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THE GEOLOGY OF THE FARO NUMBER TWO ZINC-LEAD-SILVER DEPOSIT, ANVIL RANGE, YUKON TERRITORY, CANADA

by

Michael A. Stammers

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AUTHOR : Michael A. Stammers

SUPERVISORS : 1st Term : Professor J. Crocket
2nd Term : Professor D. Shaw

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ABSTRACT

The study involves an examination of the Faro Number Two Zn-Pb-Ag stratiform deposit in terms of its regional setting, the detailed country rock geology and the geology of the ore body.

The Faro deposit is found stratigraphically, towards the base of Cambrian to Triassic sequence of meta-sedimentary, meta-igneous and sedimentary rocks in the Anvil Range of Central Yukon Territory. The actual host rocks are Cambro-Ordovician (?) schists of the Faro Group. Two schist members have been identified. The upper member is a carbonaceous quartz-biotite-muscovite-andalusite schist. The lower member, located at a level 200 feet below the horizon is a quartzo-feldspathic biotite-muscovite-andalusite-staurolite-garnet schist. The original fine-grained pelitic sediments were regionally metamorphosed during Cambro-Ordovician times to Greenschist and Lower Amphibolite facies.

The sulfide deposit, contains both massive and dissemina-ted sulfide facies. The deposit is crudely zoned with a massive pyritic, base metal-rich sulfide inner zone and a sulfide-bearing quartzite outer zone. Zinc-lead abundances and ratios are greatest in the centre of the deposit and decrease towards the deposit margins.

The presence of a metabasite of probable meta-igneous origin at a similar stratigraphic level as the Faro Number Two

deposit and the presence of the ribbon-banded graphitic quartzite indicate that both volcanogenic and biological processes contributed to the concentration and deposition of sulfides. Similar sulfide deposits, that were formed in a mainly sedimentary environment include the Sullivan deposit in British Columbia, Broken Hill in Australia and Rammelsberg in Germany.

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CHAPTER I

INTRODUCTION

A. General

The general purpose of this study is to examine the Faro Number Two stratiform zinc - lead - silver ore deposit. A broad range of geological parameters will be discussed in an attempt to give the reader an understanding of the Faro sulfide mineralization in terms of regional geology ; local country rock geology ; ore mineral facies and chemistry ; possible origin ; and deposits comparative to the Faro Number Two ore body.

Faro Number Two was chosen as a subject of considered discussion for two reasons. First, the small, overall size of the deposit allows for a convenient and concise examination of the many features that could not be appraised if the deposit were as large as the neighbouring Faro Zones 1 and 3. Secondly, the extensive and dense coverage of the deposit by conventional diamond drill grids delineates the form of the deposit well. Diamond drill core provides generally fresh specimens of ore facies and country rock that are otherwise unattainable in light of the pervasive and thick overburden. The obvious limit to using drill core is the fact that drilling is, for the most part, limited to economic grade, and finances do not permit the extension of drill holes beyond a depth of general economic sulfides. Two deep drill holes along the cross-section 142 were terminated early as a result of a labour dispute in the summer of 1976. Thus, this study is made on the basis of the data that is available through the examination of 48 bore holes with footage totalling approximately 13,000' drilled in 1965, 1967, 1973 and 1976.

The main zones of sulfide mineralization at the Faro-Anvil mine lie 1,000 feet to the northwest of Zone 2. It is considered by most workers in the area that all zones of mineralization at the Faro-Anvil mine are of similar origin and age. The mineralogy, structural and textural features of the thicker and more extensive main ore body are roughly similar to the Zone 2 mineralization. Therefore, it would not be too unreasonable to extrapolate the fundamental characteristics of Faro Zone 2 to the larger and more economic main zones of sulfide mineralization.

This report is based on drill core examination by the writer carried out in 1975 and 1976 summer field seasons while employed by the Cyprus Anvil Mining Corporation. Supplemental information such as Zn-Pb-Ag-Cu assay data and lithological data for lost drill core was available from existing diamond drill logs supplied kindly by Cyprus Anvil Mining Corporation.

B. Development and History

The Faro-Anvil Zn-Pb-Ag deposit was discovered in 1965 by Dynasty Explorations Limited, using a combination of geochemical and geophysical prospecting techniques. The first exploratory drilling took place in in the same year by conventional rotary drill work. Faro Rotary Hole - Number One, struck sulfides in what today is known as Faro Zone Two. Further rotary drilling and geophysical techniques pegged down the main sulfide mineralization in Zones One and Three to the northwest of "Discovery Hole". Diamond drill rigs were brought in later in 1965 to further delineate the deposit. Drilling in 1966 was supplemented by the construction of a 2700' long adit through the main zone of sulfide mineralization. Bulk samples from the adit were used for mill testing and economic grade considerations.

The "go-ahead" for mining came in 1967, with the decision to employ open-pit methods and to construct a mill concentrator with initial daily production set at 5,500 tons per day. Mining operations began in 1968 and continued through 1969 before concentrates of zinc and lead were first shipped out in early 1970.

Recent published figures for 1975 and 1976 for ore milled and concentrate produced are listed below. This data applies to Faro Zone 1 only. Mining of Faro Zones 2 and 3 has yet to commence.

Table I-1

Summary of Operations - Cyprus Anvil Mine

	1975	1976 *
Ore:		
Tons Mill-dry short tons (in 000's)	3,225	1,675
% Lead	2.66	4.03
% Zinc	5.48	5.41
Concentrate Produced:		
Lead Concentrate-dry short tons	47,863	145,453
% Lead	67.28	66.89
Zinc Concentrate-dry short tons	126,628	230,494
% Zinc	51.36	50.80
Bulk Concentrate-dry short tons	27,141	77,113
% Combined Lead/Zinc	44.59	47.71

Source: Cyprus Anvil Mining Corp; Interim Report, February 1, 1977

*1976 Operations shut down for 50% of year due to labour disputes

C. Location

The Faro Number Two zinc-lead-silver ore deposit is located in the Anvil Range in central Yukon Territory. Bostock (1948) defined the physiographic province as the Yukon Plateau and Gabrielse (1967) identified the tectonic province as the Selwyn basin. In Cordillera tectonic belt classification, the Faro ore body is located in the Omineca crystalline belt. A major crustal fault system defined by the Tintina Trench lies 8 miles to the south of the deposit and the Pelly River flows within this 3 mile wide topographic feature.

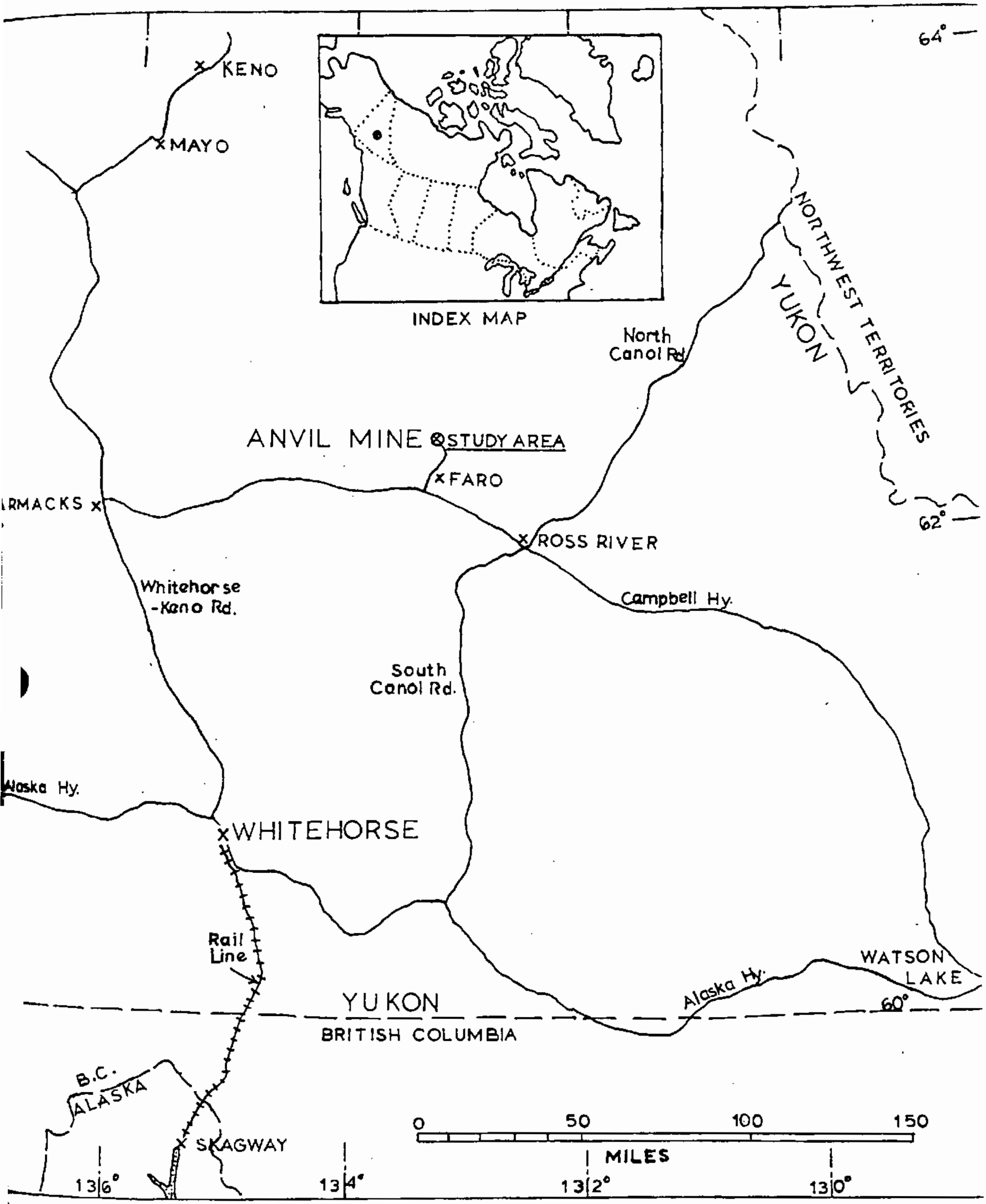


FIGURE I-1

STUDY AREA LOCATION MAP

Locally, the deposit is located northwest of Mt. Mye and east of Rose Mountain. Approximate latitude and longtitude are 62° 21' North and 133° 21' West respectively.

The town of Faro is situated 9 miles south of the deposit and the city of Whitehorse 125 miles to the southwest.

D. Town of Faro

The town of Faro, with its 1,400 inhabitants, is located to the north of the Pelly River, where it is joined by the Vangorda Creek. The townsite is set out in a two tier arrangement representing the two former levels of the Pelly River. The mean daily temperature recorded for July 1976 was 60.3°F and for January 1976 was -0.7°F. The total precipitation for the month of July 1976 was 1.48", and for January 1976 was 0.6". Winters are long and cold, and summers short and warm. The climate is sub-arctic continental.

The town houses the personnel of Cyprus Anvil Mining Corp. and other service facilities. The northern community is an amenable place to live, despite the climate, and many essential and recreational services are supplied to the residents.

The townsite was built in 1969 and may become an even larger centre if production of the nearby Kerr-Addison Mines-Canadian National Resources Grum zinc-lead deposit begins.

