British Columbia Geological Survey
Geological Fieldwork 1985

MUDDY LAKE PROJECT*
(104K/1)

By T. G. Schroeter

INTRODUCTION

Mapping and property investigation were conducted for 12 days in the Tatsamenic Lake-Muddy Lake (Bearskin Lake) area in 1985. The Muddy Lake gold prospect, which consists primarily of the Bear and Totem claims, is located 137 kilometres west of Dease Lake at latitude 58 degrees 13 minutes north and longitude 132 degrees 17 minutes west; it lies approximately 10 kilometres due south of Tatsamenie Lake (Fig. 25-1). Access is by fixed-wing aircraft to Muddy Lake or the Muddy Lake airstrip from Dease Lake, Telegraph Creek, Atlin, or Whitehorse. A winter bulldozer trail to the property exists from Telegraph Creek, located approximately 75 kilometres to the southeast. Helicopter access in the area was kindly provided by Chevron Canada Resources Ltd., the owner/operator of the property. Several other nearby properties, including Nie, Slam, Ram, Tut, Inlaw, Outlaw, Oro, Tan, Misty, and Pole, were also briefly visited by the writer.

During the 1985 season an average of 35 people worked out of the Muddy Lake base camp and two diamond drills were in operation. Drilling during 1985 totalled approximately 4 150 metres in 31 holes; 56 holes totalling approximately 10 000 metres were also drilled in 1984 and 30 holes totalling 5 300 metres in 1983.

LOCAL PHYSIOGRAPHY

Near Tatsamenie Lake the glacial movement was from north to northwest (Souther, 1971). The lake shown on late 1940's air photographs and still shown on the 1:250 000 topographic map (104K), that is located approximately 6 kilometres northwest of Muddy Lake, does not exist today. It apparently drained sometime in the 1960's.

Souther (1971) states that small landslides are found in nearly all major valleys of the Tulsequah map-area. He commented on the 'Bearskin slide', which is located on the south-facing slope above the outlet of Bearskin (Muddy) Lake (Fig. 25-2). There is not much doubt that it formed the barrier behind which the lake is impounded, as suggested by Souther in 1971. The slide appears to be the result of a large single event that came from the north and possibly north-northwest near the top of a 900-metre-high ridge, and swept down the steep slope into the valley and part way up the opposite side. The floor of the valley from the outlet of the lake to more than 1.6 kilometres downstream is strewn with huge boulders of greenstone-metagabbro; many are more than 6 metres in diameter. The cause of the slide has not been determined but its spatial proximity to the Muddy Lake prospect has prompted Chevron to examine it in some detail.

REGIONAL GEOLOGY

Early Geological Survey of Canada workers in the Tatsamenie Lake area included Kerr (1930, 1932) and Souther (1958 to 1960). Their published maps and descriptions remain the best references for regional geology. More recent geological information on the area between Tatsamenie Lake and Bearskin Lake has been compiled from Assessment Reports filed by Chevron (Fig. 25-1). The Tatsamenie Lake area is underlain by intensely folded and regionally metamorphosed Permian, Triassic, and older strata that are separated by a pre-Upper Triassic unconformity from less folded and less metamorphosed Mesozoic sedimentary and volcanic rocks. The Mesozoic strata are overlain unconformably by flat-lying Late Tertiary and Pleistocene plateau basalts of the Level Mountain Group.

Three main episodes of tectonic activity have affected the strata: (1) the Mid-Triassic Tahltanian Orogeny; (2) an Upper Jurassic event, and (3) an Early Tertiary event.

ULTRAMAFIC ROCKS (UNIT 1)

The oldest rocks in the area are small, fault-bounded slices of ultramafic rocks; they are associated with northerly trending faults, especially southeast of Tatsamenie Lake. The rock is a black to greenish black, microcrystalline serpentinite with many slickensided surfaces and trace veinlets of brittle, fibrous serpentine. The proximity of these rocks to beds of dolomitic limestone and to fault zones, the absence of primary minerals, and intense hydrothermal alteration of nearby rocks, including the formation of listwanite, all suggest that these ultramafic bodies are of deep-seated intrusive origin. Their emplacement along fractures that acted as conduits to later gold-bearing fluids is considered structural, not genetic.

