



**REA GOLD (HILTON) AND HOMESTAKE
VOLCANOGENIC SULPHIDE-BARITE DEPOSITS
SOUTHEASTERN BRITISH COLUMBIA
(82M/4W)**

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INTRODUCTION

Rea Gold and Homestake are volcanogenic sulphide-barite deposits in Devonian-Mississippian Eagle Bay Formation rocks of the Omineca Crystalline Belt in southeastern British Columbia. Homestake was discovered in 1893 and has had extensive development and intermittent production since then. Rea Gold is a recent discovery and development is confined to geological mapping, trenching, and drilling (Davidson, 1984). The deposits occur within the Shuswap Highlands, just west of Adams Lake (Fig. 7-1) and are readily accessible by gravel roads east from Louis Creek on Highway 5.

REGIONAL GEOLOGY

The Adams Plateau-Barriere area has been mapped recently by Schiarizza and Preto (1984) and the area in the immediate vicinity of Rea Gold by White (1985). The Rea Gold deposit is within a thick sequence of intermediate to felsic volcanic and volcanoclastic rocks (unit EBF, Fig. 7-1) of the Eagle Bay Formation (Schiarizza and Preto, 1984). It is underlain by predominantly sericitic phyllites, also derived from felsic to intermediate volcanic rocks (unit EBA), that host the Homestake deposit. These units are overlain by meta-sedimentary rocks that include mainly argillites, siltstones, and grits; they are structurally overlain to the east by predominantly mafic volcanic rocks (unit EBG), host rocks for a Pb-Zn-Ag deposit called Twin Mountain (Fig. 7-1). This succession has been regionally metamorphosed to greenschist facies and intensely deformed. A penetrative mineral foliation obscures many primary structures, and tight to isoclinal folds which often have sheared-out fold limbs makes stratigraphic correlations and construction of a composite stratigraphic succession difficult.

The regional structure is dominated by a northwest-trending tight overturned syncline (Fig. 7-1). Rea Gold is on its inverted northern limb and Homestake on its southern limb. An east-dipping thrust fault is inferred (Schiarizza and Preto, 1984) to separate the Rea-Homestake package from the structurally overlying package of more mafic volcanic rocks that hosts the Twin Mountain deposit. More detailed mapping by Corporation Falconbridge and by White (1985) has not been able, however, to confirm the existence of this fault.

REA GOLD (HILTON)

INTRODUCTION

Rea Gold was discovered in October, 1983 by A. Hilton and R. Nicholl, and optioned to Rea Gold Corporation who in turn optioned it to Corporation Falconbridge. Published drill-indicated

reserves include 120 000 tonnes containing 18.2 grams gold per tonne, 141.2 grams silver per tonne, 0.85 per cent copper, 4.11 per cent zinc, and 3.67 per cent lead.

The deposit includes two thin, laterally continuous sulphide lenses that lie stratigraphically above a highly altered sequence of dominantly mafic and minor felsic tuffs. Stratigraphically above these lenses is a thin mafic tuff sequence and a thicker sequence of argillite, siltstone, and grit. The succession is inverted; hence, the 'footwall alteration zone' or 'stockwork feeder zone' now forms the hangingwall of the lenses. The following description of Rea Gold is based on one week's fieldwork, mapping trenches and logging core. Although the diagrams and report are based on this work, they reflect in part the excellent detailed work of Corporation Falconbridge geologists whose maps and cross-sections were made available to us. The report is written without the support of chemical analyses, now in progress in the Ministry Laboratory, and conclusions regarding original nature of host rocks are tentative.

ROCK UNITS

The oldest unit within the deposit area comprises predominantly mafic tuffs (unit 1) that lie at the structural top of the succession. They include ash, crystal, and lapilli tuffs with variable amounts of disseminated pyrite. They are strongly foliated, producing green phyllites and schists; more massive 'greenstone' units may be derived from mafic flows. There are thin chert bands and a noticeable increase in sericite content toward the contact with unit 2. In general, this contact is gradational and reflects, in part, an increase in alteration in the stratigraphic footwall of the deposit.

Unit 2 is the 'footwall' alteration or stockwork feeder zone of the sulphide lenses. It is very extensive in the hangingwall of the more northerly of the two lenses, called L100 (Fig. 7-2), but only a few metres thick in the hangingwall of RG8, the southern lens (Figs. 7-3 and 7-4). It includes extensively altered mafic tuffs, otherwise similar to those in unit 1, chert layers, and thin more felsic (dacite?) ash tuff layers. These units now appear as pale tan to pale green siliceous phyllites and schists interbedded with pure to sericitic chert. Alteration increases dramatically toward the contact with the sulphide lenses. It includes:

- (a) silicification through introduction of silica in the form of quartz veins, and of thin to relatively thick chert layers, discontinuous chert lamellae, and 'fragmental chert';
- (b) pyrite, which is disseminated, in veins, and in discontinuous streaks; it increases from 1 to 2 per cent in unit 1 to commonly 10 to 20 per cent near the stratigraphic top of unit 2; and
- (c) sericite which becomes ubiquitous within unit 2.

White (1985) also notes both local soda enrichment (as massive albite and paragonite) and carbonatization (as dolomite, iron-rich magnesite, and calcite).

