



**GEOLOGIC SETTING OF THE PRECIOUS METAL DEPOSITS  
IN THE STEWART AREA  
(104B/1)**

**By D. J. Alldrick**

**INTRODUCTION**

The British Columbia Ministry of Energy, Mines and Petroleum Resources investigated regional geology and mineral deposits of the Stewart area during 1964 and 1965 (Grove, 1971). The opening of Scottie Gold mine, recognition of an epithermal precious metals camp in similar volcanic rocks of the Toodoggone River area, and newly discovered stratabound precious metal mineralization in the Big Missouri mine area created incentives to study the area in more detail.

The objectives of this project are:

- (1) Document structural and stratigraphic relationships of the host volcanic sequence and its contact relationships with adjacent terranes.
- (2) Determine the evolution and depositional environment of the volcanic system from petrographic and geochemical studies of the sequence.
- (3) Characterize the structural, stratigraphic, mineralogical, and trace element contents of precious metal and base metal deposits of the area.
- (4) Conduct metallogenic studies and define areas of high mineral potential.
- (5) Sample host rocks and ore zones for fossil and radiometric dating and compare them with other volcanic terranes around the Middle Jurassic Bowser basin.

The report summarizes preliminary results of the first three objectives.

**HISTORY AND PREVIOUS WORK**

Prospectors began to explore the Stewart area in 1898 enroute to the Klondike. No major placer gold deposits were found but mineralized float led to the discovery of gold-quartz vein deposits. Continued prospecting located the gossan at Silbak Premier mine in 1910. Subsequently, the Stewart camp became the third greatest lode-gold-producing area in British Columbia. Between 1918 and 1968 Silbak Premier mine production alone totalled 4.3 million tonnes grading 13 grams gold per tonne and 298 grams silver per tonne. Tipper and Richards (1976) outlined the tectonic evolution of the region. Major geological reports of the Stewart area by Grove (1971) and the Big Missouri camp by Galley (1981) include historical reviews of geological studies in the area and extensive bibliographies. Barr (1980) provides a concise geological review of the Silbak Premier mining camp. A compilation of recent mapping and Ministry work is shown on Figures 56 and 57.

**REGIONAL GEOLOGY**

The study area is underlain by a north-northwest-trending belt of folded volcanic rocks (shaded on Fig. 56) which contains a thick sedimentary sequence infolded along a synclinal axis. The volcanic and sedimentary rocks are intruded by small stocks and extensive dyke swarms. The volcanic rocks are bounded on the west by composite stocks and batholiths of the Coast Plutonic Complex.

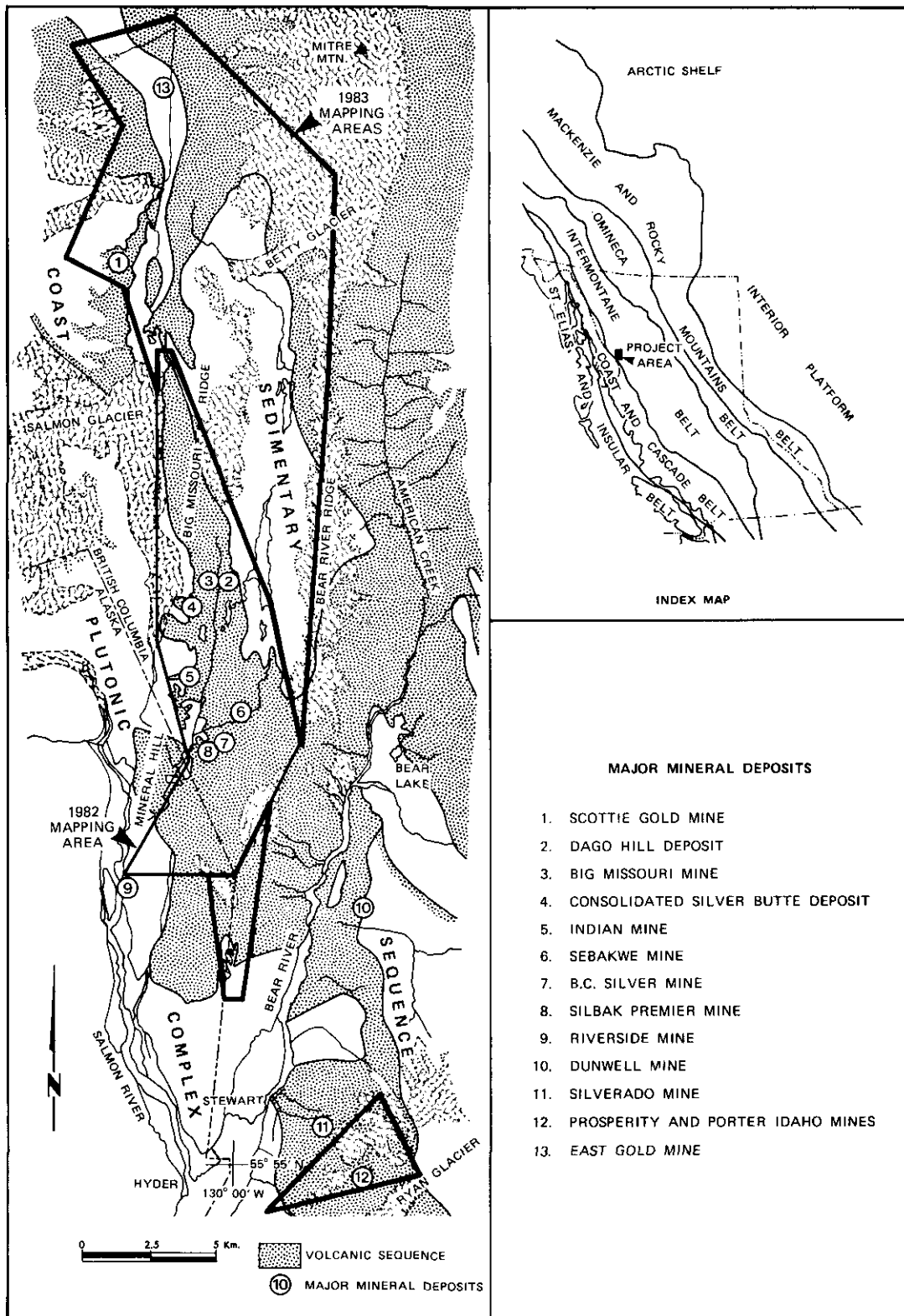


Figure 56. Regional geology and mineral deposits, Stewart area.