PERMIAN LIMESTONE (UNIT 2)

Souther (1971) estimated the Permian section at Tatsamenie Lake to be approximately 760 metres thick. It consists of a succession of limestones and dolomitic limestones, with local chert, shale, and sandstone members. The succession is best exposed in the cores of northerly trending anticlines south and east of Tatsamenie Lake. The limestone is massive to well bedded, usually fine grained, and medium grey in colour. Near intrusions it is a white, medium-grained marble. It contains abundant crinoid and shell debris, as well as poorly preserved fusulinids and corals. The limestones are considered to be part of the Stikine terrane assemblage rather than Cache Creek Group, based primarily on the different faunal content (Monger, 1977). Monger noted that the coeval fusulinid faunas in the Stikine assemblage contain far fewer genera and include forms similar to some in northern California and Nevada, suggesting major transcurrent movements. Schwagerinid fusulinids identified in the Tatsamenie Lake area (Monger, personal communication, 1985) correlate with other 'Stikine Facies' rocks in the Tanzilla-Stikine River area, the Oweegee Peak area, the Terrace area, the Whitesail area, and the Fulton Rivver area. These Permian carbonates on the west side of the Bowser Basin are distinctive in their uniform, presumably sheet-like, character over a north-south distance of 500 kilometres (Monger, 1977). The thick, widespread carbonate sections suggest that stable, shelf conditions existed at their time of formation.

PRE-UPPER TRIASSIC ROCKS (UNIT 3)

Souther (1971) estimated a thickness in excess of 2 620 metres for the Stikine terrane package of fine-grained clastic sedimentary rocks and intercalated volcanic rocks, now mainly altered to phyllite and greenstone, and minor chert, jasper greywacke, and limestone. This package overlies the Permian limestone with apparent conformity. In the Muddy Lake area this contact is often obscured by

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* This project is a contribution to the Canada/British Columbia Mineral Development Agreement.

