ISBN 0-7778-1474-9

THESE TERMS GOVERN YOUR USE OF THIS DOCUMENT

Your use of this Ontario Geological Survey document (the "Content") is governed by the terms set out on this page ("Terms of Use"). By downloading this Content, you (the "User") have accepted, and have agreed to be bound by, the Terms of Use.

Ministry of
Northern Development
and Mines
Ontario

Ontario Geological Survey
Open File Report 5858

Lithogeochemistry of Three Gold Settings in the Southern Swayze Belt

1993

Ministry of
Northern Development
and Mines

Ontario

ONTARIO GEOLOGICAL SURVEY

Open File Report 5858

Lithogeochemistry of Three Gold Settings in the Southern Swayze Belt

By

G.M. Siragusa

1993

Ontario Geological Survey

OPEN FILE REPORT

Open File Reports are made available to the public subject to the following conditions:

This report is unedited. Discrepancies may occur for which the Ontario Geological Survey does not assume liability. Recommendations and statements of opinions expressed are those of the author or authors and are not to be construed as statements of government policy.

This Open File Report is available for viewing at the following locations:

Mines Library
Level A3, 933 Ramsey Lake Road
Sudbury, Ontario P3E 6B5

Mines and Minerals Information Centre (MMIC)
Rm. M2-17, Macdonald Block
900 Bay St.
Toronto, Ontario M7A 1C3

The office of the Resident Geologist whose district includes the area covered by this report.

Copies of this report may be obtained at the user's expense from:

OGS On-Demand Publications
Level B4, 933 Ramsey Lake Road
Sudbury, Ontario P3E 6B5
Tel. (705)670-5691 Collect calls accepted.

Handwritten notes and sketches may be made from this report. Check with MMIC, the Mines Library or the Resident Geologist's office whether there is a copy of this report that may be borrowed. A copy of this report is available for Inter-Library loan.

This report is available for viewing at the following Resident Geologists' offices:

Timmins, 60 Wilson Ave., Timmins P4N 2S7

Foreword

The present report describes the geological setting of three gold occurrences in Chester, Esther and Osway townships of the southern Swayze greenstone belt. It is part of a multi-year investigation of gold occurrences in northeastern Ontario.

The author presents the results of detailed geological and lithogeochemical investigations and makes relevant recommendations for exploration.

B.Dressler
A/Director
Geoscience Branch
Ontario Geological Survey

Filename : Swayze.886
Author : G.M. Siragusa
Project No.: 88/06

LITHOGEOCHEMISTRY OF 3 GOLD SETTINGS IN THE SOUTHERN SWAYZE BELT

Contents

Figures

Tables

Abstract

This paper, aimed primarily at aiding gold exploration, covers detailed geological and lithogeochemical investigations of three gold occurrences which are located in the southern Swayze belt, contain ore reserves, and comprise widely different settings. Interpretive syntheses and relevant recommendations are given at the end of the geochemical description of each occurrence.

One occurrence, in Esther Township, is hosted by variably carbonatized tholeiitic basalt deformed by broadly east-trending folds (S1) locally affected by axial plane shearing (S2). The stronger carbonatization is associated with S2. Gold occurs almost exclusively in quartz found in discrete dilatant segments of S1, or in remnants of silicified fold limbs adjacent to S2. Carbonatization of the basalt was associated with desilication, decrease in rock density, depletion in Co, Fe, Mn, Na, Ni, P, REE, Sc, Sr, Ti, Y, Zr, and enrichment in As, Rb, V, Cu, K, and Ca. Although As and Rb are enriched in carbonatized basalt, they are more abundant and uniformily distributed in the auriferous quartz. High vanadium concentrations, instead, are restricted to carbonatized basalt. Migration of silica from more carbonatized to less altered basalt could be the process by which gold was concentrated along dilatant segments of S1.

As increasing carbonatization is reflected by progressive decrease in density of the basalt, such a relationship may be used directly in the field (drill core) to broadly assess carbonatization in the area of this occurrence. The REE depletion trend with increasing carbonatization could provide a self-calibrated method for a quantitative evaluation of carbonatization. With moderate carbonatization all the REE are depleted at a similar rate, but only the lanthanides heavier than samarium are further depleted with increasing carbonatization.

The second occurrence (which in 1988 was being explored by a decline) is hosted by a partly migmatized gabbroic complex within granitic rocks underlaying west-central Chester Township. Gold occurs in pyrrhotite- and chalcopyrite-bearing quartz veins occupying linear, subparallel, regional shear fractures which trend 110^{o}, and affect the mafic complex as well as the granitic rocks east and west of it. The wall rocks of the quartz veins are variably chloritized and carbonatized, carbonatization having (at least locally) continued after shearing.

The wall rocks of the auriferous quartz veins at the 150- and 200-foot levels of the decline are variably depleted in As, Cr, Ni, Rb, Sc, V, and Zn, while the wall rocks of the veins at the 400-foot level are generally enriched in all these elements. Also, depending on whether the wall rocks are depleted (150- and 200-foot levels) or enriched (400-foot level) in these elements, the concentrations of such elements in the auriferous quartz veins are relatively low or high, respectively. Depth, therefore, controls the distribution of minor elements in the wall rocks as well as in the ore, downward increases in Cr and Ni being

particularly significant. As the controlling role of depth is attributable to lithological - not structural - conditions, the distribution of minor elements, gold included, is likely to have been affected by lithology. The characteristic structural trend (110°) of the shear fractures hosting the auriferous quartz veins, therefore, may not be the only important element to be considered when exploring for gold in the area of this occurrence.

The third occurrence comprises a short segment of the 200-foot level of the Jerome Mine, a past producer of 56,878 ounces of gold (Brown 1948) at the contact of the Jerome Porphyry (Moorhouse 1951) with clastic metasedimentary rocks (Osway Township). The work done on this occurrence was focused on the nature of the ore, and its relationships with the Jerome Porphyry. The ore has been described as "bluish coloured cherty replacement silica" (Brown 1948) or "blue-grey to black cherty quartz" (Moorhouse 1951).

Petrographic and chemical data from previous (regional) mapping indicated that the Jerome Porphyry is a syenitic intrusion affected by carbonatization (Siragusa 1993) which is probably deuteric (ibid.). One of the two main features, revealed by the present detailed work, is that the ore is highly silicified porphyry, not quartz. Relative to the porphyry, the ore is depleted in Al, Fe, K, and Na, and enriched in Si, Mo, As, and V; potassium, although depleted, is still high in the ore (i.e. 1.28 weight percent). The other feature is a strong indication that the ore formed where the wall rocks were relatively impermeable to the volatiles emanating from the syenitic magma which intruded them. Possibly, this could imply that - in east-central Osway and west-central Huffman Townships - the syenite contacts are auriferous regardless of the (supracrustal) lithology the syenite is in contact with.

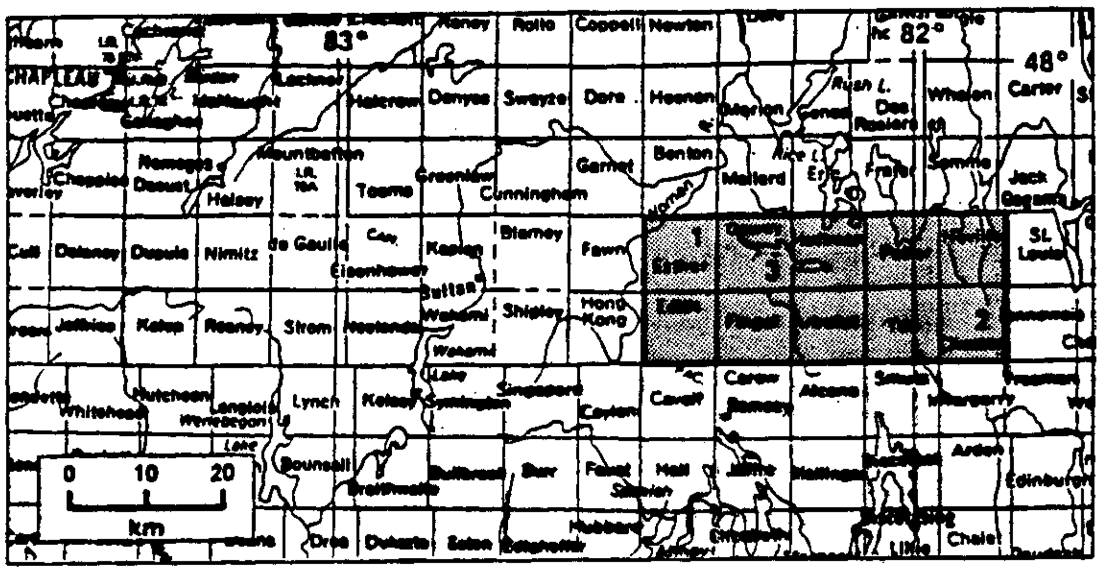


Figure 1:

Sketch Map showing general location of the 3 occurrences.

INTRODUCTION

In this paper, numerical data are in imperial or metric units, so as to conform to the original source of information.

Location and Access

The 3 occurrences visited in 1988, are in Esther, Chester, and Osway townships.

The Esther Township occurrence (Latitude 47 39' 35''N and Longitude 82 21' 57"W) is 101 km by road from Gogama via Highway 144, then a gravel road owned by E.B. Eddy Forest Products Limited, thence a narrow bush road on the north side of the latter and, finally, a tractor road which is about 3 km long. In 1988, the tractor road was locally rough and covered by water. By limited clearing of boulders and dead fall, however, it was possible to drive to within 396 m feet of the old shaft.

The Chester Township occurrence (Latitude 47 33' 20"N and Longitude 81 53' 30"W) is about 30 km by road from Gogama, most of which is on Highway 144.

The Osway Township occurrence (Latitude 47 37' 15"N and Longitude 82 14' 20"W) is about 90 km by road from Gogama, via Highway 144, the E.B. Eddy Forest Products Limited road, and then a good gravel road leading directly to the mine site.

Previous Work

The Esther Township occurrence has been known since 1928, when a shaft was sunk by A.Burton. Data available to the end of 1979 were previuosly summarized (Siragusa 1980, Occurrence 16). In 1983 and 1984, surface exploration and diamond drilling were carried out by Canadian Nickel Company Limited (Canico), which subsequently dropped the property. This work resulted in a preliminary estimate of ore reserves of 17,460 t at 10.09 ppm gold (File 63-4493). This reserve is for the "Shaft Zone", which is in the vicinity of the 1928 shaft. Canico reported that the mineralization extends east (known as the "East Zone") for approximately 1 km from the shaft; gold values, however, were reported to decrease eastward.

The Chester Township occurrence is along strike of the (former) Strathmore Shaft, a gold prospect where limited underground work was done in the 1930s and 1940s. Relevant data available to 1980 were previously summarized (Siragusa 1981). In 1988, a large program of surface and underground exploration was being carried out by Chesbar Resources Incorporated in joint venture with Murgold Resources Incorporated. The underground work utilized a decline (Figure 6), the portal of which is located on the north side of a small lake locally known as Arethusa Lake. At the time of the author's visit (August 1988), the western end of the decline was at a depth of 157 m below the portal, and its eastern end was 46 m east of, and 91 m below, the (former) Strathmore shaft. The most recent ore reserve estimate is 507,365 tons averaging 0.237 ounce gold per ton (Murgold Resources Incorporated News Release, March 9, 1989).

Gold was first discovered at the site of the Osway township occurrence by Bert Jerome (1938). Data on subsequent exploration and underground development were previously summarized (Siragusa 1980, Occurrence 1). From 1941 to 1943, the Jerome Mine (Figure 10) produced 56,878 ounces of gold and 15,104 ounces of silver (Brown 1948). In 1945, when operations ceased, the ore reserve was 344,000 tons averaging 0.19 ounce gold per ton after dilution (Canadian Mines Handbook 1946, p.159).

In 1988, an exploration program, comprising mine rehabilitation, surface diamond drilling, and underground development, was being carried out by Muscocho Explorations Limited in joint venture with Jerome Gold Mines Corporation. At the time of the author's visit (September 1988), the headframe, shaft, and hoist were operational, and dewatering had been completed to a depth of 525 feet. Diamond drilling totalled 45,000 feet (J. Millard, Muscocho Explorations Limited, personal communication, 1988).

The old underground workings of the Jerome Mine are in what is known as the Main Zone. The existence of a second gold-bearing zone extending south of the Main Zone has long been known (e.g. see Moorhouse 1951, p.22), but until 1988 it had received no significant exploration. This South Zone, had been the target of most of drilling done by Muscocho Explorations Limited at the time of the author's visit. Drill sections indicate that it comprises three subzones, and data released in June 1988 indicate that such drilling had increased the known ore reserve on the property to 437,320 tons grading 0.193 ounce gold per ton (Jerome Gold Mines Corporation, 1988 Semi-Annual Report to Shareholders). As of March 1989, 478 feet of crosscutting, connecting the South Zone with the Main Zone at the 500-foot level, had been completed (J.Millard, Muscocho Explorations Limited, personal communication, 1989).

Present Work

The Shaft Zone of the Esther Township occurrence was mapped at the scale of 1 to 166 (Figure 2), and a western segment of the East Zone (of the same occurrence) was mapped at the scale of 1 to 250 (Figure 3). Sampling of the Shaft and East Zones comprised 25 and 4 samples, respectively.

Parts of the underground workings of the Chester Township occurrence at the 150-, 200-, and 400-foot levels were mapped at the scale of 1 to 240. The data thus obtained, integrated by company data at the same scale, are shown in Figures 7, 8, and 9. Sampling of the 150-, 200-, and 400-foot levels comprised 4, 7, and 6 samples, respectively.

The work done on the Osway Township occurrence comprised mapping at the scale of 1 to 100 of a short segment of the eastern drift at the 200-foot level, and collection of 6 samples (Figure 11).

The 52 samples collected by the author from the three occurrences ranged in weight from about 5 to 12 kg. As much as possible, the samples were collected so as to be aligned normal to the strike of the sampled mineralization. In a few cases, however, due to narrowness of the mineralized zone, no sample of suitable size could be collected without moving to some extent along strike. The samples were analyzed for gold and other elements (described in the Geochemistry Section) by the Geoscience Laboratories of the Ontario Geological Survey.