E. Access

The town of Faro and the Anvil minesite are linked by a 13 mile gravel-all weather road. Road networks in the Yukon Territory are maintained year-round, and are almost always gravel surfaced. From Faro to Whitehorse via roads, one travels the "Campbell Highway" west to Carmacks and south on the "Whitehorse-Keno Road" to Whitehorse, for a total of 221 miles. To the southeast, the Robert Campbell Highway continues 263 miles to Watson Lake where it links up with the Alaska Highway.

Regular air service between Faro and Whitehorse is available with an average flight time of one hour on light, fixed-winged aircraft. Whitehorse is served by CP Air and Transair with regular flights to Vancouver, Edmonton and Winnipeg.

Milled concentrates are shipped via truck container to Whitehorse; transferred to rail cars that connect Whitehorse with ship transport at Skagway, Alaska, a year-round ocean port. The principal markets for Faro concentrates are Japan, Germany and Australia.

F. Previous Work

D. J. Templeman-Kluit, a geologist with the Geological Survey of Canada, in 1967 and 1968 mapped much of the Anvil Range north of the Pelly River. His report on the Geology and Origin of the Faro, Vangorda, and Swim Concordant Zinc-Lead Deposits was published in 1972.

Cyprus Anvil Mining Corporation has done by far the most extensive and detailed geological investigations in and around the Faro deposit. Unpublished work by D.S. Jennings of Cyprus Anvil in 1971, presented the first detailed mapping of the mine area at a 1":400' scale. Further work by Cyprus Anvil in 1975 and 1976 led to a recently completed regional map and detailed 1":200' local map sheets. The relevant map sheet, completed in early 1977, is included as an appendix to this report. The geological interpretation is by D. S. Jennings and field work and drill core logging/investigation were made by D.S. Jennings, with the assistance of the author of this paper.

A major study of the Faro main sulfide deposit was the subject of a PhD thesis at Leeds University by P.F. Lewis. An extremely unfortunate fatal car accident in 1976 put an abrupt end to this work. Mr. Lewis will be greatly missed by the geological community.

A study of lead isotopes by Kuo et al (1974) on the main ore body was published in 1974. This work determined the origin and the age of the lead in the Faro deposit.

With respect to the Faro Zone Two deposit, no previous detailed work has been published or undertaken, with the exception of the economic viability of the deposit as estimated by Cyprus Anvil geological engineers. This report was not available to the author.

CHAPTER II

REGIONAL GEOLOGY

A. General Setting

The Faro stratiform deposit lies in the Anvil Range at the western margin of the Selwyn Basin tectonic province. The Tintina fault system located to the south of the deposit is a zone of major transcurrent faulting with a right lateral displacement of about 250 miles (D.J. Templeman-Kluit, 1972). This large crustal lineament produces a striking visible feature for at least 600 miles trending northwest in the central Yukon.

For purposes of classification, D.S. Jennings' lithological and stratigraphic groupings were employed. Where possible, the geology by D.J. Templeman-Kluit and his map units are identified with the D.S. Jennings classification.

Before proceeding to the regional geology description, a short section on Plate Tectonics in the northern Cordillera will be presented.

B. Tectonic Setting

Sutherland-Brown et al (1971) define five tectonic belts extending longtitudinally in the Canadian Cordillera. The Faro deposit is found within the Omineca crystalline belt. To the east and north is the Rocky Mountain Belt and to the southwest, in succession, is the Intermontane Belt, the Coast Range Complex and the Insular Belt. The age of the belts increases from west to east.

Swinden and Strong (1976) define the Omineca Crystalline Belt as a zone of early miogeosynclinal sedimentation on the continental slope and rise, of Hadrynian to Middle Paleozoic age, followed by Mid-Paleozoic to Triassic Andean-type volcanism and finally, by late Mesozoic vulcanism, plutonism and metamorphism.

The Omineca belt trends northwest and ranges in width from about 75 km to 400 km. The belt is wholly contained within British Columbia and the Yukon Territory.

Wolfhard and Ney (1976) have defined several lithostratigraphic epoch divisions representing natural sequences of mineralization within the Canadian cordillera. The Faro sulfide deposit falls within the 360-800 million year old Kicking Horse epoch. Other deposits within this epoch include carbonate hosted Pb-Zn deposits at Salmo, Monarch and Robb Lake in British Columbia, and a shale-carbonate hosted deposit at Summit Lake in the Northwest Territories.

C. Faro Group (Units 0, 1 and 2)

The Faro Group, as defined by D.S. Jennings (1977), includes the lowermost recognizable rocks in the district, including the basal Unit 1 of D. J. Templeman-Kluit, Map Unit 0 of D.S. Jennings, and Unit 1 of D.J. Templeman-Kluit is an undifferentiated Hadrynian "Grit Unit". The unit consists of muscovite-bearing metaquartzites and is found in exposure adjacent to, and to the north of, the Tintina Trench(D.J. Templeman-Kluit, 1972). The total thickness or any estimate thereof is hampered by intensive faulting and by the unconformable relationship to the overlying Faro Schist group.

Overlying the "Grit Unit" is the Faro Schist group that D.J. Templeman-Kluit labels Unit 2, and D.S. Jennings labels Unit 1. The Faro Schist group is found locally above and below the Faro ore bodies (Unit 2 of D.S. Jennings). Irregular beds of a tremolite-actinolite bearing metabasite are found at all levels of the Schist Group. The main Schist Group has been divided into a recognizable upper carbonaceous quartz-biotite-muscovite-andalusite schist and a lower quartzo-feldspathic biotite-muscovite gneiss/schist unit.

A tactite/skarn and silicated marble unit occurring regularly has been identified in diamond drill core and in outcrop to the northeast of the Faro No. 2 ore body. This unit is found consistently within the quartzo-feldspathic-biotite-muscovite schist between 800 - 1000' below the commencement of the unit. Locally this unit is 70' thick.

A marble and silicated marble unit is found immediately above the tactite/skarn horizon and is locally 70' thick.

Irregular bands and wedges of graphitic schist are found in the Faro Group adjacent to and associated with the Faro sulfide body and at deeper levels within the quartzo-feldspathic schist.

The Faro group is dominantly metasedimentary in origin, with the schists being metamorphosed, fine-grained, argillaceous and silty sediments and the marble and silicated marbles being carbonate sediments or very calcareous, argillaceous sediments. The metabasite probably represents rocks that were originally igneous (D.J. Templeman-Kluit 1972).

Further detailed discussion of the Faro group will be presented in the next chapter of local Country Rock Geology.

D. Mount Mye Group (Unit 3)

The Mount Mye Group, as defined by D.S. Jennings, includes most of Unit 3 of D. J. Templeman-Kluit and part of his Unit 2. The Mount Mye group outcrops in the mine area and is found to the immediate west of the Faro Number Two deposit.

The lower unit within this group is a calc-silicate phyllite/schist. Pale green quartz-diopside rich bands alternate with purplish-brown biotite-rich bands.

Above the calc-silicate phyllite/schist unit and occurring in outcrops progressively westward from the Faro deposit are a series of phyllites/schists. D.S. Jennings has differentiated three units. They include a chloritic phyllite/schist, a graphitic phyllite/schist, and a non-calcareous quartz-muscovite-chlorite phyllite/schist.

Metabasite and marble/silicate-marble units are found within the Mt. Mye Group as large irregular pods and lenses. D. J. Templeman-Kluit defines upper and lower members of the Mt. Mye group.

The lower member contains abundant graphitic phyllite, is generally quartz-rich (greater than 50%) and contains only a few metabasite bodies. The lower member is about 1000' thick (D.J. Templeman-Kluit 1972).

By contrast, the upper member lacks the graphitic phyllite, is quartz-low (less than 20%) and contains abundant metabasite bodies. The lower member is about 3000' thick (D.J. Templeman-Kluit 1972).

The majority of the Mount Mye group are metasedimentary rocks with only the metabasite being meta-igneous. D.J. Templeman-Kluit suggests the phyllites are metamorphosed shales; the metabasite, a metamorphosed extrusive andesite and speculates that the tuffaceous-looking folia in the phyllite may be of volcanic derivation (D.J. Templeman-Kluit, 1972).

The age of the Mount Mye Group is also uncertain. It is known that they are older than Middle Ordovician from the dated fossils of the Vangorda Group (Unit 4)

E. Vangorda Group (Units 4, 5, 6)

The Vangorda group is important for its sulfide deposts and for the dated Middle Ordovician to Lower Silurian graptolite fossils. Units 4 and 6 define the sulfide deposits.

The units within the group are phyllitic and grade downwards to slates. Phyllitic marble, silicated marble and metabasite bodies are found within the Vangorda Group.

The phyllites are dominantly chloritic and/or calcareous. Variably calcareous, graphitic phyllites host the sulfide deposits (Units 4 & 6).

Unit 4, the Grum, Vangorda, Dy and Firth sulfide deposits are in the broadest terms, stratiform and stratibound low tonnage deposits occurring in the lower member of the Vangorda Group. The Vangorda deposit contains less than 10 million tons of 8.06% combined zinc-lead(Chrisholm 1957). The Firth deposit contains much less while the Grum and Dy deposits are currently being appraised. The Grum deposit has been drilled intensely and bulk samples for mill testing are being collected from an adit driven through the ore body. The Dy deposit was discovered in late 1976 down-dip from Grum through the use of a stratigraphic target drilling approach. A drilling project is currently investigating the full extent of the sulfide mineralization.

The Swim deposit (Unit 6) lies higher up in the Vangorda Group and is a crudely stratiform zinc-lead deposit containing 5 million tons of 9.0% combined lead-zinc (Northern Miner March 9, 1967).

The age of the unit has been determined from the carbonaceous black to brown graptolitic slates to be Middle Ordovician to Lower Silurian (D. J. Templeman-Kluit, 1972).

The Vangorda group is mainly metasedimentary with the possible exception of the metabasite that is of probable meta-igneous origin.

F. Blind Creek Group (Unit 7)

The Blind Creek Group is a group of mixed meta-igneous, meta-sedimentary and sedimentary rocks of Middle Devonian Age.

The following units have been recognized by D. S. Jennings and G. Jillson of Cyprus Anvil:

7A. amygdaloidal chloritic phyllite
7B graphitic, muscovite phyllite with slate and minor metagreywacke
7C thin-bedded, fossiliferous, blue-gray, phyllitic limestone
7D massive to fragmental, intermediate to basic, metavolcanic rocks
7E metabasite
7F laminarly banded, variably calcareous, chloritic phyllite
7G calcareous, muscovite-chlorite phyllite
(Unpublished 1977)

The 7C unit of the Blind Creek Group is the equivalent of D. J. Templeman-Kluit's Unit 6. The unit contains "two-hole" crinoids that have been determined to be of Middle Devonian Age. (D.J. Templeman-Kluit 1972).

The Blind Creek Group represents an increase in volcanic igneous activity in the region around Middle Devonian times.

G. The Anvil Range Group (Unit 9)

The Anvil Range Group has been defined and mapped by D.J. Templeman-Kluit as Unit 8. It is a group of volcanic, metavolcanic and cherty rocks. The Anvil Range Group rocks are found in an area north of the Anvil Batholith and also immediately north of the Tintina Trench, especially well exposed on Rose Mountain.