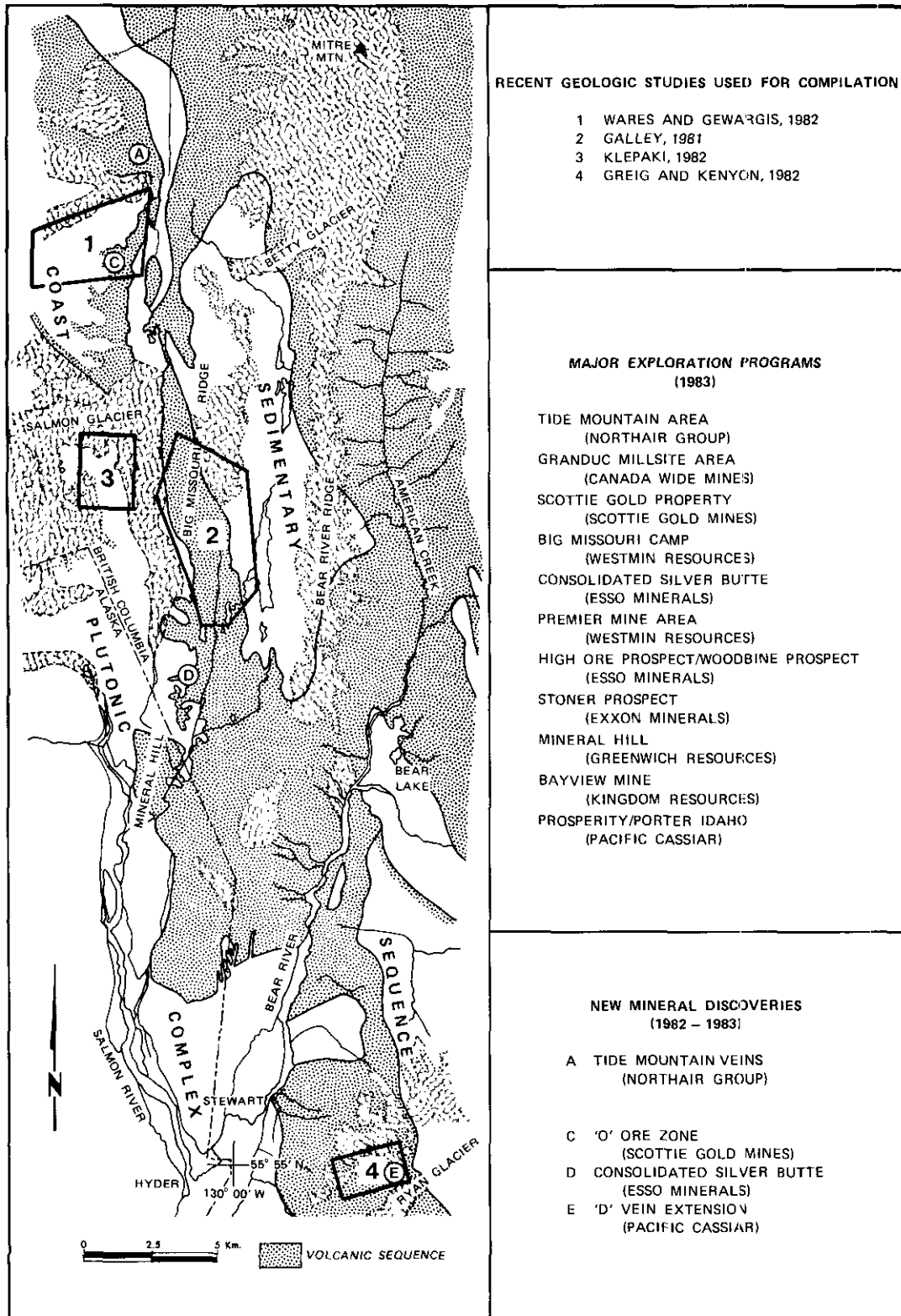


Figure 57. Recent geological studies, Stewart area.

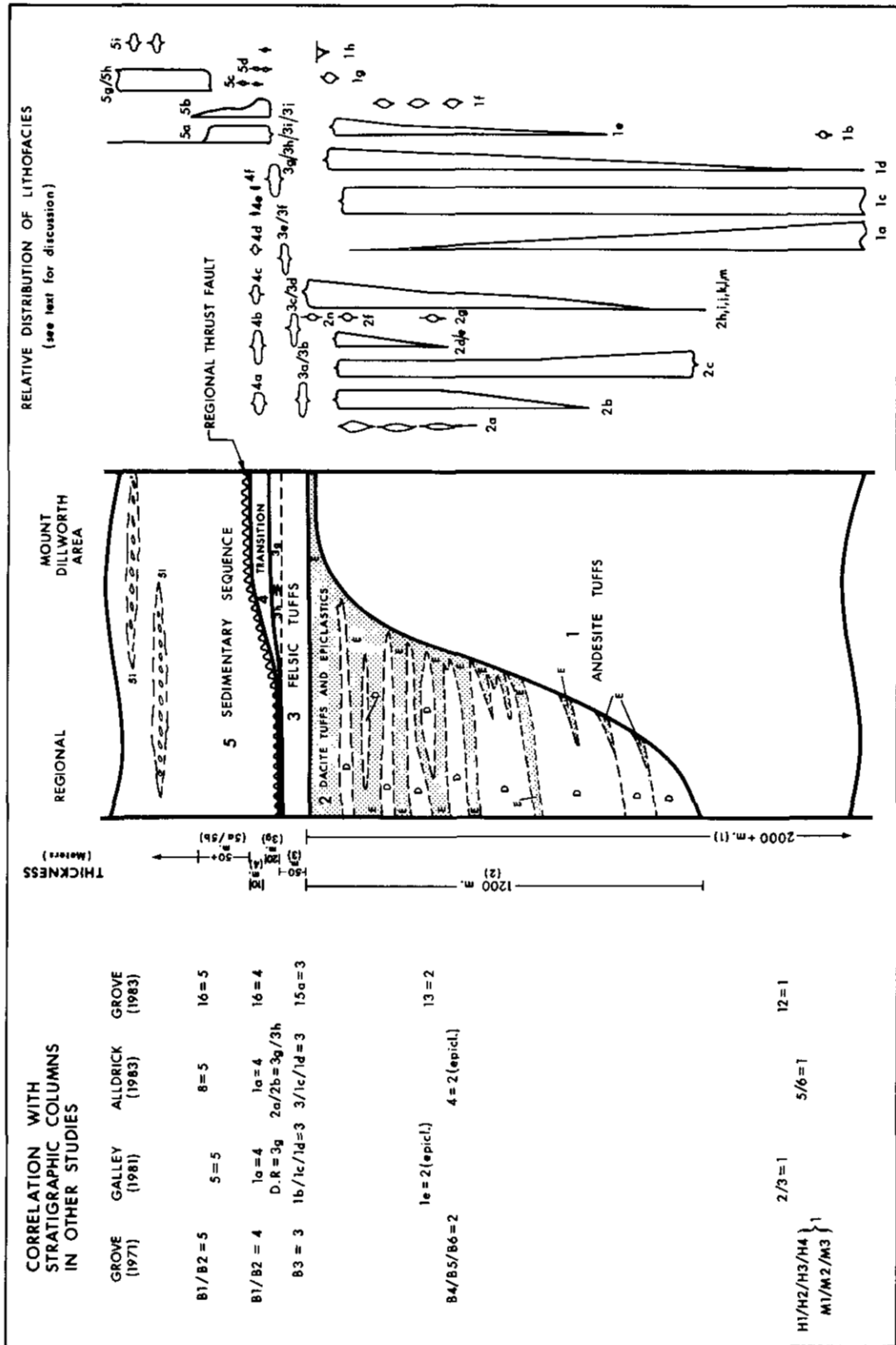


Figure 58. Stratigraphic column for Salmon River map-area.

