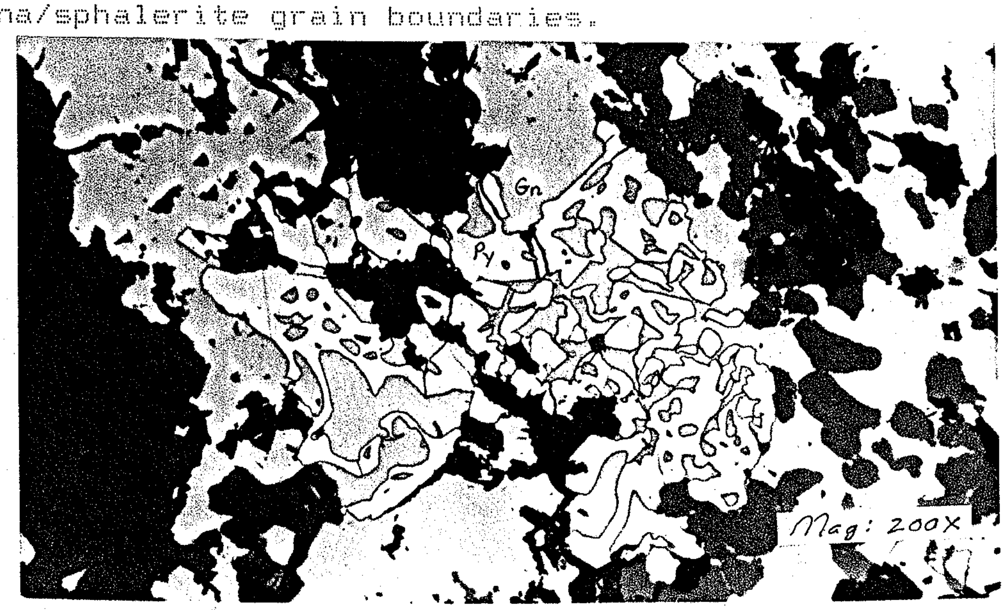
Sphalerite	60%
Galena	19%
Pyrite	17&
Chalcopyrite	4%

Specimen is dominated by sphalerite which occurs in a large elongate irregular aggregates about 2cm by 1cm. The sphalerite contains abundant inclusions and intergrowths of galena, pyrite and chalcopyrite. Galena, pyrite and chalcopyrite also occur along sphalerite grain boundaries. Sphalerite locally infills fractures in pyrite with which it is intergrown. Sphalerite also occurs as fine disseminations within the gangue (wall rocks).

Galena occurs as irregular grains up to 2mm in size. It contains inclusions of pyrite, chalcopyrite and sphalerite. Galena also occurs as irregular fracture fillings in the gangue. Locally chalcopyrite occurs at the grain boundaries between galena and sphalerite. Spectacular myrmekitic textures occur in which galena and pyrite intergrowths are common (Photos R5, #20 - 22).

Pyrite occurs as euhedral to subhedral up to 0.75mm in size. Myrmekitic intergrowths are common with galena and rare with sphalerite. Pyrite is locally fractured and infilled by galena and spahlerite.

Chalcopyrite occurs as irregular clots up to 0.5mm in size. It contains inclusions of spahlerite, galena, and pyrite. It occurs as very fine disseminations within the sphalerite. It coats all other sulphide minerals and locally occurs along galena/sphalerite grain boundaries.



Wright Brook (West)

Sample T178

Vein consisting of about 4% disseminated sulphides showing no preferred orientation.

Modal Sulphide Mineralogy

Sphalerite	50%
Galena	28%
Chalcopyrite	21%
Pyrite	1%
Rutile	tr

Sphalerite occurs as large irregular intergranular aggregates up to 2mm in size. Irregular fracture fillings and fine disseminated sphalerite also occur in the gangue. Sphalerite contains ubiquitous chalcopyrite inclusions as well as less common galena and pyrite. The sphalerite commonly displays mutual grain boundary relationships with galena and chalcopyrite.

Galena occurs as irregular intergranular grains up to 1mm in size. Small irregular fracture fillings and disseminated galena also occur in the gangue. Galena contains inclusions of chalcopyrite possibly sphalerite. Poorly developed triangular pits in galena are present locally. It occurs in contact with grains of sphalerite and chalcopyrite.

Chalcopyrite occurs as irregular intergranular grains up to 1mm. It also occurs as irregular fracture fillings and inclusions in sphalerite, and galena. Chalcopyrite locally coats pyrite euhedra. Mutual grain boundary relationships occur between chalcopyrite and spahlerite and galena (Photo R5, #19). It also occurs as irregular to equal disseminations in the gangue.

Pyrite occurs as fine disseminations in the gangue which are subhedral and up to 0.2mm in size. It is locally coated by galena.

Rutile occurs as fine disseminations in the gangue.

Wright Brook (East)

Sample T182

Fine-grained wallrock with 2% finely disseminated opaques is cut by a thin quartz vein with about 25% sulphides.

Vein Modal Mineralogy

Pyrite	80%
Goethite	10%
Hematite	5%
Chalcopyrite	5%
Covellite	tr

Pyrite occurs as fine to medium-grained euhedral crystals (up to 2mm) partially to totally replaced by hematite and goethite overgrowths (Photos R6, #4, 5, & 6).

Goethite occurs as pseudomanphic replacements of pyrite and chalcopyrite and as mammilliform infillings in fractures and vugs (Photo R6, #6).

Hematite occurs as pseudomorphic replacements after pyrite intergrown with goethite (Photo R6, #6).

Chalcopyrite occurs as fine-grained anhedral irregular-shaped grains partially to totally replaced by covellite and goethite (Photo R6, #5).

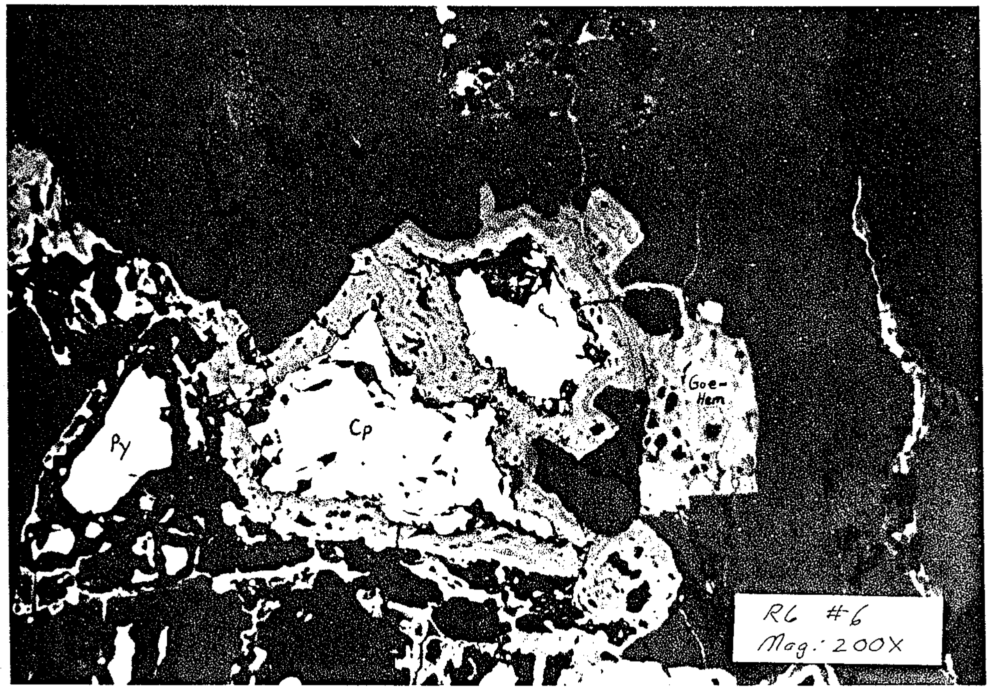
Covellite occurs as pseudomorphic replacements after chalcopyrite intergrows with goethite (Photo R6, #5) and as fine-grained anhedral infillings in late vuggy fractures (Photo R6, #6).

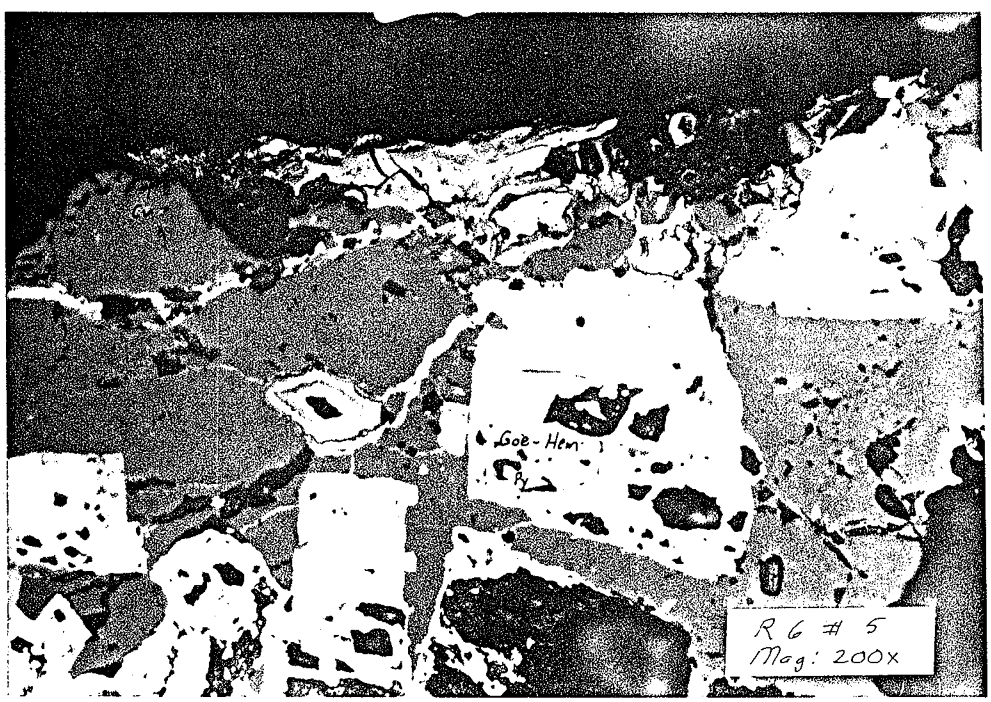
Wallrock Modal Mineralogy

Rutile	70%	Goethite 10%
Pyrite	20%	

Rutile occurs as very fine-grained (up to 0.05mm) subhedral crystals disseminated throughout the wallrock gangue.

Pyrite occurs as fine-grained euhedral (up to 0.2mm) partially to totally replaced by goethite. The pyrite occurs as disseminations restricted to a selvedge zone of bleaching which extends about 5mm from the vein.


Py
Cp
Goe-
Hem
R6 #6
Mag: 200X


Goe-Hem
Py
R6 #5
Mag: 200X

Upper Northampton Au

Sample T193A

Wall rock sample contain less than 1% disseminated sulphides.

Modal Mineralogy

Pyrite	50%
Chalcopyrite	45%
Goethite	5%
Rutile	tr

Pyrite occurs as small euhedral all about 0.2mm in size. It is commonly replaced by goethite along grain boundaries (Photo $6, #19).

Chalcopyrite occurs as irregular anhedral grains up to 0.4mm in size and as fine disseminated blebs in the gangue. It is replaced by goethite along grain boundaries.

Goethite occurs as replacements of pyrite and chalcopyrite along grain boundaries.

Rutile is finely disseminated in and locally intergrown with the gangue.

Upper Northampton Au

Sample T193C

Wall rock sample consisting of about 30% disseminated sulphides displaying no preferred orientation.

Modal Sulfide Mineralogy

Pyrite	95%
Goethite	5%
Rutile	tr

Pyrite occurs as euhedral up to 0.5mm in size locally clustered together in aggregates. The pyrite is locally fractured and replaced by goethite along the fractures and grain boundaries (Photo R5, #5 & 6). Goethite replacement along pyrite grain boundaries retains euhedral pyrite shapes. Fracturing appears to both predate and postdate goethite replacement.

Goethite replaces pyrite along grain boundaries and fractures locally forming classic pseudomorph textures (Photo R5, #5 & 6).

Rutile occurs in fine disseminations and local clusters within the gangue. It locally occurs in lath shaped grains up to 0.5mm in size (Photo R5, #7).

Upper Northampton Au

Sample T195

Specimen consists of a branching Ø.5mm wide veinlet cutting wall rock. Overall the sample consists of about 10% sulphides. Vein contains mostly sphalerite, chalcopyrite, pyrite and galena while the wall rock contains mostly pyrite.

Vein Modal Mineralogy

Sphalerite	65%
Chalcopyrite	20%
Pyrite	10%
Galena	5%
Covellite	tr

Spahlerite occurs as elongate irregular masses up to 2cm. Grain boundaries are very irregular. Sphalerite contains ubiquitous oriented chalcopyrite (Photo R5, #11 & 12) inclusions as well as gangue and galena. Mutual straight, curved, and lobate grain boundaries occur with galena and chalcopyrite. Galena and chalcopyrite also coat sphalerite.

Chalcopyrite occurs as large irregular masses up to 1mm in size and contain inclusions of gangue and galena. Chalcopyrite also occurs as irregular fracture fillings in the gangue (Photo R5, #13). It is replaced by covellite along a grain boundary in one locality (Photo R5, #12) and also occurs as ubiquitous inclusions in sphalerite.

Galena occurs in anhedral grains up to Ø.5mm in size. It occurs as coatings on and inclusions in sphalerite, chalcopyrite and pyrite. Small equant blebs of galena also occur isolated in the gangue.

Pyrite occurs in euhedral to subhedral up to Ø.5mm in size. Grains may be inclusion fence on contain inclusions of gangue or rare galena. Pyrite is also locally coated by galena (Photo R5, #14). Pyrite was not observed in contact with chalcopyrite or sphalerite.

Covellite replaces chalcopyrite in 1 locality.