D.S. Jennings and G. Jillson define three mappable units:

9A: serpentinite and altered equivalents (approximately equivalent to D.J. Timpleman-Kluit, Unit 9)

9B: chert, ribbon-banded chert, and chert pebble conglomerate sequence

9C: massive to fragmental, basaltic to metavolcanic group of rocks (Unpublished, 1977)

By comparison, earlier mapping by D.J. Templeman-Kluit has produced slightly different subdivisions:

8A: a cherty and tuffaceous lower-member sequence with a thickness of 2000' or so (same as D.S. Jennings and G. Jillson, Unit 9B?)

8B: sequence of alkali basalts and related volcanic rocks, middle member, with a thickness of about 1500' (same as D.S. Jennings and G. Jillson, Units 9A and 9C?)

8C: limestone formation with minor tuff of unkown thickness, upper member (D.J. Templeman-Kluit, 1972).

The Anvil Range Group has been dated from foraminifera to be in the age range of Pennsylvanian to late Permean (D.J. Timpleman-Kluit, 1972). Both units 8A and 8C of D.J. Timpleman-Kluit contain foraminifera-bearing limestone wedges or lenses.

D.J. Templeman-Kluit finds two very important features of the Anvil Range Group that apply to major tectonic events in the Anvil District.

The first feature is the presence of a regional scale, angular unconformity between the Anvil Range Group and all underlying groups. The unconformity represents an episode of considerable tilting or open folding, followed by an interval of erosion (D.J. Templeman-Kluit, 1972) before the emplacement of the Anvil Range Group.

Secondly, the interpretation of the entire Anvil Range Group offers an excellent perspective of Plate Tectonics and the Anvil Range environment. The following is an extract from D. J. Templeman-Kluit (1972 : 17):

> "Rocks of the Anvil Range Group represent an episode of widespread volcanism and related sedimentation under largely marine conditions, as attested by the fossils discovered in limestone in the unit and by the presence of local pillow structure in the volcanic rocks. To explain their impurity, the chert rocks are thought to contain much tuffaceous material; their silica could be derived in part by solution from pyroclastic ejecta. The pebbly rocks in the chest member probably represent intraformational breccias..."

and further:

> "The Pennsylvanian and Permean Anvil Range Group is the northernmost known eugeosynclinal assemblage of that age in the Canadian Cordillera."

Serpentinite, Unit 9A (Unit 9 of D. J. Templeman-Kluit) occurs in a narrow, continuous belt along the Vangorda fault system to the North of Tintina Trench. Serpentinite and/or peridotite are typical Alpine intrusive crystalline masses emplaced during tectonic uplift. (D. J. Templeman-Kluit).

The age of the serpentinite belt is probably Upper Pennsylvania -Lower Triassic (D. J. Templeman-Kluit, 1972).

H. Triassic Sediments (Unit 10)

Unit 10 is a group of Triassic sediments containing two recognizable lithofacies, the first a conglomerate and secondly a mixed sedimentary rock sequence.

Chert pebble conglomerate and polymictic conglomerate characterize Unit 10A of D.S. Jennings. The polymictic conglomerate contains clasts of metaquartzite,chert, basalt and limestone. (D. J. Templeman-Kluit, 1972).

The mixed sedimentary rocks,Unit 10B of Jennings and Unit 10A of D. J. Templeman-Kluit, contain interbedded greywacke, shale, siltstone, sandstone and minor conglomerate.(D.S. Jennings, unpublished).

D. J. Templeman-Kluit concludes that Unit 10 was deposited along the fault scarp produced by the vertical displacement along the Vangorda Fault System.

I. Intrusvie Igneous Rocks of Cretaceous Age (Unit 11)

Six varieties of Cretaceous igneous intrusive rocks are found in the region. They are listed below and will be discussed in greater detail in the next chapter as they all occur in the local area of study.

11A: Muscovite-Biotite Granodiorite
11B: Porphyritic Biotite Quartz Monzonite
11C: Quartz Monzonite Pegmatite Dikes
11D: Equigranular Hornblende-Biotite Quartz Diorite
11E: Porphyritic Hornblende-Biotite Quartz Diorite
11F: Smoky Quartz-Feldspar Porphyry

In terms of volume, Unit 11A, the Anvil Batholith comprises the greatest bulk of intrusives in the region. Units 11C through 11F are represented by dikes, sills and irregular bodies.

Potassium-Argon dating methods give an average approximate age of formationfrom90 to 100 million years B.P. (D.J. Templeman-Kluit, 1972).

J. Regional Structures

1) The Anvil Arch

The Anvil Arch is a large-scale feature that trends parellel to the Tintina Trench and is responsible for much of the existing deformation/ structural patterns seen in the Anvil Range. The core of the arch contains the igneous granitic rocks of the Anvil Batholith.

The Paleozoic strata on either side of the granitic core dip away from it. This results in a southwest dip of strata in the Faro Mine area.

The Anvil Arch is roughly 40 miles long and 15 miles wide and the spatial relationship between the Anvil Arch and the Anvil Batholith indicates the period of flexure is related to the intrusion of the Anvil Batholith during Cretaceous times.

2) Faults

All of the major faults in the area trend to the northwest and are steeply dipping with mainly dip-slip movement. The presence of peridotite-serpentinite intrusives along many of the faults indicates a deep penetration, perhaps to the mantle (D. J. Templeman-Kluit, 1972). All faults of this nature including the Vangorda, Glenlyon, Battle Creek, Grew Creek, Danger Creek, Lapie River, Ross River and Rose Creek faults parallel the Tintina Fault System/Trench. The magnitude of vertical displacement varies from minimum values of between 1000 and 5000 feet. Faulting probably occurred in a time spanning the Early Triassic to the Late Cretaceous.

One northeast trending fault (Blind Creek Fault) post-dates the Vangorda fault and may be formed as a result of the intrusion of the Anvil Batholith (D. J. Templeman - Kluit, 1972).

CHAPTER III

COUNTRY ROCK GEOLOGY

In this chapter, detailed descriptions of the lithological facies of the Faro Group (Unit 1), and the Cretaceous Intrusives (Unit 11) are given. All of the rock types given are found along the representative cross-section 142. The reader may refer to the representative sections (cross and long sections) found as a map supplement.

A. General

The Faro Group (Unit 1) wholly encloses the Faro number two zinc-lead-silver deposit. The group is subdivided into four distinct, regularly occurring units and two distinct irregularly occurring units. A further transition zone rock group defines a gradational sequence between the quartzo-feldspathic schist and the weakly carbonaceous schist. Each unit of the Faro group contains minor variations in the lithology and texture. Alteration of schists and other units found at shallow depths is common. The Faro group recognizable units are described below with reference to lithology and textures. Table 3-A, is the classification scheme used to determine the appropriate rock names.

Table III-1

Classification of Rock Types of the Faro Group

First Column	Second Column	Third Column	
Unit 1	A		Faro Group Undifferentiated
1	B		Tactite/Skarn
1	C		Quartzo-Feldspathic Biotite-Muscovite-Schist
1	D		Carbonaceous Biotite-Muscovite-Andalusite Schist
1	E		Graphitic Schist
1	F		Metabasite
1	G		Silicate Marble and Marble
		1	Siliceous
		2	Carbonaceous
		3	Calcareous
1	(D)	4	Bleached with Pyrite(eg) White Mica Envelope
		5	Banded
		6	Clotted
		7	Staurolite-Bearing
		8	Chloritic
		9	Sulfide Bearing
		0	Normal
1	C	D	Interbanded (eg) 1C0 + 1D0

Other Descriptive Terms:

Garnetiferous

Biotite-Muscovite Ratio

Laminated

Chiastolite-Bearing

Laminated

B. Carbonaceous Biotite-Muscovite Andalusite Schist (Unit 1D)

The typical member of this unit is a grey-beige, weakly carbonaceous moderately porphyroblastic schist. It is thinly banded with approximately 50% quartz, 25% muscovite, 15% biotite, 3-5% sericite, 2-5% opagues, 1-5% andalusite and accessory staurolite, chlorite, kaolin, sphene, zircon and tourmaline.

Quartz occurs mainly as unstrained, granoblastic grains in segregated layers. Minor quartz inclusions are found in andalusite and staurolite poikiloblasts. Quartz is the common pressure shadow growth mineral found adjacent to the andalusite and staurolite porphyroblasts.

Muscovite occurs as slender, very finely crystalline tabular crystals, frequently displaying a lepidoblastic texture. The "flow-like" growth of the muscovite is mainly confined to segregate layers with minor growth interstitial to the granobalstic quartz. Up to 5% of the muscovite has altered to a felted microcrystalline mass of sericite.

Pleochroic biotite exhibits two distinct textural phases. Fine-grained biotite porphyroblasts/poikiloblasts display a random growth orientation with respect to the main schistosity. These subhedral biotite plates have grown during and/or after the main deformational event. Some of these biotite crystals are kinked and sheared obliquely to the main schistosity indicating a further deformational phase. Partial rotation during growth is demonstrated by the helicitic texture - a curved trail of quartz inclusions. Other inclusions in the biotite include muscovite, tourmäline and abundant zircon.

The second textural phase of biotite occurs as slender, very fine-grained, tabular subhedral crystals. This variety is less abundant than the "porphyroblastic-type" and behaves texturally similar to the muscovite.

Biotite crystals are variably altered to either chlorite, clays or a rust-red goethite-limonite mineral.

Andalusite occurs as medium to coarse-grained disintegrating poikiloblasts. The crystals are colourless in plain light and a light to medium grey in polarized light. Extinction is symmetric about the two 90° intersecting cleavage traces. Rotation during growth is demonstrated by the helicitic curved trail of quartz inclusions. The corroded nature of the andalusite makes a distinction between included minerals and alteration product minerals difficult. Probable inclusions are quartz and muscovite while alteration and regrowth products may include kaolin, biotite, chlorite, staurolite and opaques.

Pleochroic yellow, medium-grained fragments of staurolite poikiloblasts are sparsely distributed throughout the unit. Quartz inclusions are common within the staurolite.

Subhedral crystals of pyrite, wispy rust-red geothite/limonite and thin septa of graphite comprise the identifiable opaque minerals.

Euhedral crystals of tourmaline and sphene are found throughout the unit in an extremely fine-grained, ubiquitous growth pattern.

Other identified accessory minerals include zircon, chlorite and kaolin.

The carbonaceous biotite-muscovite andalusite schist stratigraphically is the upper unit within the Faro Group. The unit acts as the immediate host to the ore body and is frequently found as discontinuous wedges within the deposit.

Variations from the normal unit are common and include the following units: 1D1, 1D4, 1D5, 1D6, 1D7, 1D8, and 1D9.

C. Bleached-Pyritic Quartz-Muscovite-Sericite Schist (Unit 1D4)

This unit is commonly called the "White Mica Envelope" and contains from 3-5% pyrite. The bleached, white to buff coloured schist is very fine-grained and laminarly banded. The typical mineral assemblage is sericite, quartz, muscovite and pyrite with accessory biotite, kaolin, garnet, galena and sphalerite.

The unit is found in beds of varying thickness throughout the ore horizon and frequently envelopes or haloes the main Faro deposit (see figure 26 in D.J. Templeman-Kluit, 1972). The White Mica Envelope, (sensu stricto) does not "envelope" the Faro Zone Two deposit. As seen along section 142, the bleached schist is found as discontinuous lenses and sheets with thicknesses ranging from 2 to 20 feet.