The volcanic and sedimentary rocks of the Stewart area have been mapped by Hanson (1935) and Grove (1971, 1973, and 1983) as Hazelton Group strata of Early Jurassic to Middle Jurassic age. They are considered to be correlative with the type Hazelton area 200 kilometres to the southeast.

The rocks correlate remarkably well with the Hazelton section described by MacIntyre (1976, pp. 11-19) in the Tahtsa Lake area to the south. Tentative correlation can also be made with the lower part of the Hazelton section as outlined by Duffell (1959) in the Terrace area.

Correlations with other sections elsewhere described as Hazelton Group by Duffell and Souther (1965), Tipper (1971), and Tipper and Richards (1976) cannot be made on a lithological and stratigraphic basis. Similarly map sections presented by Carter and Kirkham (1969) and Carter (1973) do not correlate with Stewart stratigraphy. However, Grove (1973) presents fossil evidence for correlation of the Stewart stratigraphy on the basis of age with other Lower to Middle Jurassic volcanic sections. Grove's Nass Formation (1983) of the upper Hazelton Group is an alternative name for the Bowser Lake Group described by Tipper and Richards (1976).

## VOLCANIC STRATIGRAPHY

Volcanic map units in most of the Salmon River valley strike north-northwest and generally dip vertically to steeply eastward. The volcanic pile is predominantly composed of massive, green andesitic tuffs which rarely show bedding features or indications of stratigraphic top. Grove (1971) discusses the extensive alteration zones that occur around many of the mineral deposits. This pervasive alteration tends to obscure primary bedding and textural features.

In 1982, Alldrick (1983) determined the direction of stratigraphic tops based on graded beds in felsic pyroclastic rocks and on variations in composition of tuff breccia fragments. Mapping during 1983 located waterlain units with distinct tops indications in all major stratigraphic subdivisions except map unit 4. The consistent tops direction was to the east, confirming the major stratigraphic divisions and major structures established by Grove (1971, 1983). Figure 58 illustrates the stratigraphic column and compares terminology used in the Stewart area by other workers.

**MAP UNIT 1:** Map unit 1 is composed of a thick succession of green, greyish green and greenish grey andesitic tuffs. Lesser red, maroon, purple, and black tuffaceous units are intercalated with these beds at irregular intervals. Textures vary from medium to coarse ash tuffs through lapilli tuffs to coarse tuff breccias. Crystal and crystal-lithic tuff units containing white feldspar and/or hornblende phenocrysts are the most common lithology. A distinctive unit of crystal tuff containing bimodal feldspar phenocrysts outcrops on 49 Ridge on the west side of Mount Dillworth. In this unit the smaller (3 to 5-millimetre) grains are subhedral to euhedral white crystals while the larger grains (1 to 3 centimetres) are buff-coloured, inclusion-rich euhedral crystals.

*Thin waterlain green tuffaceous beds have been located on Mount Welker, on 'Tide Mountain', and on the ridge west of the Scottie Gold mine. The beds are about 10 centimetres thick and up to four beds may occur together. Many beds show grading which indicates tops towards the synclinal axis on Mount Dillworth (Fig. 59). No other waterlain or submarine textures have been noted in the andesite sequence during recent mapping and the entire sequence is, therefore, interpreted to be subaerial — predominantly tuffaceous units with some intercalated andesite flows.*

The red/maroon tuffaceous units are thin ( $\leq 5$  metres) feldspar crystal tuff beds which may represent time-stratigraphic horizons of alteration rather than stratigraphic units. They do not have regional extent