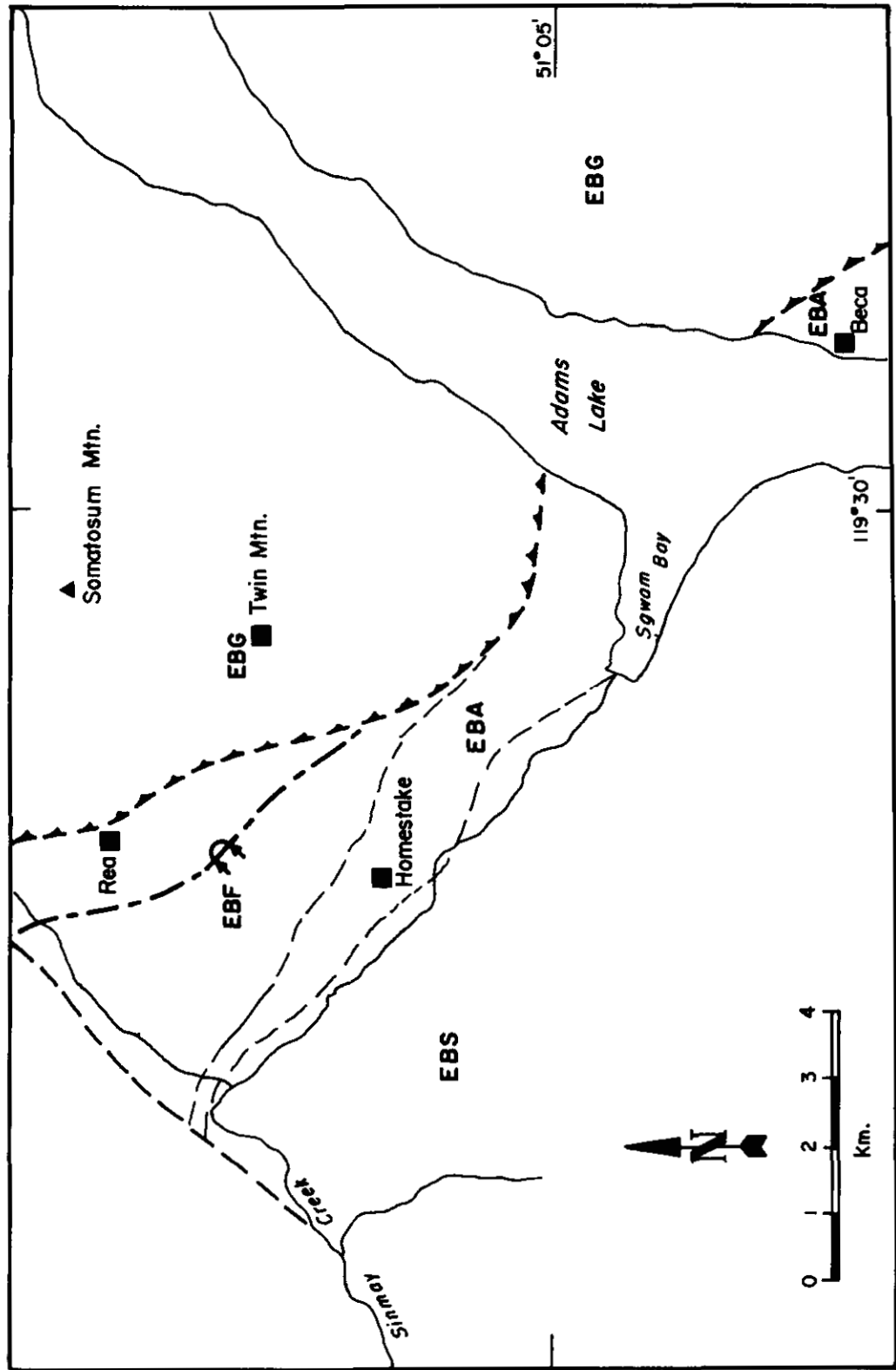


Figure 7-1. Map showing locations of Rea Gold and Homestake; geology from Schiarizza and Preto (1984).

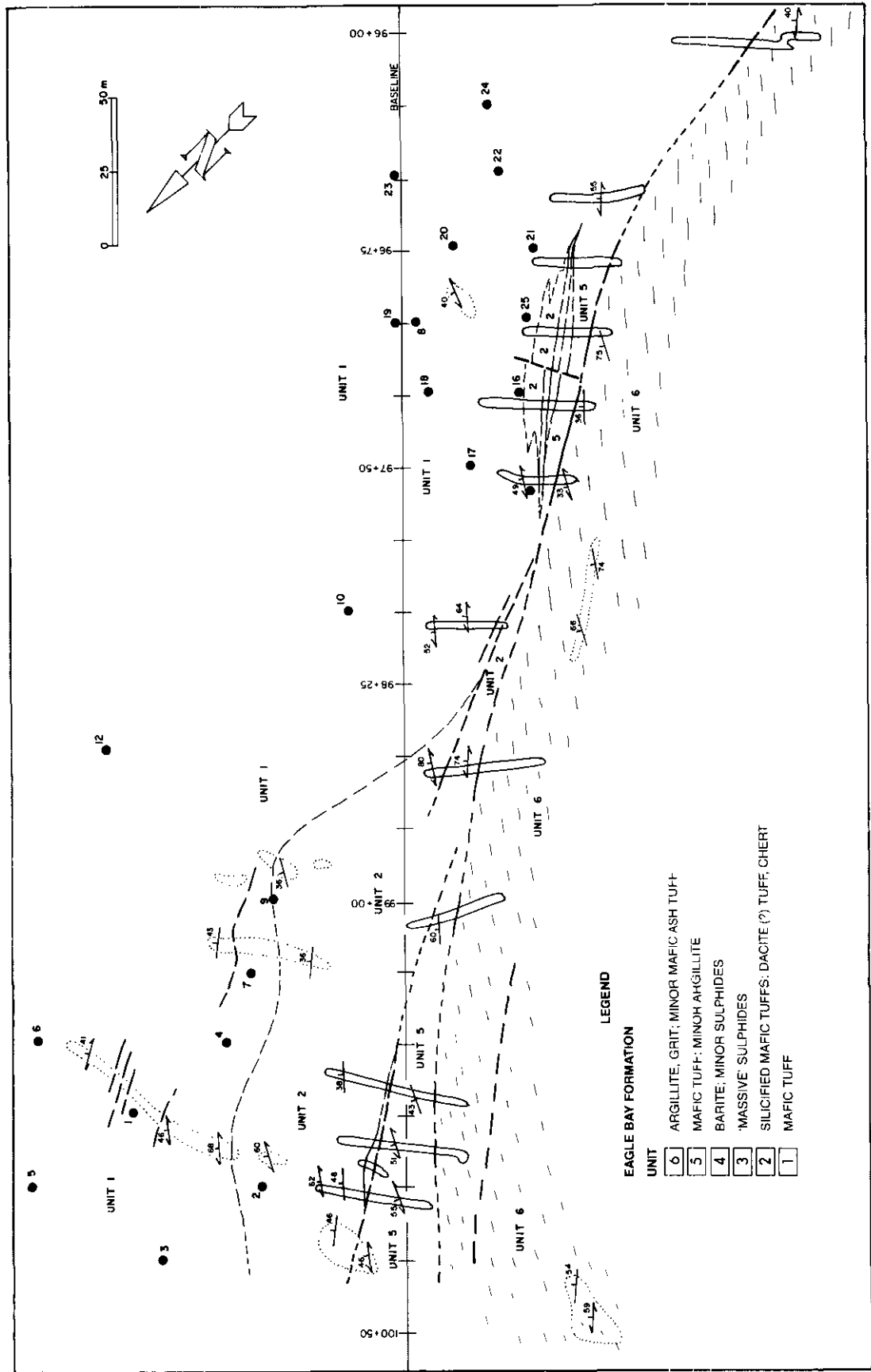


Figure 7-2. Geological map of Rea Gold property showing trenches and drill hole locations; modified from Corporation Falconbridge maps.