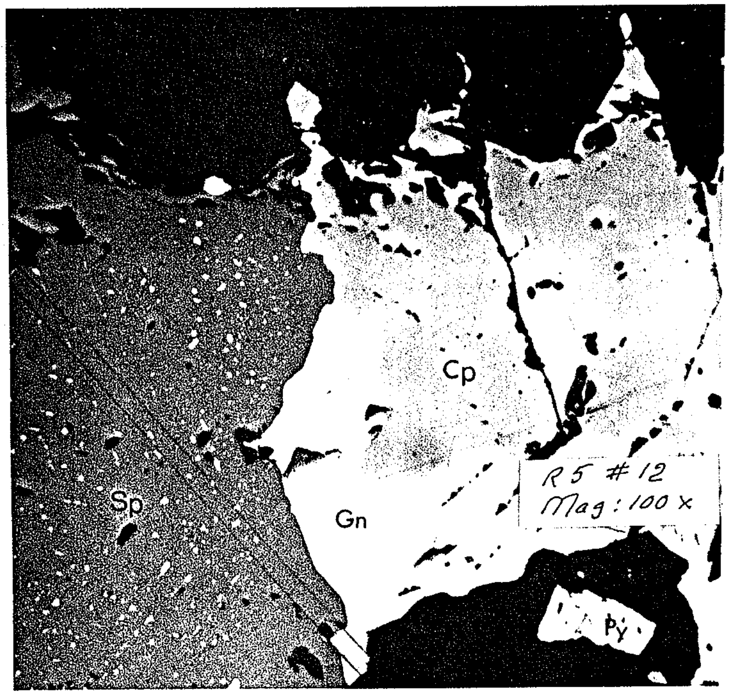
Wallrock Modal Sulphide Mineralogy

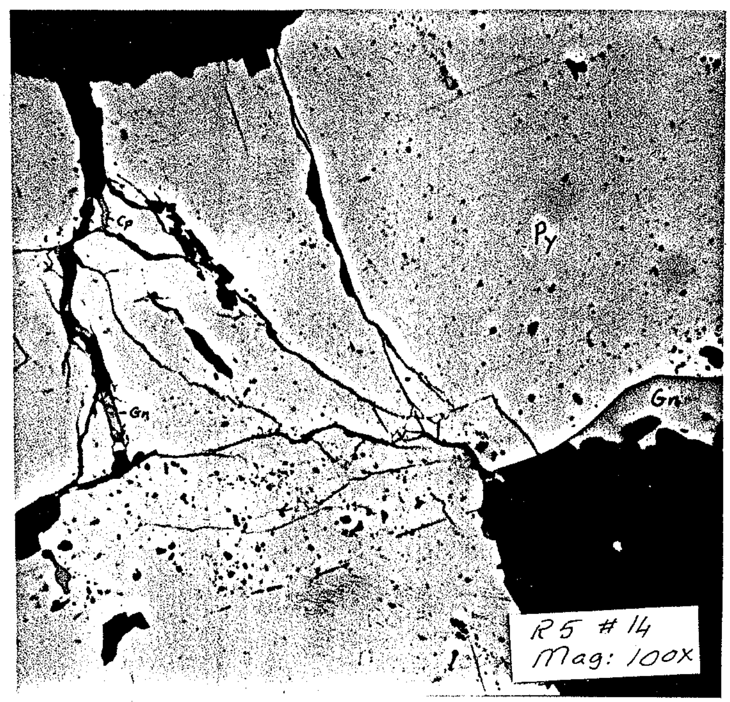
Pyrite	99%
Goethite	1%
Galena	tr
Chalcopyrite	tr
Pyrrhotite	tr
Rutile	tr

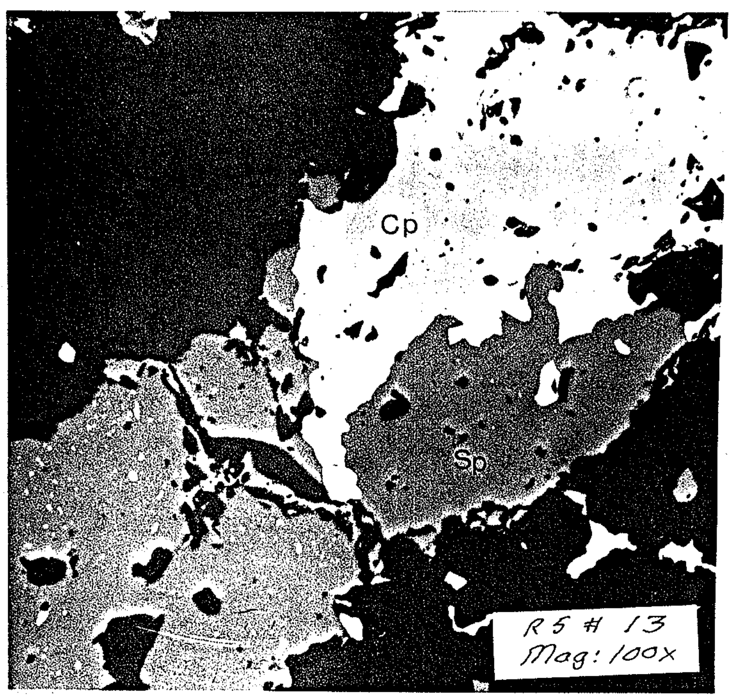
Pyrite occurs as euhedral to subhedral up to 1mm in size. It contains inclusions of gangue, rare galena and rare pyrrhotite.

Chalcopyrite and galena infill fractures in pyrite and galena locally coats pyrite. Pyrite is locally replaced by goethite along grain boundaries and penetrating seams. Very fine disseminated pyrite also occurs in this section.

Fine disseminated rutile and rare chalcopyrite and galena also occur in this specimen.







Upper Northampton Au

Sample T230C

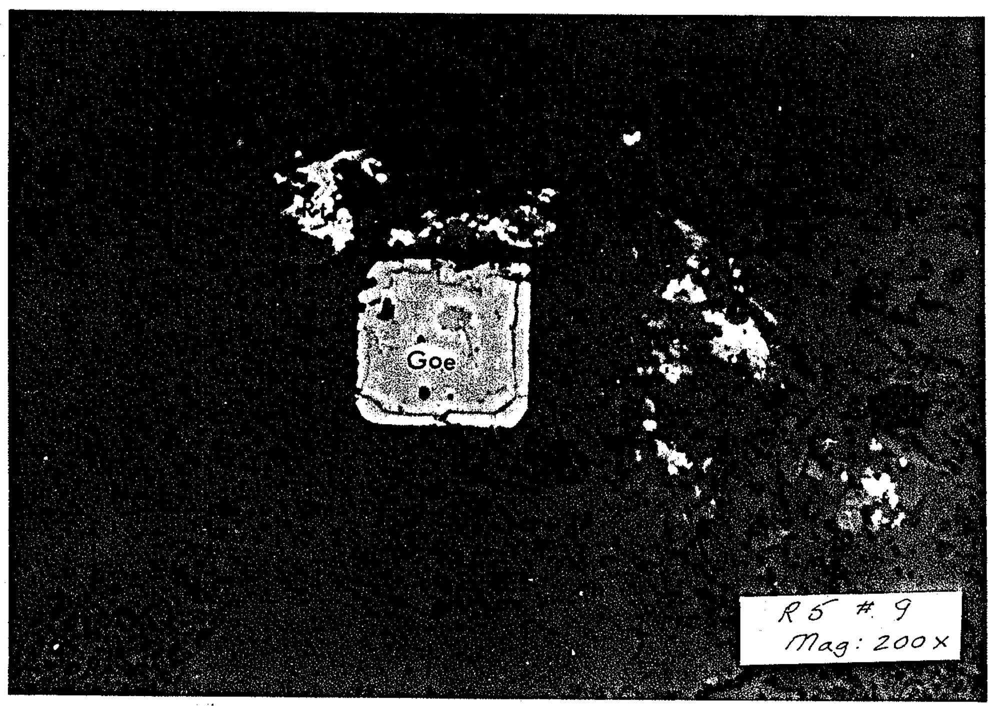
Altered wall rock sample consisting of about 4% disseminated sulphides displaying no preferred orientation.

Modal Mineralogy

Pyrite	60%
Goethite	40%
Rutile	tr

Pyrite occurs as disseminated euhedral up to 1mm in size. Grains are in general inclusion free and not fractured. Goethite replacement is extensive along grain boundaries and in irregular seams within pyrite. Some pyrite euhedra are completely pseudomorphed by goethite (Photo R5, #9).

Rutile occurs as fine disseminated grains throughout the section. Locally lath shaped rutile grains are present.



Upper Northampton Au

Sample T232B

Vein sample consisting of about 20% sulphides clustered in aggregates up to 5mm in size displaying no preferred orientation.

Modal Mineralogy

Pyrite	100%
Chalcopyrite	tr

Pyrite occurs in euhedral to subhedral up to 3mm in size which are locally clustered together forming pyrite aggregates. Pyrite grains are commonly fractured and infilled by gangue (Photo R5, #8). Inclusions of the gangue in pyrite are rarely present.

Chalcopyrite is present in trace amounts as fine disseminated blebs in the gangue.

Connell Mountain

Sample T244

Wall rock sample consisting of less than 2% oxide minerals.

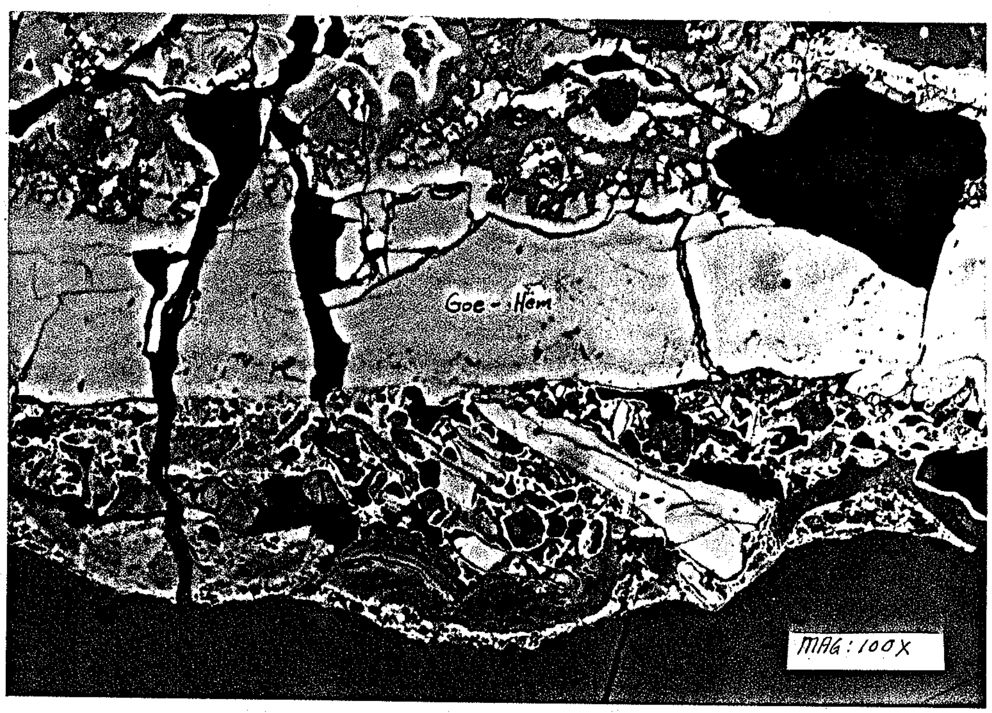
Modal Mineralogy

Goethite	80%
Hematite	20%
Covellite	tr
Chalcopyrite	tr

Goethite occurs as banded to colloform fracture infillings in the gangue up to 7mm long and 0.5mm wide. It also occurs as irregular colloform textured masses in the gangue. Goethite commonly surrounds pitted areas in which traces of chalcopyrite and covellite were identified. It occurs in close spatial association with hematite but is it not intergrown with it.

Hematite occurs in anhedral grains up to 0.1mm in size. It is locally associated with goethite but also occurs disseminated throughout the specimen. It displays good bireflectance and internal reflections.

Chalcopyrite and covellite are replaced by the goethite and typically occur along the edges of pits. These modal abundance may be greater than described here but obscured due to pitting or plucking.



Connell Mountain

Sample T248

Wallrock sample with about 3% finely disseminated sulphides.

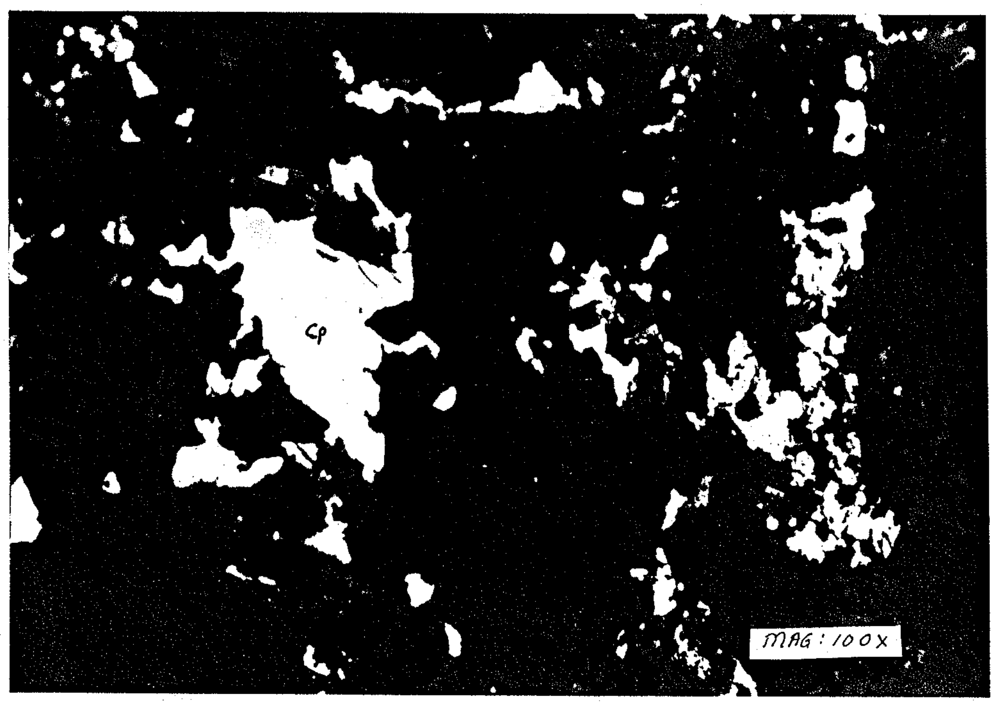
Modal Mineralogy

Chalcopyrite	80%
Goethite	10%
Rutile	5%
Pyrite	3%
Covellite	2%

Chalcopyrite is very fine-grained to fine grained (up to 0.4mm) and anhedral in irregular shaped grains partially to totally surrounding gangue minerals (Photo R6, #7) and infilling fractures in the gangue. The chalcopyrite is locally partially altered to covellite (Photo R6, #7) and goethite.