The bleached schist texturally resembles the typical carbonaceous-biotite-muscovite-andalusite schist. From the textural similarities, the spatial relationship with the ore and the high sulfide content of the bleached schist, one can postulate that the protolith of the bleached member was altered during the emplacement of the sulfides.

D. Quartzo-Feldspathic Biotite-Muscovite-Gneiss/Schist (Unit 1C)

The typical member of this unit is a light beige-brown, well-banded, variably porphyroblastic schist of undetermined thickness. The quartzo-feldspathic schist is separated from the overlying carbonaceous schist unit by approximately 200' of transition zone lithology (Unit 1CD)

The dominant mineralogy includes quartz, plagioclase, biotite, garnet, andalusite, staurolite with accessory opaques, sericite, tourmaline, zircon and chlorite. Minor alteration of feldspar, biotite and muscovite commonly occurs.

The ratios of biotite to muscovite and garnet to staurolite to andalusite are variable throughout the unit.

A typical quartzo-feldspathic schist was sampled in diamond drill hole 76 DS2 at 815'. A detailed lithological and textural description follows:

Quartz occurs as unstrained, fine-grained anhedral crystals. The granoblastic grains are mainly contained within quartz-rich bands. Quartz may also occur as inclusions in garnet, staurolite and andalusite poikilobasts. Quartz growth in porphyroblast pressure shadow zones is common.

In this particular specimen biotite is abundant comprising upwards to 30% of the section. The crystals are generally subhedral to euhedral, fine to medium-grained having a tabular habit. Two textural phases are apparent: One having pre-main deformational properties and the second, having post-main deformational properties. The pre-deformational phase crystals are fine grain and slender having a lepidoblastic texture. Segregate-layering of the biotite crystals predominates.

Coarser-grained, randomly oriented biotite poikiloblasts have grown following the main deformational phase. These biotite crystals are less abundant than the lepidoblastic variety and contain numerous inclusions of quartz, muscovite, chlorite, tourmaline and opaques.

Both varieites of biotite contain inclusions of zircon with corresponding dark brown halos. Some of the biotite crystals have altered to chlorite.

Slender, euhedral tabular crystals of muscovite are intergrown with the biotite and behave in a similar lepidoblastic fabric. Total muscovite present is under 5%. Muscovite rarely alters to sericite.

Plagioclase occurs as fine-grained anhedral crystals containing patches of sericite alteration. The grains may contain inclusions of quartz and opaque minerals. Several grains of feldspar were found as inclusions within the garnet. Texturally, the plagioclase grains are elongate and are contained within the quartz-rich layers. Only rare, faint and relict twinned plagioclase crystals were identified.

Garnet, staurolite and andalusite porphyroblasts have a poikilitic texture and occur in layers dominated by porphyroblasts. Andalusite and staurolite crystals are spatially, closely related.

Garnet porphyroblasts are coarsely crystalline and euhedral, having a diameter of approximately three millimeters. The pale pink-yellow crystals are regularly fractured in two directions, one of which is perpendicular to the prevailing schistosity. The other more minor fractures parallels the present schistosity.

Inclusions within the garnet occur regularly within the quartzo-feldspathic schist unit and present some valuable deformational history to the viewer. Other textural features add to the entire tectonic picture.

Garnet appears to predate the staurolite and andalusite as the later two porphyroblasts "wrap-around" the garnet. Within the garnet is a trail of inclusions, mainly quartz, feldspars and opaques. The trail is postulated to represent the pre-garnet growth lithology and structure. The common fabric viewed in the inclusion trail is a straight-line path oblique to the schistosity, however, two garnets contained tightly folded, chevron-like folds as defined by the inclusion trail. This feature within the garnet is postulated to be S_2 of D.S. Jennings and the predominant, pervasive schistosity is equivalent to S_4 of D.S. Jennings. Thus, rotation of garnets during growth is really insignificant or minor where present with the majority of inclusion trails which represent simple overprinting. The growth of quartz in the pressure shadow zone of garnet is common.

Pleochroic and occassionally twinned staurolite subhedral to anhedral poikiloblasts are commonly restricted to a set of segregate layers. The staurolite appears as highly fractured and variably corroded crystals and crystal fragments. The medium to coarse-grained crystals have an average maximum length of 2 millimeters. The segregate layering and the crushed and aligned fragments indicate that the grains at least pre-date the prevailing schistose fabric. The staurolite porphyroblasts are also "wrapped-around" by the micaceous minerals and quartz growth in the pressure shadow zone occurs frequently. A second condition exists whereby the staurolite is sufficiently elongate with tapered ends to behave as a micaceous mineral. Here there are no pressure shadow zones or lepidoblastic-like micas wrapping around the staurolite.

Quartz and opague minerals are the dominant inclusion species. The inclusion trails are linear and aligned both parallel and oblique to the schistosity.

Andalusite is frequently in close spatial contact with the staurolite. In one larger andalusite porphyroblast a corroded staurolite porphyroblast was identified.

Generally coarse-grained, corroded, anhedral crystals of andalusite occur in plentiful amounts within the quartzo-feldspathic schist unit. While grain size varies, grains as coarse as 4 millimeters are common.

The moderately fractured andalusite porphyroblasts are stretched to form elongate crystals paralleling the schistosity. Andalusite growth appears to be syn-deformational as crystal habit is similar to the micas. No "wrap-around" textures are seen enveloping the andalusite. By contrast andalusite does behave pseudo-lepidoblastically by wrapping around the garnets.

Inclusion trails of opaque minerals form gently curved patterns, perhaps indicating an insipient helicitic texture. Other inclusions of feldspar quartz, staurolite and biotite occur in abundance within the andalusite. Penninite growth occurs at andalusite crystal interfaces.

Accessory minerals include opague minerals (mainly pyrite), kaolin, sericite, zircon, penninite and tourmaline.

The quartzo-feldspathic schist unit is located 200' stratigraphically below the lower contact of the Faro Number Two sulfide deposit. The unit has been drilled along section 142 at DDH 76DS2 for a vertical distance of over 1000'. No conformable base has been identified in the Anvil Mine area.

Along section 142 the following variations from the ICO type assemblage were identified: 1C4, 1C2, 1C8 and 1C6.

The quartzo-feldspathic unit is a direct host to the tactite (1B) and marble (1G) units. The metabasite bands or other irregular bodies are found within the quartz-feldspathic schist. No appreciable amounts of sulfides are contained within the unit.

E. Tactite/Skarn and Silicated Marble (Unit 1B)

The tactite/skarn and silicated marble unit was intersected in DDH76D21 at the 1668 foot level. The unit is of variable compostion and includes bands of calc-silicate phyllite/schist, biotite phyllite/schist; silicated marble and the actual garnet-rich skarn. All of the compositional bands are calcareous.

The actual skarn bands appear mottled with white, green, salmon and brown-red colour mixtures. Compositionally the unit contains garnet, calcite, diopside, quartz, idocrase, andalusite and others (wollastonite? epidote? feldspars ?). The skarn bands have a hornfelsic-like texture with porphyroblasts of garnet, idocrase and andalusite being mixed with prismatic, slender crystals of clinopyroxene all randomly oriented.

The skarn/tactite and silicate marble map unit is about 70' thick and occurs regularly at approximately 1200' below the lower contact of the ore horizon. The unit outcrops approximately 3000' north-northeast from the north-northeastern boundary of the Faro #2 ore deposit in the North Division Ditch.

F. Marble and Silicated Marble (Map Unit 1G)

The marble and silicated marble map unit was intersected in DDH76DS2 at the 1597 foot level. The unit is grey-white, weakly banded and contains about 10% interbedded metabasite and quartzo-feldspathic schist. The unit appears to be part of the skarn/tactite sequence.

The marble contains 90% calcite and minor plagioclase, opaques quartz, phlogopite and amphibole. Texturally the calcite, plagioclase, quartz and opaques occur as subsequent granoblastic grains, while the phlogopite crystals are slender, euhedral and of tabular habit.

The marble and silicated marble map unit is wholly contained within the quartzo-feldspathic schist. This regularly occurring unit is also 70' thick and is intersected about 1125 feet below the lower contact of the Faro Number Two ore horizon.

G. Metabasite (Map Unit 1F)

Metabasite or amphibolite occurs as a mappable unit throughout the Faro Group and is contained within the upper carbonaceous schist member (1D), the middle transition zone schist member (1CD), and the lower quartzo-feldspathic schist member. Along section 142, amphibolite bodies become more abundant as one proceeds to the southwest. The transition zone schist is the member that contains the most amphibolite, followed by the upper carbonaceous schist member and the lower quartzo-feldspathic schist member. These trends are seen in Table III-2.

Table III-2

Metabasite/Amphibolite Occurrence in DDH 76DS2 and DDH 76DS3

	DDH 76DS2			DDH 76DS3		
	Metabasite Intersection	Total Unit Thickness	% Metabasite	Metabasite Intersection	Total Unit Thickness	% Metabasite
1DO	41.6'	400'	10.4%	0'	98'	0%
1CD	88.2'	180'	49.0%	12.4'	152'	8.2%
1CO	38.5'	1090'	3.5%	0'	300'	0%
1DO +) 1CD +) 1CO)	168.3'	1670'	10.1%	12.4'	550'	2.3%

← southwest ——

Amphibolite has not been found in the immediate area of the Faro # 2 deposit. It is first recognized 1000' southwest and 2400' to the northeast in drill core from the ore body margins along section 142.

It is clear from existing drill core that the amphibolite/metabasite map unit terminates in the vicinity of the Faro # 2 sulfide deposit. The change in facies from a probable metaigneous species to a purely metasedimentary species adjacent to the Faro Number Two sulfide deposit and at the same stratigraphic level implies a significant change in the paleo-depositional environment. This factor may be a relevant building block in better understanding the origin of the deposit.

A fresh sample of amphibolite taken from the 595 foot level in DDH 76DS2 was selected as a representative sample of the map unit. The amphibolite is medium to dark green-grey, finely crystalline and weakly banded. Several calcite-filled hairline fractures cross-cut the weakly defined schistosity. Fibrous tremolite-actinolite makes up about 90% of the section with chlorite, plagioclase, quartz, calcite and opaques making up the remaining 10% in order of abundance. The tremolite-actinolite occurs mainly as fibrous aggregates and as slender, oriented, prismatic euhedral crystals. Plagioclase is rarely twinned and occurs in very fine-grained crystals. Several Michel-Levy tests were attempted and, at best, a calcic range of labradorite up to andesine was crudely determined for the plagioclase composition. Chlorite appears as an alteration product of the amphibolite. Calcite occurs only as a secondary, post-main deformation phase in very thin veinlets. Anhedral, strained quartz crystals are very fine-grained and generally occur with the plagioclase in discontinuous pods and layers. Opaques minerals (mainly pyrite) are aligned discontinuously parallel to the main cleavage.

In relation to the Faro Number Two sulfide deposit, amphibolites above, below and equal to the Faro Number Two ore horizon were traced to the southwest along section 142.

H. Graphitic Schist (Map Unit 1E)

Graphitic schist pods and lenses are found within and adjacent to the sulfide deposit and in a thin, questionably continuous sheet within the quartzo - feldspathic schist.