Stratigraphically overlying the sulphide or sulphide-barite lenses is a thin sequence of predominantly mafic tuffs (unit 5) that grades up into argillite. The tuffs are pale grey to brown-weathering thin-bedded chlorite phyllites. Silicified zones occur only locally (Fig. 7-5) and pyrite content is generally low. A dark grey tuffaceous 'argillite' (unit 5c, Figs. 7-3 and 7-4) with high Ba content (I. Pirie, pers. comm., 1985) occurs in the immediate footwall of the RG8 lens, at the stratigraphic base of unit 5. Unit 5 is generally in fault contact with unit 6, but in some drill intersections it grades through an interval of interbedded green phyllite and argillite (Fig. 7-5).

A sequence of metaclastic rocks (unit 6) at the structural base of the succession are the youngest rocks in the deposit area. They comprise grey laminated argillite, siltstone, wacke, and local pebble conglomerate with both volcanic and sedimentary clasts. Bedding and graded beds are well preserved. Thin mafic ash tuff layers occur in the basal part of unit 6.

SULPHIDE LENSES

Two main lenses are recognized. The more southern, the RG8 lens, appears to be at a slightly higher stratigraphic level than the

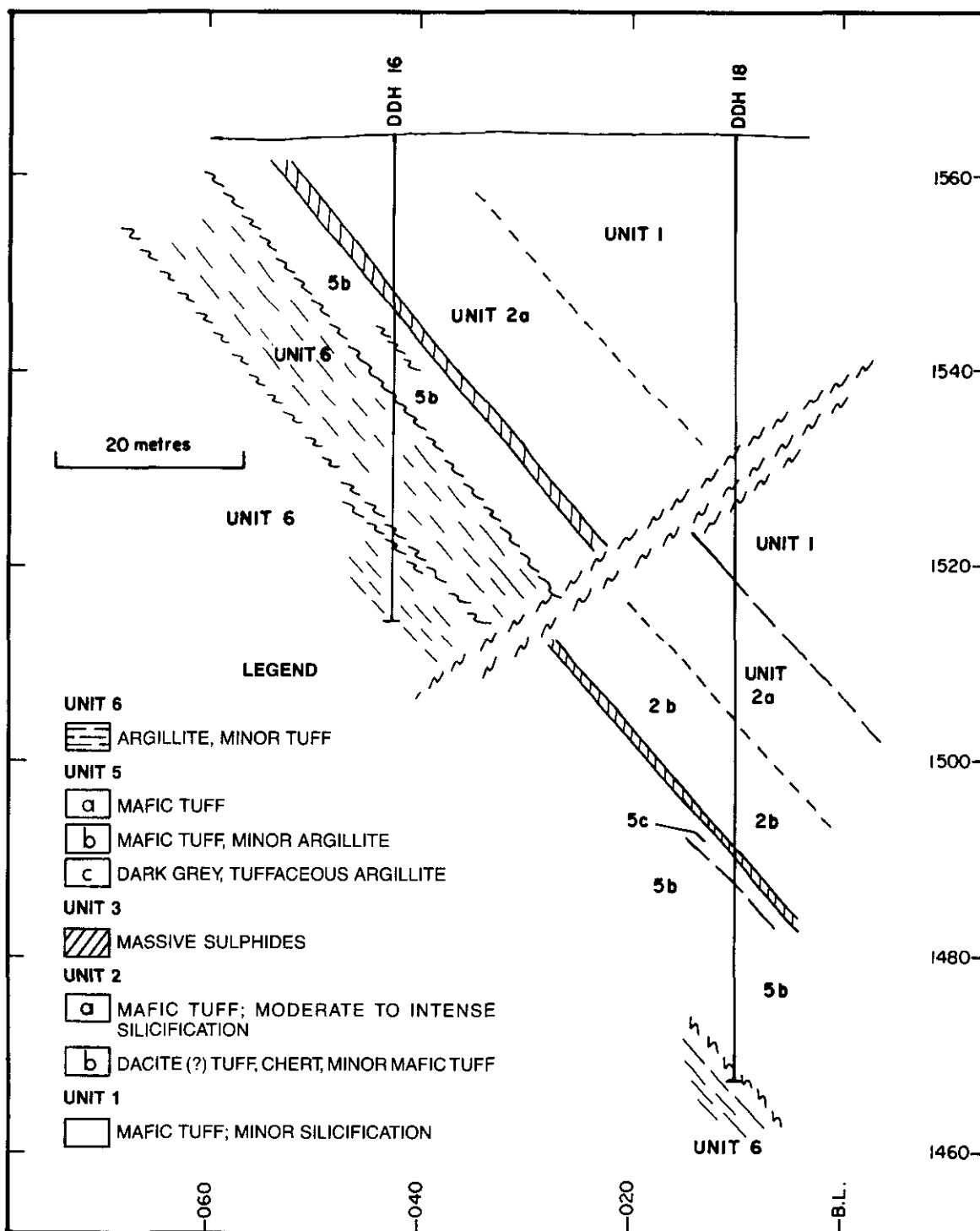


Figure 7-3. A vertical section (97 + 25) through the RG8 sulphide-barite lens, Rea Gold.