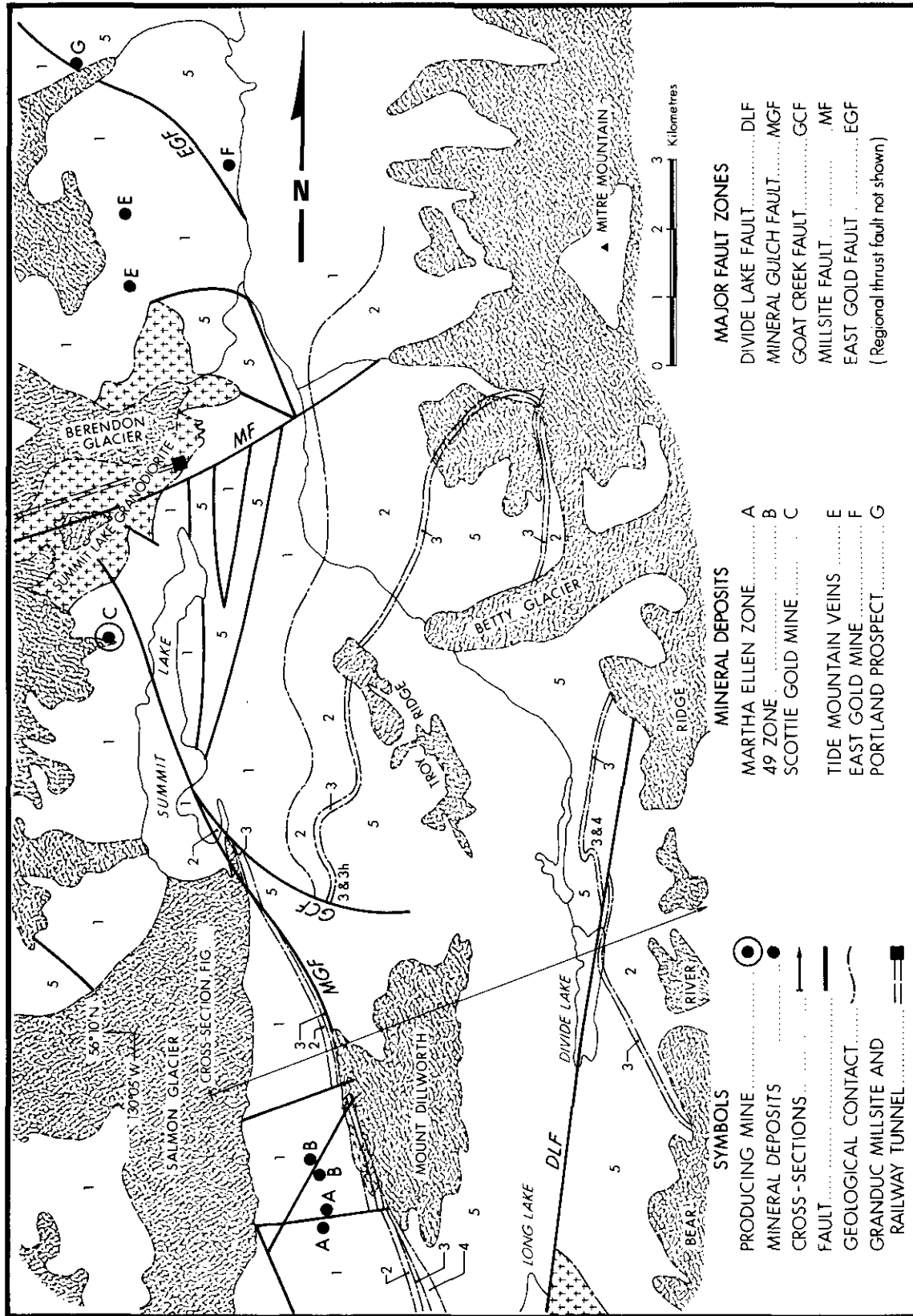


Figure 59. Geology and mineral deposits of the northern Salmon River valley.

but do provide useful markers on a property scale and were an exploration/mining control at the Silbak Premier mine (Langille, 1945). McGuigan has suggested (personal communication, 1983) that these distinctive zones could represent paleosurfaces during development of epithermal systems.

Regional correlation of individual tuff beds within the andesite sequence of map unit 1 has not been possible, but a general pattern of textural zoning within the sequence has been recognized and is illustrated on Figure 58. Medium to coarse ash tuffs (1a) are most abundant in the lower part of the sequence along with the thin waterlain tuffs (1b). Lapilli tuffs (1c) are uniformly distributed but crystal tuffs (1d) and crystal-lithic tuffs are somewhat more abundant upward in the sequence. The medium tuff breccias (1e) and red/maroon crystal tuffs (1f) occur only in the upper half of the sequence. Coarse tuff breccias (1g) and the bimodal crystal tuffs (1h) are known only at the top of the sequence in the Mount Dillworth area.

The base of the andesite volcanic sequence has not been identified but the overall thickness is at least 1 500 to 2 000 metres in the Scottie Gold mine area.

**MAP UNIT 2:** Map unit 2 is a complex succession of interbedded tuffs and fine to coarse epiclastic sedimentary rocks. The sequence is 1 200 metres thick on the west slope of Mitre Mountain; it thins southward until it nearly wedges out between Mineral Gulch and Monitor Lake and thickens southeastward in the area of Bear River Ridge at Mount Shorty Stevenson (Fig. 59). As a generalization, this map unit consists predominantly of a thick dacitic (?) tuffaceous unit near the base with occasional intercalated epiclastic beds that pass upward into interbedded dacitic tuffaceous and epiclastic units. These are overlain by a thick sequence of epiclastic beds with rare dacitic tuffaceous interbeds. Local white limestone beds (2g) crop out on the west side of Mitre Mountain about midway in the sequence and a distinctive porphyritic dacite (?) flow (2f) crops out within the upper epiclastic beds on Bear River Ridge east of Divide Lake.

The depositional environment is interpreted to be predominantly subaerial although the epiclastic beds exhibit waterlain textures such as grading, crossbedding, and scouring. These show consistent stratigraphic tops towards the synclinal axis on Mount Dillworth.

The dacitic (?) tuffs range in colour and texture from pale waxy yellow or yellow-green crystal tuffs (2c) and welded tuffs (2d) to pale green coarse ash tuffs (2b) and dust tuffs (2a). Although the tuffs are interbedded with waterlain epiclastic sediments, no distinct waterlain tuffaceous textures have been noted. Crystal tuffs with medium-grained (0.5 to 1.0-centimetre) white subhedral to euhedral feldspar phenocrysts are abundant. No hornblende phenocrysts have been noted but rare fine-grained ( $\leq 5$ -millimetre) quartz crystals have been identified in some samples.

Tuffs are massive but crystal tuffs commonly show a crude banding consisting of crystal-rich bands 1 centimetre to 2 centimetres apart separated by crystal-poor bands of fine-grained ash. Relatively thick units (10 metres or more) of this banded rock have been noted on Troy Ridge, Bear River Ridge, and Mount Rainey. Banding possibly developed during repeated eruptions of combined ash and crystals, with each eruption undergoing partial sorting during air fall.

Dacitic welded tuffs (2d) exhibit eutaxitic textures with flattened fiamme of various sizes up to 12 centimetres long.

An unusual, thinly banded or layered dacitic rock (2e) has been identified on Bear River Ridge and locally on Mount Rainey. The rock is yellowish grey in colour and consists of interlayered 1.0 to 2.0-centimetre-thick bands of yellowish coarse ash and  $\sim 0.5$ -centimetre-thick grey siliceous layers. The siliceous layers are undulatory and individual layers can be traced for at least 2 metres. The texture might possibly form by flattening and welding of layers of fine lapilli-sized pumice fragments that are interbedded with layers of ash.

A distinctive porphyritic, dacitic volcanic flow (2f) crops out on the crest and west shoulder of Bear River Ridge east of Divide Lake. The matrix consists of massive, aphanitic, siliceous, pale grey dacite or rhyodacite with 5 to 10 per cent scattered coarse white feldspar phenocrysts and phenocryst aggregates. The phenocrysts are up to 1 centimetre long and some of the aggregate masses are up to 4 centimetres in diameter. All phenocrysts have been partially digested leaving irregular rounded remnants on which crystal faces are rarely preserved. The resulting texture is similar to the 'flower porphyry' and 'snowflake porphyry' rocks that occur elsewhere in British Columbia.

The epiclastic units have distinctive bedding, textures, and colouring that make them readily recognizable. The matrix of these sedimentary rocks is typically brick-red to maroon to purple, although some cream, buff, and olive-green units were noted. Rounded cobbles of volcanic rock within these beds range in colour from red to purple, green, and grey. Exposures are common in which monolithic cobbles (2k) are identical in colour to the matrix but striking exposures of multicoloured heterolithic boulder conglomerates (2l) are widespread. Textures range from siltstones (2h) through sandstones (2i) and grits (2j) up to coarse boulder conglomerates (2m). Conglomerates are characteristically matrix supported but one clast supported, coarse boulder conglomerate bed (2n) with boulders up to 0.5 metre in diameter was noted on the east face of 49 Ridge.