Acknowledgments

J.Perry (Project Geologist, Canadian Nickel Mines Limited) provided access data for the Esther Township occurrence; C. McAlpine (President, Murgold Resources Incorporated) contributed company data; D. Lebenin (Surveyor), R. Hill and D. O'Suillebhain (Geologists, Chesbar Resources Incorporate) helped the author in Chester Township, and so did J. Millard and M. Rosatelli (Geologists, Muscocho Explorations Limited) in Osway Township. The assistance received from all these people is gratefully acknowledged.

DESCRIPTION OF OCCURRENCES

Regional Geological Setting

Part of northern Esther Township, and all but the southwestern third of Osway township, are underlain by Archean supracrustal rocks deformed by an ESE-trending synclinorium, which is relatively well-preserved as far east as central Yeo Township (Siragusa 1993).

The outer limbs of the synclinorium consist of tholeiitic metabasalt, which hosts the occurrence in Esther Township. The core of the synclinorium comprises younger calc-alkaline metavolcanic and clastic metasedimentary rocks. The Osway Township occurrence is at the contact of metasedimentary rocks with a rock which Moorhouse (1951) named Jerome Porphyry, and ascribed to the Algoman.

East of Yeo Township the synclinorium is disrupted by a granitic pluton underlying most of Chester Township. The remnant of the southern limb of the synclinorium comprises a SE-trending migmatitic zone underlying part of southwestern Chester Township. The remnant of the northern limb of the structure consists of an east-trending belt of greenschist-rank metavolcanic rocks extending along the northern boundary of Chester Township. The Chester Township occurrence is hosted by dominantly mafic migmatized rocks that are marginal to the granitic pluton, and are situated about 1500 m south of the greenschist-rank metavolcanic belt.

Esther Township Occurrence

Shaft Zone

The outstanding features readily apparent in the field are the arcuate outcrop pattern of the gossans (Figure 2), and their unusually sharp boundaries. The gossans are essentially of two types: 1) associated with curviplanar quartz veins (sample locations 3, 4, 5, 10, 13, 15, 16, 17, 24); and 2) associated with carbonatized basalt in which no quartz veins are present (sample locations 1, 2, 11, 12, 14).

Silicification (i.e. silica deposition) is of both discrete and pervasive replacement type. The former resulted in traceable quartz veins, while the latter resulted in variably pronounced hardening of the basalt adjacent to quartz veins. In the legend of Figure 2, the adverbs "locally" and "pervasively" are used with reference to pervasive silicification, meaning that, relative to a gossan as a whole, the silicification is local, whereas relative to each area of hardened basalt, it is pervasive.

The carbonatized basalt affected by the gossan shown by a square pattern in Figure 2 (sample locations 18 to 23 included) is unusually soft and crumbly. The intense weathering at this locality is attributable to the presence of severe (paper-thin) shearing, combined with relatively high topographic relief.

The gossans consist of pyrite, pyrrhotite, and arsenopyrite, in about this order of decreasing abundance, locally associated with iron hydroxides (limonite, goethite). In carbonatized basalt, the sulphides occur mainly as fine-grained, pyritic disseminations. In the quartz veins, they are present as disseminations, discontinuous trains of euhedral pyrite crystals up to a few millimetres in size, and massive, fine-grained, pyrite-arsenopyrite stringers which are up to decimetre-size in width, and metre-size in length. As shown by the inset in Figure 2, most anomalous [1] gold values, and all the larger anomalous gold values, occur in the quartz veins [2]

Visibly unmineralized and unaltered basalt (control sample No. 25) is a foliated, fine-grained rock of uniform medium green colour on both the weathered surface and the fresh cut. It consists of weakly dichroic chlorite, and lesser plagioclase, accessory carbonates, quartz, pyrite, pyrrhotite, and epidote, and a rare opaque mineral which is probably leucoxene (i.e. white, porcelain-like lustre in reflected light). Chlorite and plagioclase occur primarily as components of felty aggregates showing preferred orientation. The carbonates, where present, form microcrystalline aggregates of interlocking crystals averaging about 0.03 mm in size.

Moderately carbonatized basalt (sample No.8) is a light grey, fine- to medium-grained, rock weathering to tan-brownish hues. It consists of fine-grained carbonates, which form an estimated 30 to 35 percent of the rock in volume, and subordinate chlorite (non dichroic), and altered plagioclase. The accessory minerals are similar to those in unaltered basalt (see above), except that leucoxene is more frequent. The carbonates are ubiquitous as cryptocrystalline groundmass, microcrystalline aggregates interstitial to plagioclase relics, and alteration products of the latter. In strongly foliated and fissile basalt, however, carbonatization is yet more extensive, and carbonates

---

(1) For reasons explained in the Geochemistry Section, the term "anomalous", as used in reference to gold, means a concentration greater than 40 ppb.

(2) A composite sample of quartz from the shaft dump (location 6) was also anomalous in gold, whereas a composite sample of carbonatized basalt from the same dump (location 7), was not.

account for virtually the entire volume of the rock (sample locations 11,12,14). Carbonate minerals form a groundmass which is dominantly cryptocrystalline, and is variably textured by ovoid quartz grains, laminar aggregates of penninite, and opaques. The ovoid quartz grains tend to be relatively large, very fresh-looking, and seldom strained (undulatory extinction), such features being consistent with silica release during carbonatization of the basalt.

The crumbly carbonatized basalt that could be thin sectioned (sample locations 19, 21) consists of a cloudy groundmass which is mainly of reddish-brown colour (limonite). Apart from ovoid quartz grains, abundant leucoxene, and little pyrite, no other minerals could be identified in this rock.

The basalt is affected by two cleavages. The first (S1) defines east-trending folds which plunge westward at shallow angles, and register relatively moderate strain. As the auriferous quartz veins are concordant with S1, they tend to have variably sinuous or crescent-shaped outlines. The second cleavage (S2) trends 85^{o} to 100^{o}, and registers relatively strong strain resulted in axial planar shearing. It is regarded by the author as a structurally unfavourable element, as it offsets or truncates S1 and the auriferous quartz veins associated with it.

East Zone

The East Zone is linear, much narrower than the Shaft Zone, and is structurally characterized by a stronger development of S2. Although Figure 3 shows only part of the zone, the features illustrated are typical of its entire length. Drawn-out folds of mineralized quartz, or remnants of them, are exposed in parts of the zone (notably between lines 10450E and 10500E, about 20 m north of line 9900N), but folds with measurable plunge are rare. Drag folds in metasediments close to line 10400E plunge eastward at uncertain angle, a subhorizontal to shallow eastward plunge being also present in the sampled outcrop (locations 27, 28, 29). Incipient transposition of bedding occurs in a small outcrop of metasedimentary rocks at the southern edge of the clearing, an estimated 137 m from its western tip (outside Figure 3). Attenuation and partial obliteration of fold limbs are well illustrated by this outcrop.

As shown by the inset in Figure 3, anomalous gold values occur in quartz (location 28), or at the contact of quartz with carbonatized basalt (location 27). Within a very short distance on either side of the quartz, however, the gold values become very small (i.e. 3 ppb at location 26, and 14 ppb at location 29).

Chester Township Occurrence

The lithologic host of this occurrence has been described as "gabbro-diorite", or "gabbro-diorite complex" (Murgold Resources Incorporated, company files). This mafic complex is within granitic rocks exposed north, west, and south of the Arethusa Lake (Siragusa 1981, unit 6), and was traced southeast of the lake area (ibid., unit 5). In the western part of the decline (Figure 6) the gabbro-diorite complex is intruded by leucocratic granite showing sharp to gradational contact relationships. The eastern end of the decline is dominated by a granitic rock which is characterized by inclusions of translucent bluish quartz, and has been referred to as "Quartz-Eye Granodiorite" (Murgold Resources Incorporated, company files).

The mineralization consists of pyrrothite- and chalcopyrite-bearing, auriferous quartz veins that are hosted by relatively straight, (shear) fractures or fracture-systems (Figures 7, 8, 9). The decline is centered on the best known of these systems - the 110°-trending "No. 3 Vein System" (Watts et al. 1983) - the western, central, and eastern parts of which were previously described (Siragusa 1993, Occurrences 69, 70).

Relatively undeformed gabbro-diorite (location 35) is a medium-grained green rock locally containing quartz-carbonate veinlets. Weakly dichroic chlorite, and strongly altered (calcic ?) plagioclase phenocrysts up to 0.74 mm in size account, respectively, for an estimated 70 and 25 volume percent of this rock. The accessory minerals comprise quartz, mainly unstrained and interstitial to the relic plagioclase, pyrite, and rare sodic plagioclase (oligoclase), biotite, and zircon. Chlorite occurs in pseudomorphic aggregates of tabular or prismatic habit (possibly after clinopyroxene), indicating that chloritization predated shearing.

Most of the sheared rock (locations 30, 32) consists of a cryptocrystalline matrix comprising chlorite, carbonates, and acicular muscovite microlites up to 0.06 mm in length. While chlorite and carbonates are rather evenly distributed throughout the matrix, the muscovite microlites can be abundant in parts of the matrix and scarce elsewhere (Location 30). The matrix shows strong preferred orientation, and is textured by crystal trains of sulphides, and by large segregations of fresh-looking quartz with rounded or lobate outlines. Differential slip along laminar sections of the groundmass has resulted in perfectly preserved folds with amplitude and wave length of about 0.23 and 0.8 mm, respectively (location 32). The laminar fabric of the rock is cut by carbonate veinlets comprising large interlocking crystals with prominent polysynthetic twinning. The matrix in contact with these veinlets is conspicuously enriched in quartz (locations 30, 32), or quartz and muscovite (location 30), with marked decrease in the grain size of quartz with increasing distance from the veinlet (Location 30).

The microscopic features just described are interpreted by suggesting that :1) chloritization is likely to have pre-dated and accompanied the development of localized shearing; 2) shearing was, at least locally, accompanied by potassium metasomatism (muscovite), and; 3) carbonatization pre-dated, accompanied, and continued after shearing. The continuation of carbonatization after completion of shearing is also indicated by post-vein carbonate rhombohedra which are up to a 12 cm in size, and were noted on the back of the east drift at the 200-foot level (location 42). An assay of these crystals, incidentally, yielded 17 ppb Au.

Osway Township Occurrence

The ore of this mine has been described as "blue quartz" (Brown 1948) or "bluish-black cherty quartz" (Moorhouse 1951), also known as "Heavy Blue" at the mine site. The Jerome Porphyry and the "Heavy Blue" are henceforth referred to as porphyry and ore, respectively.

The porphyry and ore are affected by two sets of faults described in detail by Brown (1948). In addition, the porphyry is foliated and, together with the metasedimentary rocks enclosing it, is offset by a major NNE-trending sinistral fault situated 1370 m feet east of the mine (Siragusa 1980). The porphyry has been ascribed to the Algoman (Moorhouse 1951), but the structural conditions just mentioned indicate that it is of older age.

Good surface exposures of the porphyry are scarce, but excellent exposures are found at two localities. One is on the east shore of Opeepeesway Lake, 457 m north of the narrows. The other is the small island 1160 m N and 366 m west of the narrows. (Old drill collars were noted on this island). The porphyry exposed at these localities, as well as at the 200-foot level of the mine (Figure 11, location 52), has a characteristic red-purplish colour and fine-grained or aphanitic texture. Scarcity of quartz, small chloritic inclusions, and specularite aggregates up to 5 cm in size, are typical of this rock. In surface exposures close to metasediments, the porphyry is mainly of grey colour, and metasedimentary fragments up to 15 or 20 cm in size few inches in size can be found within it (e.g. at the tip of the north-pointing larger promontory approximately 450 m east of the mine). Sheared porphyry adjacent to the ore is also grey, weakly mottled by reddish hues (location 50).

The porphyry outcrop on the small island and the east shore of Opeepeesway Lake contains randomly oriented phenocrysts of altered plagioclase up to 9 mm in size. These are embedded in a microcrystalline matrix comprising chlorite, carbonates, microcline, quartz, pyrite, hematite, and a few unidentified high-relief relics (clinopyroxene ?). Chlorite is the principal component of the matrix. Porphyry not far from the ore (location

52) consists almost entirely of carbonates containing a few large relics of former feldspar phenocrysts. The carbonates occur as fine-grained groundmass, and as veinlets containing interlocking crystals of slightly larger size. Essentially unstrained quartz, with angular to almost perfectly rounded outlines, and up to 0.5 mm in size, is scattered throughout the carbonates. Close to the ore (location 51), the habit of quartz changes to streamlined aggregates of equant microlites occuring, almost exclusively, at the margins of carbonate veinlets.

At the sampled locality at the 200-foot level, the ore is a hard, dark blue, aphanitic rock which fractures in jagged splinters. Except for rare pyrite specks, it contains no visible mineralization. It occurs as a solid vein (location 49), and as abundant inclusions in a matrix of white replacement quartz containing a little carbonate. An estimated 70 volume percent of the (vein type) rock consists of equant or rounded quartz microlites that are mainly between 0.024 and 0.040 mm in size. Irregularly shaped and coarse-grained quartz-carbonate aggregates, finer grained quartz-carbonate veinlets, large tabular or prismatic relics (unidentified), and accessory pyrite, account for the balance.

The features described above indicate that the ore is porphyry containing abundant microcrystalline quartz, and that carbonatization of the porphyry increases conspicuously with decreasing distance from the ore.

GEOCHEMISTRY

Introduction

Control Samples

Control samples, used for comparative purposes, were collected at the surface (Esther Township occurrence), and underground (Chester and Osway Townships occurrences). The surface exposure was such that the control sample is representative of unaltered and unmineralized rock. The underground control samples, however, should more realistically be regarded as representative of the (visibly) least altered and/or least mineralized rock. This is an obvious constraint imposed by the comparative narrowness of the underground exposures (drifts).

Analyses, Detection Limits, Bias

All of the 52 samples were analyzed for the 18 elements Be, Sc, V, Cr, Co, Ni, Cu, Zn, As, Rb, Sr, Y, Zr, Mo, Ta, Au, Pb, and Th. Readers interested in the assay data "as is" are referred to Appendix A (gold), and Appendix B (other elements). A few samples from the Esther Township Occurrence, were also analyzed for major elements and rare earths (REE).

In the descriptions of the occurrences, reference is made to the detection limits of certain elements. For sake of brevity, these are indicated only once by the bracketed concentrations (ppm) in the following list: Be(1), Cr(10), Ni(5), Mo(10), Ta(10), Pb(10), Th(10).