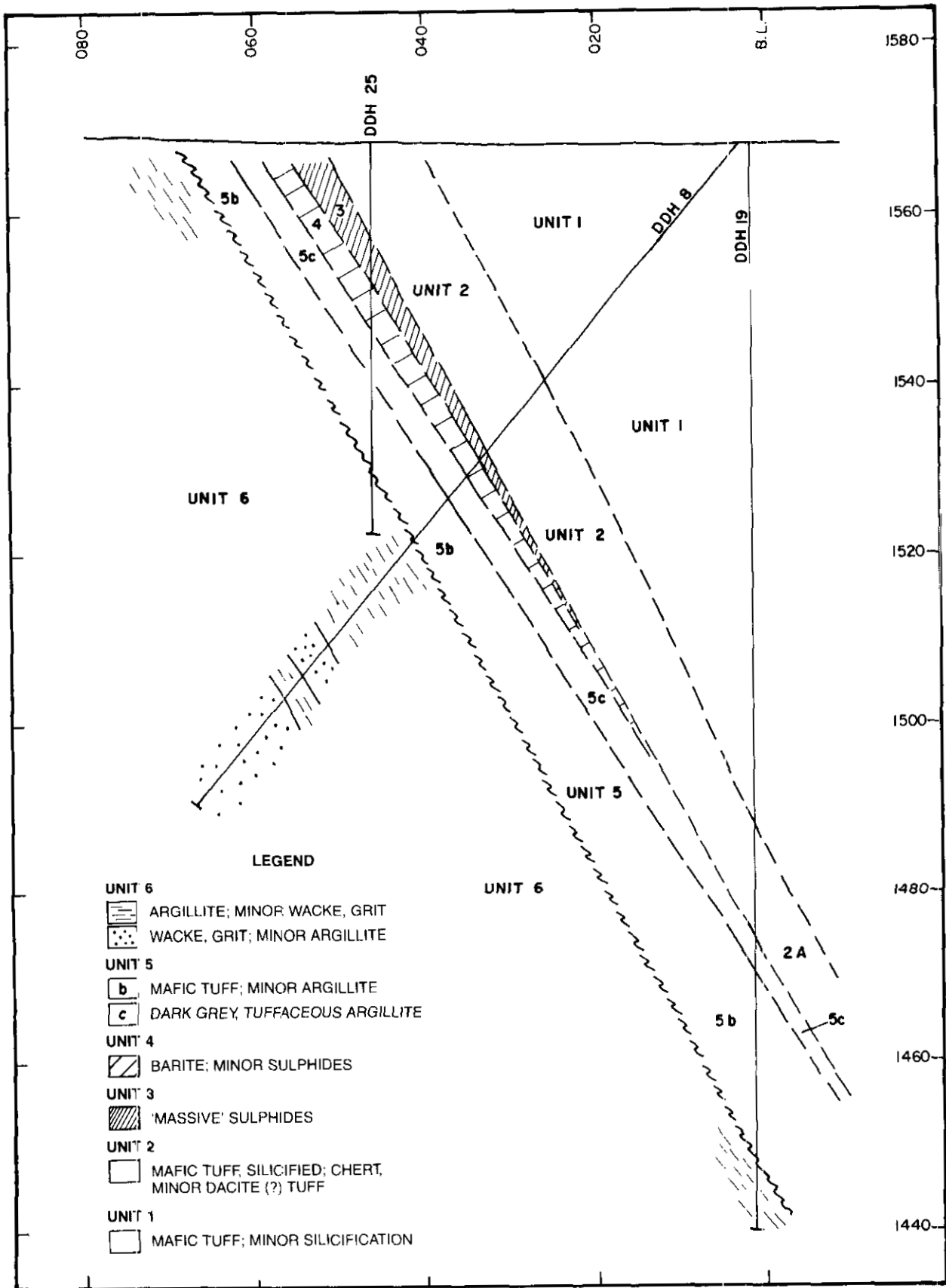


Figure 7-4. A vertical section (97+00) through the RG8 sulphide-barite lens, Rea Gold.

L100 lens (Fig. 7-2). It has a less extensive footwall alteration zone, and is 'capped' by massive barite. Descriptions of these sulphide lenses are based on visual examination of drill core and mapping of trenches.

The RG8 lens is well exposed in two trenches, 97+00 and 97+25, and its fringes in trenches 96+75 and 97+50 for a surface strike length of approximately 75 metres. It extends down dip at least 80 metres (Fig. 7-3). It has a relatively sharp contact with altered 'footwall' rocks of unit 2 and grades stratigraphically 'up' into massive barite of unit 4. However, it is in sharp contact with tuffaceous muds or mafic tuffs of unit 5 at its fringes. The barite 'cap' consists of grey to white, massive or faintly banded barite with variable amounts of disseminated sulphides. The sulphide content of the barite generally decreases away from the underlying massive sulphide.

The L100 lens has a surface strike length of approximately 50 metres and a down dip projection of at least 120 metres (Fig. 7-5). As described previously, it has a thick zone of intense silica alteration stratigraphically below, and is abruptly overlain by mafic tuffs of unit 5a. It does not have a barite 'cap.'

Sulphide mineralogy in both lenses includes pyrite, arsenopyrite, sphalerite, galena, chalcopyrite, and tetrahedrite-tennantite (White, 1985). Sulphides are fine grained and massive, crudely banded or brecciated. Gold occurs mainly in the massive sulphides but is also found in barite, in the footwall stockwork, and in fault gouge (I. Pirie, pers. comm., 1985). Silver is associated with both barite and massive sulphides, while zinc, lead, and copper occur primarily in massive sulphides.

STRUCTURE

The deposit and host rocks are essentially a northwest-trending, northeast-dipping homoclinal succession that has been structurally inverted. A pronounced mineral schistosity largely masks primary bedding except in structural footwall rocks where well-bedded and commonly graded metaclastic rocks occur. The observed bedding is commonly sub-parallel to the schistosity (Fig. 7-6) indicating tight to isoclinal folding. Changes in vergence of the bedding-schistosity intersections and the many small, rootless isoclinal folds indicate, however, that the succession is folded. Folding is asymmetrical in style and individual folds are confined to specific units since repetition of the major lithologic subdivisions is not apparent (Fig. 7-2). Within unit 2, cleavage-bedding intersections indicate a synformal