Bedded epiclastic units locally display graded beds, crossbedding, and scour and fill channels that allow tops determinations. These features consistently show tops towards the synclinal axis on Mount Dillworth. Cobbles in the epiclastic beds are composed of the andesitic and dacitic lithologies described previously; no clasts of rhyolitic volcanic material have been identified. The epiclastic beds predominate at the top of the interbedded dacitic volcanic/epiclastic sequence of map unit 2 and have a sharp upper contact with the overlying felsic volcanic sequence (map unit 3).

**MAP UNIT 3:** Map unit 3 is a widespread relatively thin ( $\pm 50$ -metre) succession of 20 centimetre to 25-metre-thick felsic volcanic tuffaceous and pyroclastic beds. The map unit is thicker along the western edge of Mount Dillworth north to Summit Lake. The rocks appear to be highly siliceous and are probably rhyolitic in composition. Galley (1981) shows whole rock analyses from felsic rocks near the Long Lake dam which are dacitic in composition.

The regional succession examined on Mitre Mountain, at Divide Lake, and on the west slope of Mount Shorty Stevenson is remarkably consistent. The lowermost bed is an aphanitic dust tuff (3a) which is typically pale olive-grey to grey but it grades laterally into a bright turquoise rock near Summit and Divide Lakes. This rock has been extensively altered to a bright maroon or purple colour (3b) and the alteration can be seen lensing in and out over short distances. This rock is normally massive but near the southeast corner of Summit Lake it contains fine (up to 4 millimetres) silica-filled vesicles and large euhedral pyrite cubes (up to 1 centimetre).

This dust tuff unit grades upward into a lapilli tuff (3c) which is variably welded (3d). The lapilli tuff locally contains fiamme but more commonly has angular pumice fragments (3c) as well as angular felsic volcanic lapilli.

The lapilli tuff, in turn, grades upward into a siliceous lapilli tuff or tuff breccia (3e). The clasts are heterolithic, laminated to massive, grey to white cherts and rhyolites or other pervasively silicified lithologies. This siliceous tuff breccia is the uppermost member of map unit 3 seen at Mitre Mountain and Mount Shorty Stevenson. In both areas this unit is 20 to 25 metres thick and is in fault contact with overlying black siltstones and slates. In the Mount Shorty Stevenson area the upper half of this unit is progressively darkened by carbon until the siliceous tuff breccia is medium grey to charcoal coloured (3f).



In the Troy Ridge, Mount Dillworth, Fetter Lake, Divide Lake, and Monitor Lake areas the uppermost lithology of map unit 3 is a chaotic rhyolitic ash flow tuff. It is highly pyritic (3g) from the south end of Mount Dillworth to the Summit Lake area and contains heterolithic rounded cobbles and large angular lithic fragments. This rock contains 15 to 20 per cent very fine disseminated pyrite as well as large pods and minor lenses of massive fine-grained pyrite. Outcrops form resistant domes and ridges of brilliant red-orange, yellow, and red-brown colour along the west side of Mount Dillworth. On Troy Ridge and southward from Mount Dillworth similar ash flow textures can be identified, but the unit contains no pyrite (3h). No rounded cobbles have been noted in this distal facies of the rhyolite ash flow and the angular lithic fragments are lapilli size; it extends southeastward beyond Monitor Lake and northward along the west side of Troy Ridge but exact limits have not been defined. At the northeast corner of Divide Lake this unit is only 2 to 3 metres in thickness and contains small lapilli size angular fragments.

The coarse, chaotic, pyritic, boulder and cobble-rich facies (3g) of this rhyolitic ash flow is interpreted to be a near-vent facies, a relationship originally proposed by Galley (1981). However, an exposed dome or volcanic vent has not been located. On Troy Ridge and near Monitor Lake the distal facies (3h) of this ash flow contains minor impure, gritty, limestone lenses (3i). Between Mount Dillworth and Fetter Lake the distal facies is variably enriched in carbon and may be charcoal in colour (3j). The ash flow is either in fault contact with overlying black siltstones and slates of map unit 5 or in sharp conformable (?) contact with charcoal to black rocks of map unit 4, called the 'transition sequence'.

**MAP UNIT 4:** The 'transition sequence' consists of mixed charcoal to black interbedded tuffs (4a), fine-grained black crystal tuffs (4b), ash-rich argillaceous sedimentary rocks (4c), and minor amounts of gritty limestones (4d) and fossiliferous limestones (4e and 4f). This map unit is exposed intermittently due to faulting, talus cover from adjacent black siltstones and slates, or snow and ice cover on Mount Dillworth. Possibly locally it was not deposited. It has been identified in outcrops virtually everywhere that the underlying rhyolitic ash flow tuffs (3g, h, j) cap the felsic volcanic sequence of map unit 4. Therefore, this transition sequence is thought to be derived by mixing of varying proportions of fine, water-transported detritus with air fall ash and crystals from felsic pyroclastic activity during waning volcanism. These mixed sediments were deposited in an encroaching, carbon-rich marine environment.

The predominant rock type is a distinctive black to charcoal grey crystal tuff (4b) containing fine ( $\leq 3$ -millimetre) white feldspar crystals; it is extensively exposed south and south-southeast of Monitor Lake and is visible in drill core left near the Lakeview workings. Other lithologies include black gritty coarse ash tuffs (4a) and black argillites and slates (4c) that are locally pyritic; they crop out along an old road running north from Fetter Lake. The black gritty coarse ash tuff (4a) is exposed at the southwest end of the penstock tunnel near the Long Lake Dam. Gritty, grey, weakly pyritic, fossiliferous limestone lenses and pods are exposed 100 metres north of the northern end of 49 Ridge (4e) and are also exposed a few hundred metres north of Divide Lake (4f). The upper contact of map unit 4 is always marked by a regional thrust fault.

**MAP UNIT 5:** The regional thrust fault puts rocks of map units 4 and 3 and, rarely, map unit 2 into contact with black carbonaceous siltstones and slates at the base of map unit 5.

The stratigraphy of these sedimentary rocks is described in Grove (1971); it has been examined only partly in the present study. The lower 50 to 100 metres of the sedimentary succession consists of black, thin to medium-bedded siltstones (5a) and shales (5b) with minor amounts of intercalated siliceous beds (5c) and limestones (5d) that are locally fossiliferous (5e and 5f). This sequence grades upward into medium grey greywackes (5g), sandstones (5h), and intraformational conglomerates (5i). The conglomerates consist of black siltstone slabs and cobbles in a grey sandstone matrix. The limestone lenses are regionally distributed but thin. The only two that are fossiliferous correlate well with fossiliferous limestones in map

unit 4 on the other side of the thrust fault (Fig. 59). The slates and siltstones locally contain small amounts of disseminated pyrite. Local rounded pebbles and small cobbles occur in one exposure on Mount Dillworth. The sedimentary sequence is characterized by abundant scour and fill structures, grading, and crossbedding; tops are toward the axis of the Mount Dillworth syncline.