Rutile is very fine-grained (up to 0.1mm) and subhedral typically in lath-shaped intergrowths with gangue minerals disseminated throughout the section.

Pyrite is very fine to fine-grained (up to 0.2mm) and euhedral. It is locally partially altered to goethite.



Connell Mountain

Sample T249B

A sample of wallrock with about 5% finely disseminated sulphides.

Modal Mineralogy

Pyrite	85%
Chalcopyrite	10%
Goethite	3%
Hematite	2%
Covellite	tr

Pyrite occurs as fine-grained euhedral crystals (up to 0.5mm). Larger crystals have numerous very fine-grained gangue inclusions in sieve-textured cores and locally inclusions of chalcopyrite (Photo R6, #8). Pyrite is locally partially to totally replaced by intergrowths of goethite and hematite (Photo R6, #9).

Chalcopyrite is very fine-grained (up to 0.1mm) and anhedral. It occurs in irregular shaped blebs with partially to totally included rounded gangue crystals and infilling fractures in gangue. Chalcopyrite is locally altered to rims of covellite.

Oak Mountain (Au) Sb

Sample T356 (2 polished sections)

Vein sample consisting of about 25% sulphides clustered in aggregates up to 5mm.

Modal Mineralogy

Tetrahedrite	80%
Sphalerite	10%
Goethite	10%
Covellite	tr
Chalcopyrite	tr

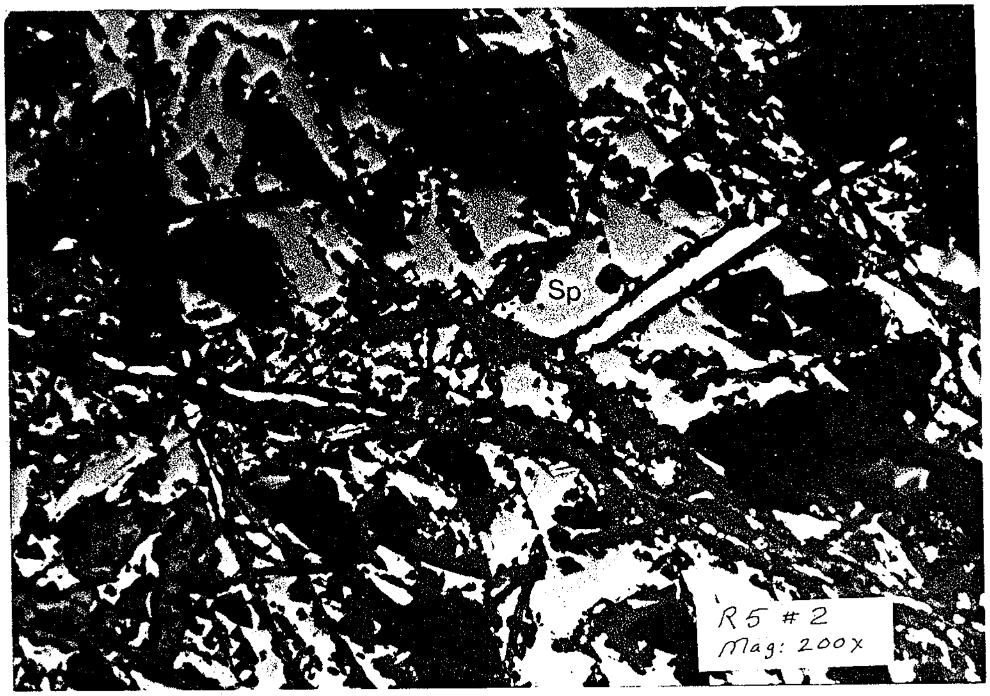
Tetrahedrite occurs in large grains up to 5mm in size. This mineral was determined by X-ray diffraction analysis at Carleton University. It's petrographic properties include silver colours, high reflectance and no detected bireflectance or anisotropy. These are not properties typical of tetrahedrite but a second X-ray determination confirms the mineral is tetrahedrite. The mineral occurs in anhedral pitted grains (Photo R5, #3) locally replaced along grain bondaries and irregular "wormy" seams by covellite and goethite (Photo R5, #4). Several thin blades of tetrahedrite were observed in spahlerite (Photo R5, #2).

Sphalerite was observed in one large extensively replaced grain in one of the sections. This mineral was also determined by X-ray diffraction. The sphalerite is extensively altered to goethite and covellite along triangular cleavage traces (Photo R5, #1 & 3). Rod-shaped inclusions of tetrahedrite occur locally in the spahlerite.

Goethite replaced tetrahedrite along irregular seams and triangular cleavage traces in spahlerite. Covellite is intimately associated with the goethite, typically occurring in the cores of goethite replacement lamellae. Locally covellite occurs at the interface of goethite and either tetrahedrite or sphalerite.

Chalcopyrite rarely occurs as coatings on tetrahedrite.

Note: Two sections of this sample were studied in polished section. The second section was identical to the above but sphalerite was only observed as finely disseminated grains in gangue adjacent to tetrahedrite.


Sp
R5 #2
Mag: 200X


Sp
Td
Goe
R5 #4
Mag: 200X

APPENDIX II

ANALYTICAL RESULTS

1. CONNELL MOUNTAIN

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
035	21	27	3	179	26	560	40000	11	9	1900	85	36.0	<1	8	2.7	<1	4	<1	<1	4	43	2	1	380
036	9	16	4	144	19	300	21000	5	8	530	28	8.8	<1	35	<0.5	<1	4	<1	<1	2	2	<1	1	230
037	14	14	3	135	20	520	36000	15	12	3800	73	20.0	<1	43	1.5	<1	3	<1	<1	4	7	<1	1	320
038	21	16	3	179	28	480	46000	12	12	1800	59	32.0	<1	16	3.6	1	4	<1	1	3	8	1	1	270
039	18	49	3	312	26	890	61000	55	10	5200	160	42.0	<1	1	3.8	2	4	<1	1	2	6	<1	1	250
040	7	49	4	268	14	800	56000	8	3	490	63	50.0	<1	1	0.6	1	3	<1	1	2	30	<1	1	180
041	19	73	4	269	24	720	62000	19	8	9500	65	60.0	<1	6	2.9	1	4	<1	2	9	52	<1	2	230
043	14	19	4	217	34	340	37000	17	7	9800	63	40.0	1	4	3.4	1	7	<1	1	7	20	<1	1	380
044	8	52	3	115	68	490	36000	9	24	2400	32	20.0	<1	1	1.6	1	4	<1	<1	6	2	<1	3	320
045	130	11	<1	24	15	130	360000	259	26	4400	28	110.0	<1	3	1.5	1	11	1	29	8	9	5	<1	90
046	110	27	1	72	36	510	130000	20	9	50000	159	22.0	<1	2	20.0	4	10	<1	6	22	7	4	3	170
047	6	26	2	65	52	440	40000	8	16	2800	30	2.4	<1	<1	2.4	2	6	<1	<1	11	2	<1	3	190
048	290	34	4	146	104	420	57000	25	37	10000	58	0.4	1	9	3.2	3	8	<1	3	14	2	1	5	210
052	13	12	1	92	14	530	31000	13	9	2100	65	28.0	<1	53	2.0	<1	2	<1	<1	4	12	1	1	260
053	59	22	<1	77	17	820	140000	25	13	22000	240	16.0	<1	1	12.0	2	9	<1	5	25	5	4	2	210
A141	2	10	3	346	113	900	110000	15	46	280	36	6.4	1	3	1.9	2	6	<1	<1	12	13	<1	6	510
A142	90	11	8	272	76	450	84000	13	17	6100	25	9.2	8	8	2.3	2	7	2	2	14	13	2	5	420
A143	1300	7	4	377	57	250	120000	5	5	14000	34	4.6	11	6	8.7	2	17	4	6	22	11	13	4	380
A144	36	8	4	381	31	340	83000	12	11	6400	74	30.0	6	1	3.0	1	6	<1	1	5	10	2	2	240
A146	<1	10	4	364	132	1800	150000	25	59	170	83	7.0	<1	2	2.2	1	7	<1	1	7	25	<1	5	580
A147	25	7	3	282	29	380	99000	43	15	3400	59	8.3	10	<1	1.4	1	2	<1	1	3	10	1	1	310
A148	7	5	1	145	31	210	37000	3	9	1600	15	10.0	3	1	1.1	<1	4	<1	1	5	9	1	2	110
A176	<1	5	5	391	72	150	24000	4	12	62	14	2.8	1	3	2.7	2	9	<1	1	22	19	<1	5	330
A178	<1	3	<1	325	27	90	7900	3	6	4	7	0.8	<1	1	<0.5	<1	1	<1	1	<1	4	<1	<1	80
A183	<1	4	4	265	77	530	37000	13	26	10	42	1.6	<1	1	1.7	2	4	1	2	4	11	<1	4	400
A202	400	10	7	260	63	250	180000	5	1	2700	24	5.7	52	8	10.0	<1	17	<1	5	19	37	18	4	290
A203	10	10	2	337	52	370	110000	30	16	570	57	1.0	3	<1	<0.5	<1	7	<1	<1	8	52	1	2	280
A204	8	9	<1	421	51	250	92000	38	20	1500	57	1.0	12	53	<0.5	<1	2	<1	<1	<1	20	2	2	200
A205	14	6	2	850	51	1700	220000	69	53	180	160	11.0	<1	3	<0.5	<1	3	<1	<1	<1	19	<1	1	100
A207	65	3	3	792	36	1800	210000	37	45	21	78	1.0	<1	<1	<0.5	<1	3	2	<1	<1	54	<1	1	60
A208	2	5	1	210	31	190	54000	29	20	1400	30	2.1	2	2	0.8	<1	3	<1	<1	<1	31	2	5	150
A209	32	10	3	278	32	710	110000	20	23	1400	43	0.6	2	17	0.5	<1	3	<1	<1	<1	23	<1	5	390
A210	7	17	4	239	100	800	98000	18	65	640	80	13.0	1	12	0.8	<1	6	<1	<1	14	27	<1	6	220
A211	<1	14	2	259	100	730	100000	5	31	110	54	48.0	1	4	0.5	<1	5	<1	<1	9	57	<1	7	170
A213	2	4	1	187	37	330	45000	6	16	250	24	4.4	1	<1	0.6	<1	3	<1	<1	10	31	<1	5	220
A214	8	9	5	384	32	620	98000	16	19	720	52	11.0	3	2	0.7	<1	2	<1	<1	10	43	1	2	130
A215	4	6	<1	170	15	180	28000	7	8	480	18	10.0	2	5	<0.5	<1	2	<1	<1	5	23	<1	2	520
A217	2	13	4	379	160	1200	130000	24	51	220	75	2.4	1	1	1.2	<1	10	<1	<1	13	9	<1	7	80
A219	<1	8	3	394	53	560	110000	33	32	86	62	9.8	1	<1	<0.5	<1	9	<1	<1	10	13	2	2	110
A220	<1	9	5	486	128	700	84000	20	54	91	62	1.8	1	1	1.2	<1	7	<1	<1	9	16	<1	7	410
A221	<1	3	<1	225	5	28	2000	<1	<1	16	7	0.2	<1	<1	<0.5	<1	<1	<1	<1	<1	9	<1	<1	40

2. SOUTHEAST CONNELL MOUNTAIN

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
A222	<1	4	1	214	34	680	42000	4	11	10	81	5.7	<1	<1	0.5	<1	15	<1	<1	2	151	2	3	220
A223	32	11	4	294	157	920	190000	38	64	410	57	330.	1	4	1.3	<1	6	5	<1	18	77	12	10	380

3. CONNELL BROOK

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
097	<1	15	4	160	102	680	55000	25	55	61	120	0.4	<1	<1	1.0	<1	6	<1	<1	5	12	<1	4	770
098	<1	18	3	170	104	1000	71000	31	61	150	150	1.7	<1	1	1.3	1	6	<1	<1	7	8	<1	4	570
099	<1	10	2	74	44	850	32000	14	29	40	54	1.6	<1	1	0.8	<1	2	<1	<1	3	6	<1	3	270
100	<1	13	1	333	81	1500	79000	37	40	31	120	1.6	<1	2	0.7	<1	2	<1	<1	<1	6	<1	1	280
114	1	20	3	165	97	990	70000	26	54	170	150	0.9	<1	<1	1.3	1	6	<1	<1	9	10	<1	5	640

4. MONTEITH

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
080	2	22	2	145	91	730	51000	20	75	510	81	72.0	<1	<1	1.8	1	11	1	<1	9	3	<1	4	720
081	6	18	2	147	88	910	57000	35	54	390	43	90.0	<1	8	1.6	<1	5	2	<1	6	8	1	7	580

5. SMART FARM

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
076	<1	10	<1	195	21	770	42000	18	19	330	76	0.7	<1	1	0.8	<1	4	<1	<1	2	4	<1	1	220
077	<1	10	2	55	28	430	18000	5	9	75	23	9.8	1	2	0.9	<1	1	<1	<1	4	5	<1	2	220
078	94	16	1	347	<1	910	65000	37	17	10000	320	0.3	<1	190	3.2	2	7	<1	2	71	4	<1	1	170
079	<1	7	1	60	8	300	22000	13	7	570	87	0.5	<1	3	0.7	1	1	<1	<1	1	16	<1	3	490
082	2	13	2	231	16	1200	43000	25	19	1400	150	0.8	<1	1	1.3	1	3	<1	<1	5	10	<1	1	330
084	21	23	<1	134	<1	1000	71000	17	8	140	89	16.0	<1	261	0.7	1	4	<1	<1	2	67	20	1	130
085	32	11	2	210	4	1000	48000	20	18	2500	96	0.7	<1	25	0.8	<1	2	<1	<1	3	45	12	1	320
117	13	27	<1	172	9	1100	54000	16	11	160	120	7.6	<1	218	0.6	1	4	<1	2	3	6	<1	1	140
A282	8	8	<1	189	9	900	57000	16	20	920	99	0.7	1	4	1.4	<1	3	<1	<1	1	6	1	1	280