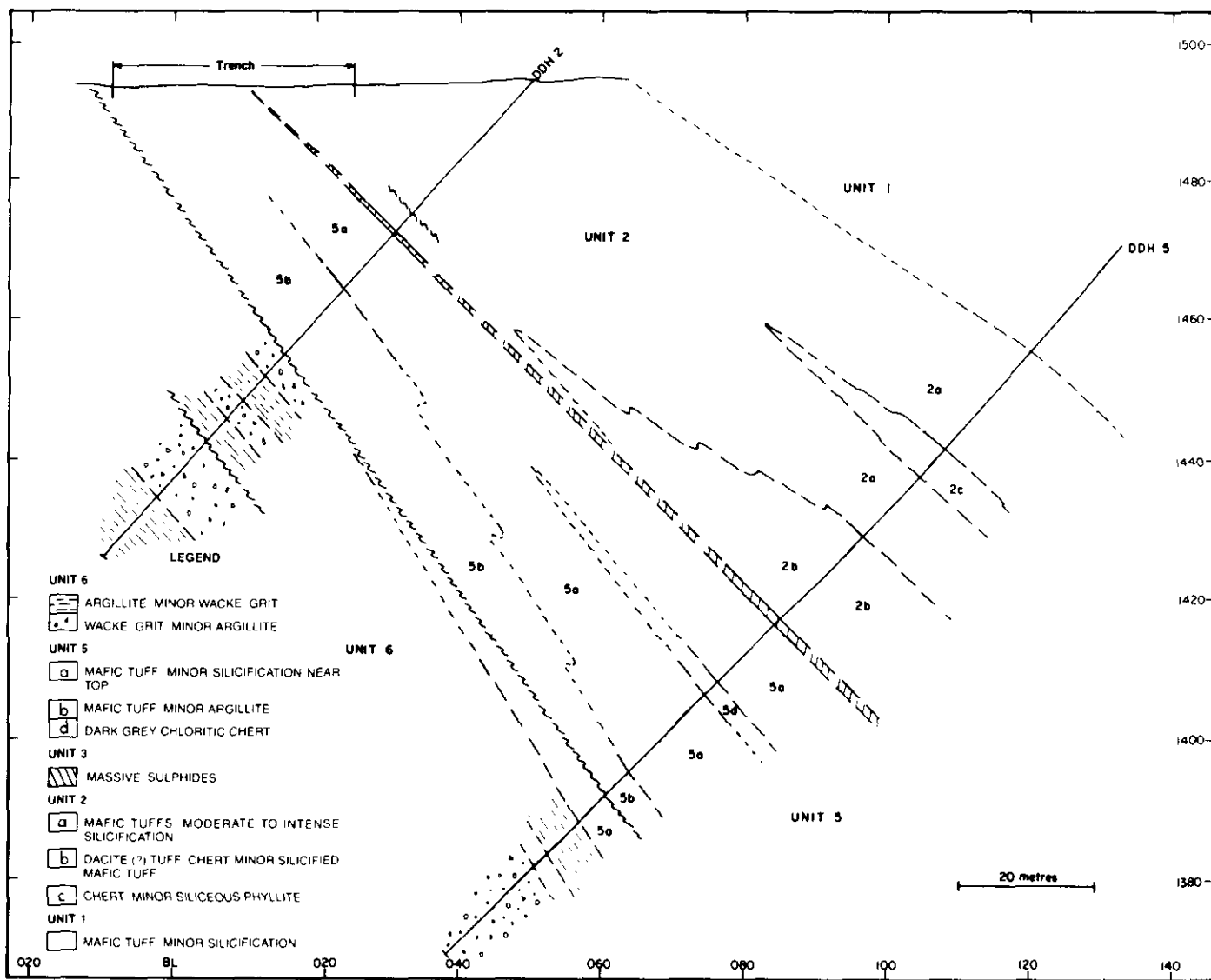


Figure 7-5. A vertical section (100+00) through the L100 sulphide lens, Rea Gold.

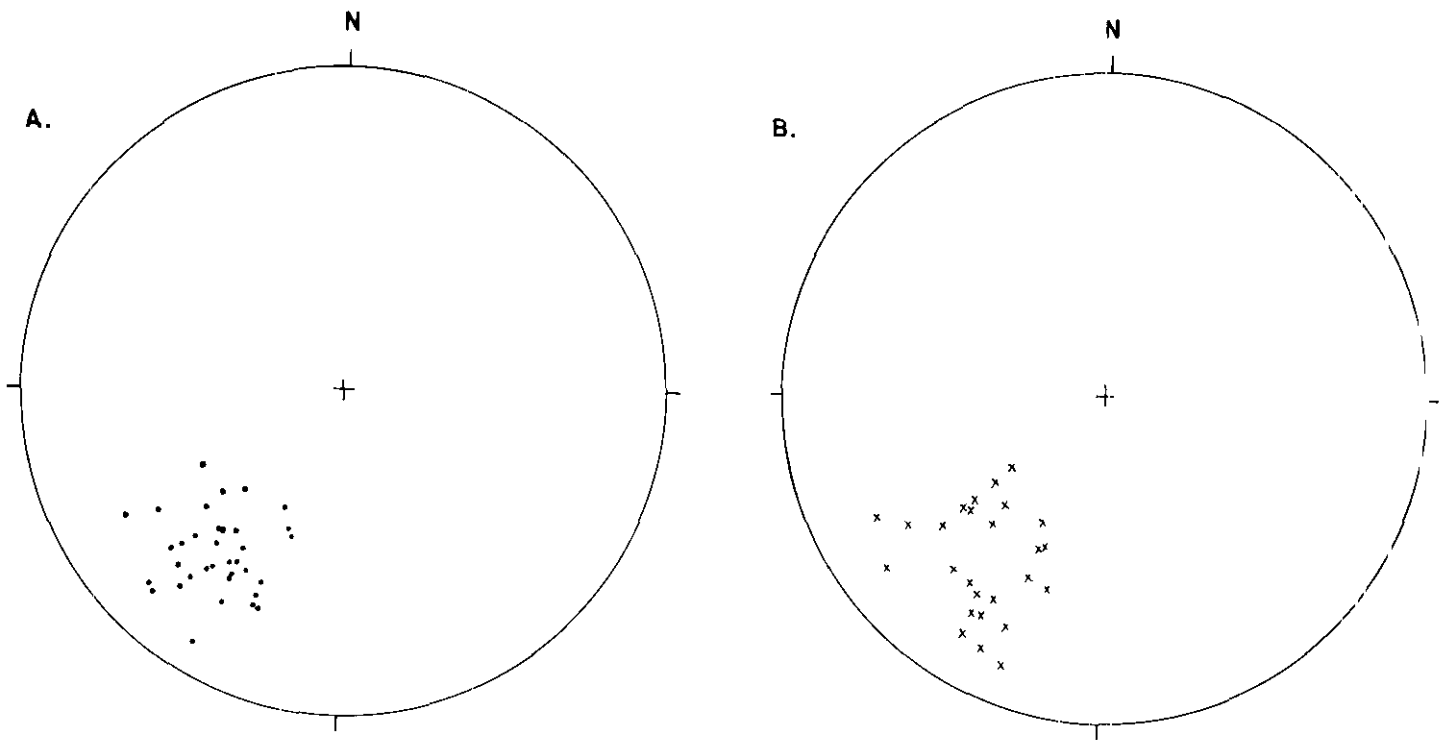


Figure 7-6. Equal area projections onto lower hemisphere of structural elements, Rea Gold. A -- poles to foliation, B -- poles to compositional layering.

axis located to the northeast. Yet relationships between the massive sulphides, barite, and alteration zone indicate the deposit is inverted; this suggests that the observed schistosity and associated folds are second generation structures superimposed on a previously inverted panel. Within more competent structural footwall rocks (unit 6), these folds are relatively open and the location of fold hinges can be defined. The most prominent is an overturned anti-form located just southwest of the exposure at 100+50-060 (Fig. 7-2). A late southeast-trending crenulation cleavage, associated with minor open folds, is superimposed on the earlier schistosity.