Where bias (i.e. the introduction of arbitrary numerical values) was unavoidable for purpose of statistical calculations, the bias was set at half the value of the detection limit. This value was chosen for the reason illustrated by the following example. As in 9 (out of 29) samples from the Esther Township Occurrence nickel was below detection limit (5 ppm), the nickel concentration in these 9 samples may have any value in the range of 0 to (almost) 5 ppm. Now assume that, in order to calculate the mean nickel content of the 29 samples, the nickel content of the 9 samples is arbitrarily set either at 0 ppm, or at 5 ppm. In the first case, the maximum possible error is an underestimate of about 5 ppm, and in the second case, the maximum possible error is an overestimate of the same magnitude. If the nickel content of the 9 samples is set at half of the detection value, however, the maximum possible error, in excess or defect, reduces to about 2.5 ppm

Anomalous Gold Values

The insets in Figures 2,3,7,8,9 and 11 show which samples yielded anomalously high gold values and, for samples analyzed more than once, the range of values thus obtained (for a complete set of gold assay data, see Appendix A). The term "anomalous", used here with reference to gold, means "greater than 40 ppb", such definition being justified by the following considerations. Study of (of 106 analyses) of gossans - which occur in the northern Hemlo belt, are far from the orebodies, and are hosted by metavolcanic, metasedimentary, and intrusive rocks (Siragusa 1985) - led the author to suggest that 40 ppb could represent a natural "dividing line" between: 1) lower values reflecting a dispersion of primary, or largely primary, nature, and; 2) higher values which could reflect localized concentrations of possible economic merit. This criterion is not demonstrably applicable to the Swayze belt, but in lack of more ehaustive data, it is assumed to be an acceptable term of reference for the Swayze study.

Geochemical Description of Occurrences

Esther Township Occurrence

Major element and REE trends with increasing carbonatization.

Major elements

The general character and microscopic features of unaltered basalt (control sample 25), moderately carbonatized basalt (sample 8), and strongly carbonatized basalt (sample 11), were previously described (see Description of Occurrences Section; Esther Township Subsection; Shaft Zone). The chemical changes from unaltered, through moderately carbonatized, to strongly carbonatized basalt, are illustrated in Table 1. The parameter V (for variation) is added to simplify comparison. For instance, the weight percent of CO_2 in unaltered, moderately carbonatized, and strongly carbonatized basalt, is 0.41, 4.29, and 9.88, respectively. Thus, relative to unaltered basalt, the weight percent of CO_2 increases by 3.88 in moderately carbonatized basalt, and by 9.47 in strongly carbonatized basalt. The parameter V is positive or negative depending on whether the difference is an increase (enrichment), or a dicrease (depletion).

<u>Table 1</u> : Major element composition (weight percent) of unaltered basalt (UNB), moderately carbonatized basalt (MCB), and strongly carbonatized basalt (SCB); Esther Township Occurrence. Table explained in text. (Sample locations in Figure 2).

Sample No.	25	8		11	
Lithology	UNB	MCB		SCB	
			---V---		---V---
SiO_2	50.40	47.90	(- 2.50)	45.20	(- 5.20)
Al_2O_3	12.90	14.80	(+ 1.90)	13.00	(+ 0.10)
Fe_2O_3	3.20	1.10	(- 2.10)	1.90	(- 1.30)
FeO	12.80	9.58	(- 3.22)	9.38	(- 3.42)
MgO	5.39	5.75	(+ 0.36)	5.13	(- 0.26)
CaO	6.11	7.27	(+ 1.16)	7.28	(+ 1.17)
Na_2O	3.13	3.24	(+ 0.11)	1.87	(- 1.26)
K_2O	0.03	0.00	(- 0.03)	1.05	(+ 1.02)
TiO_2	1.40	0.81	(- 0.59)	0.74	(- 0.66)
P_2O_5	0.13	0.06	(- 0.07)	0.04	(- 0.09)
MNO	0.22	0.17	(- 0.05)	0.20	(- 0.02)
CO_2	0.41	4.29	(+ 3.88)	9.88	(+ 9.47)
S	0.14	0.02	(- 0.12)	0.07	(- 0.07)
H_2O+	3.75	4.62	(+ 0.87)	3.62	(- 0.13)
H_2O-	0.12	0.11	(- 0.01)	0.22	(+ 0.10)
Totals	100.13	99.72		99.58	
L.O.I.	2.6	8.3		11.9	
Sp.Gr.	2.99	2.78		2.70	

The main features shown by data in Table 1 is that, relative to unaltered basalt, the strongly carbonatized basalt is: 1) depleted in Si, Fe, Na, Ti, P, and Mn, in this order of decreasing magnitude, and; 2) enriched in Ca and K, also in order of decreasing magnitude. The variations in aluminum and magnesium appear to be too small to be significant.

Note that pronounced desilication of the basalt is associated with increasing carbonatization, this being consistent with the silica release indicated by the (previously described) microscopic evidence.

It is also evident that the greater the CO_2 content - and the loss on ignition (L.O.I.) - of the rock, the smaller is the density of the latter. The CO_2/density relationship is illustrated by the graph in Figure 4 obtained from the data of samples 25, 8, and 11 in Table 1. If further drilling were to be carried out in the area of the Esther Township occurrence, this relationship can assist in assessing consistently the extent of carbonatization in drill cores, provided that the rock is carbonatized tholeiitic basalt, and that it contains no graphite. For example, if carbonatization affects the core of numerous drill holes, it may be difficult to decide which hole intersected stronger carbonatization. The density of core samples can readily be measured in the field, and the core where lower density values are most frequent, is likely to be the most carbonatized.

Rare Earth Elements (REE)

The normalized plots in Figure 5, derived from the analytical data in Appendix C, illustrate the REE trend with increasing carbonatization. The basalt represented by plot 8 has an estimated carbonate content of about 30 percent by volume. As the the plot of this rock is essentially parallel to that of unaltered basalt (plot 25), it is clear that up to approximately such extent of carbonatization, all the lanthanides are depleted at a similar rate. With increasing carbonatization, however, the lantanides heavier than samarium continue to be differentially depleted, but those ligther than samarium remain remarkably unchanged.

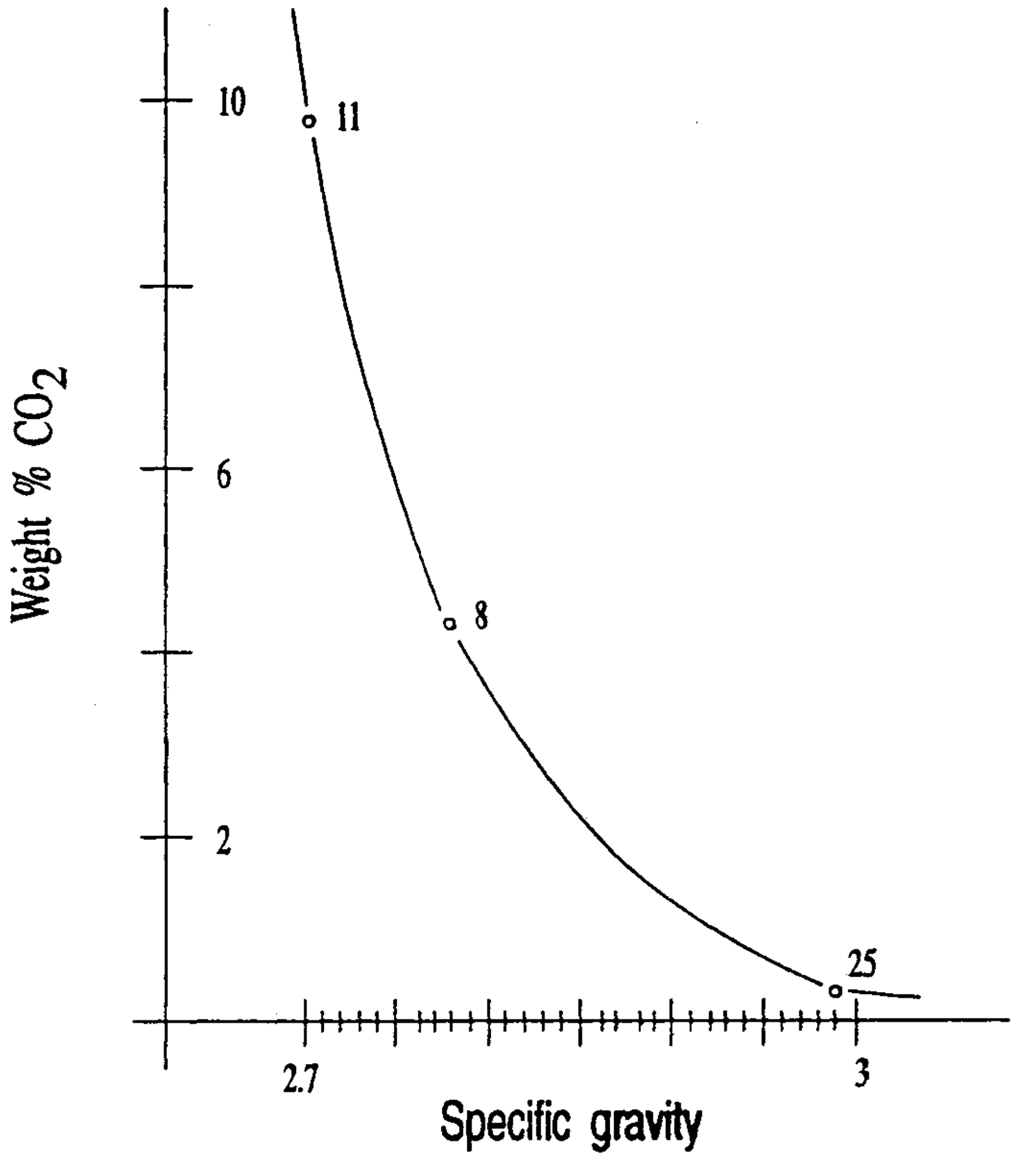


FIGURE 4

Esther Twp. Occurrence: Density loss with increasing carbonatization (Data from table 1; sample locations in figure2)

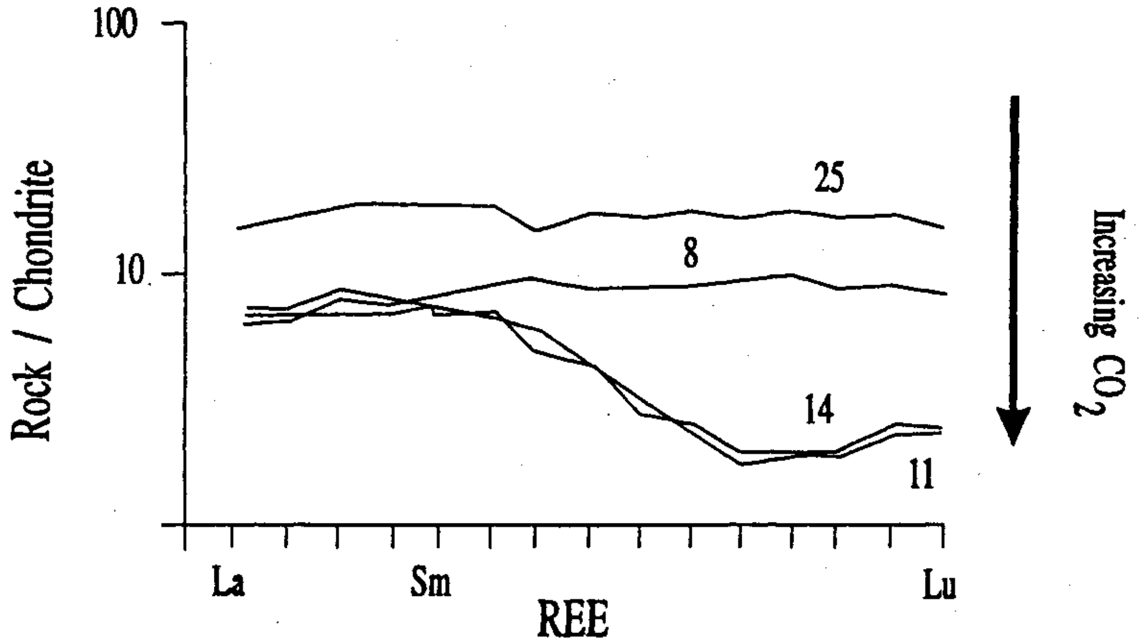


FIGURE 5

Esther Twp. Occurrence: Chondrite normalized plots of unaltered basalt (25) carbonatized basalt (8), and strongly carbonatized basalt (11,14); data from appendix c (sample locations in figure 2)

Minor Elements

Beryllium, Cr, Mo, Ta, Pb, and Th were below detection limits in most of the analyses, and close to detection limits in a few of them. These elements will not be discussed any further.

Data on other minor elements are summarized in Table 2. The first column on the left side of the table lists 11 elements in order of increasing atomic weight, and the second column shows their concentrations in the control sample of unaltered and unmineralized basalt from location 25 (Figure 2).

The third column of Table 2 is a statistical summary of data obtained from 16 samples of variably carbonatized basalt (VCB) collected at locations 1, 2, 7, 8, 9, 11, 12, 14, 18, 19, 20, 21, 22, 23 (Figure 2), 26, and 29 (Figure 3). The mean concentration and standard deviation of each element in the carbonatized samples are indicated by m and s, respectively. The parameter d - added to simplify comparison of the data in columns 2 with those in column 3 - expresses the percentage difference between the mean concentration, and the concentration in the control sample. This parameter is negative or positive depending on whether the difference is a relative increase (enrichment), or a decrease (depletion). Cobalt, for example, has a concentration of 47 ppm in the control sample, and a mean concentration of 43 ppm in carbonatized basalt. Thus, in carbonatized basalt, the mean concentration of cobalt is 8 percent less than in unaltered basalt (i.e. 47 - 8% = 43).

The fourth column of Table 2 is a statistical summary of data obtained from 11 samples of auriferous quartz veins collected at locations 3, 4, 5, 6, 13, 15, 16, 17, 24 (Figure 2), 27, and 28 (Figure 3). No d parameter is shown in this column, as no control sample could be found for the quartz. That is, out of (a total of) 12 quartz veins that were analyzed, only one did not yield anomalous gold (see sample location 10 in Figure 2, and Appendix A).