The schist is variably graphitic and siliceous, thinly to laminarly - banded and weakly pyritic. It grades into either the ribbon - banded graphitic quartzite (Mapt Unit 2A) or the carbonaceous biotite - muscovite andalusite schist. Discontinuous lenses and/or pods are always less than ten feet thick and occur randomly throughout the sulfide deposit.

Within the quartzo-feldspathic schist unit an 8 foot intersection of quartz-graphite schist is found at a level 500 feet below the lower contact of the Faro Number Two ore deposit. Similar lenses or sheets have been recognized at the same general stratigraphic level in the Anvil Mine area.

I. Igneous Intrusive Rocks (Map Unit 11)

Intrusive igneous rocks of Cretaceous age temper the predominantly metamorphic terrain with sills, dikes, sweats and irregular bodies. Most, if not all, of the igneous activity occurred at the time of the intrusion of the Anvil Batholith, between 90 and 100 million years B.P. .

Five recognizable igneous intrusive units along section 142 and within the immediate area of the Faro Number Two sulfide deposit have been identified. Table III - 3, outlines the appropriate intrusive unit with

* Location and Abundance of Igneous Intrusives

	Anvil Batholith 11B	Pegmatite Sweats 11?	Diorite Equigranular 11D	 Porphyritic 11E	Porphyritic Micro-Monzonite 11?	Smoky Quartz Feldspar Porphyry 11F
76 DS2	-	2 x 1" bands @1400'	-	477-491' =14'	430'-471.5' 1140.6'-1149.3' =50.2'	-
76 DS3	-	-	-	133-199 278-281 359-390 607-643 =136'	-	-
65-56	-	-	-	86-124 256-303 480-502 =107'	-	-
67-23	-	-	-	13-65 =52'Min.	-	-
76x18	-	-	-	-	-	486-554+ =68'Min.
76 DS4	-	-	14-402+ =388'Min.	-	-	-
74 DS1	1014-1031 =17'Min.	549.5-555.5 668-672 =10'	-	508-532 701.5-938 =260.5'	-	-

* Along section 142

respect to its location at depth along section 142.

It appears that most of the intrusives followed the path of pre-existing fault zones or other planes of weakness. The Faro Number Two sulfide deposit is not adversely affected with respect to intrusives displacing the economic ore with the exception of the southeastern end as seen in the long section #12.

1. Smoky Quartz Feldspar Porphyry

The smoky quartz feldspar porphyry of quartz - monzonite composition contains a light grey matrix, dark grey, rounded quartz phenocrysts, euhedral, variably altered feldspar phenocrysts and the occasional dark brown to black subhedral laths. Maximum measured dimensions for the quartz and the feldspar are 3mm and 16mm respectively.

In thin section, the feldspars have altered to either calcite or saussurite and are weakly fractured. Biotite crystals are heavily included with zircon, tourmaline and quartz. The matrix is very fine-grained to microcrystalline containing mainly quartz and feldspar. Accessory minerals include opagues, calcite and saussurite.

2. Porphyritic Quartz - Feldspar Monzonite

The porphyritic quartz - feldspar " micro - monzonite " appears to be vaguely related to the smoky quartz feldspar porphyry. The major difference is that his unit was more quickly " quenched " than the previous unit described. The end result produces a more weakly porphyritic rock. That is to say, the ground matrix is coarser - grained and the phenocrysts are less abundant and smaller.

The principal minerals as seen in thin section are quartz, feldspar and calcite with accessory biotite, sericite and opagues. Quartz grains occur in granular aggregates or as single large, rounded phenocrysts. Minor " graphitic " textural intergrowths between the quartz and feldspar are present. The matrix is very fine to fine - grained and is made up of primarily quartz and feldspars with minor sericite.

3. Equigranular Quartz - Plagioclase - Biotite Diorite/Granodiorite

This diorite (11D of Jennings) /granodiorite contains subequent medium to coarse grains of quartz, plagioclase, potash feldspar and biotite. The unit is generally light grey with brown flecks representing the biotite and opague minerals.

In thin section the rock texture is hypidiomorphic - granular with subsequent crystals of anhedral, strained quartz ; euhedral, normally - zoned, variably altered plagioclase of general andesine composition ; anhedral to subhedral potash feldspar and subhedral tabular growths of biotite. Accessory minerals include opagues, zircon, tourmaline, calcite, kaolin, and sericite.

The porphyritic hornblende - biotite - quartz diorite/granodiorite (?) (Map Unit 11E) contains hornblende, biotite, quartz and feldspar phenocrysts set in a matrix of dominantly quartzo - feldspathic matrix.

4. Porphyritic Quartz - Feldspar - Biotite Monzonite/Granodiorite of the Anvil Batholith

The medium grey granitic rocks of the Anvil Batholith range from quartz - monzonite to granodiorite in composition. Phenocrysts of quartz, plagioclase, potash feldspar and biotite are set in a fine - grained matrix of quartzo - feldspathic minerals. Quartz occurs as anhedral equant crystals occasionally forming myrmekitic intergrowths with potash feldspar. The plagioclase is normally zoned with saussuratized cores and an average composition of oligoclase (Templeman - Kluit, 1972). Subhedral biotite crystals are frequently corroded and may contain inclusions of zircon. Potash feldspar forms long euhedral crystals. The presence of two feldspars indicates a sub - solvus origin - from a granitic magma. The preferential alignment of feldspars and biotite crystals in the intrusion suggest that implacement occured within directed stress field.

J. Metamorphism

The country rock is metamorphosed to different degrees. The common metamorphic mineral assemblages found in Faro schist group include :

1. Quartz - muscovite
2. Quartz - chlorite - muscovite
3. Quartz - muscovite - biotite - andalusite - staurolite
4. Quartz - muscovite - biotite - andalusite - staurolite - plagioclase - garnet

The assemblages are characteristic of greenschist to lower amphibolite facies of regional metamorphism. Assemblages one through three are found in the carbonaceous (1D) schist unit and assemblage four is the representative facies found in the quartzo - feldspathic (1C) schist unit. D. J. Templeman - Kluit (1972) suggests the age of metamorphism to be Cambro - Ordivician.

CHAPTER IV

FARO NUMBER TWO ORE HORIZON

A. General

The Faro Number Two orebody is a generally regular and continuous south - west - dipping tabular lens. Its longest axis, about 1600 feet, trends northwest. The deposit is 1200 feet wide and as much as 95 feet thick ; the average thickness is about 60 feet. The depth of the mineralized zone beneath the surface ranges from 30 feet at the northeast end to 185 feet at the southwest end ; the average depth is 60 feet. An isopach profile of the number two sulfide deposit is given in Figure IV-1. Also, two cross sections and one long section are contained within the map suppliment to the text.

The Faro Number Two deposit contains several different facies of ore grade and barren sulfide rocks. The general classification scheme is out - lined in Table IV-1. A similar three figure alpha - numeric - computor compatible format was used. In addition to the Faro sulfide facies, previously described Faro group schists and Cretaceous intrusives are present.

Table IV-1

A Descriptive Classification of the Faro Group Sulfide Facies

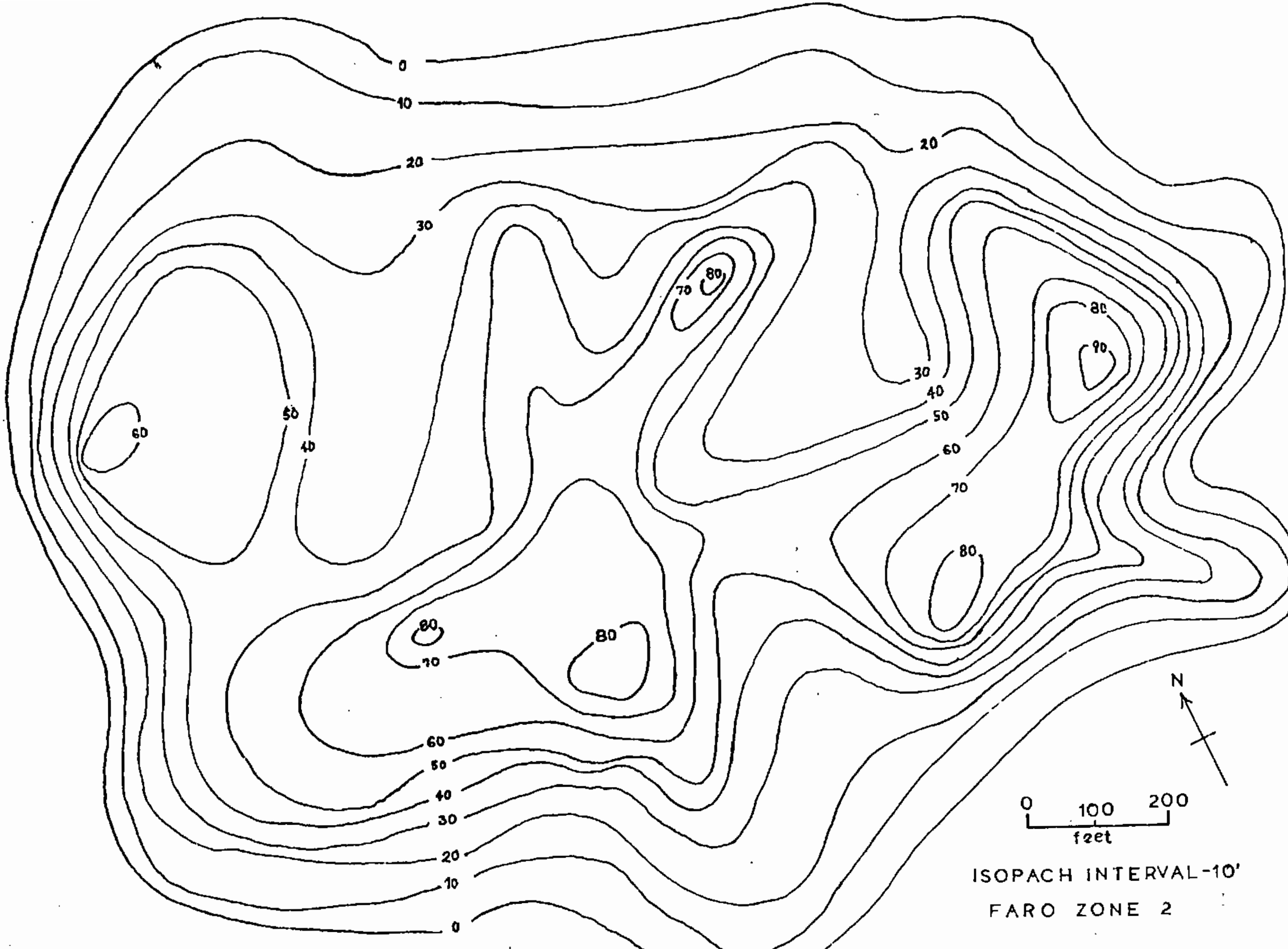
First Column	Second Column	Third Column	
Unit 2	A		Ribbon Banded Graphitic Quartzite
2	B		Sulfide - Free Quartzite
2	C		Pyritic Quartzite
2	D		Base Metal Bearing Quartzite
2	E		Massive Pyritic Facies
2	F		"Buckshot Facies"; Massive Pyrite-Basemetal Sulfides
2	G		Baritic Facies, Massive Sulfides - Sulphates
2	H		Pyrrhotite Facies, Massive Sulfides
		1	Siliceous
		2	"Buckshot" or Tertiary Coarse Pyrite - Bearing
		3	Fine - Grained Pyrite - Marcasite Bearing
		4	Sphalerite And/Or Galena - Rich
		5	Base Metal Sulfide And Sulfate - Bearing
		6	Barite Bearing
		7	Pyrrhotite Bearing
		8	Magnetite Bearing
		9	Chalcopyrite Bearing
		0	Normal

Other Descriptive Terms :

Brecciated

Interbanded

Calcareous



ISOPACH INTERVAL-10'

FARO ZONE 2

B. Ore Horizon : Facies Descriptions

1. Ribbon - Banded Graphitic Quartzite (Unit 2A)

The ribbon - banded graphitic quartzite is a fine - grained, variably graphitic, thinly - banded quartz, graphite, sericite - pyrite bearing rock. Accessory galena, siderite and sphalerite are commonly present.