Faults parallel to schistosity are common but only the largest are shown on the map. The most prominent fault strikes northwest, juxtaposing unit 5 against unit 6. The displacement on the fault is probably not large as there does not appear to be much loss of stratigraphy across it; the fault cuts locally up into unit 5 (for example, DDH 5, Fig. 7-5) leaving a normal stratigraphic contact between units 5 and 6.

SUMMARY AND CONCLUSIONS

Two massive sulphide lenses occur at the stratigraphic top of a thin felsic tuff and exhalative chert sequence that lies above a thicker sequence of mafic ash, crystal, and lapilli tuffs. Both lenses are underlain by a footwall feeder and alteration zone, characterized by intense silicification, pervasive pyrite, and sericite development, indicative of Si, Fe, and K metasomatism. The southern lens is 'capped' by a layer of massive barite. Both lenses are stratigraphically overlain by a thin sequence of mafic tuff which grades up into argillites, wackes, and grits. Deposition of sulphides and barite occurred near the end of a cycle of explosive volcanism. Intense regional deformation and greenschist facies regional metamorphism have altered the host rocks to produce a succession of sheared chlorite phyllites, quartz-sericite schists, and chert.

HOMESTAKE

INTRODUCTION

Homestake is a polymetallic base and precious metal deposit in intensely altered and sheared sericite schists of the Eagle Bay Formation (Schiarizza and Preto, 1984). Mineralization is generally contained in barite lenses or, locally, it is in quartz veins. Access to the property is provided by a switchback road that leaves the main road 5 kilometres northwest of Squam Bay.

HISTORY

The property, as recorded in *Minister of Mines Annual Reports* (1927, 1936), was discovered in 1893 and first developed between 1893 and 1895. Work on the property was intermittent and shipments of ore occurred sporadically until 1927. The mine was reopened by Kamloops Homestake Mines Ltd. in 1935; workings at

TABLE 7-1
STRATIGRAPHIC SECTION OF THE EAGLE BAY
FORMATION AT THE HOMESTAKE DEPOSIT

Map Unit	Description	Possible Primary Source Rock
	Greenstone	Basalt
5	Tuffaceous chlorite schist	Intermediate tuff
3/4	Chloritic schist/ankeritic phyllite	Andesitic volcanic rocks/sedimentary rocks
2b	Sericite-quartz paper schist	Felsic tuff
2a	Sericite-quartz schist	Felsic volcanic rocks
1	Chlorite phyllite	Intermediate volcanic rocks

that time consisted of four adits and more than 455 metres of crosscuts, drifts, raises, and a winze. A 50-tonne per day flotation mill was installed on the site. Recorded production between 1935 and 1941 totalled approximately 6 965 tonnes from which 12 400 grams of gold, 9 565 900 grams of silver, 11 080 kilograms of copper, 171 325 kilograms of lead, and 246 520 kilograms of zinc were recovered. In the early 1970's, work on the property was resumed with geophysical and geochemical surveys, diamond drilling, and drifting to gain access to the old workings and to provide underground diamond-drill sites. Proven reserves were, at that time, estimated to be 1 010 800 tonnes with an average grade of about 240 grams silver per tonne, 2.5 per cent lead, 4.0 per cent zinc, 0.55 per cent copper, and 28 per cent barite (The Financial Post, Jan. 13, 1973). Since 1982 work by Kamad Silver Company Ltd. has confirmed and improved previous grade estimates but the deposit is considered difficult to mine, mainly because of the poor strength of the host rocks.

ROCK UNITS

The mineralized barite lenses are overlain by a siderite phyllite that contains interbedded argillite and by a tuffaceous chlorite schist unit. A wide zone of altered rock occurs below the mineralized

lenses. Regional metamorphism and local hydrothermal alteration have obscured the primary composition of the host rocks; consequently, the following unit descriptions are based on mineral assemblages. Primary compositions are tentatively inferred from these assemblages (Table 7-1), and chemical analyses in progress will better characterize the original host rocks.

A poorly exposed chlorite phyllite (unit 1) occurs in the southern part of the map-area (Fig. 7-7). It is a thinly laminated brownish green chlorite phyllite that is noticeably less foliated than the overlying schists.

Unit 2 comprises dominantly sericite-quartz schist with abundant disseminated pyrite throughout. Unit 2a is a more massive phase of the 'paper' schist of unit 2b and contains lenticular, silica-rich segregations up to 6 centimetres in length. Unit 2b, referred to as a sericite-quartz 'paper' schist (Table 7-1, Fig. 7-7), is the most conspicuous unit in the map-area. In outcrop, the paper schist unit is easily discernible by its fissile appearance and by its weathered coating of yellow ferric sulphate. It is the host and the footwall to the barite-sulphide lenses and is interpreted to be a highly altered, predominantly felsic tuff unit. A number of quartz veins up to a