The data in Table 2 show that, relative to unaltered basalt, carbonatized basalt is: 1) enriched in arsenic, rubidium, vanadium, copper, and zinc, in order of decreasing magnitude, and; 2) depleted in yttrium, zirconium, nickel, strontium, cobalt, and scandium, also in order of decreasing magnitude. For sake of brevity, the elements in the first group are henceforth referred to as "enriched", those in the second group as "depleted", and the sentence "relative to unaltered basalt" is omitted.

Enriched Elements

The conspicuous As enrichment in carbonatized basalt is attributable to some high values which, being erratic, result in poor data-grouping and, hence, in a standard deviation which is about three times larger than the mean. Quite possibly,

<u>Table 2</u> : Minor element concentrations (ppm), in unaltered basalt (UNB), variably carbonatize basalt (VCB), and quartz veins (QTZ); Esther Township Occurrence. Table explained in text. (Decimal figures approximated to closest integer; asterisk indicates calculation biased as explained in the Introduction; m = mean; s = standard deviation; d = percentage difference).

	UNB	VCB (N=16)	QTZ (N=11)
Sc	49	m = 47 s = 10 d = - 4%	m = 29 s = 11
V	280	m = 487 s = 320 d = + 74%	m = 149 s = 121
Ni	34	m = 29(*) s = 14 d = - 14%	m = 9 s = 11
Co	47	m = 43 s = 11 d = - 8%	m = 34 s = 15
Cu	99	m = 150 s = 68 d = + 52%	m = 141 s = 154
Zn	81	m = 85 s = 23 d = + 5%	m = 28 s = 25
As	3	m = 3381 s = 11429 d = + 112602%	m = 33157 s = 28401
Rb	7	m = 24 s = 15 d = + 243%	m = 34 s = 20
Sr	68	m = 60 s = 19 d = - 12%	m = 60 s = 18
Y	34	m = 25 s = 18 d = - 27%	m = 31 s = 21
Zr	114	m = 88 s = 43 d = - 23%	m = 92 s = 60

this could reflect the (unavoidable) presence of minor arsenopyrite in the carbonatized basalt. In the auriferous quartz veins, however, the mean concentration of arsenic is about 10 times larger than in carbonatized basalt and, in addition, the standard deviation is slightly smaller than the mean. Thus, although arsenic is erratically high in carbonatized basalt, it is more abundant and more uniformily distributed, in the auriferous quartz veins. At a smaller scale, a similar behavior is shown by rubidium which is enriched in carbonatized basalt, but is more abundant and slightly more uniformily distributed, in the quartz veins. The higher concentrations and more uniform distributions of arsenic and rubidium, therefore, characterize the silicification which resulted in the present auriferous quartz veins. The higher concentrations and more uniform distributions of vanadium, copper, and zinc, instead, are primarily indicative of the carbonatization (of basalt) which preceded or occompanied such silicification.

Depleted Elements

The depleted elements fall into two groups. The first includes relatively light elements comprising scandium, cobalt, and nickel. These elements: 1) show small (Sc, Co) to moderate (Ni) depletion in carbonatized basalt, and; 2) have the lowest concentrations in the auriferous quartz veins.

The second group includes the heavier elements strontium, yttrium, and zirconium. These elements: 1) show moderate (Sr) to pronounced (Y) depletion in carbonatized basalt, and; 2) have similar concentrations in carbonatized basalt and auriferous quartz veins. Strontium is particularly noticeable in this respect, as it shows virtually identical concentrations and standard deviations in both lithologies.

Interpretive Synthesis

The gold of this occurrence is hosted by curviplanar, arsenopyrite-bearing quartz veins that are concordant with east-trending folds with shallow westward plunge (S1). These folds affect variably carbonatized basalt, and are locally offset by axial plane shearing (S2). Chemical data, consistent with microscopic observations, indicate that the carbonatization of basalt was accompanied by desilication which resulted in silica release of up to 5 weight percent. Carbonatization did also result in density loss, and differential REE depletion in the basalt, both these features being of interest as they provide methods for consistent evaluation of the intensity of carbonatization.

Lack of field evidence that carbonatization preceded S1 or postdated S2, leads to the interpretive constraint that carbonatization (continuous or intermittent) occurred during the deformation that resulted in S1 and S2. In addition, as the density loss in carbonatized basalt implies volumetric adjustment between this rock and unaltered basalt, carbonatization - ever since it began - is likely to have variably affected or intensified the development of progressive, localized deformation.

The close spatial relationship of auriferous quartz veins, and desilicated carbonatized basalt, is interpreted by suggesting that the migration of silica from intensely to less carbonatized rock was probably the hydrothermal "fine comb" by which gold was concentrated along dilatant segments of S1. As such process may have occurred only during deformation (see above constraint), it reflects the complex interaction of carbonatization and deformation. In synthesis, this interaction appears to have been such that: a) where carbonatization was strong, the basalt reacted preferentially by shearing and silica was released, whereas; b) silica may - even simultaneously - have concentrated along dilatant segments of S1, where carbonatization was less intense, and the rock reacted dominantly by folding. The carbonatized basalt, therefore, is regarded by the author as the probable source of the silica presently found in the auriferous quartz veins. If such interpretation is valid, then the mineralization of this occurrence is not due to a deep-seated (i.e. mantle-resident) source, but to localized concentration of gold formerly dispersed through a larger volume of basalt.

Recommendations

The reported decrease in gold values east of the Shaft Zone (see Previuos Work Subsection) is consistent with the fact that the East Zone is structurally characterized by the dominance of axial plane shearing. This shearing is regarded by the author as a negative feature, as it could have resulted in dispersion of gold over a relatively long distance.

If further exploration were to be carried out in the area of this occurrence, one may consider drill-testing of the folds which could extend at depth, west of the Shaft Zone. Based on the present structural data, these are characterized by E to ENE trend, pronounced tightness (indicated by dips of 65° to 80° in asymmetric synformal limbs), and westward plunge of 26° to 30°. Drilling along strike, and west of, the Shaft Zone, with an eastward dip of about 62°, would minimize the length of holes aimed at testing these shallow-plunging folds. If more than one hole were drilled, and difficulties were experienced in ascertaining in which direction carbonatization increases (or decreases), one may want to consider the previously mentioned density-loss method. It should be noted, however, that if the intersected rock is not basalt, or the rock is basalt but contains graphite, then said method in not applicable.

Chester Township Occurrence

Minor Elements

The analyses of the samples from this occurrence were aimed at investigating the minor element distribution in the auriferous quartz veins, their wall rocks, and the control samples. As previously noted, "control sample" means, in this case, the visibly least mineralized or altered sample collected, as far as possible, from the auriferous quartz.

Beryllium, Mo, Ta, and Th were below detection limit in most of the analyses, and close to or above, detection limit in very few of them; lead was below detection limit in all the samples, except 30, 31, 32, and 33 (400-foot level) which yielded 235, 53, 13, and 61 ppm Pb, respectively. None of these elements will be discussed any further.

The present data on trace elements, and the variables relevant to their distribution, are such that considerable complexity would result if one were to summarize them all at once. Hence, the data presentation is split in two steps conceptually equivalent to "Source" (Table 3), and "Results" (Table 4).

Table 3 shows how the data were grouped in order to summarize them in Table 4. For example, Table 3 shows that the control samples at the 150-, 200-, and 400-foot levels are samples 43, 41, and 35 (Figures 7,8,9). The mean scandium concentration in these 3 samples is 16 ppm, and thus 16 ppm is the Control Value shown for scandium in Table 4. Similarly, Table 3 shows that the wall rock samples at the 150-, 200-, and 400-foot levels are the 3 sets [46, 44], [36, 37, 39, 40], and [30, 31, 33, 34]; Table 4 shows that the mean scandium concentrations in these 3 sets of samples are 12, 6, and 19 ppm. (The sample sizes and standard deviations are not shown in Table 4 so as to keep the table as simple as possible). Finally, Table 3 shows that the ore samples at the 150-, 200-, and 400 foot levels are 45, 38, and 32, and Table 4 shows that they yielded 6, 2, and 23 ppm scandium, respectively. The same applies to all the other elements listed in Table 4. The symbols (+) and (-) in Table 4, are added to simplify comparison between the Control Value of each element, and its mean concentration in the wall rocks at the indicated level; an increase (erichment) or decrease (depletion) - relative to the Control Value - is indicated by (+) or (-), respectively.

As indicated in Table 3, low gold concentrations occur in the control samples of the 150- and 200-foot levels, as well as in the wall rocks at the 150- and 400-foot levels. It is also evident that, at the sampled locality of 200-foot level, anomalous gold values occur across the entire width of the drift.

Table 3 : Data structure utilized in Table 4; Chester Township Occurrence. Table explained in text.

Control Samples	Wall Rock Samples	Vein Samples
	150-Foot Level	
43 (13 ppb Au)	46 (4 ppb Au) 44 (14 ppb Au)	45
	200-Foot Level	
41 (19 ppb Au)	36 (Anomalous Au) 37 (Anomalous Au) 39 (Anomalous Au) 40 (Anomalous Au)	38
	400-Foot Level	
35 (< 2 ppb Au)	30 (11 ppb Au) 31 (12 ppb Au) 33 (22 ppb Au) 34 (24 ppb Au)	32

Table 4 : Minor element concentrations (ppm) in wall rocks and quartz veins of the Chester Township Occurrence. Table explained in text. (Figures approximated to nearest integer; asterisk indicates calculation biased as explained in the Introduction).

Control	Value	Level	Wall Rock	Vein
Sc	16	150-ft.	12 (-)	6
		200-ft.	6 (-)	2
		400-ft.	19 (+)	23
V	100	150-ft.	70 (-)	24
		200-ft.	60 (-)	5
		400-ft.	134 (+)	161
Cr	49	150-ft.	5 (-) (*)	5 (*)
		200-ft.	5 (-) (*)	10
		400-ft.	85 (+)	119
Co	27	150-ft.	35 (+)	12
		200-ft.	14 (-)	19
		400-ft.	32 (+)	40
Ni	31	150-ft.	2 (-) (*)	2 (*)
		200-ft.	9 (-) (*)	6
		400-ft.	71 (+)	97
Cu	139	150-ft.	189 (+)	1963
		200-ft.	562 (+)	9146
		400-ft.	163 (+)	2300
Zn	85	150-ft.	70 (-)	54
		200-ft.	39 (-)	99
		400-ft.	314 (+)	297
As	2	150-ft.	2	2
		200-ft.	8 (+)	<1
		400-ft.	32 (+)	23
Rb	41	150-ft.	33 (-)	11
		200-ft.	50 (+)	11
		400-ft.	43 (+)	46
Sr	167	150-ft.	217 (+)	73
		200-ft.	71 (-)	14
		400-ft.	87 (-)	41
Y	23	150-ft.	24 (+)	15
		200-ft.	25 (+)	13
		400-ft.	26 (+)	24
Zr	136	150-ft.	72 (-)	43
		200-ft.	159 (+)	12
		400-ft.	92 (-)	88

The three main features revealed by the analytical data in Table 4 are as follows.

1) At the 150- and 200-foot levels, the wall rocks are variably depleted in Sc, V, Cr, Ni, and Zn; Rb is also depleted in the wall rocks at the 150-foot level, the As concentration remaining unchanged.

2) The wall rocks at the 400-foot level, instead, are variably enriched in all these elements, Cr and Ni being particularly significant in this respect. At the 150- and 200-foot levels, Cr and Ni were mainly below detection limits (so that - for purpose of calculations - they were biased at half detection limit), whereas 85 to 119 ppm Cr and 71 to 97 ppm Ni occured at the 400-foot level

3) In the auriferous quartz veins at the 400-foot level, the concentrations of Sc, V, Cr, Co, Ni, Zn, As, Rb, Y, and Zr are clearly higher than they are in the auriferous quartz veins at the 150- and 200-foot levels.

These features indicate that depth controls the distribution of most of the analyzed minor elemnts in the wall rocks (items 1 and 2), as well as in the auriferous quartz veins (item 3).

It is also apparent that where certain elements are depleted in the wall rocks, such elements are relatively scarce in the auriferous quartz veins, and vice versa. At the 150-foot level, for example, the wall rocks are depleted in Sc, V, Cr, Ni, and Zn and the concentrations of these elements in the auriferous quartz are 6, 24, 5, 2, and 54 ppm, respectively; at the 400-foot level, the wall rocks are enriched in Sc, V, Cr, Ni, and Zn, and the concentrations of these elements in the auriferous quartz are 23, 161, 119, 97, and 297 ppm, respectively. Also, based on the Cu and Sr data, it appears that the distribution of minor elements in the auriferous quartz veins not only "parallels" that in the in the wall rocks, but tends to do so rather closely. Thus, the veins with highest Cu occur where the wall rocks are the most enriched in Cu (200-foot level), and the veins with highest Sr occur where the wall rocks are the most enriched in Sr (150-foot level).

Interpretive Synthesis

The mineralization of this occurrence consists of sulphide-bearing auriferous quartz veins which are part of the No. 3 Vein System (see General Geological Setting). These veins occupy discrete segments of subparallel, regional fractures which trend 110°, and affect a mafic complex as well as and the granitic and migmatitic rocks enclosing it. The work done on this occurrence comprised detailed mapping and sampling at 3 levels of the decline by which the No 3 Vein System was being explored when the author visited the occurrence (1988).

The results of this work indicate that most of the minor elements which are depleted in the wall rocks at the 150- and 200-foot levels, are enriched in the wall rocks at the 400-foot level , this trend being mirrored by the relative abundances of such elements in the auriferous quartz veins themselves. The distribution of minor elements in the auriferous quartz veins and their wall rocks, therefore, is controlled by depth

As interpreted by the author, the depth-controlled distribution of minor elements is attributable to only two possible conditions. One is that the "gabbro-diorite complex" is a relatively large, irregularly shaped, gabbroic or basaltic xenolith variably assimilated by the granitic neosome in the upper levels of the decline (e.g. agmatite occurs at the portal of the decline). The other, less likely, possibility is that the distribution of minor elements reflects the presence of (relic) intrusive layering in a gabbroic intrusion (see Ni and Cr distributions). As both these conditions are of lithological - not structural - nature, it follows that lithology is bound to have affected the distribution of minor elements, gold included. The characteristic structural trend of the the No. 3 Vein System (110°), therefore, may not be the only important element controlling the distribution of gold in the area of this occurrence.