6. NORTH HAMPTON COPPER

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
070	<1	9	1	98	22	140	27000	<1	1	310	14	0.8	<1	<1	<0.5	<1	3	2	<1	1	7	<1	2	210
071	<1	12	2	127	81	320	43000	<1	2	140	23	2.2	<1	1	1.2	<1	6	<1	<1	6	11	<1	4	580
072	<1	16	2	168	105	840	45000	<1	2	52	98	0.2	<1	<1	1.6	<1	7	<1	<1	4	1	<1	4	730
073	<1	23	2	289	251	710	57000	28	71	350	59	0.6	<1	<1	<0.5	<1	5	<1	<1	1	3	1	<1	140
074	6	14	2	75	44	650	64000	48	22	540	41	4.2	<1	1	1.5	<1	4	4	<1	4	7	<1	3	140
095	<1	21	5	148	97	1900	59000	35	60	80	87	10.0	<1	1	1.4	<1	5	<1	<1	5	5	<1	4	600
A253	4	8	<1	157	23	360	54000	14	16	680	41	0.9	6	<1	0.6	<1	1	<1	1	<1	16	1	1	460
A270	1	13	2	130	76	710	54000	11	31	180	39	3.2	2	1	1.3	<1	7	<1	1	3	11	<1	3	640
A278	<1	13	4	127	77	6800	65000	20	47	52	100	7.8	<1	1	2.1	<1	5	<1	<1	4	32	<1	4	540
A279	<1	13	5	129	76	6600	66000	23	50	39	120	14.0	<1	<1	2.2	<1	5	<1	<1	4	24	<1	4	620
A281	1	20	2	105	78	330	34000	32	1070	290	420	0.4	21	132	1.2	2	53	8	<1	8	9	<1	59	460

9. BULLS CREEK NO. 1

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
028	<1	42	2	386	273	1600	74000	98	106	1600	130	5.8	<1	1	3.7	<1	4	3	<1	4	36	156	<1	140
029	31	18	<1	111	34	1100	150000	76	62	4800	130	78.0	<1	23	1.4	1	7	9	<1	<1	81	14	1	80
030	13	20	<1	20	9	270	53000	8	9	29000	110	50.0	<1	14	4.8	<1	2	2	1	<1	85	248	<1	60
031	<1	16	<1	108	96	1400	46000	19	37	8600	110	3.0	<1	<1	0.9	<1	<1	<1	<1	<1	47	2	<1	100
032	5	75	2	341	303	2700	67000	57	107	440	210	4.8	<1	<1	<0.5	<1	3	<1	<1	<1	9	2	1	250
033	<1	35	3	411	193	2800	70000	50	96	120	180	3.5	<1	<1	<0.5	<1	<1	<1	<1	<1	1	<1	<1	290
051	11	24	<1	121	42	1300	93000	39	39	3800	130	24.0	<1	32	1.2	<1	7	3	<1	2	31	7	2	90
A185	8	32	4	177	115	2000	190000	51	39	13000	310	19.0	4	222	3.9	3	14	5	25	1	82	102	5	140
A186	<1	34	3	163	71	960	62000	23	24	930	75	3.0	<1	13	0.8	<1	4	1	2	2	33	13	5	130
A187	<1	4	2	72	15	620	53000	12	15	12000	52	2.8	4	19	0.6	<1	2	<1	<1	<1	19	2	<1	60
A188	<1	5	4	207	110	1700	120000	34	75	44	110	1.6	<1	3	0.8	<1	6	<1	<1	4	12	<1	5	360
A189	<1	6	3	938	170	2300	200000	94	96	91	150	4.4	<1	1	<0.5	<1	5	5	<1	<1	17	<1	<1	160
A218	<1	17	2	1350	238	3300	310000	118	119	320	200	3.0	<1	1	0.7	<1	3	<1	<1	7	9	<1	<1	80
A274	4	18	2	286	205	1600	78000	42	71	68	110	4.4	<1	<1	0.7	<1	2	3	<1	1	12	<1	<1	180

10. BULLS CREEK NO. 2

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
016	<1	33	1	135	28	750	40000	20	25	410	82	44.0	<1	<1	1.0	<1	6	<1	<1	11	2	5	1	510
017	1200	22	<1	97	19	300	90000	5911	44	40000	480	37000.	<1	<1	21.6	4	22	20	<1	1300	118	1187	2	330
018	150	21	1	204	27	530	76000	70	11	12000	110	970.	<1	<1	6.0	<1	17	<1	<1	158	44	51	2	420
019	<1	23	2	116	21	720	28000	13	19	150	59	16.0	1	<1	0.6	<1	3	<1	<1	6	4	<1	1	400
021	7	77	2	134	27	620	33000	25	21	590	64	3.2	<1	1	1.9	<1	3	3	<1	1	6	<1	1	410
022	88	84	1	140	24	420	60000	8	8	18000	130	520.	1	<1	4.5	<1	24	24	<1	61	15	12	<1	320
023	100	49	2	87	13	300	38000	10	4	8700	80	1600.	<1	1	2.3	<1	16	<1	<1	136	5	29	2	360
049	47	11	2	106	22	390	49000	4	4	9300	86	0.3	<1	2	3.4	<1	18	<1	<1	93	12	28	1	310
A242	1	15	2	77	59	1700	56000	16	32	52	84	18.0	<1	<1	1.2	<1	3	<1	<1	2	7	<1	2	330
A245	4	3	<1	5	9	470	14000	5	6	280	330	1.2	<1	<1	<0.5	<1	2	<1	<1	<1	42	<1	<1	90
A246	<1	8	<1	44	26	1300	37000	9	21	64	60	9.2	<1	<1	2.5	<1	2	<1	<1	<1	11	<1	<1	190
A247	<1	5	1	46	30	780	28000	7	12	39	44	2.2	<1	<1	0.8	<1	1	<1	<1	<1	19	<1	2	230
A248	3	5	1	64	16	620	30000	6	6	170	49	0.9	<1	2	0.6	<1	2	<1	<1	3	20	4	2	330
A249	2	5	1	104	19	750	37000	10	9	52	58	0.2	<1	2	0.8	<1	1	<1	<1	44	16	<1	2	330
A273	2	8	<1	69	11	800	29000	7	8	300	64	7.0	1	<1	0.6	<1	2	<1	<1	16	13	<1	<1	560

11. BULLS CREEK NO. 3

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
024	2	48	4	163	113	6500	62000	37	70	160	110	36.0	<1	1	1.1	<1	4	<1	<1	6	7	<1	3	480
025	540	27	<1	43	10	760	30000	14	11	6800	4800	6.2	<1	81	5.8	62	5	2	<1	<1	1945	20	<1	170
026	650	47	1	89	31	830	32000	15	18	3900	1200	3.6	<1	58	2.9	15	7	2	<1	1	791	10	<1	280
027	12	7	2	143	65	160	67000	23	23	3300	120	3.2	<1	11	3.1	<1	10	<1	1	2	280	10	2	610

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
12. COBBLER-SEXTON																								
059	25	11	<1	30	3	290	44000	14	25	24000	19	11.0	<1	3	2.3	2	6	<1	10	<1	28	27	<1	50
060	6	8	<1	<1	<1	10	3700	<1	<1	870	<1	0.7	<1	<1	<0.5	<1	<1	<1	1	<1	13	3	<1	50
062	7	13	<1	57	23	670	43000	14	11	3300	140	8.8	<1	2	1.0	<1	31	<1	<1	4	421	22	1	90
093	17	7	<1	20	<1	510	34000	9	11	190000	44	9.0	<1	2	1.3	<1	4	<1	10	<1	21	24	<1	50
A163	12	12	<1	191	16	1400	290000	63	10	2000	140	400.	6	3	0.8	1	22	<1	6	21	59	48	<1	50
A234	14	15	<1	52	22	2500	190000	44	13	1700	280	11.0	3	2	1.2	<1	19	<1	3	2	122	12	1	60
A235	4	5	<1	20	22	1300	290000	50	12	84	120	6.8	4	<1	2.6	<1	36	<1	3	2	11	8	2	110
A237	10	5	<1	32	25	2200	190000	80	15	40	240	7.6	7	<1	0.7	<1	30	<1	3	3	26	15	2	80
A238	71	10	<1	27	19	1300	150000	38	31	10000	230	8.4	4	2	3.4	<1	11	<1	3	1	1290	343	2	70
A239	9	10	1	39	31	1400	170000	32	16	620	140	7.0	4	3	0.5	<1	20	<1	2	3	179	7	2	290
A240	8	5	<1	2	11	580	42000	9	5	2900	49	9.2	4	4	0.8	<1	3	<1	1	1	37	20	1	100
A250	27	5	<1	69	28	730	140000	43	37	230	140	9.6	3	2	1.4	<1	8	<1	2	2	1050	11	2	250
A271	<1	10	1	221	5	1100	54000	12	10	33	76	1.0	<1	<1	<0.5	<1	2	<1	<1	1	10	<1	<1	150
A276	13	15	<1	65	5	1300	74000	20	10	9000	110	9.6	8	15	1.3	<1	11	<1	3	<1	76	17	<1	60
A277	4	13	<1	49	2	980	53000	13	6	1800	74	9.2	5	2	0.8	<1	10	<1	<1	<1	14	3	<1	60
13. DUGAN ROAD EAST																								
006	1	61	3	145	96	2700	47000	46	59	73	270	6.4	2	5	1.6	2	4	3	<1	4	20	<1	7	860
008	<1	100	4	194	124	2300	68000	34	54	86	160	110.	<1	17	5.5	<1	5	8	<1	5	13	<1	7	850
009	<1	63	3	183	126	2800	61000	63	115	88	93	30.0	<1	9	3.8	1	5	1	<1	4	23	1	5	550
010	<1	94	4	176	107	11000	78000	66	114	99	120	50.0	<1	<1	1.6	<1	7	4	<1	4	33	<1	3	380
011	55	26	3	181	117	2300	100000	42	87	75	120	580.	<1	9	2.3	1	5	20	<1	4	101	<1	6	470
012	<1	27	4	203	132	3800	61000	44	94	31	130	32.0	<1	<1	2.2	1	6	1	<1	4	8	<1	3	550
014	<1	38	7	280	190	3100	58000	53	110	64	92	48.0	1	<1	2.6	2	6	2	<1	6	13	1	5	1600
015	<1	30	4	196	136	3000	55000	41	77	73	110	60.0	<1	4	2.5	<1	5	2	<1	4	28	<1	4	530
A272	20	23	2	166	85	2900	83000	30	59	94	90	170.	1	2	2.7	<1	5	4	<1	5	30	<1	3	630
14. DUGAN ROAD WEST																								
001	7	15	3	183	123	3100	51000	37	53	36	82	42.0	<1	13	3.5	<1	5	3	<1	3	40	<1	8	590
002	<1	31	3	146	111	4100	48000	38	63	35	130	0.8	<1	<1	1.5	<1	4	<1	<1	3	18	<1	4	700
003	<1	21	2	107	77	1500	38000	19	44	150	77	0.7	<1	<1	1.5	<1	4	<1	<1	3	5	<1	3	370
004	2	18	2	75	45	4600	150000	51	33	200	170	1.0	<1	<1	1.6	1	41	5	<1	7	13	6	2	120
005	2	63	3	132	81	3100	92000	43	66	380	200	6.8	<1	<1	2.0	<1	26	2	<1	3	7	2	3	510
18. LOWER NORTHAMPTON Cu																								
054	<1	12	1	49	25	630	35000	14	23	350	97	5.8	1	<1	0.9	<1	1	<1	<1	1	16	<1	2	140
055	10	25	3	110	69	470	39000	14	32	220	97	9.0	<1	9	1.3	<1	4	3	<1	3	52	4	3	690
056	<1	10	<1	39	27	540	21000	8	17	49	120	1.8	<1	<1	1.3	<1	1	<1	<1	1	77	<1	2	100
092	15	5	1	45	19	200	43000	7	11	210	43	7.2	<1	9	3.3	<1	2	<1	<1	3	384	16	2	790
A275	2	20	3	97	75	800	60000	13	37	20	120	8.6	<1	<1	1.0	<1	4	<1	<1	1	10	<1	3	480

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
19. RICEVILLE																								
057	4	11	<1	44	30	270	19000	6	11	33	24	32.0	<1	<1	1.2	<1	1	<1	<1	2	124	2	2	110
058	<1	10	<1	45	29	220	17000	5	10	16	29	24.0	<1	3	0.7	<1	1	<1	<1	2	12	<1	2	120
20. BENTON Pyrite																								
007	<1	45	2	73	9	260	20000	14	12	5	48	1.6	1	<1	2.8	<1	4	<1	<1	2	3	<1	3	570
020	<1	59	2	62	1	720	18000	13	5	20	28	4.2	1	<1	<0.5	<1	4	<1	<1	2	1	<1	3	650
050	<1	9	<1	6	<1	250	20000	1	<1	120	14	2.0	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	580
075	<1	6	2	56	<1	320	22000	8	<1	11	23	1.0	<1	1	1.0	<1	4	<1	<1	2	1	<1	3	700
090	3	31	<1	34	11	410	26000	19	22	300	51	28.0	<1	<1	1.1	<1	4	13	<1	2	40	<1	2	150
115	<1	22	3	69	10	370	26000	11	9	47	49	0.9	<1	<1	1.0	<1	4	<1	<1	3	5	<1	4	690
A124	<1	7	<1	92	10	320	55000	10	35	9	22	0.2	<1	<1	1.5	<1	3	<1	<1	<1	4	<1	3	330
A125	<1	4	<1	127	14	180	37000	4	37	15	17	2.0	<1	2	1.4	<1	2	<1	<1	<1	12	<1	3	710
A133	<1	6	<1	169	6	350	50000	7	5	2	19	1.0	<1	<1	1.5	<1	<1	<1	<1	<1	6	<1	4	620
A159	<1	5	3	220	15	340	53000	13	6	2	24	0.9	<1	1	1.9	1	5	<1	1	3	8	<1	5	570
A181	<1	4	3	369	22	500	40000	10	7	5	26	0.6	<1	1	1.9	2	6	<1	2	3	13	<1	5	700
A212	<1	3	3	171	<1	320	48000	16	3	20	30	3.0	<1	<1	0.6	<1	5	<1	<1	3	18	<1	6	640
A229	<1	3	2	15	4	270	16000	4	4	10	42	5.2	<1	<1	1.6	<1	2	<1	<1	1	4	<1	<1	570
A257	55	<1	2	48	5	300	18000	5	2	9	20	0.6	<1	<1	2.1	<1	3	<1	<1	2	7	<1	3	560
21. LILLY BROOK Cu-Mo																								
A191	<1	3	3	104	53	550	40000	14	26	12	54	1.2	<1	1	0.7	<1	4	8	<1	2	23	<1	6	160
A230	1	5	1	17	28	460	23000	6	15	22	46	0.4	<1	<1	1.0	<1	3	<1	<1	<1	48	<1	2	220
24. WETMORE																								
112	<1	13	1	165	40	680	36000	20	36	3200	61	3.2	3	7	0.6	<1	2	<1	<1	1	20	<1	2	80
113	2	7	<1	11	<1	390	15000	2	<1	910	23	1.7	<1	2	<0.5	<1	<1	1	<1	<1	9	8	<1	60
25. BRITTON MINE																								
110	1	11	<1	12	<1	410	5300	1	4	140	350	14.0	<1	2	<0.5	7	<1	19	<1	<1	1526	<1	2	60
111	<1	22	<1	35	17	620	19000	7	16	7	46	3.2	<1	2	<0.5	<1	1	2	<1	1	10	<1	4	110