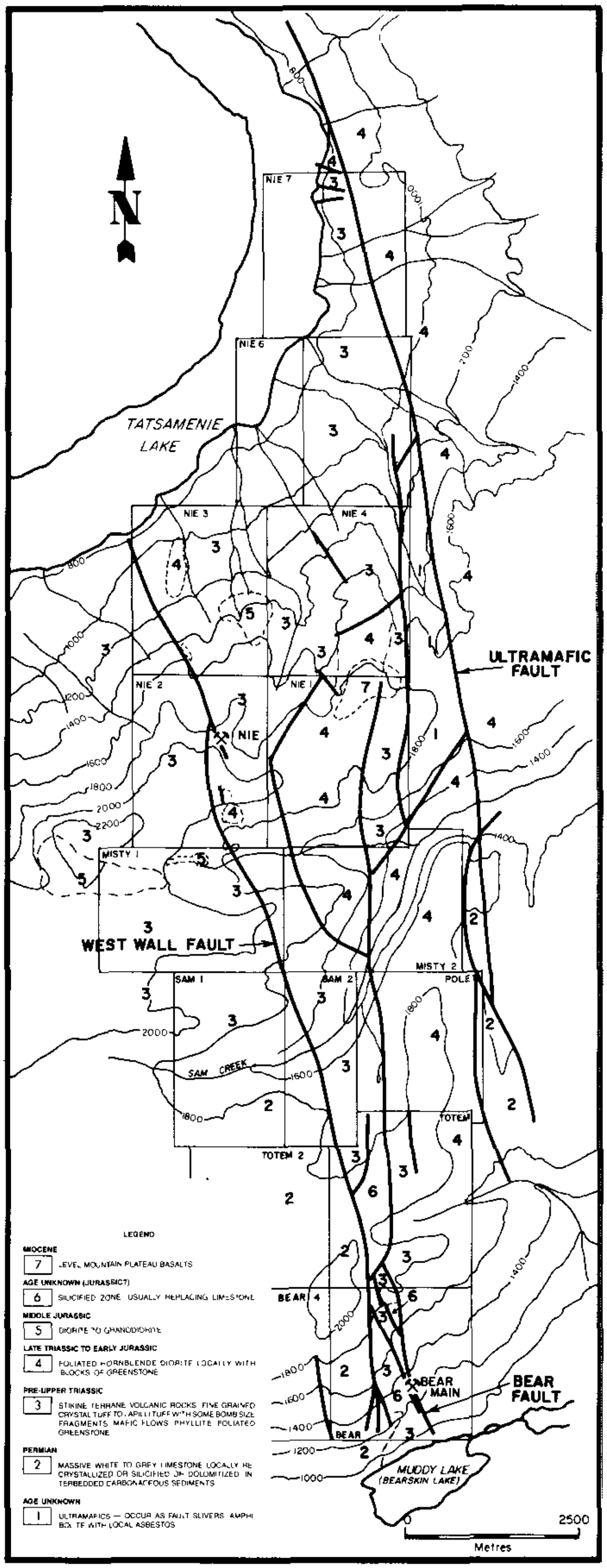

Figure 25-1. Geological plan of the area between Tatsamenie Lake and Muddy Lake. Base map supplied by Chevron Canada Resources Ltd.; compilation in part from British Columbia Ministry of Energy, Mines and Petroleum Resources Assessment Reports.