The quartz is commonly separated into light - coloured bands and grey graphite - bearing bands giving the rock its " ribbon - banded " character. The amount of granoblastic quartz varies from 85-95% of the total rock. Euhedral crystals of pyrite occur in discreet layers and may reach up to 10% of the rock. Finely disseminated sphalerite is the common base - metal sulfide present. Combined lead - zinc within the ribbon - banded graphitic quartzite unit averages 5%, and may be as high as 10%.

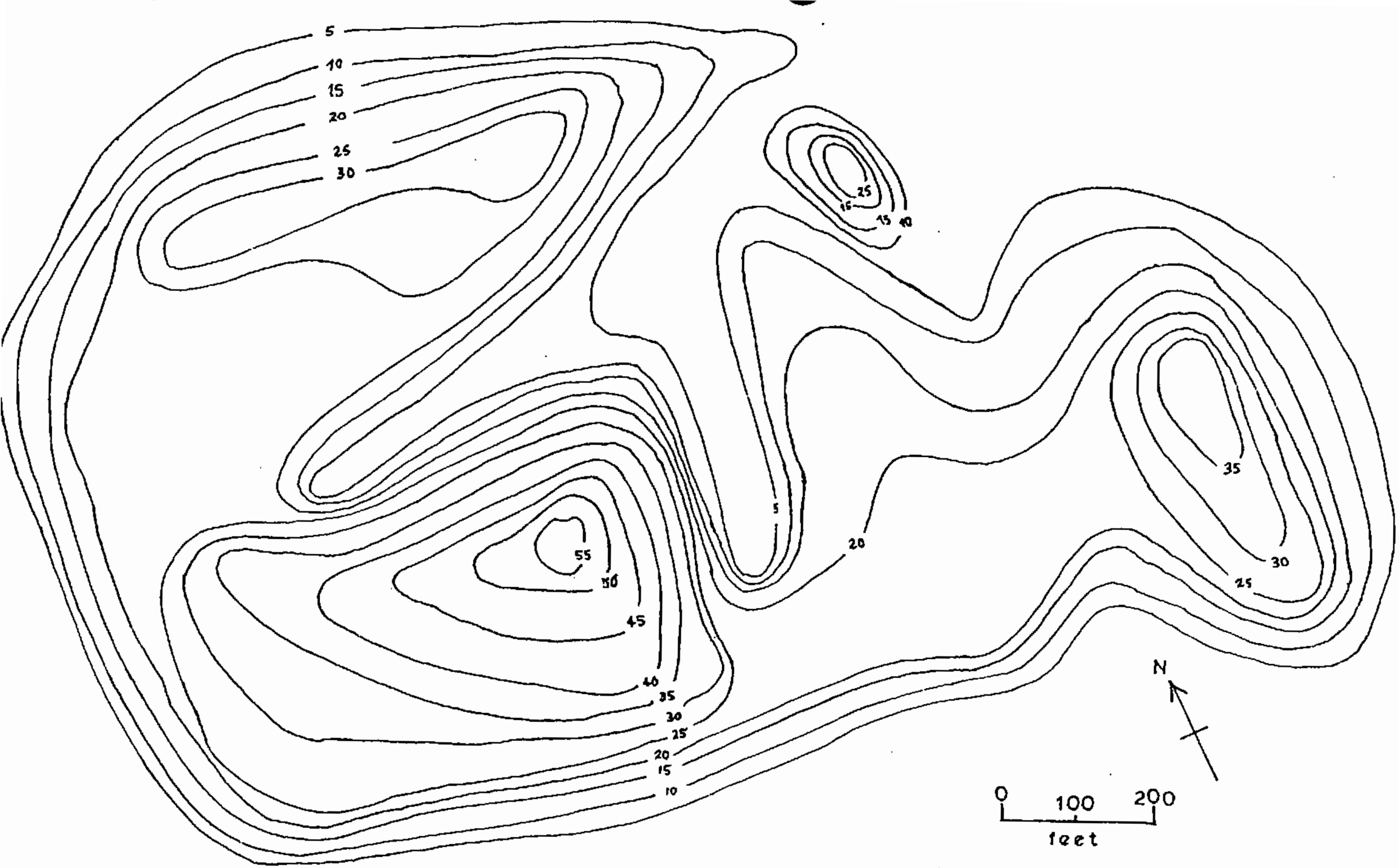
The ribbon - banded graphitic quartzite, as seen in long section 12 commonly underlies the massive sulfides. However, this cannot be stated as a general rule for this particular facies as it is also found overlying and within the deposit. Figure IV-2, demonstrates the distribution of this facies. The greatest thicknesses of the ribbon - banded graphitic quartzite are at the deposit margins and in particular at the southwest margin.

The presence of graphite indicates a basin or region of deposition in which chemical conditions are suitably reducing. The ribbon - banded graphitic quartzite may represent a meta- carbonaceous chert or a meta - carbonaceous exhalative chert.

2. Quartzites with Disseminated Pyrite, Galena, and Sphalerite (Units 2B,2C,and 2D)

The quartzites have been divided into three main lithological groups

FIGURE IV-2 Isopach Map Showing The Distribution of the Ribbon-Banded Graphitic Quartzite



ISOPACH INTERVAL - 5'

FARO ZONE 2

based on the presence or absense of minerals. The groups are : 1) sulfide - deficient quartzites, 2) pyritic, base metal - deficient quartzites and 3) sulfide - rich quartzites.

The sulfide - deficient quartzites contain less than 5% galina, sphalerite and pyrite. The unit is commonly buff - grey, massive to weakly - banded, variably micaceous and occasionally brecciated. The sulfide - deficient quartzites commonly grade into the ribbon - banded graphitic quartzite.

The pyritic, base metal - deficient quartzites are buff to medium grey, moderately crystalline, variably pyritic, weakly micaceous, variably carbonaceous and occasionally brecciated. Disseminated pyrite occurs as stringers and blebs interstitial to the anhedral quartz grains. Total pyrite ranges from 5 - 20%. Combined galena and sphalerite is less than 1%.

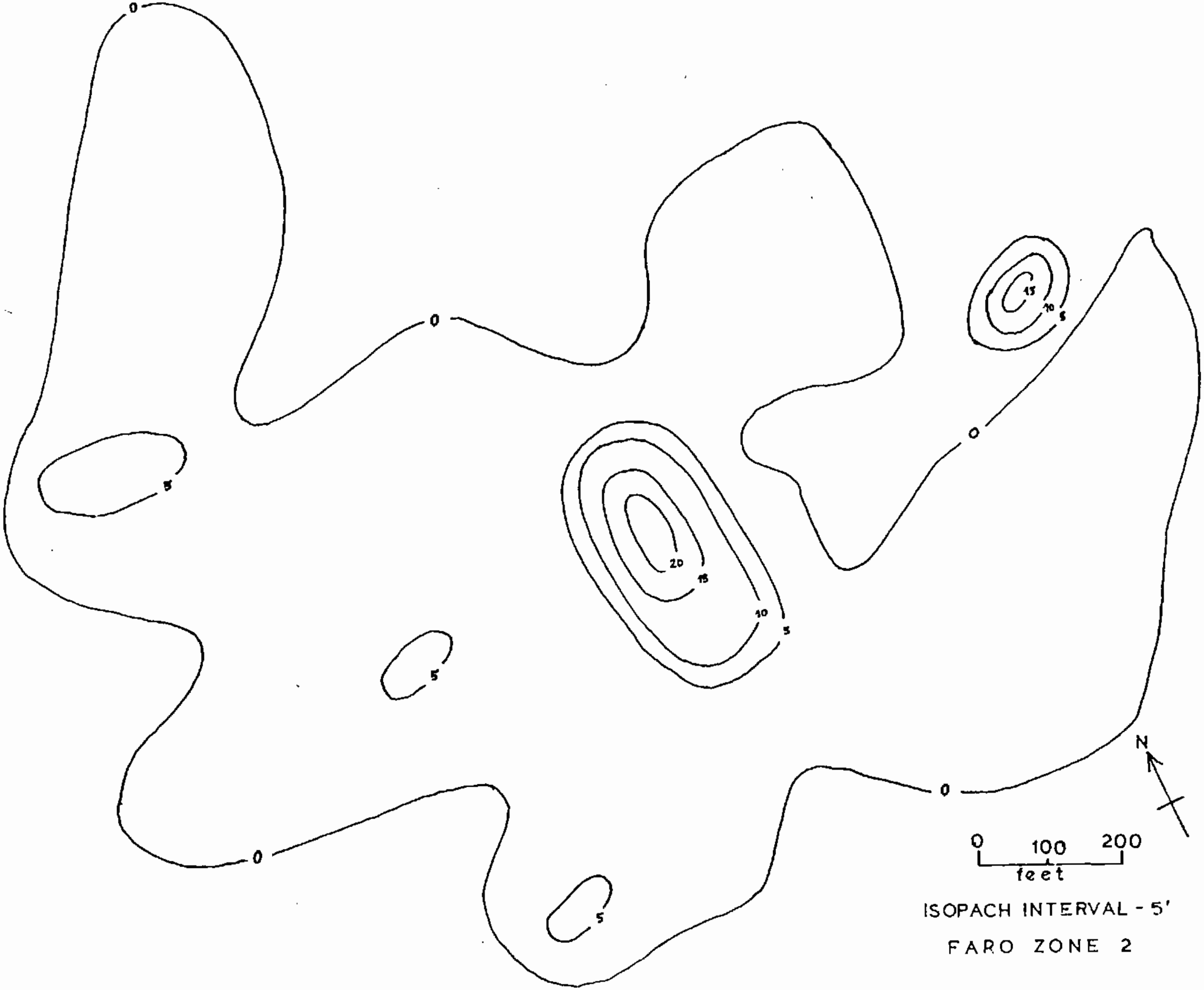
The total accumulated pyritic and sulfide - deficient quartzites rarely exceeds 15 feet through the ore horizon and is thickest at the deposit margins.

The sulfide - rich quartzites are composed of fine - grained, disseminated pyrite, sphalerite and galena set in a moderately crystalline host of anhedral quartz grains (accessory chalcopyrite is common). The unit is variably carbonaceous, moderately banded and occasionally brecciated. Combined lead - zinc ranges from 5 - 15%. The sulfide - rich quartzites rarely exceed 10 feet in thickness through the ore horizon and appear to be more concentrated in the central part of the deposit.