26. WRIGHT BROOK

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
101	<1	16	1	58	30	7200	96000	10	17	38	140	3.0	<1	2	1.0	<1	2	<1	<1	2	20	<1	3	110
102	<1	11	2	55	29	1600	32000	8	15	110	75	3.7	<1	<1	1.0	<1	2	<1	<1	1	3180	<1	2	220
103	32	11	<1	20	8	900	16000	4	8	390	2900	40.0	<1	2	0.7	29	<1	2	<1	2	5776	<1	1	90
105	220	18	<1	25	6	430	90000	20	20	760	14000	300.	<1	34	2.4	115	<1	5	<1	1	8350	3	<1	90
106	53	7	<1	27	16	380	23000	7	13	190	3400	52.0	<1	15	1.0	27	1	2	<1	2	3722	<1	2	120
107	6	7	1	49	29	770	19000	10	11	52	500	3.4	<1	<1	0.8	3	2	<1	<1	3	445	<1	3	170
108	<1	8	2	74	43	630	23000	12	28	600	87	1.0	<1	<1	0.9	<1	3	<1	<1	2	56	<1	3	260
109	3	6	1	25	17	310	21000	6	6	1600	930	1.7	<1	4	5.0	7	1	<1	<1	2	803	10	1	80
116	2	7	2	67	36	540	22000	11	16	330	64	0.6	<1	<1	0.8	<1	2	<1	<1	2	13	<1	3	280
A174	91	8	2	259	31	160	58000	5	11	1700	13000	86.0	2	16	3.0	33	2	6	2	2	690	6	1	100
A184	49	6	3	43	16	52	45000	4	8	600	940	44.0	<1	19	0.8	12	1	4	<1	2	5150	2	<1	140
A216	8	7	1	275	83	550	350000	62	168	180	44	7.2	1	7	<0.5	<1	<1	2	<1	<1	34	2	3	160

27. DOMINION NO. 1

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
086	13	12	<1	36	12	2600	32000	8	13	610	18000	4.0	<1	2	4.5	72	1	<1	<1	3	9054	9	2	60
087	2	6	<1	22	10	520	9400	3	2	23	270	0.4	<1	<1	0.7	1	1	<1	<1	1	85	<1	3	100
088	<1	4	<1	17	4	370	7200	2	<1	25	110	0.4	<1	<1	<0.5	<1	<1	<1	<1	1	122	<1	2	70
A193	<1	2	2	92	14	1100	26000	4	6	470	59	1.2	<1	7	0.7	<1	1	1	<1	4	188	2	2	60
A194	<1	7	5	314	152	930	130000	36	84	57	260	2.8	<1	<1	0.5	<1	8	2	<1	4	249	<1	6	650
A268	1	10	3	112	77	1000	63000	20	46	59	320	2.6	<1	<1	1.2	<1	5	<1	<1	2	85	<1	3	610
A283	14	10	<1	39	14	1800	20000	4	7	76	260	0.2	<1	<1	1.2	<1	2	<1	<1	2	207	<1	2	90
A285	1	8	4	124	82	1500	70000	19	48	58	440	2.4	<1	<1	1.7	2	5	<1	<1	2	108	<1	3	520

30. LILLY BROOK Pb

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
A231	1	5	2	38	37	510	28000	8	18	19	65	3.0	<1	<1	0.7	<1	2	<1	<1	1	26	<1	2	230
A232	<1	5	1	26	17	550	17000	4	9	16	44	0.3	<1	<1	<0.5	<1	1	<1	<1	<1	7	<1	1	120
A233	2	5	1	85	5	1100	48000	7	4	13	92	1.1	<1	1	1.1	<1	1	<1	<1	1	16	<1	2	320

31. GRAFTON Pyrite

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
090	3	31	<1	34	11	410	26000	19	22	300	51	28.0	<1	<1	1.1	<1	4	13	<1	2	40	<1	2	150
091	2	27	<1	64	25	1300	99000	24	14	280	120	22.0	<1	<1	0.8	<1	4	2	<1	7	25	7	2	170
A149	5	14	3	433	78	950	130000	17	31	190	67	13.0	1	1	1.3	1	5	1	5	8	14	23	4	360
A152	7	160	5	402	102	430	110000	22	39	58	110	76.0	<1	2	1.8	2	7	7	1	3	18	<1	6	380
A153	<1	25	1	219	22	420	19000	7	9	17	42	210.	<1	<1	0.5	<1	1	4	1	<1	70	<1	1	70
A154	<1	9	2	322	57	270	44000	4	16	150	25	7.3	<1	<1	1.5	2	15	2	<1	7	14	1	5	250
A156	<1	72	3	323	55	980	100000	27	46	44	120	40.0	<1	3	1.0	2	2	3	1	1	57	1	3	170
A157	<1	26	5	287	117	870	140000	33	82	50	150	46.0	<1	1	2.4	2	8	4	1	4	12	<1	6	570
A158	6	5	4	318	89	660	71000	17	33	41	110	7.0	<1	1	1.5	2	5	3	<1	4	187	<1	4	440
A160	19	18	2	493	35	1100	160000	23	20	260	60	9.8	1	1	0.6	1	4	2	33	7	25	122	1	310
A161	13	13	1	462	39	740	140000	25	21	230	47	18.0	2	2	1.0	1	5	2	15	11	25	61	2	320
A162	94	8	3	349	74	460	270000	79	90	520	42	160.	12	2	1.6	2	6	6	3	16	32	12	4	330
A226	14	13	<1	11	20	1400	53000	5	16	41	73	1300.	<1	<1	1.1	<1	3	19	<1	2	26	<1	1	130
A227	1	13	1	34	18	5900	23000	5	24	17	42	5.2	<1	2	<0.5	<1	1	<1	<1	1	4	<1	<1	140
A228	2	23	1	32	23	400	37000	7	15	250	68	15.0	7	<1	<0.5	<1	2	1	<1	2	10	2	2	150
A254	7	38	<1	24	13	400	130000	35	29	990	60	32.0	18	<1	1.3	<1	2	6	<1	1	21	4	2	130
A255	<1	8	3	91	67	330	30000	7	23	50	60	2.8	<1	<1	1.3	<1	6	2	<1	5	13	<1	4	880
A259	16	3	<1	68	18	120	57000	16	8	46	7	34.0	3	1	0.8	<1	6	4	<1	2	25	5	1	370

32. UPPER NORTHAMPTON GOLD

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu
013	130	7	1	102	12	260	21000	10	8	74
034	62	10	<1	<1	<1	290	23000	<1	<1	81
042	800	61	1	123	10	280	27000	12	5	220
061	180	7	1	98	6	230	22000	9	12	82
104	340	7	1	115	3	310	26000	11	7	93
A126	2100	4	<1	220	16	310	60000	11	15	520
A131	<1	7	<1	350	12	890	130000	22	17	22
A132	<1	8	<1	273	14	710	67000	15	12	22
A134	57	3	2	275	13	870	140000	10	7	31
A135	2	10	3	439	12	200	41000	22	9	42
A136	<1	10	3	435	25	1100	140000	30	21	420
A137	<1	10	2	255	17	580	79000	23	12	46
A138	100	4	1	186	15	170	58000	9	5	250
A139	<1	10	3	306	21	550	74000	16	14	7
A140	<1	22	2	725	33	1600	190000	49	35	110
A150	<1	9	4	416	22	830	87000	9	14	160
A155	<1	9	2	399	63	320	51000	6	23	78
A165	4	11	2	266	21	550	63000	8	10	100
A166	<1	11	4	247	19	580	62000	7	10	110
A167	5	10	4	400	23	640	70000	9	11	160
A168	420	5	2	294	22	290	45000	11	7	71
A169	4	7	2	449	24	780	73000	10	10	100
A170	<1	6	3	418	28	470	62000	15	21	61
A171	<1	6	1	364	66	200	34000	4	19	36
A172	4	9	2	253	65	270	59000	12	20	180
A192	51	3	3	252	12	310	56000	16	10	59
A196	6600	4	2	189	3	190	46000	7	4	4000
A197	86	8	2	580	70	930	120000	40	45	110
A198	4	7	3	487	42	990	120000	42	34	83
A199	6	12	2	497	33	1100	160000	75	24	22
A200	8	10	2	519	25	940	110000	38	22	47
A201	57	9	1	344	2	120	33000	11	4	49
A206	4200	5	<1	246	4	260	50000	12	6	270
A261	<1	10	1	116	12	470	36000	10	9	6
A262	2	13	1	190	14	1100	63000	21	14	610
A263	590	5	1	88	9	320	28000	8	4	83
A266	7	8	<1	136	6	400	44000	17	3	2200
A267	11	5	<1	32	4	74	7200	2	1	440
A284	50	10	<1	70	4	290	24000	7	5	64

Sample	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
013	55	36.0	<1	2	0.9	<1	1	2	<1	1	242	1	1	230
034	71	36.0	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	260
042	71	52.0	<1	3	0.9	<1	1	2	<1	2	450	1	1	290
061	55	48.0	<1	4	0.7	2	1	2	<1	1	349	1	1	250
104	86	58.0	<1	3	0.6	<1	1	2	<1	1	522	1	1	280
A126	220	60.0	<1	2	1.0	<1	<1	<1	<1	<1	1550	1	<1	250
A131	56	0.4	<1	<1	0.9	<1	<1	<1	<1	<1	12	<1	<1	110
A132	58	2.1	<1	<1	0.7	<1	1	<1	4	<1	13	7	<1	280
A134	100	70.0	<1	7	<0.5	1	1	3	2	1	36	2	<1	180
A135	25	12.0	<1	4	0.7	1	4	<1	1	2	12	1	2	330
A136	100	3.3	1	1	0.9	1	3	3	2	2	41	<1	2	310
A137	94	3.3	<1	<1	0.8	1	5	<1	2	2	13	2	2	490
A138	39	21.0	1	2	1.1	1	3	3	6	<1	872	12	1	270
A139	29	0.2	<1	<1	0.8	1	2	1	2	1	13	<1	3	250
A140	110	0.7	<1	1	0.5	1	1	4	1	<1	17	<1	2	360
A150	88	46.0	<1	1	0.9	2	4	2	<1	1	47	<1	3	190
A155	48	12.0	<1	1	1.4	2	2	<1	<1	2	19	<1	4	210
A165	55	30.0	<1	2	1.3	2	4	71	2	2	98	<1	2	210
A166	67	46.0	<1	2	0.9	1	2	5	2	1	111	<1	3	230
A167	61	65.0	<1	2	1.0	1	3	7	1	2	66	<1	3	230
A168	100	46.0	<1	3	0.8	2	1	8	1	1	1340	1	1	240
A169	1300	46.0	2	11	2.0	13	4	3	8	2	491	15	2	190
A170	85	1.4	1	<1	1.0	2	2	3	1	<1	18	<1	2	350
A171	28	7.2	1	1	1.2	2	2	1	1	2	16	<1	4	120
A172	45	56.0	3	3	1.6	2	2	2	1	2	21	<1	4	220
A192	67	55.0	<1	6	<0.5	<1	2	8	<1	2	450	2	2	300
A196	1000	86.0	2	3	3.0	9	<1	3	<1	<1	11248	37	<1	140
A197	89	2.1	<1	17	<0.5	<1	1	<1	<1	<1	141	<1	<1	360
A198	82	2.1	<1	<1	<0.5	<1	1	<1	<1	<1	79	<1	1	340
A199	120	12.0	1	5	<0.5	<1	5	<1	<1	2	117	4	1	240
A200	65	12.0	1	<1	<0.5	<1	<1	<1	<1	2	39	<1	<1	420
A201	19	70.0	<1	14	<0.5	<1	<1	2	<1	<1	86	2	<1	210
A206	1100	48.0	<1	4	<0.5	7	<1	3	<1	<1	920	2	1	230
A261	30	0.5	<1	<1	<0.5	<1	1	<1	<1	<1	12	<1	1	140
A262	100	2.8	3	<1	<0.5	<1	2	<1	<1	1	11	<1	1	280
A263	72	40.0	<1	3	0.7	<1	1	1	<1	<1	259	2	1	330
A266	4500	11.0	46	3	4.9	52	2	<1	1	1	3300	25	<1	310
A267	120	8.0	25	4	8.4	<1	1	5	4	<1	1470	25	<1	19000
A284	64	32.0	<1	2	0.9	<1	1	1	<1	<1	255	<1	1	230