Recommendations

The "gabbro-diorite complex" comprises "...various phases which grade into one another without well-defined contacts. They range from medium to dark green in colour, from fine- to coarse-grained in texture, and from massive to schistose in structure. Some of the fine-grained chlorite phases resemble basalts [which are]...distributed in an irregular manner throughout the gabbroic phases and it is assumed that they are part of the gabbro-diorite complex." (Watts et al. 1983, p. 22).

Based on the present data, the combination of lithologic and structural features regarded by the author as most favourable, consists of the dominantly mafic lithology quoted above, and the presence of silicified, ESE-trending, shear fractures. Such fractures extend to areas west and east of Arethusa Lake, but these areas are regarded by the author as less attractive as their lithologies are dominantly granitic (i.e. leucocratic granitic phases westward, and "Quartz Eye Granodiorite" eastward).

Due to scarcity of outcrops when the author mapped Chester Township (1980), the geological boundary of the "gabbro-diorite complex" were largely iterpretive. If further exploration were to be considered in the area of this occurrence, it is advisable to compile data that may have accrued since then (geological and geophysical mapping, stripping, drilling), and integrate them with detailed mapping if warranted by new exposures. The objective of this approach is to define the extent and boundaries of the mafic complex as accurately as possible. If new occurrences of ESE-trending shear fractures are found within the mafic complex, they should be to drill-tested even if they are of incipient nature, or show little silicification.

Osway Township Occurrence

Due primarily to safety reasons, the eastern drift at 200-foot level (Figure 10) was the only part of the Jerome Mine that could be visited. Because of this, and of difficulties inherent to the conditions of the drift (e.g. timbered drift back), the author's work was mainly confined to investigating the nature of the ore, and its relationship with the Jerome Porphyry. The ore of this mine has unusual colour and physical characteristics, and may contain high gold values even where no (traces of) sulphides are present. This ore, referred to as "Heavy Blue" by company personnel, has been described as "bluish-coloured cherty replacement silica" (Brown 1948), or "blue-grey to black cherty quartz" (Moorhouse 1951).

Major Elements

Two analyses of the porphyry, and one analysis of the vein-type ore are shown in Table 5. The parameter d, added to simplify comparison of wall rock and ore, is positive or negative depending on whether the ore is enriched or depleted of an oxide. For example, relative to the wall rock (location 51), the ore (location 49) contains 18.50 percent more silica and thus, for this oxide, d = + 18.50.

Table 5: Major element compositions (weight percent) of porphyry and ore; Osway Township Occurrence. Table explained in text. (Locations in Figure 11).

	Red Porphyry (Loc.52)	Gray Porphyry (Loc.51)	Ore (Loc.49)	----d----
SiO_2	58.60	58.40	76.90	(+18.50)
Al_2O_3	13.70	13.90	2.98	(-10.92)
Fe_2O_3	2.77	1.68	0.88	(- 0.80)
FeO	2.20	3.13	0.80	(- 2.33)
MgO	2.85	2.97	2.62	(- 0.35)
CaO	4.50	3.82	4.87	(+ 1.05)
Na_2O	2.93	3.34	0.00	(- 3.34)
K_2O	3.82	4.16	1.20	(- 2.96)
TiO_2	0.45	0.47	0.07	(- 0.40)
P_2O_5	0.24	0.22	0.03	(- 0.19)
MnO	0.05	0.05	0.02	(- 0.03)
CO_2	5.78	5.21	7.28	(+ 2.07)
S	0.19	0.18	0.96	(+ 0.78)
H_2O +	1.34	1.34	0.34	(- 1.00)
H_2O -	0.00	0.05	0.06	(+ 0.01)
Totals	99.42	98.92	99.01	
L.O.I.	7.20	6.30	7.00	
S.G.	2.78	2.76	2.72	

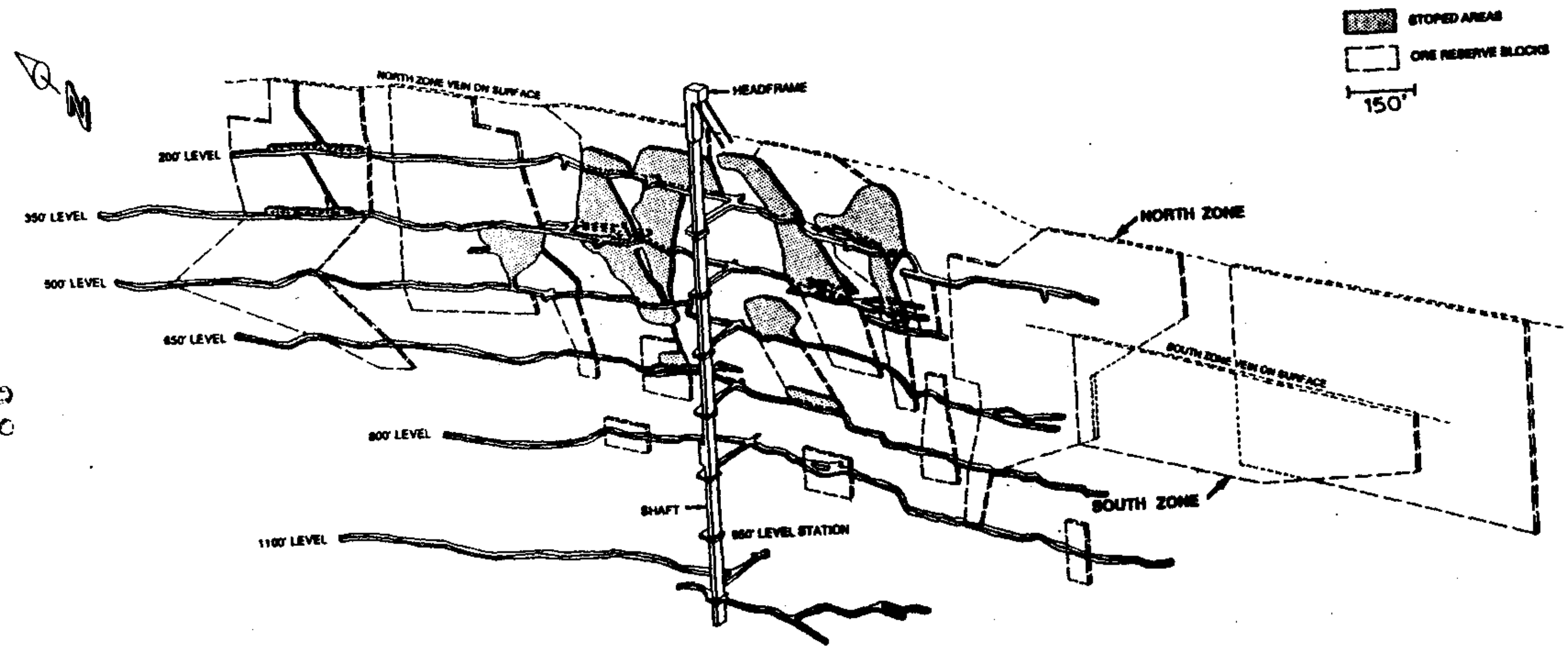


Figure 10:

Osway Twp.occurrence; Jerome Mine isometric (contributed by Jerome Gold Mines Corporaton, june 1988; approximate scale added by author)

As the red and grey porphyries differ in the degree of carbonatization, they were analyzed to define such difference in chemical terms. The data in Table 5 confirm that the red porphyry contains more Ca, CO_2, and Fe_2O_3. Apart from this, however, the two compositions are remarkably similar. The high alkalies are consistent with previous (surface) data indicating that - relative to (any composition in) the tholeiitic and calc-alkaline suites of the southern Swayze belt - the Jerome Porphyry has the highest contents in total alkalies (Na_2O+K_2O), and in K_2O (Siragusa 1993, Table 4).

The analysis of the ore (location 49) is consistent with the microscopic evidence indicating that the ore is silicified porphyry, not quartz. The main chemical changes associated with this silicification comprise depletion in Al, Na, Fe, and K, and enrichment in Si, and, to a lesser extent, Ca. Potassium, although depleted, is still high, while Mg is largely unaffected.

Both analyses of the porphyry show high CO_2 and S contents which, however, are yet higher in the ore. This is a clear indication that the ore formed where volatiles concentrated at the contact of porphyry and metasediments.

Minor elements

Table 6 shows the minor element concentrations in the same three samples of Table 5 (Ta and Th are not shown as they were below detection limits in all three samples). The parameter v (for variation) is added to simplify comparison of the ore (location 49) with the carbonatized porphyry in the wall rock (location 51). Relative to the wall rock, for instance, the ore contains 100 percent more Be, and 69.23 percent less Sc.

Table 6: Minor element concentrations (ppm) in porphyry and ore; Osway Township Occurrence. Table explained in text. (Locations in Figure 11)

	Red Porphyry (Loc.52)	Gray Porphyry (Loc.51)	Ore (Loc.49)	----v----
Be	2	1	2	(+ 100.00)
Sc	13	13	4	(- 69.23)
V	101	104	265	(+ 154.80)
Cr	104	108	48	(- 55.55)
Co	18	24	9	(- 62.50)
Cu	96	117	68	(- 41.88)
Zn	25	46	16	(- 65.21)
As	17	16	44	(+ 175.00)
Rb	109	119	30	(- 74.78)
Sr	293	607	173	(- 71.49)
Y	9.2	9	8	(- 12.08)
Zr	146	162	45	(- 72.22)
Mo	<10	<10	2178	NA
Pb	<10	<10	89	NA

As previously noted, the two samples of porphyry differ in the degree of carbonatization, but otherwise have similar major element compositions. Table 6 shows that the two samples have minor element concentrations that are also similar. These similarities indicate that no process external to the emplacement of the porphyry is likely to be responsible for its carbonatization.

Relative to the porphyry, the ore is depleted in Rb, Zr, Sr, Sc, Zn, Co, Cr, Cu, and Y, in order of decreasing magnitude, and enriched in Mo, Pb, As, and V, also in decreasing order. The anomalous Pb is unlikely to be typical of the ore, as high lead values occur in all the rocks adjacent to a major fault east of the Jerome Mine (Siragusa 1993).

Interpretive Synthesis

The Jerome Porphyry is a carbonatized alkalic intrusion which is most likely of pre-Algoman age, and the ore consists of Mo-,As-, and V-enriched, silicified porphyry, not quartz. The present data indicate that the carbonatization of the porphyry was associated with its emplacement, and that the ore formed where volatiles concentrated at or near contacts of porphyry and metasedimentary rocks. Anomalous lead values occur in the ore, but also in other rocks of the area affected by a major post-vein fault.

The present analyses are consistent with previous chemical and geological data which were obtained from (surface) outcrops of the Jerome Porphyry, and were interpreted by suggesting that its carbonatization is probably deuteric (Siragusa 1993; "Jerome Porphyry and associated Carbonatization"). Such interpretation implies that , in east-central Osway and west-central Huffman Townships, the carbonatization of supracrustal rocks is likely to diagnostic of the proximity to syenite, rather than of anything else.

In addition to being carbonatized, the metasedimentary rocks intruded by the Jerome Porphyry are variably affected by sericitization, silicification, hematization, and albitization, that were described by Moorhouse (1951), and collectively referred to by him as "porphyritization". In relation to gold, however, the feature of greater interest is the presence of the porphyry-"Heavy Blue" system, not the porphyritization of the sediments. Based on the present data, these rocks were important only in so far as they limited or prevented the escape of volatiles emanating from the syenitic magma, the alteration undergone by them being a matter of lesser significance. Conceivably, this may also apply to other supracrustal rocks (e.g. volcanic) that could be in contact with syenite in east-central Osway or west-central Huffman Townships.

Recommendations

The search for additional gold mineralization in east-central Osway and west-central Huffman Township may be equivalent to localization of syenite (Jerome Porphyry) contacts, regardless of which supracrustal rock the syenite is in contact with. Due to the fact that the syenite plunges eastward beneath the Opeepeesway Lake East Arm, however, such contacts can only be found by a succesful combination of geophysical interpretation and drilling. A significant feature, in this context, is the correlation between auriferous alteration zones and low magnetic anomalies (File 63-3937) reported by Bridgeview Resourses Incorporated after completion of work in the mine area (1980-1981). Further east, a similar correlation was reported by Osway Explorations Limited (1982-1983) in two localities of Huffman Township (Siragusa 1993; Occurrences 17 and 18).

An old longitudinal section of the Jerome Mine (Brown 1948) shows that :1) the porphyry plunges eastward at about 30^{o}, and is underlain by a carbonatized zone broadly parallel to the lower boundary of the porphyry, and that; 2) the lower limit of this zone was intersected by the 1100-foot level of the mine, at which level the zone also dips eastward at about 30^{o}. While these data indicate that the porphyry and associated carbonatization may extend significantly eastward, they also indicate that the further east one is from the mine, the greater is the length of surface drilling required to reach the lower porphyry contact. From the data available to the author, however, no systematic testing of this zone has thus far been done, the deep drilling required being possibly a reason.

APPENDIX A

Gold concentrations in the 52 samples collected from the three occurrences. Data emphasized by asterisks are ppm, all others are ppb. Multiple values represent repeated analyses of the same sample. (For sample locations, see Figures 2,3,7,8,9, and 11).

Sample No.	[------------ Au ------------]			
1	26			
2	75	50		
3	520	505		
4	395	405		
5	4540	3530	4035	
6	1400	1400		
7	18			
8	<2			
9	<2			
10	2			
11	<2			
12	<2			
13	1440	2700	1580	
14	4			
15	*** 13.2 ***			
16	3245	2980	3510	
17	*** 13.2 ***		*** 15.0 ppm ***	
18	3			
19	18			
20	9			
21	230	240	215	
22	1410			
23	270			
24	1410			
25	<2			
26	3			
27	2950	3490	2390	2980
28	9140	9600	8350	9460
29	14			
30	11			
31	12			
32	*** 48.0 ***			
33	22			
34	18			
35	<2			
36	65	80	50	
37	130	120	145	
38	** 205.0 ***			
39	805	1310	357	750
40	340	340	340	
41	19			
42	17			
43	13			
44	14			
45	7130	7760	6040	7590

APPENDIX A (continuation)

Sample No.	[------------	Au	-----------]
46	4		
47	810	910	
48	3340	2440	3500
49	*** 15.2 ***		
50	85		
51	26		
52	6		

APPENDIX B

Minor element concentrations in the 52 samples collected from the three occurrences. Data emphasized by asterisks are weight percent, all others are ppm. (For sample locations see Figures 2,3,7,8,9, and 11).