## STRUCTURE

**FOLDING:** The major structural feature in the area is the Mount Dillworth syncline; it trends north-north-west/south-southeast and is doubly plunging. The syncline deforms the stratigraphy described previously and the outcrop pattern now resembles a series of concentric rings. Vergence of minor folds that crop out north of Divide Lake and north of Daisy Lake support this structural interpretation. The hinge area of the major fold is exposed on Mitre Mountain and on the west slope of Mount Shorty Stevenson. Regional dips on the west side of the syncline are typically vertical but can range between 80 degrees west and 70 degrees east. The alternating thin-bedded siltstones and thicker, more massive greywackes and sandstones of map unit 5 are folded disharmonically (Grove, 1971, Plate XI). An idealized cross section of this structure is presented on Figure 60.

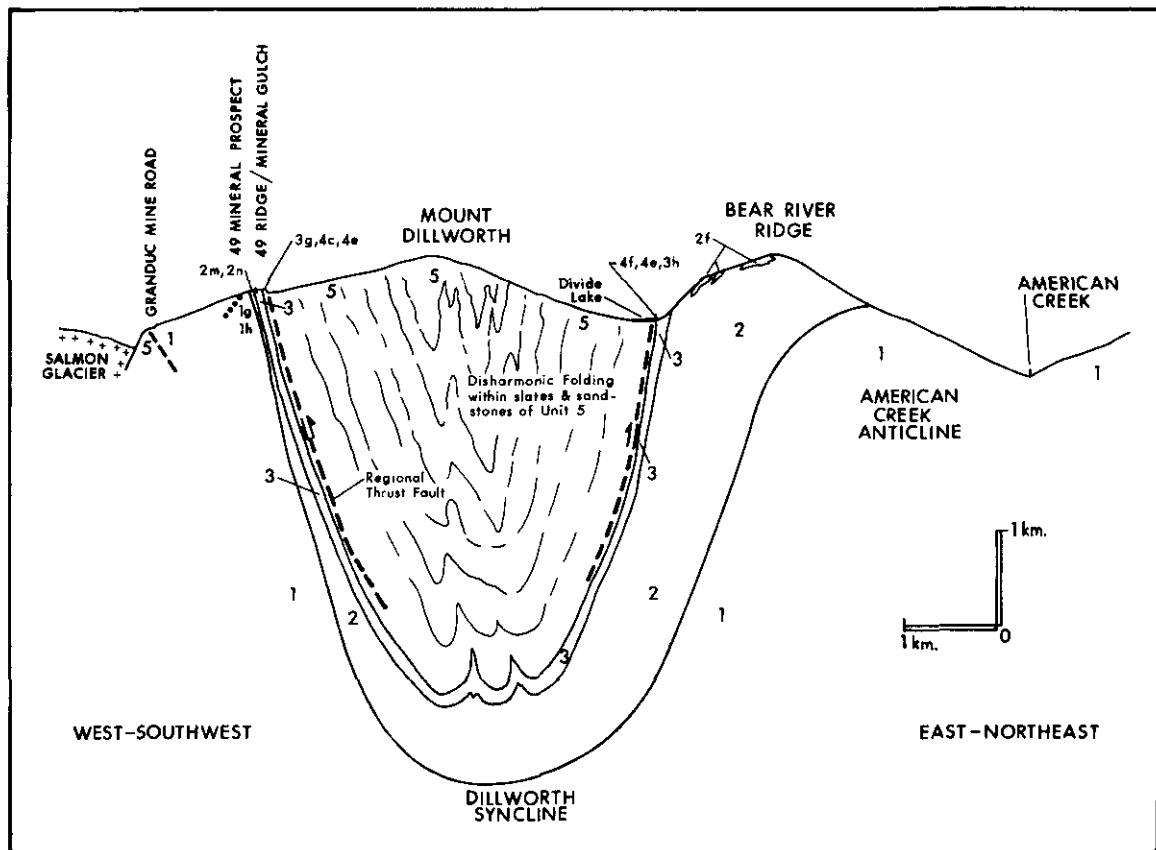


Figure 60. Geologic cross-section through Mount Dillworth (compare with Alldrick, 1983, Fig. 67).

**FAULTING:** A minor thrust fault that encircles the Dillworth syncline separates the sedimentary sequence from volcanic rocks of map units 4 and 3 and, locally, map unit 2. Volcanic rocks adjacent to this fault show little or no deformation but thin-bedded black slates and siltstones are chaotically deformed and cut by white quartz veinlets. The fault plane is characteristically marked by a 6 to 8-centimetre massive white quartz vein that locally swells up to 50 centimetres. Clayey fault gouge fills this fault plane in exposures near the east side of Summit Lake. In the Slate Mountain area it is filled with scattered, pea-sized, black siltstone pebbles in a matrix of massive white vein quartz. This distinctive rock has been called 'chert pebble conglomerate'; it was interpreted to be the basal conglomerate unit of the sedimentary sequence. On the Lower Granduc road this fault places black siltstone beds on highly pyritic rhyolite ash flow tuff (3g) at the top of map unit 3. There the fault plane is 2 metres wide and filled with well-rounded siltstone pebbles up to 3 centimetres in diameter in a friable matrix of pyrite and black clay. Over most of the region the fault zone is not exposed.

Major and minor faults abound and present serious problems for regional and property scale exploration. Induced polarization geophysical surveys have been useful in tracing mineralized zones across major and minor fault dislocations. Some major faults are illustrated on Figures 59 and 60.

**PALEOTOPOGRAPHY:** The schematic section of Figure 61 uses the base of the rhyolitic ash flow as a time line datum. It is not a paleotopographic datum line but is probably a close approximation. Apparent paleorelief on the underlying andesitic volcanic unit is extreme. If chaotic felsic volcanic rocks in the Mount Dillworth area represent a near-vent sequence, the stratigraphy probably drapes downward to the north and south from the 'vent area'.

## **METAMORPHISM**

Galley (1981) identified greenschist facies metamorphic minerals in a petrographic study of the Big Missouri claim group. Interpretation is complicated by extensive alteration associated with the many mineral deposits in the area (Galley, 1981; Grove, 1971). Macroscopic examination of slabbed rocks suggests that the regional metamorphic grade is roughly the same intensity throughout the Salmon River area.