34. OAK MOUNTAIN (Au) Sb

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
063	180	15	<1	20	18	280	3800	1	3	5700	1800	140.	2	<1	68.0	44	<1	6939	<1	<1	755	5	<1	<10
064	7	22	2	114	35	1100	28000	42	65	94	52	100.	<1	3	1.1	1	2	16	<1	<1	208	2	2	290
065	<1	8	<1	26	43	140	4100	6	15	12	14	32.0	<1	<1	0.5	<1	<1	12	<1	<1	3	<1	<1	120
066	<1	17	<1	7	<1	460	24000	1	1	16	47	10.0	<1	<1	<0.5	<1	<1	20	<1	<1	66	<1	<1	70
067	<1	12	<1	6	<1	130	760	<1	9	7	<1	3.0	<1	<1	<0.5	2	<1	9	<1	<1	7	<1	<1	40
068	4	7	<1	9	<1	2600	13000	8	33	57	120	16.0	<1	3	0.7	1	<1	35	<1	<1	28	<1	<1	70
069	10	9	<1	26	7	290	7700	<1	<1	60	40	110.	<1	<1	<0.5	<1	1	86	<1	<1	77	<1	<1	130
094	<1	25	1	38	14	680	24000	7	14	110	110	2.0	<1	<1	0.5	<1	1	2	<1	1	9	<1	1	130
A164	98	10	<1	198	16	10	4100	<1	2	4900	760	150.	8	<1	79.0	73	<1	19600	4	<1	9600	14	<1	<10
A173	<1	8	2	344	21	1100	110000	22	16	5	56	0.6	<1	1	1.1	1	2	1	<1	<1	11	<1	2	630
A190	3	20	<1	108	7	100	3000	1	2	1000	440	40.0	7	<1	5.0	49	<1	14300	<1	<1	3830	15	<1	30

35. SOUTH NEWBRIDGE

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
089	15	22	<1	26	5	660	39000	10	21	65	60	7.0	<1	<1	0.7	<1	<1	1	<1	1	3176	<1	<1	1600

36. UPPER NORTHAMPTON Barite

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
A241	2	15	3	76	62	650	52000	10	31	120	110	4.5	<1	<1	1.2	<1	3	<1	<1	2	47	<1	3	450
A243	3	10	3	76	83	900	67000	11	29	62	100	7.2	4	<1	2.1	<1	5	<1	<1	1	85	<1	3	610
A251	3	5	1	75	47	580	50000	12	30	61	59	8.5	3	<1	10.9	<1	3	<1	<1	1	51	<1	3	460
A252	2	5	<1	25	20	230	13000	2	4	64	21	4.4	<1	2	1.8	<1	3	<1	<1	<1	16	<1	2	20000
A267	11	5	<1	32	4	74	7200	2	1	440	120	8.0	25	4	8.4	<1	1	5	4	<1	1470	25	<1	19000

37. WICKHAM

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
A127	<1	19	<1	467	86	1200	140000	43	58	110	77	2.8	<1	<1	0.9	<1	<1	<1	<1	<1	14	<1	<1	120
A128	6	77	1	165	39	26000	200000	189	114	81	81	110.	<1	3	0.7	<1	<1	14	<1	6	84	<1	<1	110
A129	8	52	<1	215	51	24000	230000	258	112	99	71	83.0	<1	5	0.9	<1	<1	6	<1	8	101	<1	<1	140
A130	5	44	<1	211	35	22000	210000	182	106	82	75	86.0	<1	6	1.6	<1	<1	21	<1	6	72	<1	<1	130
A264	5	55	2	70	24	37000	97000	114	73	82	64	24.0	<1	4	<0.5	<1	1	6	<1	4	100	<1	1	90

38. OAK MOUNTAIN Fe-Mn

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
A175	<1	20	6	547	111	1600	26000	103	87	6	14	100.	<1	12	2.2	2	6	36	3	13	243	2	4	1000
A179	43	18	3	377	77	12000	91000	75	78	180	140	28.0	<1	6	1.5	1	2	12	3	6	53	2	2	790
A180	15	32	6	500	150	17000	170000	130	163	200	230	8.3	<1	6	2.4	2	7	9	3	4	38	<1	5	1300
A182	26	11	7	416	119	16000	260000	100	116	48	120	72.0	<1	8	2.0	1	9	27	3	12	172	1	5	1300
A258	<1	48	1	260	77	9700	63000	24	66	14	110	70.0	<1	1	0.6	<1	1	4	<1	2	24	<1	1	630

MEDIUM STANDARD

Sample	Au	Li	Be	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Se	Mo	Ag	Cd	Sn	Sb	Te	W	Pb	Bi	U	Ba
118	10	11	1	176	63	450	120000	37	80	310	47	6.2	<1	7	0.8	<1	<1	2	<1	<1	16	2	3	230
119	14	11	1	169	59	280	75000	32	83	170	34	7.6	<1	9	0.8	<1	<1	2	<1	<1	14	1	3	210
120	10	11	2	162	61	480	120000	36	70	240	46	9.0	<1	6	0.7	<1	<1	2	<1	<1	12	1	3	260
121	8	16	<1	160	47	350	120000	23	52	1200	160	5.7	<1	9	1.1	<1	<1	2	<1	<1	6	<1	2	200
122	13	11	1	134	60	700	140000	36	94	420	64	8.8	<1	5	1.4	<1	<1	2	<1	<1	10	1	2	140
123	12	8	2	150	72	1200	150000	61	98	360	49	12.0	<1	4	1.4	<1	<1	3	<1	<1	15	1	2	180
A124	<1	7	<1	92	10	320	55000	10	35	9	22	0.2	<1	<1	1.5	<1	3	<1	<1	<1	4	<1	3	330
A125	<1	4	<1	127	14	180	37000	4	37	15	17	2.0	<1	2	1.4	<1	2	<1	<1	<1	12	<1	3	710
A145	7	7	3	382	94	720	280000	37	74	430	38	6.2	2	8	1.2	1	1	3	2	1	19	2	3	270
A151	8	7	2	311	87	510	340000	30	76	270	36	6.0	1	4	0.9	1	<1	2	1	<1	16	2	2	130
A177	6	8	4	397	106	650	290000	52	113	200	40	7.0	<1	9	1.1	2	1	3	2	<1	22	2	3	240
A216	8	7	1	275	83	550	350000	62	168	180	44	7.2	1	7	<0.5	<1	<1	2	<1	<1	34	2	3	160
A236	8	8	1	77	45	810	130000	17	34	420	60	7.2	1	5	0.7	<1	<1	2	<1	<1	4	<1	2	280
A269	7	10	<1	120	41	440	150000	17	30	400	43	2.0	2	3	0.9	<1	<1	1	<1	<1	33	1	2	290
A280	13	8	1	85	42	880	180000	52	55	190	72	16.0	3	2	1.2	<1	<1	2	<1	<1	15	1	2	90

Au in ppb, all other elements in ppm

All sample numbers preceeded by the letter "A"

Geochemical Analyses of Composite Rock

Samples M001 - M012

SAMPLE	AU PPB	LI PPM	BE PPM	F PPM	V PPM	CR PPM
M001	2	3	2	420	58	3
M002	<1	10	1	640	167	13
M003	2	5	<1	300	50	31
M004	3	5	<1	130	29	23
M005	<1	26	2	610	83	59
M006	<1	25	3	580	110	62
M007	<1	5	2	540	38	8
M008	<1	8	1	240	112	8
M009	6	8	1	220	87	8
M010	3	5	1	290	87	13
M011	27	10	2	530	133	12
M012	8	10	<1	640	128	23

SAMPLE	MN PPM	FE PPM	CO PPM	NI PPM	CU PPM	ZN PPM
M001	440	28000	6	4	5	26
M002	1800	67000	22	148	65	140
M003	970	37000	8	22	19	70
M004	620	22000	6	10	12	41
M005	1200	69000	20	42	57	160
M006	550	68000	24	50	53	110
M007	770	27000	5	5	5	28
M008	730	40000	13	8	42	76
M009	670	33000	8	11	35	51
M010	730	29000	8	8	130	51
M011	610	49000	9	6	5500	80
M012	340	43000	12	13	900	55

SAMPLE	AS PPM	SE PPM	MO PPM	AG PPM	CD PPM	SN PPM
M001	0.2	<1	<1	1.6	1	2
M002	0.6	2	<1	1.4	<1	8
M003	1.0	<1	<1	1.1	<1	2
M004	0.4	<1	<1	1.0	<1	2
M005	13.0	<1	<1	2.0	<1	4
M006	27.0	<1	<1	1.6	2	4
M007	0.2	<1	<1	1.4	<1	3
M008	1.5	<1	<1	0.6	<1	1
M009	4.4	<1	<1	0.8	<1	2
M010	1.1	<1	<1	0.8	<1	1
M011	2.9	15	5	2.8	<1	3
M012	1.0	19	1	0.8	<1	3

SAMPLE	SB PPM	TE PPM	W PPM	PB PPM	BI PPM	U PPM
M001	<1	<1	<1	12	<1	3
M002	1	<1	2	8	<1	8
M003	<1	<1	2	11	<1	3
M004	<1	<1	<1	9	<1	2
M005	2	<1	3	15	<1	3
M006	1	<1	3	28	<1	3
M007	<1	<1	2	6	<1	3
M008	<1	<1	1	9	<1	1
M009	<1	<1	<1	8	<1	2
M010	<1	<1	2	9	<1	1
M011	<1	<1	3	28	<1	1
M012	<1	<1	11	6	<1	1

X-RAY ASSAY LABORATORIES 21-NOV-86 REPORT 30139 REFERENCE FILE 25490 PAGE 1

SAMPLE	SIO2	AL2O3	CAO	MGO	NA2O	K2O	FE2O3	MNO	TIO2	P2O5	LOI	SUM %/o
M001	68.9	14.5	1.88	1.15	4.56	3.36	3.51	0.06	0.51	0.13	1.47	100.2
M002	56.9	16.2	4.32	3.43	3.52	2.20	8.41	0.24	0.93	0.29	2.77	99.4
M003	77.4	9.24	0.24	1.51	2.25	1.15	4.58	0.13	0.97	0.12	2.00	99.7
M004	81.8	7.96	0.23	0.91	2.98	0.68	2.65	0.09	0.68	0.11	1.23	99.4
M005	62.0	15.6	0.77	2.64	0.96	3.36	9.07	0.14	0.91	0.17	3.77	99.5
M006	60.0	17.4	0.87	2.61	1.61	3.61	8.69	0.70	0.94	0.15	3.54	100.3
M007	68.4	14.7	2.47	1.07	4.88	2.48	3.44	0.07	0.46	0.12	1.54	99.8
M008	68.0	15.1	0.88	1.93	4.64	1.61	5.36	0.10	0.45	0.08	2.31	100.5
M009	68.8	14.7	1.95	1.56	5.13	0.92	4.18	0.09	0.38	0.07	2.00	99.9
M010	69.6	13.8	2.27	1.61	3.75	2.23	3.96	0.10	0.34	0.07	2.31	100.1
M011	64.3	15.4	1.56	2.56	3.09	1.72	6.38	0.08	0.30	0.07	3.31	98.8
M012	64.7	15.1	4.38	2.69	2.00	1.23	5.55	0.04	0.23	0.05	4.39	100.4

ITORIES 21-NOV-86 REPORT 30139 REFERENCE FILE 25490 PAGE 2

CR ppm	RB ppm	SR ppm	Y ppm	ZR ppm	NB ppm	BA ppm
30	120	270	<10	220	30	830
40	80	400	40	150	10	930
70	70	30	30	460	30	320
60	<10	60	<10	400	30	250
100	70	<10	40	210	20	530
110	190	70	40	190	20	820
30	90	310	30	230	30	700
40	70	150	20	90	<10	320
40	50	300	10	110	20	230
40	110	150	10	90	10	460
40	<10	130	<10	60	10	390
50	60	140	<10	30	20	240

SAMPLE	H2O+ %	CO2 %	S %	CL PPM	FEO %
M001	0.9	0.01	0.05	<50	1.2
M002	2.4	0.01	0.02	50	4.3
M003	1.7	0.01	NIL	<50	2.9
M004	1.1	0.02	NIL	50	1.8
M005	3.6	0.43	0.04	<50	6.7
M006	3.1	0.14	0.03	<50	6.2
M007	1.2	0.03	NIL	<50	1.9
M008	2.7	0.03	0.10	<50	3.1
M009	1.6	0.17	0.06	<50	2.5
M010	1.5	0.51	NIL	<50	2.3
M011	2.6	0.03	0.57	<50	3.6
M012	2.7	0.01	1.02	<50	2.4

X-RAY ASSAY LABORATORIES 21-NOV-86 REPORT 30139 REFERENCE FILE 25490 PAGE 1

SAMPLE	SIO2	AL203	CAO	MGO	NA20	K20	FE203	MNO	TIO2	P205	LOI	SUM %
M001	68.9	14.5	1.88	1.15	4.56	3.36	3.51	0.06	0.51	0.13	1.47	100.2
M002	56.9	16.2	4.32	3.43	3.52	2.20	8.41	0.24	0.93	0.29	2.77	99.4
M003	77.4	9.24	0.24	1.51	2.25	1.15	4.58	0.13	0.97	0.12	2.00	99.7
M004	81.8	7.96	0.23	0.91	2.98	0.68	2.65	0.09	0.68	0.11	1.23	99.4
M005	62.0	15.6	0.77	2.64	0.96	3.36	9.07	0.14	0.91	0.17	3.77	99.5
M006	60.0	17.4	0.87	2.61	1.61	3.61	8.69	0.70	0.94	0.15	3.54	100.3
M007	68.4	14.7	2.47	1.07	4.88	2.48	3.44	0.07	0.46	0.12	1.54	99.8
M008	68.0	15.1	0.88	1.93	4.64	1.61	5.36	0.10	0.45	0.08	2.31	100.5
M009	68.8	14.7	1.95	1.56	5.13	0.92	4.18	0.09	0.38	0.07	2.00	99.9
M010	69.6	13.8	2.27	1.61	3.75	2.23	3.96	0.10	0.34	0.07	2.31	100.1
M011	64.3	15.4	1.56	2.56	3.09	1.72	6.38	0.08	0.30	0.07	3.31	98.8
M012	64.7	15.1	4.38	2.69	2.00	1.23	5.55	0.04	0.23	0.05	4.39	100.4