Sample Number	Be	Sc	V	Cr	Co	Ni	Cu	Zn	As	Rb	Sr	Y	Zr	Mo	Ta	Pb	Th
1)	1	44	329	10	42	26	78	96	48	8	81	29	84	<10	<10	<10	<10
2)	<1	27	155	<10	23	<5	146	23	10	12	56	38	124	<10	<10	<10	<10
3)	<1	24	78	<10	30	<5	537	11	*1.17*	27	47	41	129	<10	<10	<10	<10
4)	<1	31	49	<10	43	<5	278	15	8750	39	55	54	162	<10	<10	<10	<10
5)	<1	33	32	<10	32	<5	27	86	*3.15*	32	90	76	227	<10	<10	<10	<10
6)	<1	26	117	<10	12	<5	11	12	*2.48*	17	49	18	51	<10	<10	<10	<10
7)	1	40	324	<10	29	16	61	72	130	14	94	35	103	<10	<10	<10	<10
8)	<1	41	234	44	39	50	107	93	1.0	6	89	18	53	<10	<10	<10	<10
9)	1	44	251	10	41	39	118	78	68	27	62	18	51	<10	<10	<10	<10
10)	1	30	286	<10	30	23	58	51	44	36	56	15	42	<10	<10	<10	<10

APPENDIX B (continuation)

Sample Number	Be	Sc	V	Cr	Co	Ni	Cu	Zn	As	Rb	Sr	Y	Zr	Mo	Ta	Pb	Th
11)	<1	45	254	10	38	41	108	100	75	35	75	4	53	<10	<10	<10	<10
12)	<1	56	496	<10	56	47	167	87	56	36	40	5.6	60	<10	<10	<10	<10
13)	<1	12	77	<10	11	7	27	11	2850	19	23	7	16	<10	11	<10	<10
14)	<1	47	464	<10	49	42	251	90	98	19	64	4.1	49	<10	<10	<10	<10
15)	2	39	351	<10	63	40	229	29	*6.25*	64	86	9	47	<10	<10	<10	<10
16)	<1	29	169	<10	30	16	28	17	*3.50*	38	57	10	31	<10	<10	<10	<10
17)	1	35	272	<10	46	16	56	24	*6.50*	46	68	23	83	<10	<10	<10	<10
18)	<1	53	364	<10	53	39	169	84	104	42	48	5.6	67	<10	<10	<10	<10
19)	3	53	737	<10	56	36	165	82	175	17	28	24	73	<10	<10	<10	<10
20)	3	54	759	<10	56	42	176	92	170	14	53	28	74	<10	<10	<10	<10
21)	2	58	1035	<10	59	28	201	91	580	21	31	8.4	79	<10	<10	<10	<10
22)	5	69	1238	<10	36	22	326	77	3850	45	50	29	87	<10	<10	<10	<10

APPENDIX B (continuation)

Sample Number	Be	Sc	V	Cr	Co	Ni	Cu	Zn	As	Rb	Sr	Y	Zr	Mo	Ta	Pb	Th
23)	3	51	763	<10	50	18	182	123	1150	18	65	39	105	<10	<10	<10	<10
24)	2	30	379	<10	20	<5	26	19	*2.75*	73	51	20	55	<10	<10	<10	<10
25)	<1	49	280	20	47	34	99	81	3	7	68	34	114	<10	<10	<10	<10
26)	<1	29	45	<10	20	<5	79	53	*4.75*	62	46	76	230	<10	<10	<10	<10
27)	<1	51	97	<10	49	<5	198	71	135	8	56	47	105	<10	<10	<10	<10
28)	<1	9	25	<10	44	<5	142	10	*9.50*	13	73	35	111	<10	<10	<10	<10
29)	1	42	347	<10	44	18	74	121	82	8	73	37	109	<10	<10	<10	<10
30)	1	19	133	89	40	68	81	660	53	44	84	31	84	<10	<10	235	<10
31)	<1	14	96	50	28	57	95	281	35	30	92	31	67	<10	<10	53	<10
32)	1	23	161	119	40	97	2300	297	23	46	41	24	88	<10	<10	13	15
33)	1	24	171	118	33	86	273	233	23	47	52	23	109	<10	<10	61	<10
34)	1	19	135	83	26	64	203	82	18	50	120	21	108	<10	<10	<10	<10

APPENDIX B (continuation)

Sample Number	Be	Sc	V	Cr	Co	Ni	Cu	Zn	As	Rb	Sr	Y	Zr	Mo	Ta	Pb	Th
35)	<1	22	145	113	33	79	53	92	3.5	40	209	23	111	<10	<10	<10	<10
36)	1	7	39	<10	9	<5	214	27	5.5	42	74	28	222	<10	<10	<10	<10
37)	1	7	112	<10	15	14	1044	54	18	48	73	30	133	<10	<10	<10	20
38)	<1	2	5	10	19	6	9146	99	<1	11	14	13	12	<10	<10	<10	13
39)	1	5	25	13	10	6	529	39	6.5	52	59	26	161	<10	<10	<10	<10
40)	1	7	65	<10	24	12	462	39	3.0	58	77	18	122	<10	<10	<10	<10
41)	<1	10	43	10	13	6	65	46	1.0	56	51	24	169	<10	<10	<10	<10
42)	<1	19	79	<10	10	8	9	21	<1	5	122	91	27	<10	<10	<10	<10
43)	1	16	113	23	300	9	118	118	3.0	28	242	22	129	<10	<10	<10	<10
44)	1	14	73	<10	47	<5	329	69	2.5	37	254	14	71	<10	<10	<10	<10
45)	<1	6	24	<10	12	<5	1963	54	2.5	11	73	15	43	<10	<10	<10	<10
46)	<1	11	68	<10	23	<5	50	71	2.0	30	180	34	74	<10	<10	<10	<10

APPENDIX B (continuation)

Sample Number	Be	Sc	V	Cr	Co	Ni	Cu	Zn	As	Rb	Sr	Y	Zr	Mo	Ta	Pb	Th
47)	2	11	167	93	13	34	206	26	51	138	268	10	116	108	<10	18	<10
48)	<1	3	156	10	6	15	22	35	9.0	11	278	8	30	516	11	26	<10
49)	2	4	265	48	9	19	68	16	44	30	173	8	45	2178	<10	89	<10
50)	2	13	110	100	21	37	89	40	17	119	618	12	151	16	<10	<10	<10
51)	1	13	104	108	24	39	117	46	16	119	607	9.1	162	<10	<10	<10	<10
52)	2	13	101	104	18	33	96	25	17	109	293	9.2	146	<10	<10	<10	<10

APPENDIX C

REE concentrations in unaltered and carbonatized basalt of the Esther Township Occurrence. Data emphasized by asterisks are ppm, otherwise they are ppb. Sample locations in Figure 2; UNB=Unaltered Basalt; MCB=moderately Carbonatized Basalt; SCB=Extremely Carbonatized Basalt; CVP=Carbonates Volume Percent estimated in thin section (*).

	Sample No.	25	8	11	14
	Character	UNB	MCB	SCB	SCB
	CVP	<6%	30-35%	95%	95%
Lanthanum		* 4.9 *	* 2.2 *	* 2.5 *	* 2.3 *
Cesium		*14.0 *	* 5.7 *	* 6.3 *	* 6.1 *
Praseodymium		* 2.3 *	960	1000	910
Neodymium		*11.0 *	* 4.9 *	* 4.8 *	* 4.5 *
Samarium		* 3.9 *	* 1.8 *	* 1.4 *	* 1.4 *
Europium		* 1.2 *	740	460	380
Gadolinium		* 4.9 *	* 2.5 *	* 1.1 *	* 1.2 *
Terbium		880	460	150	150
Dysprosium		* 6.0 *	* 3.1 *	780	870
Holmium		* 1.3 *	710	140	160
Erbium		* 4.0 *	* 2.1 *	430	460
Thulium		570	300	60	70
Ytterbium		* 3.8 *	* 2.0 *	510	540
Lutetium		530	280	80	80

(*) The chondrite normalized graph in Figure 5 (Geochemistry Section) was derived from the data tabulated above by increasing REE atomic weight from top to bottom. Note that: 1) relative to unaltered basalt (No. 25), the moderately carbonatized basalt (No. 8) is depleted in similar proportions of light and heavy lanthanides, whereas; 2) relative to moderately carbonatized basalt, the strongly carbonatized basalt (Nos. 11, 14) shows little change in light lanthanides (La,Ce,Pr,Nd,Sa), but significant depletion in elements heavier than samarium.

References

Brown, W.L.
1948: Jerome Mine; p. 438-441 in Structural Geology of Canadian Ore Deposits, edited by M.E. Wilson, Canadian Institute of Mining and Metallurgy Symposium, Volume 1, 948 p.

Canadian Nickel Company Limited (Canico)
1985: 1984 Annual Report of Activities, Canico-Golden Hope Agreement; File 63-4493, Geoscience Data Centre, Ontario Geological Survey, Toronto.

Moorhouse, W.W.
1951: Geology of Osway Township; Annual Report for 1950, Ontario Department of MInes, Volume 43, Part 5, p.1-25

Siragusa, G.M.
1980: Jerome Area (West), District of Sudbury; Ontario Geological Survey, Preliminary Map P.2369, Geological Series, scale 1:15 840 or 1 inch to 1/4 mile. Geology 1979.

1981: Precambrian Geology of Chester and Yeo Townships, and parts of Neville and Potier Townships, District of Sudbury; Ontario Geological Survey, Preliminary Map P.2449, Geological Series, scale 1:15 840 or 1 inch to 1/4 mile. Geology 1980.

1985: Precambrian Geology of the White Lake (Hemlo) Area, Theresa Lake Section, District of Thunder Bay; Ontario Geological Survey, Preliminary Map P.2738, Geological Series, scale 1:15 840 or 1 inch to 1/4 mile. Geology 1984.

1993: Geology, Geochemistry and Mineralization of the Southern Margin of the Swayze Belt; Ontario Geological Survey, Open File Report 5844, 131 p.

Watts, Griffis, and McOuat Ltd.
1983: The Chester, Benneweis, and St.Louis Tps. Property of Murgold Resources Inc. in Porcupine Mining Division, District of Sudbury, Ontario; Company Files, Murgold Resources Inc., Toronto.

CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

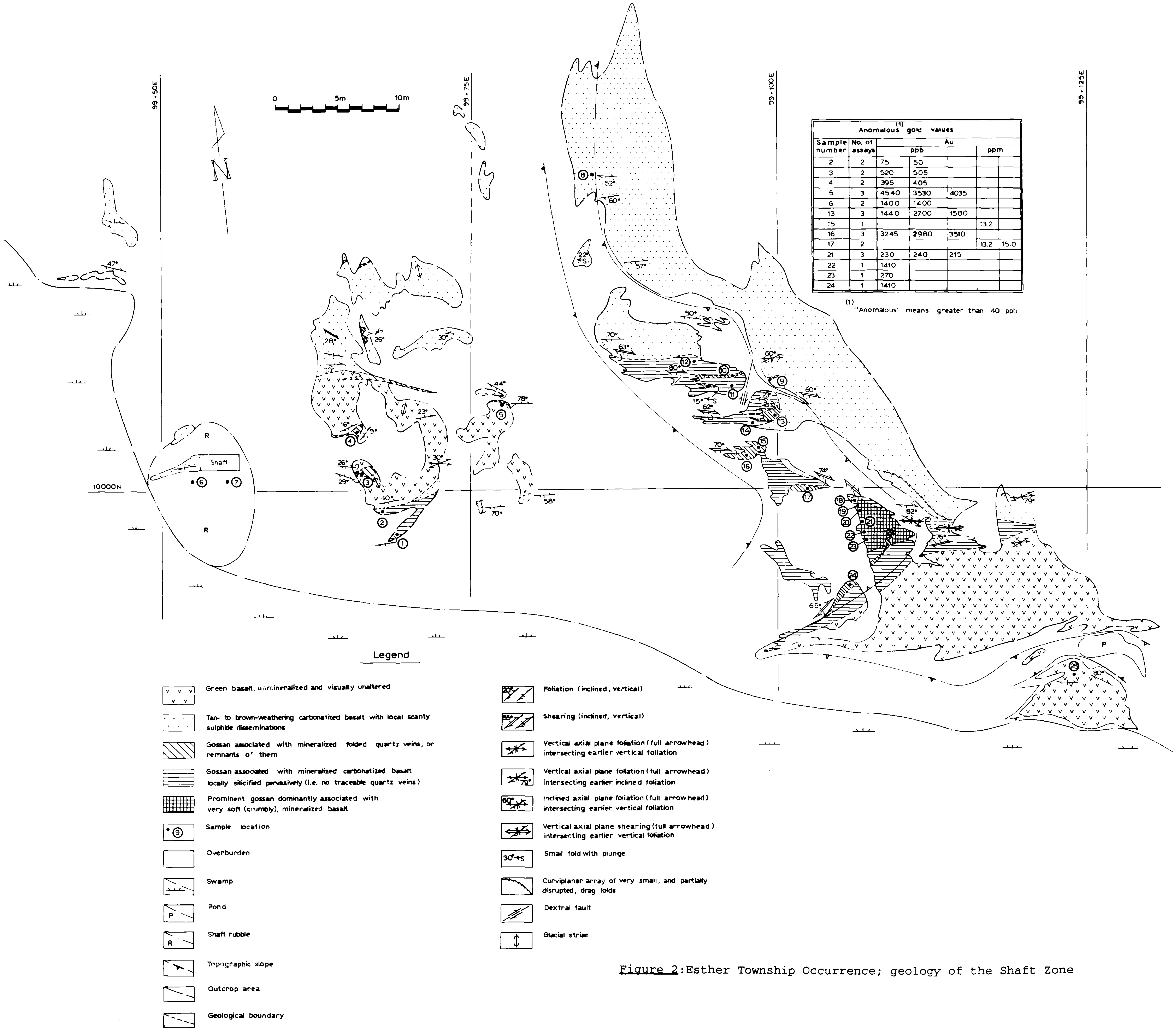
Conversion from SI to Imperial			**Conversion from Imperial to SI**		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
			CAPACITY		
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
			MASS		
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
			CONCENTRATION		
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

	Multiplied by	
1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.