## **MINERAL DEPOSITS**

Detailed studies are underway on major mineral deposits at the Prosperity/Porter Idaho mine (Alldrick and Kenyon, this volume), Scottie Gold mine, Big Missouri mine area, and Silbak Premier mine. Most other prospects and mineral occurrences in the Salmon River valley have also been examined, including new precious metal discoveries of Scottie Gold Mines Ltd., Northair Group, Canada Wide Mines Ltd., Esso Minerals Canada Ltd., and Pacific Cassiar Limited.

This progress report briefly reviews the stratigraphic and structural setting of a few of the deposits, schematically plotted on Figure 61, and considers some of the constraints on genetic interpretation imposed by the regional geologic setting.

**SCOTTIE GOLD MINE:** The gold-silver ores of Scottie Gold mine occur as parallel veins of massive pyrrhotite and pyrrhotite-pyrite. These veins have associated base metal sulphide mineralization disseminated in envelopes of intense chlorite, and hematitic siliceous alteration. The three main veins in the mine, including the newly discovered O vein, lie in subparallel fault or shear zones that trend 110 degrees and dip 75 to 80 degrees north. Within these structures the ore veins plunge 65 to 70 degrees north-north-west. Several subparallel mineralized veins are exposed at surface north of the mine workings (Wares and

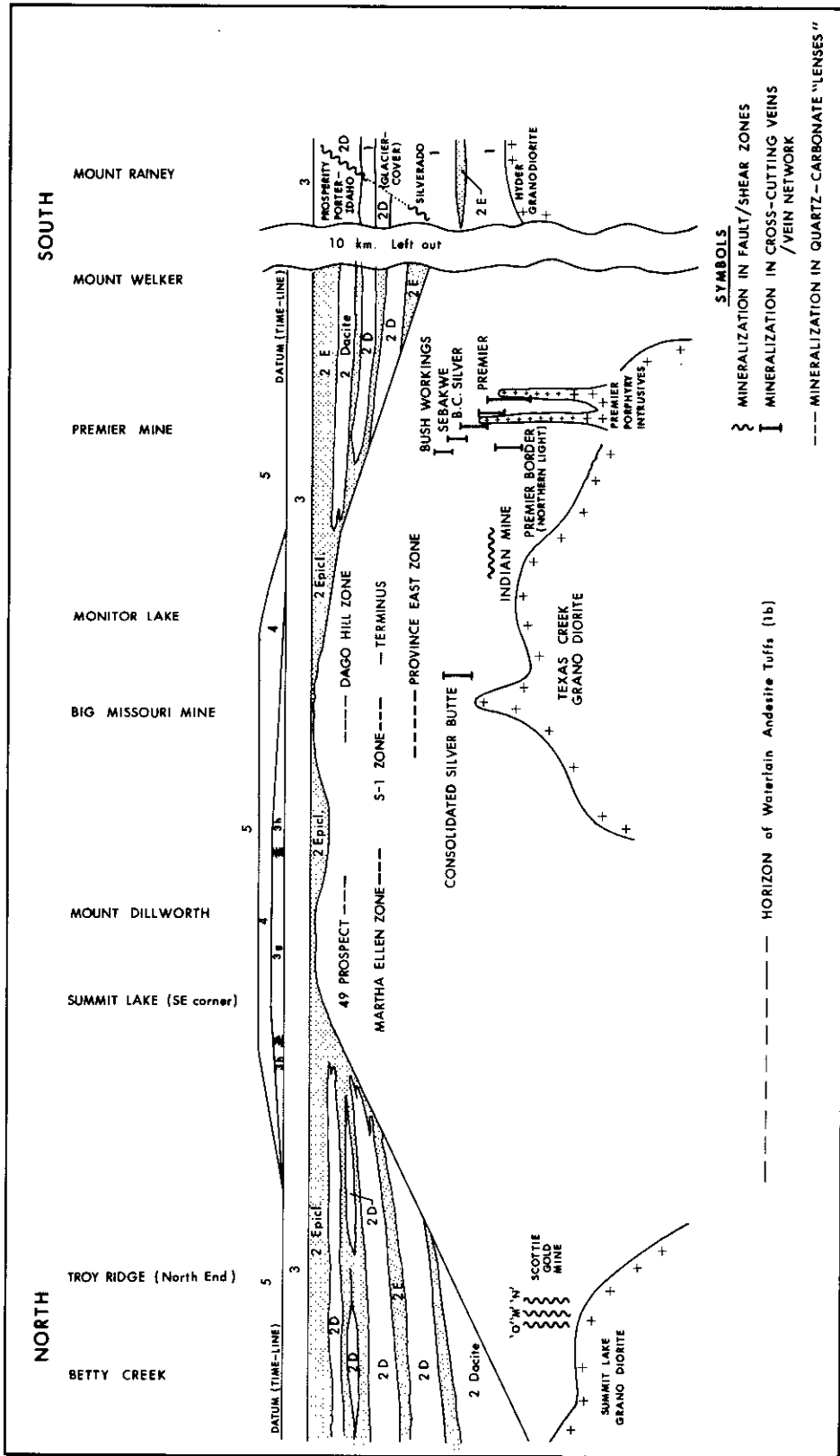


Figure 61. Schematic cross-section showing the stratigraphic position of mineral deposits, Salmon River area.

Gewargis, 1982). These surface showings were the focus of a major exploration program this summer. The ore structures cut host rock andesite lapilli tuff and tuff breccia which strike 135 degrees and dip 75 degrees northeast in the mine area.

The high-grade pyrrhotite veins have been interpreted as epigenetic mesothermal veins that may have originated from the nearby Summit Lake stock. Both Tribe and McGuigan (personal communication) suggested that the deposits could represent original 'epithermal' veins that have been recrystallized and possibly locally remobilized during intrusion of the granodiorite stock.

**BIG MISSOURI MINE AREA:** The geology and mineral deposits of the Big Missouri area are described in detail by Galley (1981) and summarized by Soregaroli and Meade (1983); Holbeck (1983) has completed an ore petrography and trace metal study. The many small, precious metal-rich showings have extensive alteration haloes and are distributed over a 6-kilometres by 1-kilometre area. The deposits have been interpreted to be moderately westward dipping, stratabound, syngenetic quartz-carbonate lenses. These lenses have angular andesite fragments scattered along the footwall contact. The fine to coarsely crystalline quartz-carbonate rock hosts disseminated to semi-massive pyrite with gold-silver values. Several unmineralized quartz-carbonate zones and three small massive pyrite/base metal pods or lenses (Prosperity West, Creek Zone, and TBI-3) also occur in the area. Both hangingwall and footwall consist of andesitic lapilli tuffs and/or crystal tuffs that are moderately to intensely altered; both are cut by barren and mineralized quartz veinlets.