RATORIES 21-NOV-86 REPORT 30139 REFERENCE FILE 25490 PAGE 2

CR ppm	RB ppm	SR ppm	Y ppm	ZR ppm	NB ppm	BA ppm
30	120	270	<10	220	30	830
40	80	400	40	150	10	930
70	70	30	30	460	30	320
60	<10	60	<10	400	30	250
100	70	<10	40	210	20	530
110	190	70	40	190	20	820
30	90	310	30	230	30	700
40	70	150	20	90	<10	320
40	50	300	10	110	20	230
40	110	150	10	90	10	460
40	<10	130	<10	60	10	390
50	60	140	<10	30	20	240

SAMPLE	H2O+ %	CO2 %	S %	CL PPM	FEO %
M001	0.9	0.01	0.05	<50	1.2
M002	2.4	0.01	0.02	50	4.3
M003	1.7	0.01	NIL	<50	2.9
M004	1.1	0.02	NIL	50	1.8
M005	3.6	0.43	0.04	<50	6.7
M006	3.1	0.14	0.03	<50	6.2
M007	1.2	0.03	NIL	<50	1.9
M008	2.7	0.03	0.10	<50	3.1
M009	1.6	0.17	0.06	<50	2.5
M010	1.5	0.51	NIL	<50	2.3
M011	2.6	0.03	0.57	<50	3.6
M012	2.7	0.01	1.02	<50	2.4

Rock samples from Lower Woodstock Stock (LWS-1), Upper Woodstock Stock (UWS-16) and Sharp's Mountain Stock (SMS-19)

X-RAY ASSAY LABORATORIES 22-JUN-87 REPORT 32415 REFERENCE FILE 27709 PAGE 1

SAMPLE	SIO2 %	AL2O3 %	CAO %	MGO %	NA2O %	K2O %	FE2O3 %	MNO %	TIO2 %	P2O5 %	LOI %	SUM %
LWS-1	73.6	12.7	0.11	0.75	1.57	2.94	4.56	0.07	0.21	0.05	2.85	99.5
UWS-16	64.3	14.7	2.86	3.25	4.46	1.57	5.49	0.10	0.41	0.08	2.54	99.8
SMS-19	76.4	14.0	0.05	0.33	0.12	3.81	1.49	0.01	0.35	0.07	3.08	99.3

X-RAY ASSAY LABORATORIES 22-JUN-87 REPORT 32415 REFERENCE FILE 27709 PAGE 2

SAMPLE	CR ppm	RB ppm	SR ppm	Y ppm	ZR ppm	NB ppm	BA ppm
LWS-1	80	110	10	<10	60	10	490
UWS-16	120	50	130	20	70	10	320
SMS-19	80	120	<10	<10	80	10	610

22-JUN-87 REPORT 32415 REF.FILE 27709-J4 PAGE 1 OF 5

SAMPLE	AU PPB	H2O+ %	LI PPM	BE PPM	CO2 %	S %
LWS-1	27	2.0	3	1	0.01	0.56
UWS-16	<1	2.1	20	1	<0.01	NIL
SMS-19	11	2.6	5	1	<0.01	0.17

22-JUN-87 REPORT 32415 REF.FILE 27709-J4 PAGE 2 OF 5

SAMPLE	CL PPM	V PPM	CR PPM	MN PPM	FE PPM	FEO %
LWS-1	<50	30	59	441	39000	1.[illegible]
UWS-16	50	140	91	602	50000	2.[illegible]
SMS-19	<50	92	56	51	15000	0.[illegible]

22-JUN-87 REPORT 32415 REF.FILE 27709-J4 PAGE 3 OF 5

SAMPLE	CO PPM	NI PPM	CU PPM	ZN PPM	AS PPM	TH PPM
LWS-1	6	2	4	43	43.0	4
UWS-16	16	31	9	65	0.5	6
SMS-19	3	2	40	13	34.0	6

22-JUN-87 REPORT 32415 REF.FILE 27709-J4 PAGE 4 OF 5

SAMPLE	MO PPM	AG PPM	CD PPM	SN PPM	SB PPM
LWS-1	3	<0.5	<1	<1	<1
UWS-16	<1	<0.5	<1	<1	<1
SMS-19	<1	<0.5	<1	<1	5

22-JUN-87 REPORT 32415 REF.FILE 27709-J4 PAGE 5 OF 5

SAMPLE	TE PPM	W PPM	PB PPM	BI PPM	U PPM
LWS-1	<1	<1	25	0.6	2.2
UWS-16	1	<1	6	0.2	2.5
SMS-19	2	<1	18	0.3	3.0

APPENDIX III

FIELD DESCRIPTION OF ANALYZED SAMPLES

TABLE OF CONTENTS

1. CONNELL MOUNTAIN

(1)	(2)		(3)	(4)
AØ35		Plagioclase-quartz porphyritic tonalite,2% sulphides and oxides disseminated and fracture fillings	T62A	TP
AØ36		Plagioclase-quartz porphyritic tonalite;abundant quartz veins trace sulphides	T62B	
AØ37	(AØ52)	Highly fractured plagioclase- quartz porphyritic tonalite;malachite on fractures	T62C	
AØ38		Chip sample over 1.5m;fractured plagioclase-quartz porphyritic tonalite across AØ35, AØ36, AØ37	T62D	
AØ39		Highly chloritized and silicified, plagioclase-quartz porphyritic tonalite 3% pyrite,Tc-1% chalcopyrite, 2% sericite,much malachite	T63A	
AØ4Ø		Less altered than AØ39 and AØ41 (all from same outcrop)	T63B	
AØ41		Highly silicified and chloritized, plagioclase-quartz porphyritic tonalite 5% pyrite, chalcopyrite disseminated	T63C	
AØ43		Fine grained equigranular,slightly foliated tonalite;5-1Ø% sulphides, disseminated,adjacent to AØ44	T64A	
AØ44		Quartz wacke,fine to medium grained 5% sulphides(pyrite,chalcopyrite) disseminated masses,adjacent to AØ43	T64B	
AØ45		Pyrite cube, 13mm	T67A	P
AØ46	(AØ53)	Quartz vein with 5% sulphides in quartz wacke host	T67B	P
AØ47		Quartz wacke, fine grained, no sulphides	T67C	

A048	Hornfelsed argillite, chip sample over 0.85m of chloritized, silicified zone;2% chalcopyrite, 1-4% pyrite	T69B	T
A052 (A037)		T62C	
A053 (A046)		T67B	
A141	Silt stone;highly silicified and fractured;5% pyrite on fractures, Tc-1% sphalerite?	T240	
A142	Quartz wacke,highly silicified, chloritized,moderate sericitization, 5-10% sulphides	T242	
A143	Gossan,2cmx50cm channel sample-in quartz wacke,highly silicified (see A202)	T244	
A144	Plagioclase quartz porphyritic tonalite 3% sulphides,disseminated and on fractures	T248	P
A146	Quartz wacke,highly schistose, brecciated-generally looks unaltered	T247	
A147	Plagioclase-quartz porphyritic tonalite 5% disseminated sulphides,highly silicified,moderate sericite	T249B	P
A148	Quartz vein, 40cm wide, 2% pyrite, 1% chalcopyrite	T252	
A176	Quartz wacke bleached adjacent to fractures,highly silicified	T281	T
A178	Quartz wacke,less altered than A176	T281B	
A183	Quartz vein, boudined in A176-A178	T281A	
A202	Quartz wacke,2% oxides grab sample of less weathered rock near A143	T244	P
A203	Plagioclase-quartz porphyritic tonalite 5% fine pyrite,traces chalcopyrite + molybdenite	T291	

A204	Plagioclase-quartz porphyritic tonalite sheared,10-15% sulphides (pyrrhotite + chalcopyrite),low silicification	T295
A205	Mafic dyke (diabase) 2-5% sulphides (pyrrhotite)	T296
A207	Highly chloritized quartz wacke adjacent to a diabase dyke	T308B
A208	Quartz wacke bleached moderate silicification 2-5% fine grained pyrite on fractures	T310
A209	Siltstone,very bleached,finely laminated	T311
A210	Siltstone,bleached,finely laminated 2% pyrite moderately silicified	T314
A211	Quartz wacke,highly chloritized, silicified	T316
A213	Quartz wacke,highly bleached and silicified in contact with A214	T317A
A214	Plagioclase-quartz porphyritic tonalite highly chloritized	T317B
A215	Quartz vein in A213	T317C
A217	Siltstone,moderately bleached,some 1-2 mm pyrite seams	T319
A219	Tonalite,medium grained,equigranular 5-10% pyrrhotite disseminated,moderate chloritization	T330
A220	Siltstone breccia,30% quartz matrix, 3-5% pyrite in matrix	T333
A221	Quartz vein,clear,in plagioclase-quartz porphyritic tonalite	T339

(1) A samples = laboratory number
(2) Duplicate sample number
(3) T samples = field number
(4) T = thin section; P = polished section

2. SOUTHEAST CONNELL MOUNTAIN

A222	Quartz wacke,intensely silicified, 1% disseminated pyrite,random chip sample	T341A	
A223 (A224)	Argillite,highly fractured and crenulated	T341C	
A224 (A223)		T341C	
A225	Quartz wacke highly silicified	T343	

3. CONNELL BROOK

AØ97	Argillite,brecciated,few quartz veinlets,moderate chloritized	T17Ø	
AØ98 (A114)	Siltstone,finely laminated,very highly silicified	T171	
AØ99	Siltstone,moderately silicified,Tc-1% pyrite, disseminated	T174	
A1ØØ	Diabase,very fine grained	T175	
A114 (AØ98)		T171	

4. MONTEITH

AØ8Ø	Spotted argillite,numerous quartz stringers to 4 mm,Tc-1% py. cp.	T153	
AØ81	Spotted argillite,Tc-1% py. + cp. on fractures	T156	T

5. SMART FARM

AØ76	Quartz-hornblende porphyritic tonalite	T139	
AØ77	Quartz wacke,banded,Tc py,Tc" malachite	T149	
AØ78	Quartz-feldspar tonalite,5-1Ø% sulph. diss. mod. chlor.	T151	P
AØ79	Quartz-feldspar tonalite,Tc-1% sulph. disseminated	T152	
AØ82	Tonalite,Tc-1% sulphides (py. cp.)	T158	T159

AØ84 (A117)	Tonalite,highly fractured,very high chlor.,high silic.,5-1Ø% py,Tc-1% cp., Tc-1% mo.	T16Ø	
AØ85	Dyke of tonalite in porphyritic tonalite,1% py + cp.	T161	
A117 (AØ84)		—	
A282	Tonalite, equigranular;low chlor.,2-3% sulphides disseminated + fractures	T141	

6. UPPER NORTHAMPTON COPPER

AØ7Ø	Plagioclase-quartz-hornblende porphyritic tonalite,5% py,Tc-1% cp, Tc Mo disseminated	T125	T
AØ71	Quartz wacke,well banded,fine grained sheared;2% py disseminated and fractures	T127	
AØ72	Spotted argillite, moderately chlor., silic; Tc py, dissemianted	T131	
AØ73	Plagioclase-quartz porphyritic tonalite,1Ø% fine py disseminated + fractures high chlor. silic.	T133	PT
AØ74 (AØ95)	Quartz wacke,highly fractured,5% sulphides	T134	P
AØ95 (AØ74)		—	
A253	Plagioclase-quartz porphyritic tonalite,5-1Ø% fine py,disseminated Tc cp.	T129	PT
A27Ø	Spotted argillite,finely laminated	T135	T
A278 (A279)	Argillite,black,Tc-1% sulphides	T136	
A279 (A278)		—	
A281	Mylonite ? highly altered;v. high silic. mod. chlor., 5% sulphides	T124	

9. BULLS CREEK NO. 1

A028	Quartz wacke,moderately carbonatized (fractures) and silicified;Tc-1% sulphides in 1 - 2 mm seams,brecciated	T49A	
A029 (A051)	Quartz wacke,brecciated with calcite matrix 20% sulphides (pyrite,chalcopyrite,sphalerite)	T51	P
A030	Quartz vein 20% sulphides (chalcopyrite, pyrite)	T53	P
A031	Quartz-calcite vein in quartz wacke, 5% sulphides (chalcopyrite,pyrite)	T55A	
A032	Quartz wacke,sheared,moderately carbonatized,Tc-1% pyrite + chalcopyrite	T56	
A033	Sheared zone in quartz wacke, moderately carbonatized,50% goethite	T58	
A051 (A029)		-	
A185	Shear zone in quartz wacke;composite samples across 1 m	T284A	
A186	Bleached fine grained quartz wacke	T284B	
A187	Quartz + calcite vein with angular chloritic fragments;Tc pyrite	T286	
A188	Bleached quartz wacke,trace pyrite on fractures	T287	
A189	Mafic dyke,highly carbonatized, moderately chloritized,1% pyrite	T288	
A218	Quartz vein,white milky,few vugs, malachite and azurite on fractures	T325	
A256	Siltstone,brownish grey,weathering buff;abundant quartz stringers	T285	
A274	Brecciated and altered argillite	T49B	T

10. BULLS CREEK NO. 2

A016	Granodiorite + mineralized wall rock adjacent to A017	T40A(2)TP	
		T40A(1)	
A017	Sulphide + quartz-calcite fracture filling in granodiorite	T40B	P
A018	Granodiorite,5% py, Tc-1% cp concentrated on fractures	T41	
A019	Granodiorite, Tc-1% py, dissem.	T42	
A021	Granodiorite, Tc-1% py, Tc Cp., mal. diss. and fract.	T44	
A022 (A049)	Chloritized quartz vein, 10% diss. cp, hem, py, goc, cov.	T45	P
A023	Granodiorite with 3% diss. sulphide and 1-3mm massive sulphide + quartz fracture fillings	T46	P
A049 (A022)			
A242 (A246)	Quartz wacke, highly silicified 1% py, diss.	T374A	
A245	Quartz vein + grantie,1% py. Tcp. in qv + fract.	T370D	(T)
A246 (A242)			
A247	Quartz wacke, highly silicified,1% py.	T374B	
A248	Granodiorite, mod. carb. Tc Mal.	T374A	
A249	Granodiorite, mod. chlo., Tc scheelite	T376	T
A273	Granodiorite, white, fine to medium grained, Tc. py.	T40 C	T