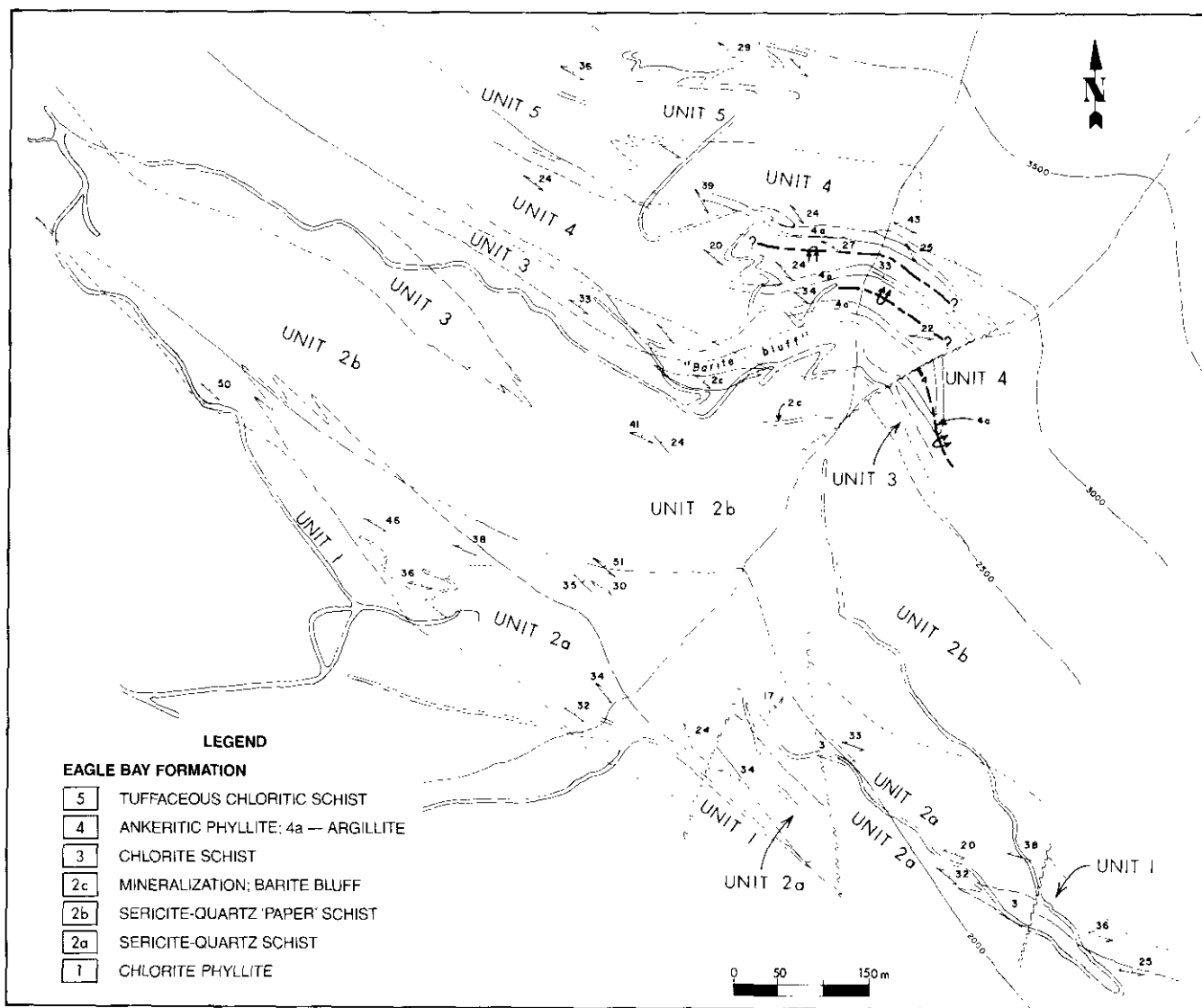


Figure 7-7. Map of the Homestake property showing geology and access roads.

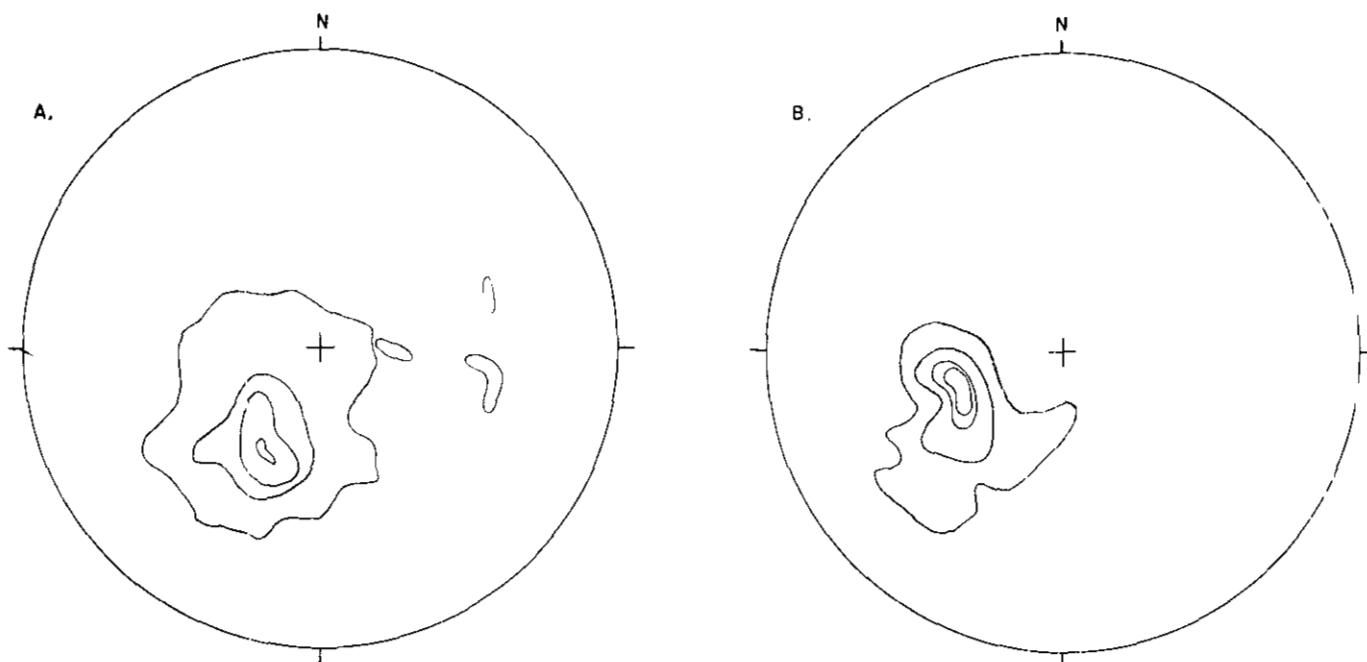


Figure 7-8. Lower hemisphere equal area projections of structural elements, Homestake deposit area. A — poles (92) to foliation, maximum concentration — 30%; B — poles (15) to compositional layering, maximum concentration — 33%; contour intervals — 1, 10, 20, 30%.

metre thick are found within the paper schist below the barite lenses; they contain pyrite but are generally barren of other sulphides.