3. Massive Sulfides (Units 2E,2F,2G, and 2H)

The massive sulfide group is characterized by subhedral, coarse - grained porphyroblasts of pyrite with interstitial sphalerite, galena, marcasite, barite and chalcopyrite. Fine - grained quartz is the principal silicate mineral

FIGURE IV-3 Isopach Map Showing The Distribution of the Massive Pyritic Facies



ISOPACH INTERVAL - 5'

FARO ZONE 2

present. Accessory minerals include pyrrhotite, tetrahedrite and siderite. Templeman - Kluit (1972) has, in addition, recognized minor amounts of magnetite, arsenopyrite and bournonite in his study of the main Faro ore zones. Pyrrhotite occasionally replaces pyrite in substantial amounts (giving Unit 2H). An ore horizon facies was considered as " massive " ; only if it contained more than 75% sulfide mineralization. The massive sulfide group has been subdivided into three principal recognizable facies : 1) Massive pyritic, base metal - deficient sulfides; 2) " Buckshot"facies - massive pyritic - base metal sulfides ; 3) " Baritic facies " - massive pyritic - base metal sulfides and sulfates.

The massive pyritic facies is characterized by coarse - grained, hedral equant grains of pyrite comprising of up to 95% of the rock. Quartz, marcasite, sphalirite, galena, pyrrhotite, chalcopyrite and tetrahedrite are present as fine - grained, institial grains commonly totalling 10% of the rock. Pyrite also occurs as secondary euhedral cubes and some of the pyrite porphyroblasts have a fuzzy, mottled appearance. Fine - grained marcasite may be present in greater amounts giving the rock a " porphyritic " appearance. Varying amounts of the massive pyritic facies are present. Figure IV-3, indicates a general sparse scattering of this facies. Only three zones of enrichment are found, and the unit is commonly absent. The " Buckshot Facies " is the most economic ore facies. Combined lead - zinc may reach as high as 25% and usually maintains an average of between 10 and 15%. The massive pyritic - base metal sulfides are generally moderately crystalline, insipiently - banded, variably baritic and weakly siliceous. It is not uncommon to find polymictic breccia - like clasts within the " Buckshot Facies ". Pyrite, sphalerite, galena, marcasite, chalcopyrite and pyrrhotite are the common sulfide minerals. Pyrite occurs as medium - grained subhedral single crystals and in crystalline aggregates. Sphalerite and galena are generally concentrated into discreet base metal - rich bands. Chalcopyrite occurs as finely crystalline stringers and blebs. Pyrrhotite is mainly found as exsolution blebs within the chalcopyrite.

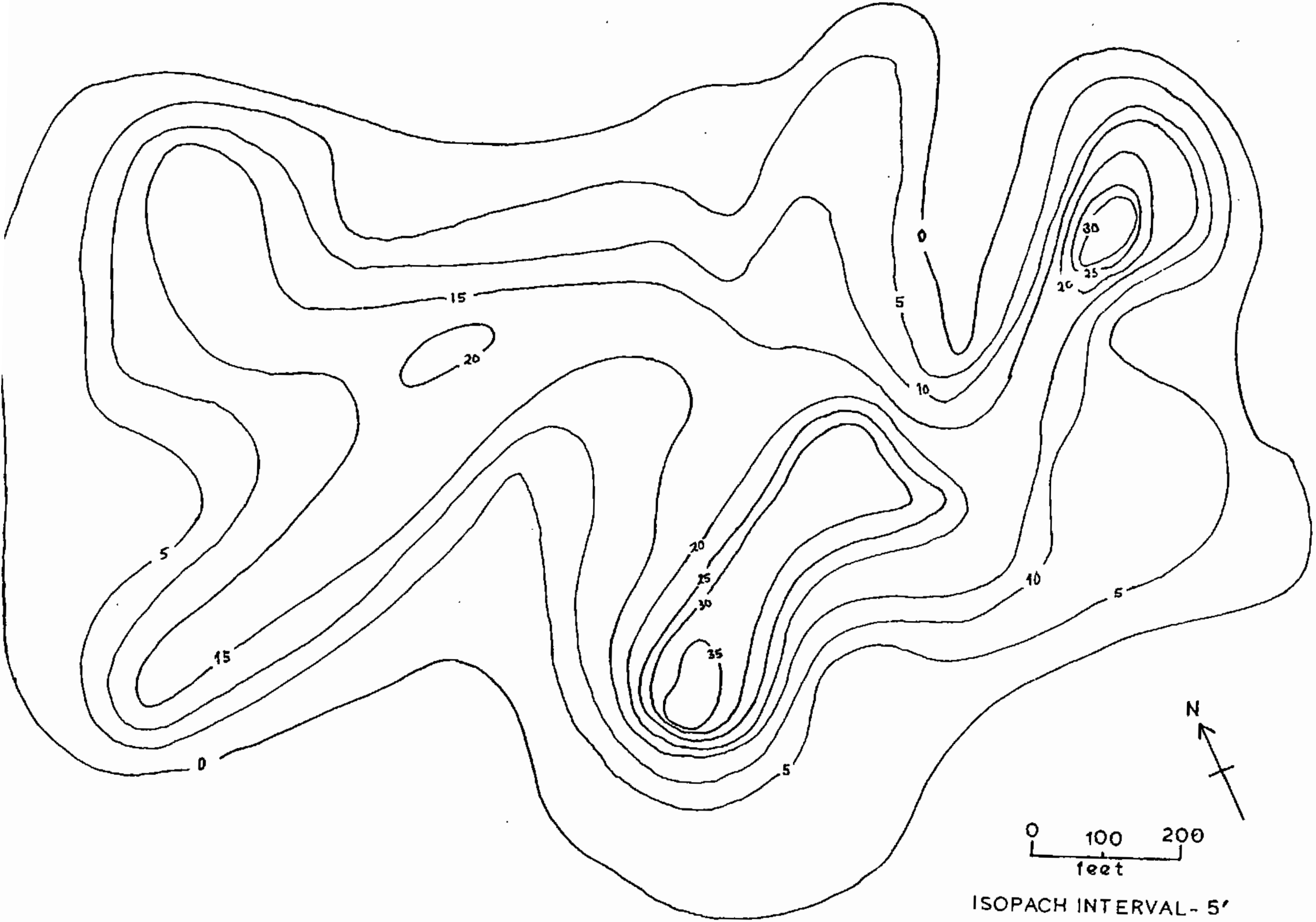
Figure IV-4, is an isopach map of the total accumulated massive base metal - rich sulfides. Of the three facies depicted, the Buckshot (2F) variety is by far the most abundant. Base metal concentration is consistently higher in the deposit's central region. A southwest trending, base metal - rich zone is found in the south - central area of the deposit. The margins of the deposit are clearly base metal - deficient.

The " Baritic Facies " closely resembles the " Buckshot Facies ". Only a highly subjective barite composition calculation separates the " Baritic Facies " from the baritic " Buckshot Facies ". Arbitrary guidlines set the former facies as greater than 5% and the later at between 1 and 5%. The greatest concentrations of barite occur at the outer fringes of the central core of the enriched base metal sulfide zone.

C. Summary of Facies Distribution through the Faro Number Two Ore Horizon

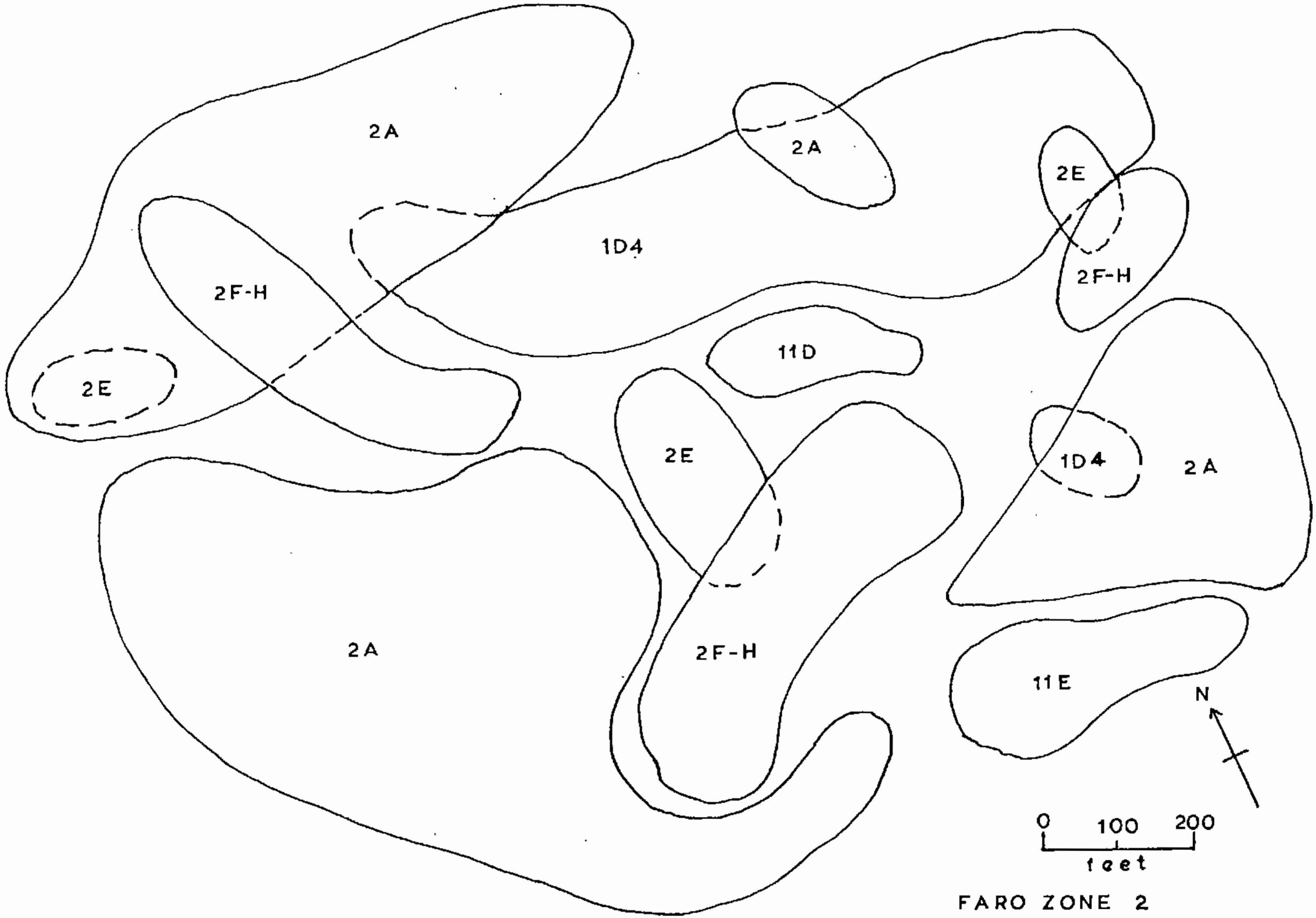
In general, a model of sulfide facies distribution can be derived from Figures IV-1 to IV-4. Figure IV-5 illustrates the distribution of the Massive pyritic base metal sulfides ; Massive pyritic, base metal - deficient sulfides; the ribbon - banded graphitic quartzite and the bleached - pyritic schists.