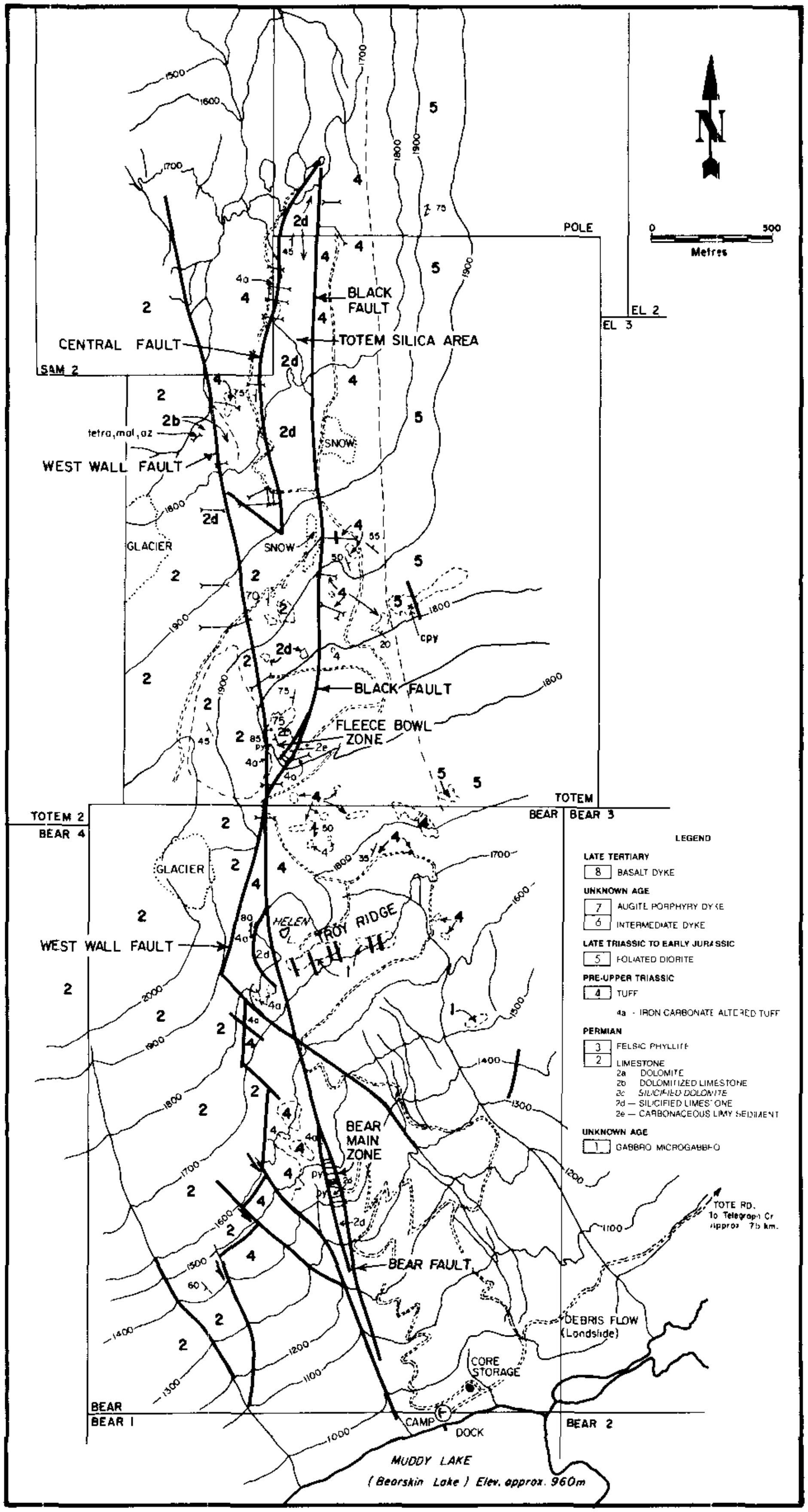

Figure 25-2. Geological plan of the Muddy Lake gold prospect. Base map supplied by Chevron Canada Resources Ltd.