A dark green laminated chlorite schist (unit 3, Table 7-1; Fig. 7-7) occurs stratigraphically above and laterally west of unit 2b. It consists of carbonate phenocrysts within a fine-grained chlorite-feldspar matrix. These phenocrysts, which may be pseudomorphic after plagioclase, are rimmed and partially replaced by chlorite. This unit is probably altered andesite tuff; its contact with unit 2b is in part an interfingering of felsic and intermediate tuffs but may also reflect an irregular pervasive potassic and silicic alteration boundary.

A fine-grained ankeritic phyllite (unit 4) composed of interbedded layers of ankerite-bearing chlorite phyllite occurs above units 2b and 3. In outcrop, limonite pseudomorphs after iron-rich carbonate give the rock a characteristic brown tinge. Some fine-grained pyritic argillites within the phyllite package are the most continuous and reliable marker units at Homestake. These argillite layers contain elongate quartz eyes or augen-shaped clasts up to 0.8 millimetre in diameter. The quartz eyes have cores of euhedral pyrite crystals and are set in a fine-grained pyritic and carbonaceous matrix of phyllosilicates, quartz, and feldspar. Unit 4 is interpreted to be largely a sedimentary clastic rock with interbedded chloritic tuff layers.

A tuffaceous chlorite schist (unit 5) occurs on the steep cliffs in the upper, northern portion of the Homestake area. The rock contains massive and tuffaceous zones composed of chlorite and carbonate, probably developed from regional metamorphism of rocks of intermediate composition such as andesite. Relict flattened felsic clasts imply a pyroclastic origin for at least part of this unit. Pyritic quartz veins and calcite stringers occur throughout the schist and, in several places, cut the foliation. Locally, cherty pods and argillite layers are interbedded with the schist. This unit is overlain by a thick greenstone sequence (V. A. Preto, pers. comm., 1985).

SULPHIDE-BARITE LENSES

A number of barite lenses with variable amounts of sulphides occur within the upper part of unit 2b. They are described in detail in

early *Minister of Mines Annual Reports* (1927, 1936) and will be briefly reviewed here. At least three lenses, separated by sericite schist, are recognized. They range in thickness from less than a metre to at least 10 metres and underground some have been traced several hundred metres. Metallic minerals within these lenses include tetrahedrite, galena, sphalerite, pyrite, chalcocopyrite, argentite, minor native silver, and trace ruby silver and native gold.

The lenses may consist either of massive to banded barite with only scattered metallic minerals throughout, or interlayered barite, schist, and sulphides. Two lenses are exposed on surface. The largest, referred to as the 'barite bluff' (unit 2c, Fig. 7-7), has an exposed thickness of 5 to 6 metres. It pinches out rapidly along strike, has a sharp hangingwall contact with sericite schist, and grades down into massive sericitic chert. A smaller lens, 1 to 2 metres thick, occurs below the 'barite bluff' unit (Fig. 7-7); it is banded but contains only minor sulphides.

STRUCTURE

A well-defined penetrative mineral foliation is ubiquitous throughout the Homestake area. The foliation is outlined by the preferred orientation of platy minerals such as sericite and chlorite, and lenticular silica-rich segregations in unit 2. Foliation, plotted on a stereonet (Fig. 7-8A), has a reasonably tight cluster around a maximum that strikes 120 degrees and dips 30 degrees northeast.

Original compositional layering is generally difficult to see. Except within argillite bands of unit 4, it has been largely obscured by either metamorphism or the intense deformation. In general, however, it strikes between 120 and 160 degrees with an average dip of 35 degrees northeast (Fig. 7-8B). The similarity between foliation and bedding attitudes indicates either tight to isoclinal folding or a constant facing direction.

No large folds have been identified in the chlorite or sericite phyllites beneath the barite lenses. Nearly all bedding-cleavage intersections in these phyllites have a common vergence. Therefore, the succession could be a homoclinal, non-folded sequence on the lower, upright limb of a tight syncline. However, rootless tight to isoclinal minor folds throughout the succession and the presence of

large folds outlined by argillite beds in overlying rocks (unit 4) suggest that larger folds also occur within the phyllites. These folds would be asymmetric, essentially confined to a single unit, with shortened or sheared-out overturned fold limbs.

On a regional scale the Homestake property is located on the southern limb of a large overturned syncline (Schiarizza and Preto, 1984; Preto and Schiarizza, 1985). Evidence in the Homestake area, including fold closures and vergence obtained from bedding-cleavage intersections, supports a synclinal fold closure to the northeast.

SUMMARY

Sulphide-barite lenses at Homestake occur near the top of a thick sequence of pyritic quartz-sericite phyllites within a predominantly mafic to intermediate tuff succession. The quartz-sericite phyllites include both felsic tuffs and metasomatically altered footwall rocks in which potassium, silica, and iron have been introduced. Although macroscopic folds are not recognized within the footwall phyllites, their presence is inferred due primarily to recognition of folds in overlying units where bedding is more visible and to the presence of rootless minor folds within the phyllites.

CONCLUSIONS

Rea Gold and Homestake have many similarities. They are sulphide \pm barite lenses within or near the top of a felsic (?) pyroclastic unit within a thicker pile of more mafic tuffs and minor mafic flows. Both have extensive footwall alteration zones characterized by silicification, sericitization, and pyrite development, and both are overlain by a mixed mafic pyroclastic and clastic sedimentary sequence. These deposits, as well as a number of other somewhat similar deposits in Eagle Bay Formation rocks such as Beca and Birk Creek (Goutier, *et al.*, 1985), are similar in many respects to the volcanogenic 'polymetallic' or Kuroko class of deposits.

ACKNOWLEDGMENTS

We wish to acknowledge the cooperation of Corporation Falconbridge while working on the Rea Gold property. Alex Davidson and Ian Pirie made available to us their maps and sections, and discussed freely many aspects of the geology of Rea Gold. Although the report on Rea Gold reflects many of their views, they do not necessarily agree with all the interpretations. Discussions with Colin Godwin, University of British Columbia, and P. Schiarizza, V. A. Preto, and G.P.E. White of the British Columbia Ministry of Energy, Mines and Petroleum Resources are appreciated. M. Fournier assisted with mapping at both Homestake and Rea, and in logging Rea core.

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