3268
ISSN 0826-9580
ISBN 0-7778-1474-9

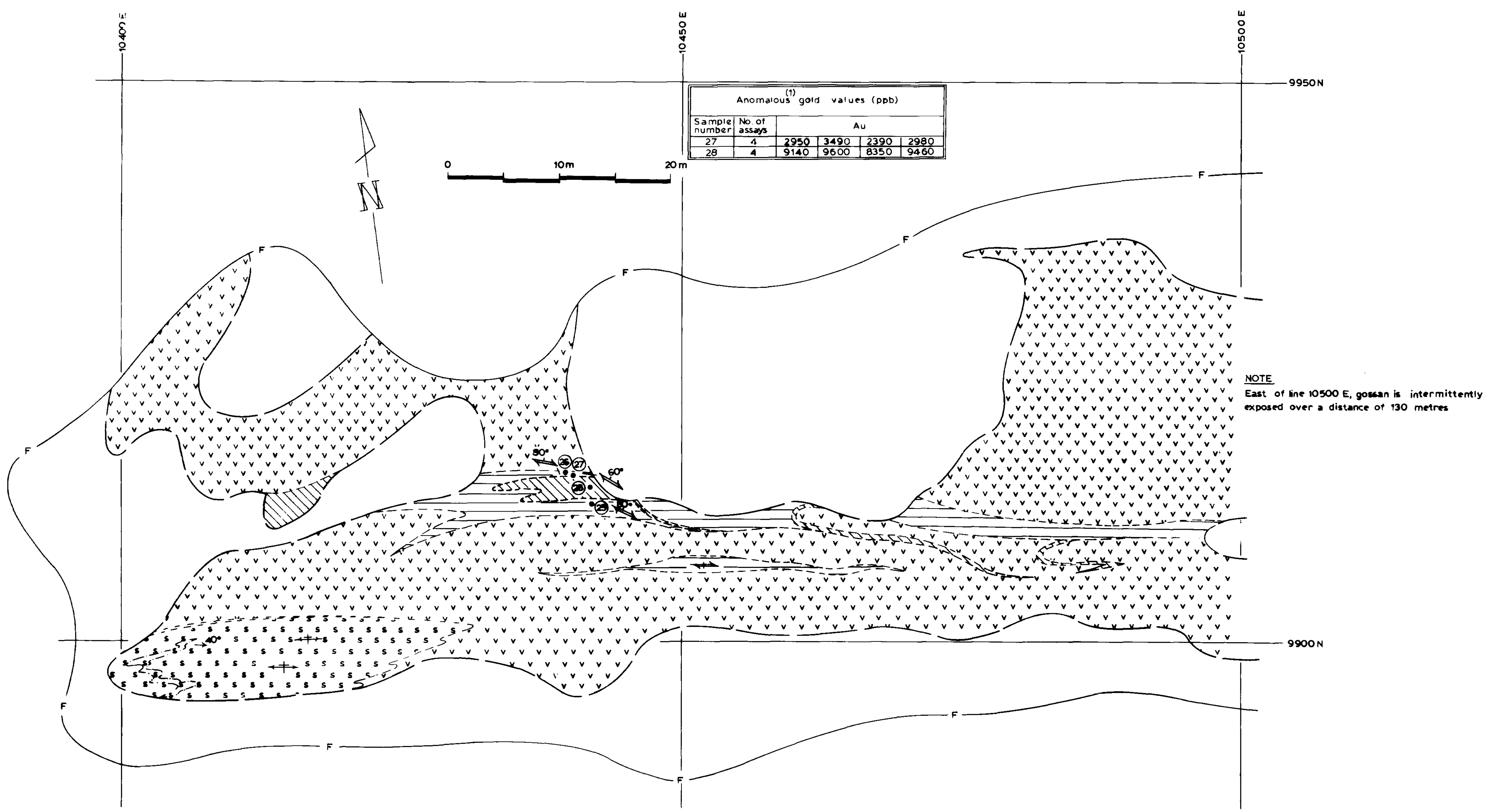


Anomalous[1] gold values

Sample number	No. of assays	Au ppb			Au ppm	
2	2	75	50			
3	2	520	505			
4	2	395	405			
5	3	4540	3530	4035		
6	2	1400	1400			
13	3	1440	2700	1580		
15	1				13.2	
16	3	3245	2980	3510		
17	2				13.2	15.0
21	3	230	240	215		
22	1	1410				
23	1	270				
24	1	1410				

(1) "Anomalous" means greater than 40 ppb

Figure 2: Esther Township Occurrence; geology of the Shaft Zone



Anomalous[(1)] gold values (ppb)

Sample number	No. of assays	Au			
27	4	2950	3490	2390	2980
28	4	9140	9600	8350	9460

Figure 3: Esther Township Occurrence; geology of western part of the East Zone. (For additional information see File 63-4493, Canadian Nickel Company Ltd. 1984, Overburden Stripping, Sheet 1, Figure 5)

Legend

(1) "Anomalous" means greater than 40 ppb

- Green basalt, unmineralized and visually unaltered
- Gossan associated with mineralized folded quartz veins, or remnants of them
- Gossan associated with sheared and carbonatized basalt locally affected by dominantly pervasive silicification
- Pelitic sediments
- Sample location
- Approximate outline of forest clearing
- Muddy and/or sandy overburden
- Outcrop area
- Geological boundary
- Shearing (inclined, vertical)
- Vertical or subvertical bedding parallel to axial plane foliation
- Prominent shear fracture
- Generalized outline of prominent plunging drag folds

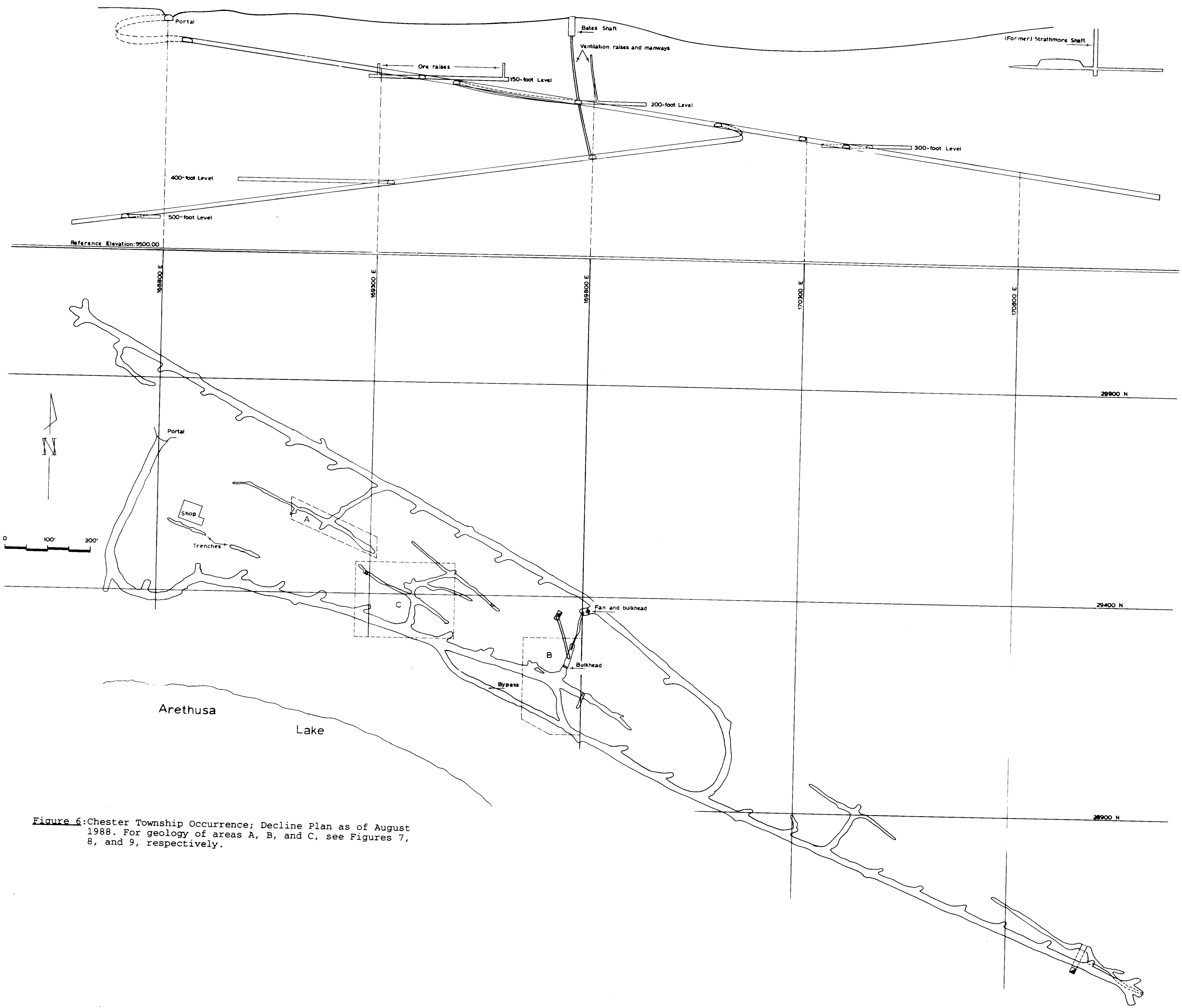


Figure 6: Chester Township Occurrence; Decline Plan as of August 1988. For geology of areas A, B, and C, see Figures 7, 8, and 9, respectively.