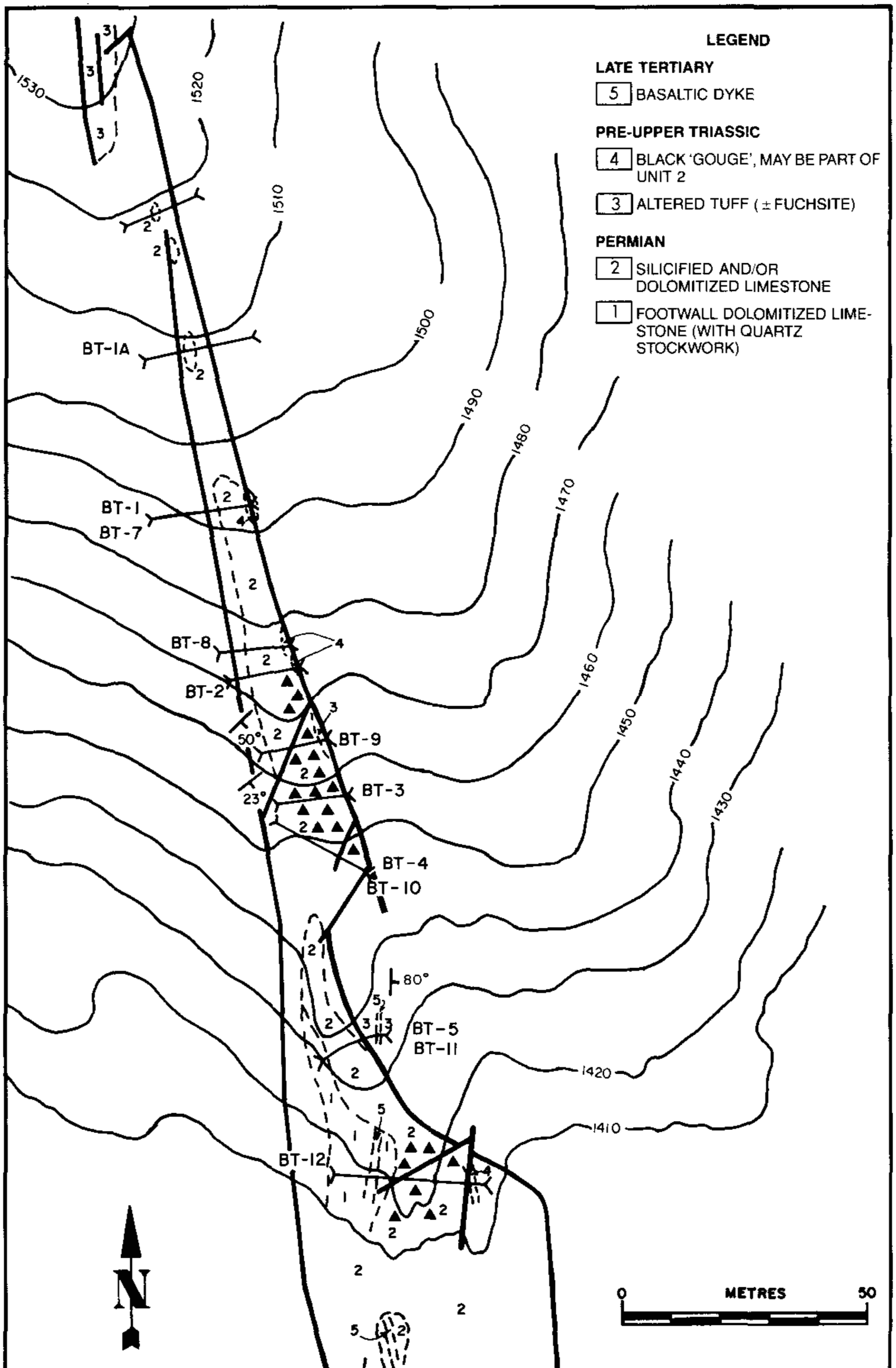

Figure 25-3. Geological plan of Bear Main zone, Muddy Lake.

faulting. The volcanic rocks are intensely folded and sheared; they display a well-developed slaty cleavage and foliation. Regional metamorphism has converted original crystal-lapilli tuffs and mafic flows to greenstone, chlorite-amphibole schist, and phyllite but primary bedding and textural features are preserved locally. Souther (1971) described a relatively undeformed, 610-metre-thick section south of Tatsamenie Lake, consisting of light green, siliceous phyllite interlayered with calcareous and dolomitic phyllite and overlain by more than 500 metres of dark green chloritic phyllite. In general, marker horizons are absent in the greenstone package. Tabular bodies, often dyke swarms, of gabbro (metagabbro) and basic diorite of unknown age are associated with the ultramafic rocks. Zones of intense shearing within these dykes are common. Their spatial relationship to the pre-Upper Triassic volcanic rocks and their chemical similarity suggest that the two correlate. In the Chutine map-area, south of Muddy Lake, black calcareous siltstone occurs more than 100 metres above the Permian limestone. Other banded sediments include shale, siliceous siltstone, and fine-grained greywacke. These rocks correlate with Mid to Upper Triassic rocks.

LATE TRIASSIC TO EARLY JURASSIC (UNIT 4)

Foliated hornblende quartz diorite is the predominant intrusive rock in the eastern portion of the area. The rock is fine to medium grained and ranges in composition from diorite to quartz monzonite. The rock is usually strongly altered with abundant chlorite, epidote, and hematite developed along fractures. The diorite is richer in hornblende near its contacts, and adjacent sedimentary rocks are usually hornfelsed; many contacts are faulted. An Early or Middle Jurassic age is assigned to these rocks on the basis of textural and mineralogical similarity to boulders found in the Lower Jurassic Takwahoni Formation. K/Ar age determinations on two such boulders yielded Late Triassic to Early Jurassic ages of 206 and 227 Ma (Geological Survey of Canada, Age Determinations 62-76 and 62-77). The diorite intrudes pre-Upper Triassic rocks north-northeast of Muddy Lake.

MIDDLE JURASSIC (UNIT 5)

A number of hornblende diorite to granodiorite stocks crop out in the western portion of the region. Contacts with the country rock are sharp and regular; the intrusive rocks are not foliated. Locally, such as at the Nie showing, these bodies occur in fault planes and may have a genetic relationship with mineralization.

An albitized quartz diorite of this suite from the southeast end of Tatsamenie Lake yielded a K/Ar whole rock date of 171 ± 6 Ma (Hewgill, 1985); it probably represents the latest stage of hydrothermal activity associated with Unit 5 rocks.

MIOCENE (UNIT 7)

Flat-lying plateau basalts of the Level Mountain Group are the youngest rocks in the region. They are black, fine-grained basalts with open vesicles along dyke margins, and in flow tops.