In the broadest terms, the deposit has a massive pyritic, base metal - bearing inner zone with a barite - rich fringe. The zone is surrounded by an outer zone of ribbon - banded graphitic quartzite and base metal - deficient quartzites. A large zone of bleached quartz - sericite - pyrite quartzite



ISOPACH INTERVAL - 5'

FARO ZONE 2



FARO ZONE 2

FACIES CODES FOUND IN MAP SUPPLIMENT

trending northwest is found at the northern periphyry of the deposit. Two small igneous intrusive bodies replace the sulfides at two random locations.

D. General Chemistry of the Ore Facies

The Faro Number Two sulfide deposit contains economic ore grades of zinc, lead and silver. Using the assay data (provided by Cyprus Anvil Mining Corporation) expressing zinc, lead and copper in weight percent and silver in ounces per ton, a representative reconnaisance of the ore chemistry was made along section 142 through the sulfide body.

1. Zinc - Lead - Silver - Copper Abundance

Overall Zn - Pb - Ag - Cu values are highest in the massive pyritic - base metal sulfide facies (Units 2F-2H). In this sulfide group, combined zinc - lead averaged 11.8%. Total silver and total copper averaged 2.61 ounces per ton and 0.16% respectively. Low copper values and its random distribution in the deposit, makes this metal uneconomic for mining.

In the massive pyritic facies (Unit 2E) combined zinc - lead averaged 8.5% ; total silver 1.82 ounces per ton, and total copper .06%. In the base metal - bearing quartzites (Unit 2D) , combined zinc - lead, total silver and total copper averages were respectively 8.9%, 2.24 ounces per ton, and 0.09%. In unit 2A, the ribbon graphitic quartzite, combined zinc - lead, total silver and total copper averaged 5.7%, 0.63 and 0.07% respectively. For the base metal - deficient quartzites combined zinc - lead averages were under 5% and silver and copper values were very low.

Over the entire section 142, including all sulfide facies, the average sulfide values were : Zinc - 3.83% ; Lead - 2.45% ; Silver - 1.27 ouncer per ton and Copper - 0.05%.

Silver is contained within the crystallographic structure of the galena. Figure IV-6, demonstrates the linear relationship between lead and silver abundances.

2. Zinc - Lead Ratios

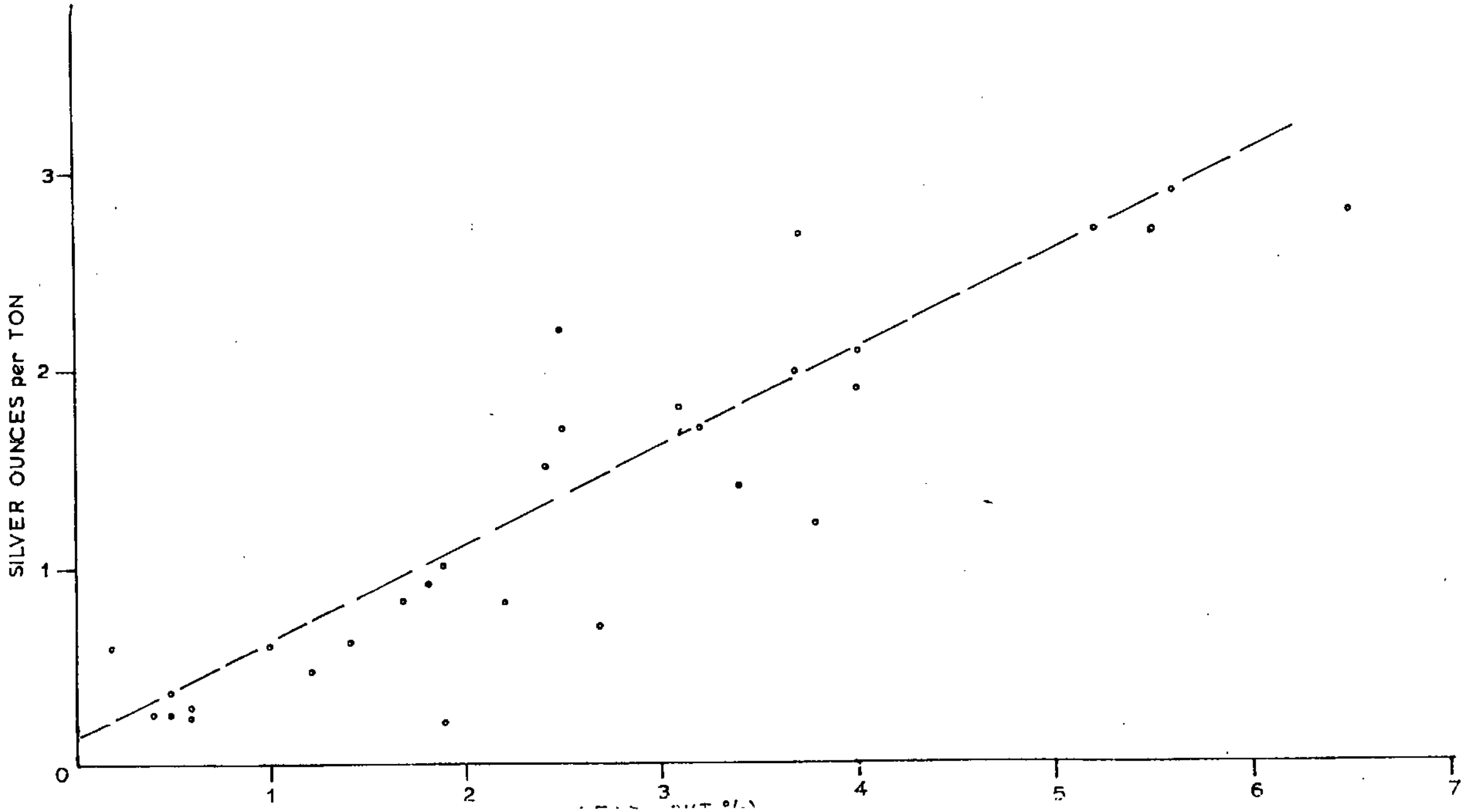
Zinc - lead ratios along the sampled section 142, vary according to the prevailing facies. The averaged zinc - lead for rocks containing more than 5% combined zinc - lead is 0.560. The principal variations in the ratios correspond to the total zinc - lead amount which in turn are related to the particular ore horizon facies. The massive, pyritic base - metal sulfides have an average zinc - lead ratio of 0.680. Further, the average zinc - lead ratios for the base metal - bearing quartzites is 0.582, for the massive pyritic facies, 0.578, for the ribbon - banded graphitic quartzite, 0.415, and for the base metal - deficient quartzite, 0.370. A compilation of the zinc - lead ratios gives the massive sulfide facies an average ratio of 0.62 and for the sulfide - bearing quartzites and average ratio of 0.460 is attained.

E. Possible Origins

Having determined that the Faro sulfide deposit is a stratiform Zn - Pb - Ag ± Cu deposit, we must now turn to the possible origins of such a deposit. The understanding of the origins of stratiform pyritic, base metal sulfide ores is a complex and a genuinely controversial issue. The origin of the Faro Number Two deposit is certainly no exception. Problems in studying the Faro bodies are compounded by the metamorphosed and highly deformed terrain hosting the deposit.

Two theories for the origin of conformable, massive, pyritic ores are held. The first, involves hydrothermal replacement of the host rock after its

FIGURE IV-6 Silver-Lead Abundance Along Sampled Section 142



emplacement. In this instance, the hydrothermal solutions would be associated with a locally intruded plutonic body.

The second theory, contends the sulfide ores were emplaced at the time of deposition of the host rocks. Most workers in the area, including D. J. Templeman - Kluit and D. S. Jennings favour the second theory as a general base for discussion.

D. S. Jennings (personal communications) favours a theory whereby sulfides are drawn from volcanically - associated, hydrothermal emanations such as submarine springs or fumeroles. Concentration of the sulfides is possibly facilitated with the aid of convective overturn of base metal - rich connate brines trapped in a localized, paleo - depositional environment. A deep - seated heat source would provide the neccessary drive to initiate and maintain the convective cell.

The sulfides, if this theory were to be proven correct, were deposited in a dominantly sedimentary, marine environment with the extremely important aid of local volcanic activity of one form or another. The presence of the graphitic schist and the ribbon - banded graphitic quartzite within the deposit appear to indicate the association and possibly the assistance of biogenic activity in sulfide formation and/or sulfide concentration. And finally, the close spatial distribution of metabasites of probable meta - igneous origin at the same stratigraphic level as the Faro Number Two sulfide deposit would seem to justify the proximal existence of at least one form of volcanic activity. Thus, from the presently available information, it would appear that a combination of volcanic and biogenic events led to the formation of Faro ore bodies.

F. Deposits Comparative to the Faro Number Two ore Body

The Faro zinc - lead - silver stratiform deposit appears to be unique, in that there are no other similar deposits ; excepting in the most general terms.

Two main forms of criteria were used in comparing the Faro deposit with other prospectively similar deposits. These were : 1) the type of sulfide minerals present and 2) the type and character of the host rock lithologies.

The Faro Number Two ore body contains economic zinc, lead, silver and uneconomic copper. The deposit is hosted by meta - sediments of probable shale and siltstone lithologies.

Deposits with generally similar mineralogies and host rock lithologies include the Sullivan and Howard's Pass deposits in Canada ; the Rammelsberg deposit in Germany and the Mount Isa, McArthur, Broken Hill and Hilton deposits in Australia.

CHAPTER V

CONCLUSIONS

The Faro Number Two zinc - lead - silver stratiform sulfide deposit is found within a stratigraphic sequence of Cambro - Ordivician meta - sediments located in the Anvil Range, central Yukon Territory. Minor occurences of metabasites of probable meta - igneous derivation are found close to the Faro Number Two deposit and at compatable stratigraphic levels.

The principal host rock lithologies have been metamorphosed to mainly schists of greenschist to lower amphibolite metamorphic facies. Two main schist lithologies have been recognized. The ore body is hosted by the carbonaceous quartz - biotite - muscovite - andalusite schist. This upper member of the Faro Group is separated by a 200' transition zone schist, from the lower quartzo - feldspathic biotite - muscovite - andalusite - staurolite - garnet schist member. Cretaceous igneous sills, dikes and irregualr bodies were later intruded into the Faro group rocks.

The ore body is broadly conformable with the host rocks and appears to have formed during roughly the same depositional time period. The source of the sulfides is uncertain, but it is postulated that a combination of volcanogenic and biogenic processes acted to concentrate and deposit the sulfides.

The ore body shows general zoning of the sulfide facies. An inner zone of massive, pyritic - base metal sulfides is fringed by an outer zone of sulfide - bearing quartzites. Zinc - lead concentrations and ratios are greatest within the central core of the deposit and trail off towards the deposit margins. A bleached quartz - sericite - pyrite schist is found adjacent to and within the ore horizon and probably represents alteration of the former country rock during ore emplacement.

The Faro sulfide bodies are unique. No exact comparison can be made with any other stratiform Zn - Pb - Ag ± Cu sulfide deposit. However, the Faro deposit does belong to a certain class of sulfide deposits which are hosted by clastic sedimentary rocks (or their metamorphosed equivalents). The Mount Isa, Broken Hill, McArthur and Hilton deposits in Australia ; The Rannelsberg deposit in Germany and the Sullivan Mine in British Columbia belong to a class of Zn - Pb - Ag ±Cu sulfide deposits that is similar to the Faro Number Two ore body.

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