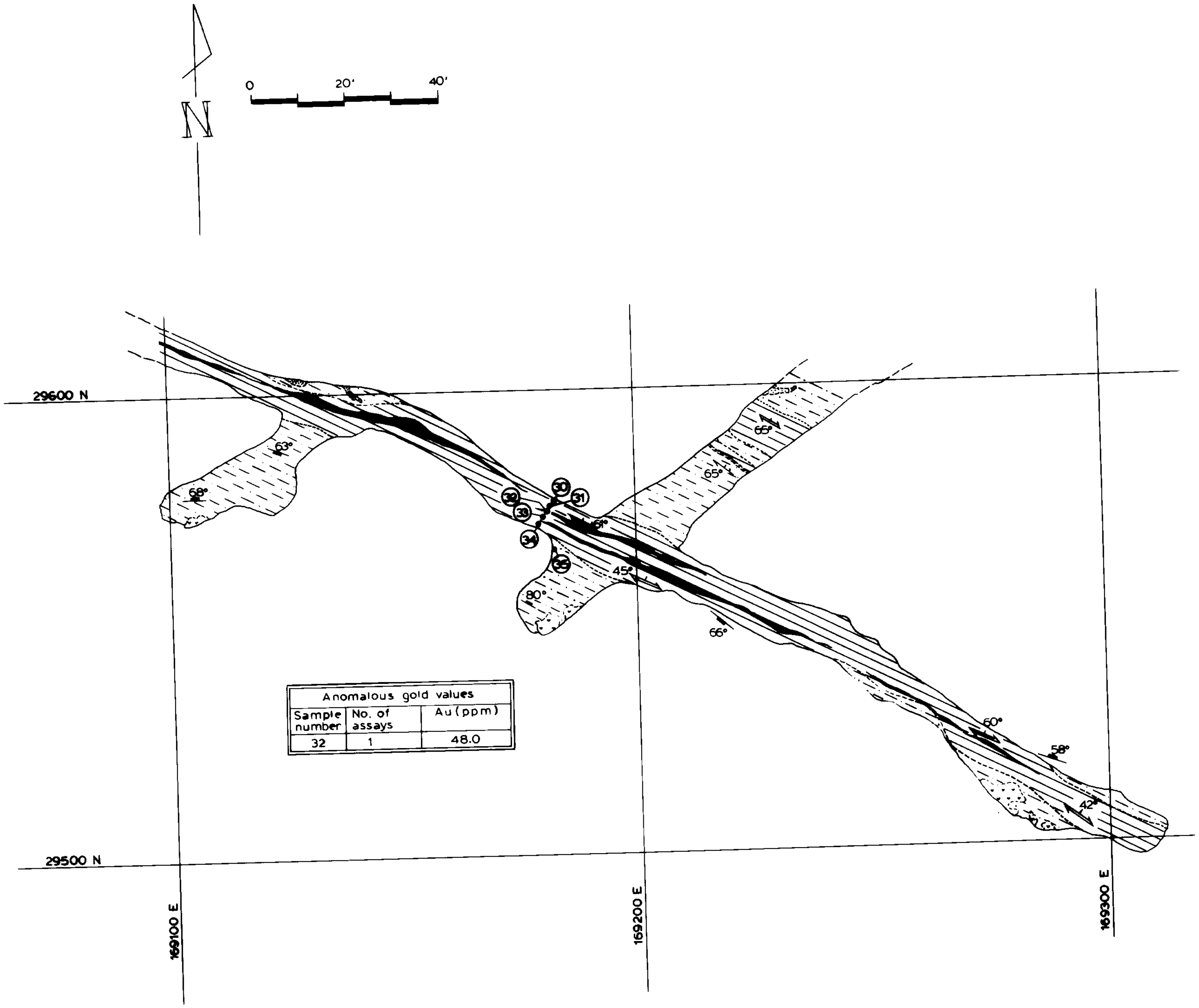
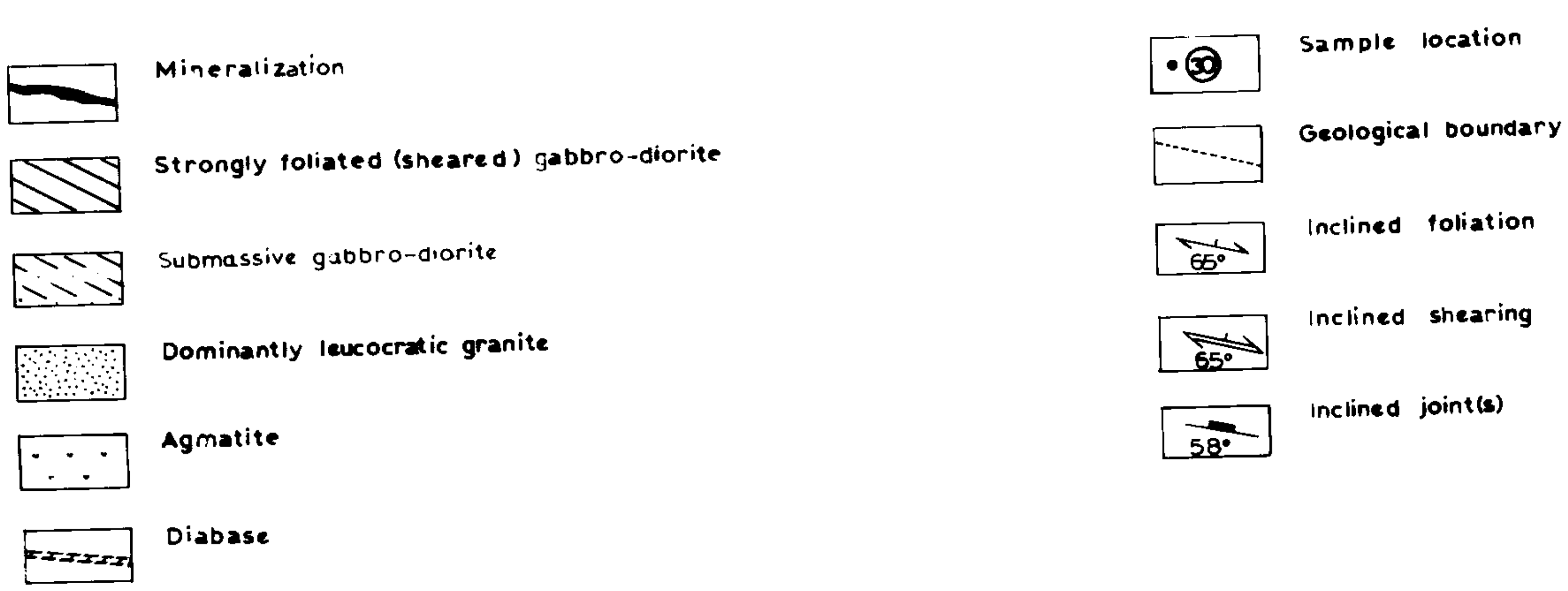
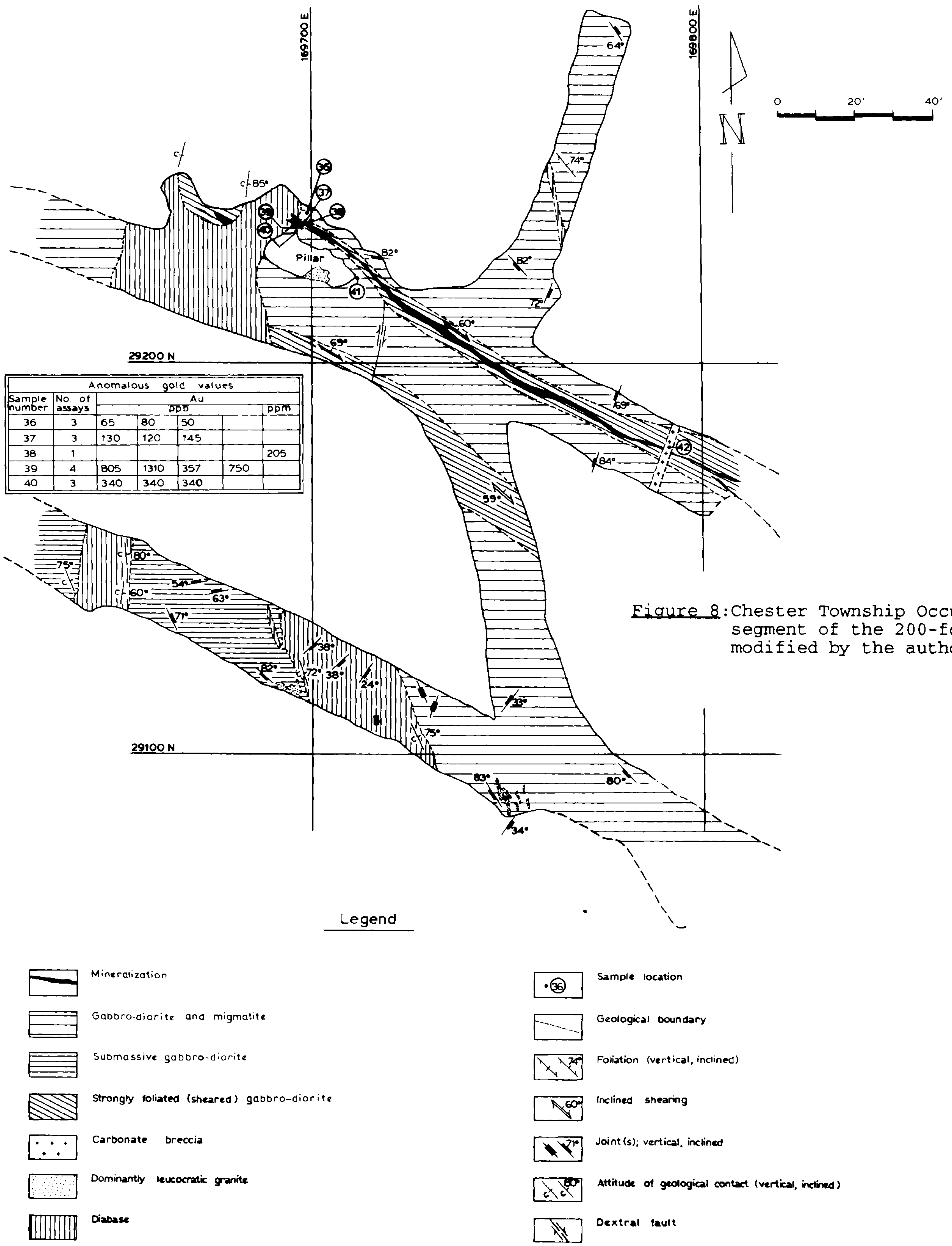


Figure 7: Chester Township Occurrence. Geology of the sampled segment of the 400-foot level; inclusive of company data modified by the author.

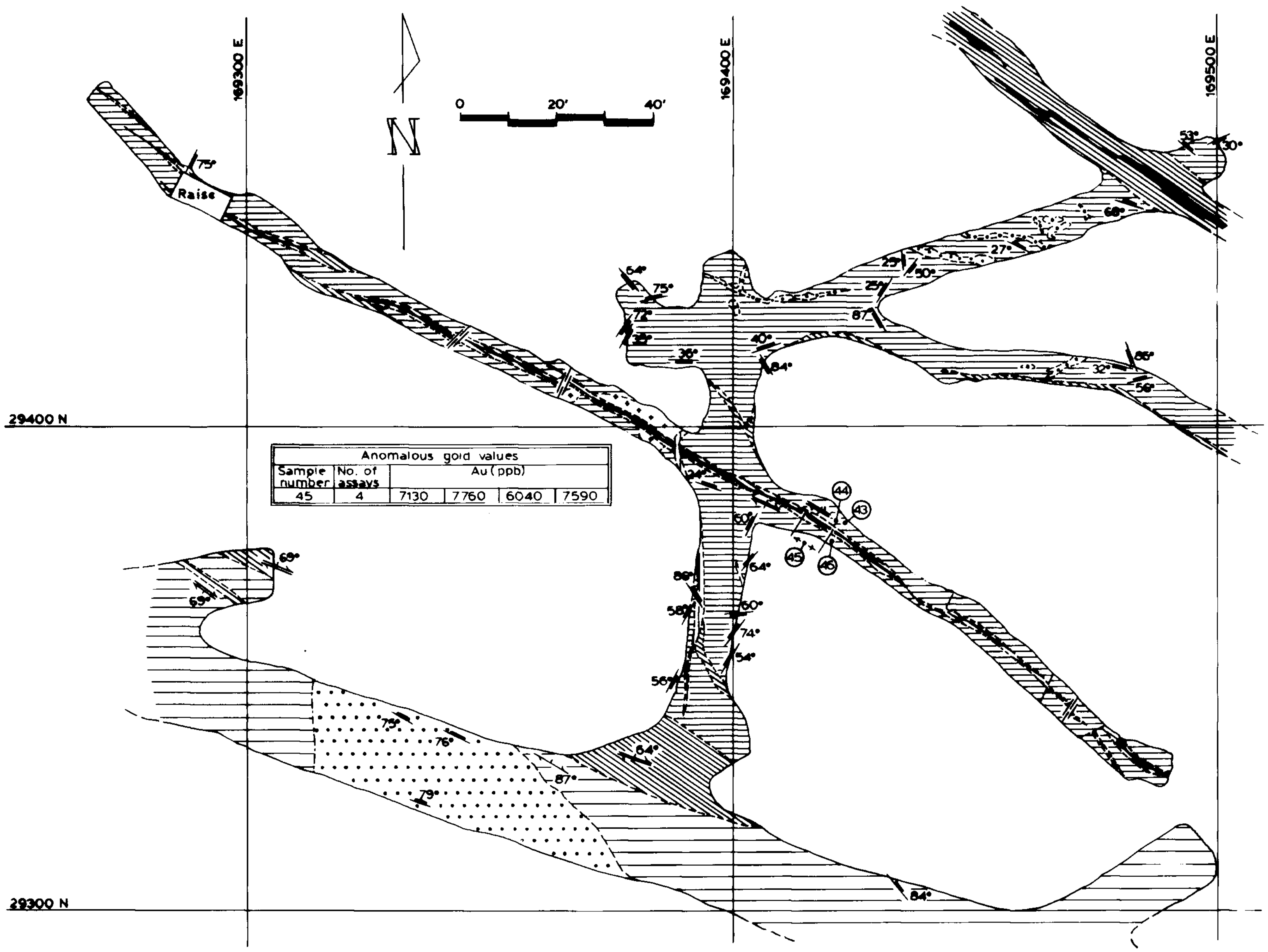
Legend





Anomalous gold values						
Sample number	No. of assays	Au				
		ppb				ppm
36	3	65	80	50		
37	3	130	120	145		
38	1					205
39	4	805	1310	357	750	
40	3	340	340	340		

Figure 8: Chester Township Occurrence. Geology of the sampled segment of the 200-foot level; inclusive of company data modified by the author.

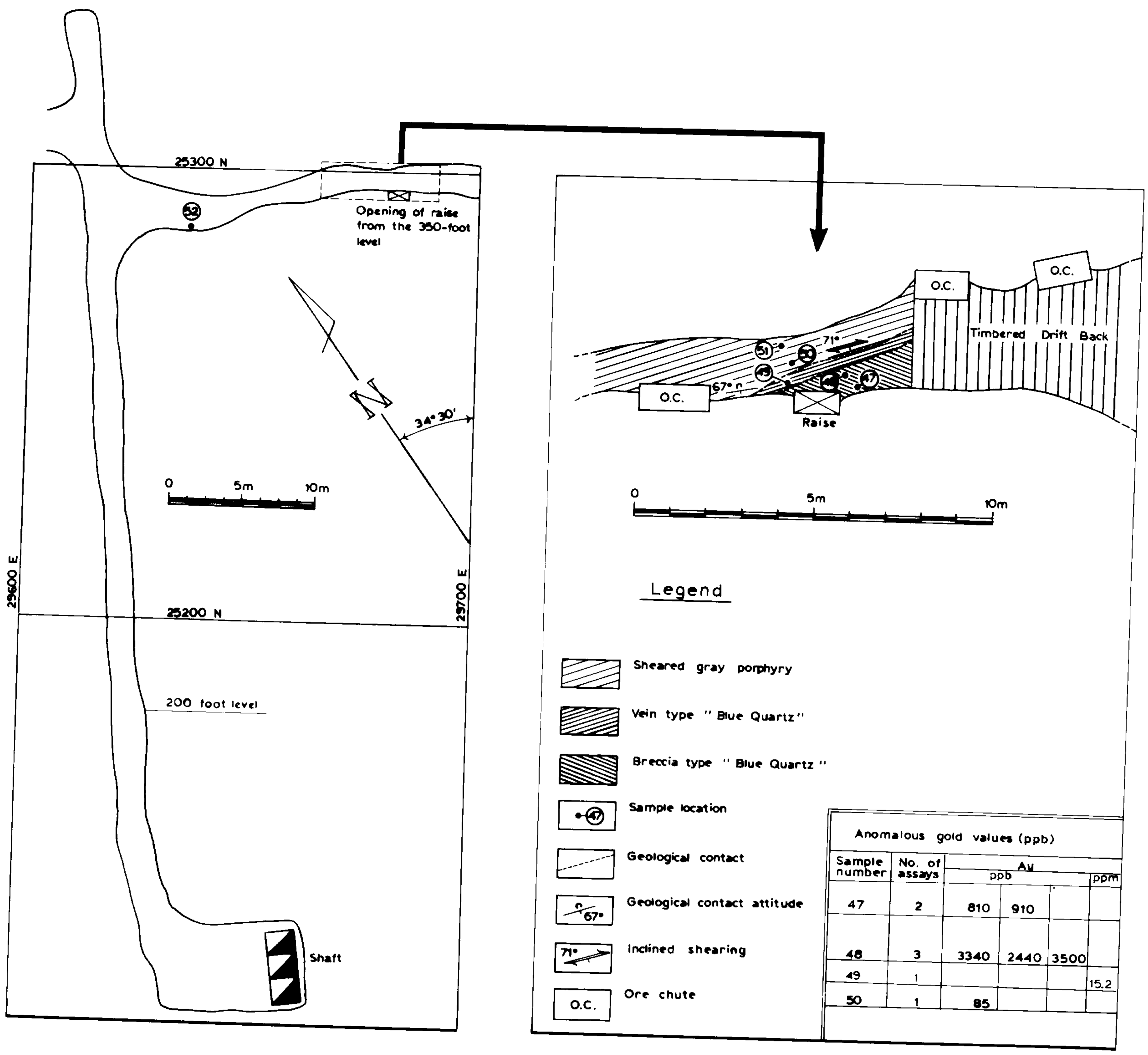


Sample number	No. of assays	Au (ppb)			
45	4	7130	7760	6040	7590

Figure 9: Chester Township Occurrence. Geology of the sampled segment of the 150-foot level; inclusive of company data modified by the author.

Legend

- Mineralization
- Gabbro-diorite and migmatite
- Submassive gabbro-diorite
- Strongly foliated (sheared) gabbro-diorite
- Carbonate breccia
- Dominantly leucocratic granite
- Diabase
- Sample location
- Sample location; sample collected along strike of the indicated vein segment
- Geological contact (gradational, relatively sharp)
- Inclined foliation
- Shearing (vertical, inclined)
- Inclined joint(s)
- Fault (unspecified, dextral)



Sample number	No. of assays	Au ppb			ppm
47	2	810	910		
48	3	3340	2440	3500	
49	1				15.2
50	1	85			

Figure 11: Osway Township Occurrence. Geology of the sampled segment of the 200-foot level.