The syngenetic model requires that the andesitic volcanic host rocks of map unit 1 dip gently to moderately (10 to 40 degrees) westward throughout the Big Missouri area. No stratigraphic orientations have been recorded within the andesitic country rocks (Dykes, personal communication, 1983; Galley, 1981). Outcrop is limited, alteration is intense and widespread, and the andesitic tuffs are generally massive. Alldrick (1983, Fig. 67) presented a cross section which relates the observed bedding in the outcrops of map units 2 and 3 on 49 Ridge to postulated dips around the '49' mineral prospect — if the deposit is stratabound.

The regional structural and stratigraphic picture, developed during two years of fieldwork, indicates that strata in the Big Missouri area must be vertical to steeply eastward dipping (Figs. 59 and 60). Outcrops of andesite near Silver Lake that are several hundred metres long strike from the Dago Hill mineralized zones dip 90 degrees to 80 degrees east, supporting the structural picture developed from regional studies.

While the possibility remains that the quartz-carbonate zones are stratabound lenses localized in minor fold structures, the deposits may be epigenetic and localized in structures that crosscut the stratigraphy.

**SILBAK PREMIER MINE:** The geology and mineral deposits of the extensive Silbak Premier mine workings are best described by Langille (1945); additional descriptions are by Burton (1926), White (1939), Grove (1971 and 1973), and Barr (1980). The deposits are high grade and considered to be epithermal precious metal veins hosted either in dense networks of reticulate quartz veinlets or in silica-flooded zones. These vein networks are spatially associated with the 'Premier porphyry'.

Phenocrysts in this porphyritic microdiorite intrusion are bimodal. It contains finer grained ( $\leq 5$ -millimetre) white plagioclase phenocrysts and larger ( $\leq 30$ -millimetre) euhedral, zoned feldspar phenocrysts that appear to be potassium feldspar. In the mine workings there are several apophyses of this intrusive rock into the massive, dark green, andesitic, coarse ash tuff country rock (Langille, 1945, Fig. 2, Barr, 1980, Fig. 10). The total number, overall shape, and distribution of these intrusive bodies is not well established, nevertheless, they represent important exploration guides. The majority of the ore zones are localized along and 'wrapped around' intrusive/country rock contacts. Other factors must be involved because most of the intrusive contact exposed in the mine workings is unmineralized and in these areas

hornfelsing extends only 2 to 3 centimetres into the country rock. In certain areas the 'Premier porphyry' occurs without any phenocrysts (phenocryst density ranges from 0 per cent to 50 per cent). In these areas the intrusive and country rock are almost identical and can only be tentatively separated; the intrusive rock is slightly more blocky and less foliated.

There is no documented evidence available to establish orientation of the andesitic volcanic strata in the mine area. It is generally assumed to be parallel or subparallel to the pervasive foliation in the area which strikes north and dips at 35 to 45 degrees west.

## **EXPLORATION**

Exploration activity in the Stewart area has been intensive during the past few years. Mining and exploration companies are investigating new mineral discoveries such as: the Consolidated Silver Butte prospect (Esso Minerals Canada), the Angelo vein and D vein extensions (Pacific Cassiar Limited), and the O zone (Scottie Gold Mines Ltd.). In addition, many previously known mines and prospects are being re-evaluated: Big Missouri mine area and Silbak Premier mine area (Westmin Resources Limited), the Scottie prospect (Scottie Gold Mines Ltd.), Indian mine (Esso Minerals Canada), the East Gold mine, the Bayview mine (Kingdom Resources Ltd.), the Prosperity/Porter Idaho mine (Pacific Cassiar Limited), and others. There is also renewed exploration activity in Alaska focussed on similar mineral showings in the same stratigraphic setting, such as: the Mineral Hill area (Greenwich Resources Inc.), the Stoner prospect (Exxon Minerals Company), and Moh's showings (Pulsar Exploration Ltd.).

The Surveys and Mapping Branch (Maps B.C.) of the British Columbia Ministry of Environment has announced release of a new, high-resolution, black and white series of air photographs that cover the Stewart area. The airphoto survey was flown July 27 and 28, 1982; it provides documentation of current glacial extent with a minimum of snow cover. The standard 1:50 000 photographs can be enlarged at least four times (to 1:6250) without significant loss of resolution.

**PROSPECTING:** Intensive prospecting has continued to be the most successful reconnaissance exploration tool throughout the area. Locally, steep topography and cover require different approaches. Base of hill stream sediment and talus sampling led to Northair's discovery of gold-bearing quartz-arsenopyrite-pyrite-epidote veins on the upper slopes of Tide Mountain above the East Gold mine. Boulder tracing at the toes of glaciers and around the margins of snowfields contributed to discoveries by Scottie Gold Mines Ltd. and Skyline Explorations Ltd.

Wide variations in ore mineralogy, textures, gossans, and peripheral alteration among the various mineral deposits preclude establishing a 'short list' of key prospecting guides.

**GEOPHYSICS:** Both Westmin Resources and Esso Minerals have conducted extensive tests of a variety of geophysical systems over their known mineralized zones. The systems tested included horizontal and vertical-loop electromagnetic, VLF electromagnetic, induced polarization, self-potential, and magnetometer surveys. Both companies have independently concluded that time-domain induced polarization (IP) was most effective for following the disseminated to semi-massive mineralization they were dealing with. Induced polarization surveys have allowed both companies to trace mineralized zones through overburden-covered areas and to relocate mineral zones displaced by major and minor fault offsets.

Scottie Gold Mines searched for massive pyrrhotite veins within major fault zones with a magnetometer and a VLF electromagnetic unit.

## CONCLUSIONS

The general stratigraphic section in the Salmon River valley consists of a thick section of andesitic tuffs overlain by interbedded dacitic tuffs and epiclastic beds. This sequence is overlain by a felsic volcanic unit with a locally developed near-vent ash flow facies. The felsic unit is overlain by a thick sedimentary sequence that consists of black, carbonaceous siltstones and overlying sandstones. This regional stratigraphy is folded into a north-northwest/south-southeast-trending doubly plunging syncline which produced a minor regional thrust fault along the base of the black siltstones.

Pyritic ash flow facies (map unit 3g) and overlying transition zone sedimentary rocks of map unit 4 are potential exploration targets for syngenetic volcanogenic massive sulphide deposits. These rocks represent the classic stratigraphic and paleotopographic (?) massive sulphide environment. Visible sulphides, the onset of submarine conditions, and reducing conditions argue that massive sulphide deposits might have formed and been preserved. This favourable zone is exposed for a strike length of 7 kilometres; it could be evaluated rapidly by a rock sampling program along the exposures or by a helicopter-borne electromagnetic survey.

MacIntyre's brief comment (1976, p. 17) about similar stratabound sulphide lenses at a similar stratigraphic horizon in the Tahtsa Lake area 300 kilometres to the southeast suggests that a regional exploration program within and immediately above this distinctive felsic volcanic strata is worth considering.

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