11. BULLS CREEK NO. 3

A024	Quartz wacke, Tc py on fractures	T47A	
A025	Breccia, Tc-4% py + cp., Tc-2% gn; white quartz,50% angular fragments of quartz wacke	T47B	P

A026	Quartz vein, 2% cp, 1% py., Tc cerrusite	T47C	
A027	30% quartz vein, 30% pyrite in quartz vein and 40% wall rock	T47D	

12. COBBLER SEXTON

A059 (A093)	Quartz vein with 10% mafic inclusions, 5% chalcopyrite on fractures, 3% pyrite; trace calcite (from waste pile)	T106	P
A060	Quartz vein (1-2% chalcopyrite in fractures) in quartz wacke(see A062)	T113A	
A062	Quartz wacke, bleached for 5cm beside quartz vein (A060)	T113B	P
A093 (A059)			
A163	Quartz-feldspar porphyritic tonalite, highly chloritized,10% quartz stringers, 30% sulphides	T267	
A234	Quartz wacke, foliated,highly chloritzed, 40% pyrite	T357A	
A235	Quartz wacke w. 60% pyrite	T357B	
A237	30% pyrite in interbanded bleached and unbleached quartz wacke (mylonite?)	T357C	
A238 (A250)	Highly chloritized and silicified quartz wacke, 30% pyrite	T357D	
A239	Same as A238,but away from quartz veining and less pyrite and chloritization	T357E	
A240	Chip sample over 2m width of shear zone inquartz wacke exposed in shaft	T358D	
A250 (A238)			
A271	Fine grained tonalite	T103	T
A276	Quartz-calcite vein in chloritized quartz wacke,10% sulphides (from waste pile)	T109	P

A277	Highly chloritized and silicified quartz (-feldspar?) porphyritic tonalite 5% sulphides (from waste pile)	T108	P

13.DUGAN ROAD EAST

	See also M006, silty argillite (T28, Appendix I)	T29	T
A006	Hornfels-hanging wall of shear zone	T31A	
A008	4cm wide fault gOuge	T31B	
A009	30cm zone of brecciated rock,1-2% py	T31C	
A010	Hornfels-footwall of shear zone	T31D	
A011	Massive pyrite, 10x10x2cm lens parallel to main fractures	T33	
A012	Hornfels-hanging wall of shear zone	T35A	
A014	Shear zone, 1-2cm wide,mylonite material	T35B	
A015	Hornfels,breccia zone,Tc-1% pyrite on fractures (chip sample across zone)	T35C	
A272	Hornfels,5% sulp[hides as dissemination and small tenses on fractures	T34	

14. DUGAN ROAD WEST

A001	Hornfels,2% sulphides-disseminated and in seams on fractures	T23	P
A002	Hornfels,highly fractured, Tc py, disseminated-random grab sample	T24	
A003	Hornfels,much Mn stain on fractures; Tc-disseminated pyrite	T27A	
A004	Massive fine grained pyrite lens, 10x3x5cm, on fractures	T27B	
A005	Hornfels,much Mn+Fe stain on fractures; Tc py on fractures with quartz	T27C	

18. LOWER NORTHAMPTON Cu

A054	Quartz wacke,5% sulphides,few quartz veins to 1cm,mod.chlor.	T74
A055	Shear zone,40cm wide;high silicification;5-10% sulphides	T82
A056	Quartz wacke,fine grained,some irregular quartz-calcite stringers Tc py.	T92
A092	Quartz wacke,highly silicified with quartz veins,5% sulphides	T82B
A275	Argillite,laminated,low sericitization	T93

19. RICEVILLE

A057	Quartz vein,vuggy and quartz wacke wall rock,2% pyrite	T98
A058	Quartz wacke,rusty in places,few 1 mm quartz stringers,5% pyrite	T100

20. BENTON PYRITE

Low standard

A007 A096 A181 A020 A115 A212 A050 A133 A229 A075 A159 A257	Plagioclase porphyritic granite 2% pyrite, slightly chloritzed	T1	T
A124	Sheared granite, moderate silicification,trace pyrite	T208	
A125	Grey plagioclase porphyritic granite, moderately silicified,4% pyrite	T210	
A265	Plagioclase porphyritic granite, slightly chloritized, trace magnetite	T203	T

21. LILLY BROOK Cu Mo

A191	Basalt,amygdaloidal,slightly chloritized and silicified	T352
A230	Quartz wacke, moderate carbonatization (on fractures), moderately silicified, trace pyrite on carbonated fractures	T351

24. WETMORE

A112	Plagioclase quartz porphyritic tonalite: 1% pyrite, 1% chalcopyrite disseminated	T188
A113	Vein quartz, white milky; 5% chalcopyrite and malachite on fractures	T189

25. BRITTON

A110	Quartz vein, white milky; some calcite: 2% sulphides (gn, cp, py)	T184
A111	Breccia, quartz wacke clasts in quartz + calcite matrix; Tc-1% pyrite	T185

26. WRIGHT BROOK

West A101	Quartz wacke, highly carbonatized and chloritized, trace disseminated pyrite	T176	
A102	Quartz wacke, moderate carbonatization, chloritization,silicification, trace pyrite, 1% galena associated with calcite veins	T177	
A103	Quartz wacke, moderately carbonatized, highly silicified, 1% pyrite dissem. 1% gn,sp,cp in quartz+calcite veins	T178	P
A105	Quartz vein, up to 25% sulphides; carbonatized on hanging wall	T179	

A106	Quartz wacke, highly silicified,10% sulphides (py, cp, gn, sp) in quartz veins	T180	
A107	Quartz wacke, slightly carbonatized, traces disseminated pyrite	T181	
A174	Chip sample across vein (50cm wide) in trench above pit	T283	
A184	Random grab sample from trench above pit	T283M	
East			
A108 (A116)	Quartz wacke,moderately chloritized; few quartz veins with 25% sulphides (py,cp,co) (boulder-1.0x0.7x0.5cm)	T182	P
A109	Quartz wacke,highly silicified,pyrite, chalcopyrite, sphalerite (boulder)	T183	
A116 (A108)		T182	
Road			
A260	Green slate, weathers rusty red	T253	

27. DOMINION NO. 1

A086	Sulphide bearing quartz-carbonate vein (from dump)	T162D	P
A087	Quartz wacke, v. highly silic. as q.v. Tc py.	T165	
A088	Quartz wacke,w.q.-c.v. with 2% sulphides	T166	
A193	Quartz vein with 1% py,1% galina (from head of shaft)	T162H	
A194 (A268)	Argillite,very finely laminated, from head of shaft	T162I	
A195	Quartz vein, 15% sulphides; from contact of quartz wacke and argillite in head of shaft	T162J	P
A268 (A194)			

A283	Quartz-calcite vein in quartz wacke; 25% sulphides in vein (from dump)	T164	P
A285	Argillite, very fissile; no mineralization	T162C	

30. LILLY BROOK Pb

A231	Quartz wacke, bleached?, abundant 1mm quartz stringers,some calcite veinlets trace pyrite	T350A
A232	Quartz wacke, silicified,abundant 1mm calcite veins, Tc pyrite	T349
A233	Mafic dyke, fine grained,silicified, 5% pyrite, disseminated	T348

31. GRAFTON PYRITE

A090	Quartz wacke,medium greyish green,fine medium grained,numerous quartz ± calcite veins to 5 mm;2-5% coarse pyrite	T168A	
A091	Breccia,southward dipping,10-20% coarse pyrite, chalcopyrite	T168B	
A149 (A161)	Slate wallrock of porphyry dyke (A160) very schistose and brecciated	T266B	
A152	Shear zone,5 cm wide,rounded clasts of quartz wacke in fine grained matrix, high chloritization,moderate sericitization,trace pyrite,blebs	T256C	T
A153	Quartz vein,15 cm wide,in quartz wacke	T256E	
A154 (A259)	Quartz vein,milky white,trace pyrite, in quartz wacke	T256F	
A156	Mylonitic zone in quartz wacke	T260B	
A157	Siltstone,finely laminated,quartz veinlets on some fractures,sericite in some fractures	T261	

A158	Intrusive breccia, 4 m diameter pipe-like freature, quartz wacke +1% tonalite clasts, pebble sized, rounded	T263
A160	Plagioclase-quartz porphyritic tonalite dyke, highly chloritized, 2% sulphides (cp ?) dissemianted (see A149-A161 -A162)	T266A
A161 (A149)		T266B
A162	Quartz wacke wall rock of porphyry dyke (A160), light grey, 2 mm seams massive pyrite in places	T266C
A226	Highly silicified carbonatized pyritized argillite (20% quartz + calcite veins, 5-20% medium to coarse grained pyrite, 60-70% argillite).	T344
A227	Shear zone and breccia zone with calcite matrix, 2-80 cm wide trace pyrite in calcite	T345
A228 (A254)	Argillite, rusty weathering, 2 mm pyrite seams, few quartz lenses	T346
A254 (A228)		T346
A255	Argillite, relatively unaltered	T344A
A259 (A154)		T256F

32. UPPER NORTHAMPTON Au

High standard:

A013, A034, A042, A061, A104, A126, A168, A192, A206, A263, A284

A131	Quartz-feldspar porphyritic tonalite, high chlor., unmineralized	T230A	
A132	Quartz-feldspar porphyritic tonalite; abundant q - c.v. (<1cm(Tc py	T230B	
A134 (A201)	Quartz vein, 30cm; 5% py; plus inclusions of wall rock	T230C	P

A135	Highly chloritized inclusion of f.g. porph. tonalite in qtz-fel porph. tonalite	T230D	T
A136 (A262)	Fine grained porph. tonalite;high chlor. silic; q-c.v. present	T230E	
A137	Quartz-porphyritic tonalite; mod. chlor. silic; q-c.v. present	T232	
A138	Quartz vein, tc gn in analytical sample, not in polished section	T232B	P
A139	Quartz-feldspar porphyritic tonalite; low-mod. chlor. silic.	T233A	
A140	Amygdaloidal basalt	T233B	T
A150 (A167)	Quartz-feldspar porphyritic tonalite, 5% fine dissem. py 3m grab	T269C	
A155 (171)	Quartz wacke, bleached at contact of Quartz-feldspar porphyritic tonalite (see A170)	T272B	
A165	Quartz-feldspar porphyritic tonalite, 5% fine dissem. py. 3m grab	T269A	
A166	Same as A165	T269B	
A167 (A150)		T269C	
A169	Quartz-feldspar porphyritic tonalite, 5-10% py, "high grade" selected sample	T269D	
A170	Quartz-feldspar porphyritic tonalite, at contact of quartz wacke (see A155, A171)	T271A	
A171 (A155)		T271B	
A172	Quartz wacke at limit of bleaching, 2m north of contact with tonalite; 5% pyrite on fract. + dissm. few q.v.	T271C	
A196	Quartz vein, highly mineralized	T69B	P
A197	Med. grained porph. tonalite with 1-4 mm q.v.,10% sulphides	T193A	P
A198	Intrusive breccia, f.g. tonalite in m.g. porph. tonalite matrix	T193B	(T)

A199	Quartz vein in f.g. porphyry	T193D	
A200	Intrusive breccia, f.g. tonalite in m.g. porph. tonalite matrix	T193C	
A201 (A134)			
A261	Plagioclase-quartz-hornblende porphyritic tonalite	T234	T
A262 (A136)		T230E	
A266	Plagioclase porphyritic tonalite	T195	(T)P
A267	Quartz-feldspar porphyritic tonalite, high chlor. + quartz vein		

34. OAK MOUNTAIN (Au) Sb

A063	Quartz vein boulder,43x20x17cm;10-20% chloritic masses;Tc malachite	T117	
A064	Quartz vein boulder,22x15x13cm,10% black chloritic material,20% pyrite	T118A	
A065	Quartz vein boulder,30x18x18cm,Tc chlorite on fractures,Tc pyrite	T118B	
A066	Quartz vein boulder,42x28x20cm,highly fractured and sheared ?,Tc pyrite	T119	
A067	Quartz vein boulder,20x14x5cm,Tc py.	T120A	
A068	Quartz vein boulder,22x20x19cm,much Fe stain; pyrite clasts filled with goethite	T121(A)	
A069	Quartz vein boulder,40x35x15cm,black chloritic material on sides,Tc pyrite	T122	
A094	Quartz vein in volcanic rock,25x17x13cm, foliated, Tc pyrite	T120B	
A164	Quartz vein boulder,70x60x50cm;with tetrahedrite in 2cm wide bands	T356	P
A173	Plagioclase porphyritic granodiorite, outcrop	T273A	T
A190	Quartz vein boulder,100x70,40cm;highly fractured; Tc mal.	T355	

35. SOUTH NEWBRIDGE

A089	Quartz wacke, highly chloritized with numerous quartz veinlets and one fracture coated with barite	T167

36. UPPER NORTHAMPTON Barite

A241	Siltstone, Tc-1% py, mod. silic. chlor; abundant q.v.	T362
A243	Fine grained quartz wacke,brecciated, rusty weathering,2% pyrite,diss.+fract.	T364
A251	Siltstone, Tc-1% py. fract.	T363 T
A252	2-4cm barite veinlet	T272
A267	Quartz feldspar porphyritic tonalite, high chlor. + qtz veins	T192D

37. WICKHAM

A127	Amygdaloidal basalt, amyg. filled with qtz + cal.	T218
A128	Slate, highly fractured	T219
A129	Slate; Tc py, v.f. grained, dissem. and <1mm lenses on fractures.Sample from old pit	T223
A130	Random chip sample from around the outcrop	Composite
A264	Siltstone or sandstone, few 1-5mm wide quartz stringers, sample from large pit	T227

38. OAK MOUNTAIN Fe-Mn

A175	Red slate, well developed cleavage with minor coating of Fe + Mn stain on cleavage	T274
A179	Quartz veins, white with comb structure 3-40cm wide x 2.5m	T277A

A180	Slate, bleached grey, adjacent (3cm) to the vein	T277B
A182	Composite sample from each red slate outcrop	T279
A258	Mafic tuff, granular	T278

NOTE:

A samples = laboratory number   P=polished section
T samples = field number   T=thin section

MEDIUM STANDARD

118 to 125, 145, 151, 177, 216, 236, 269, 290

Quartz sericite chlorite pyritic schist from Napier Lake gold occurrence in Darling Township, Ontario (NTS 31 F/2)