PROPERTY GEOLOGY

Remarks on property geology will refer mostly to the Bear and Totem claim groups of the Muddy Lake property (Fig. 25-2), and to specific zones within these claims, such as the Bear Main zone (Fig. 25-3, Plate 25-1).

UNKNOWN AGE (UNIT 1)

A gabbro or metagabbro of unknown age crops out on the eastern portion of the property, particularly on Troy Ridge. It is extensively chloritized and hematized. Its relationship with other rocks is unclear, but it may correlate with the pre-Upper Triassic mafic volcanic rocks. The gabbro appears to be cut by foliated hornblende diorite of the Late Triassic to Early Jurassic age.

PERMIAN (UNIT 2)

The unaltered limestone is massive to well bedded with cherty grey 'boudins' up to 15 centimetres in length. Fossils are not abundant. Local brecciation and sedimentary breccias that occur as conformable layers within the limestone section consist of angular to subangular clasts of limestone in a fine-grained carbonate matrix. Late-stage calcite veins and cavity fillings both crosscut and parallel bedding planes within the limestone. On the bluff above Helen Lake, veins are up to 1 metre in width.

Adjacent to fault contacts, particularly the West Wall fault, the limestone is pink, variably dolomitized, and contorted to isoclinally folded. In altered areas, the limestone is silicified and locally vuggy with the late-stage veinlets of calcite and siderite.

A sedimentary package of siltstone and carbonaceous siltstone lies conformably on the limestone and dips 75 degrees to the east. This unit is invariably strongly faulted and not well exposed. The name 'Black fault' was chosen because it forms a black, carbonaceous zone adjacent to silicified limestone in the hangingwall.

PRE-UPPER TRIASSIC (UNIT 4)

Overlying the limestones with apparent conformity is a thick section of ash, lapilli and crystal andesitic tuffs, and possibly mafic flows. Locally graded beds, flame structures, and rip-up clasts in ash layers give tops. In detail the mafic volcanic rocks grade into tuffs across distances as little as 2 metres. Local coarsening gives the volcanics a dioritic appearance. The sequence has few markers — one being a chalcopyrite-bearing horizon in lapilli tuff. Where altered, mainly in the hangingwall, tuffs are silicified, carbonatized, and contain fuchsite (listwanites). Locally the tuffs are interbedded with black siliceous siltstone and may contain up to 3 volume per cent pyrite. At the Fleece Bowl showing and elsewhere, altered fuchsite-bearing tuffs occur as fault pods or slices.

LATE TRIASSIC TO EARLY JURASSIC (UNIT 5)

Hornblende diorite is strongly foliated and exhibits strong alteration to chlorite, hematite, and epidote, and contacts with pre-Upper Triassic rocks are brecciated. Locally the diorite contains up to 5 per cent pyrite, and traces of chalcopyrite both as disseminations and on fractures. It intrudes the pre-Upper Triassic rocks and is locally agmatitic. Angular blocks of greenstone-metagrabbro 0.3 metre to 2 metres in diameter, have been incorporated into the diorite. Dykelets of felsite cut both the foliated diorite and the intruded greenstones; later fracturing offsets these dykelets.

UNKNOWN AGE (MIDDLE JURASSIC ?) (UNIT 6)

Four occurrences of narrow dykes of hornblende diorite composition were noted — three in the area of the Totem silica zone and one in drill core from the Fleece Bowl zone. The dykes cut all older rocks. A sample for possible age dating was collected from a dyke cutting foliated hornblende diorite on the east side of the Totem silica area. In Fleece Bowl, a 'felsic dyke', which was mineralized in several sections, was intersected by drilling.

MIOCENE (UNIT 8)

A 1-metre-thick dyke of black basalt, probably a feeder to Level Mountain Group flows, crops out in Bear Main zone.

BEAR MAIN ZONE (Fig. 25-3; Plate 25-1)

The silicified 'pod' on Bear Main zone has been traced by drilling along a length of 1 kilometre, across a width of 10 metres and to a depth of at least 200 metres. The 'pod' is composed of silicified dolomite and is bounded on the west side by altered tuffs. Rare

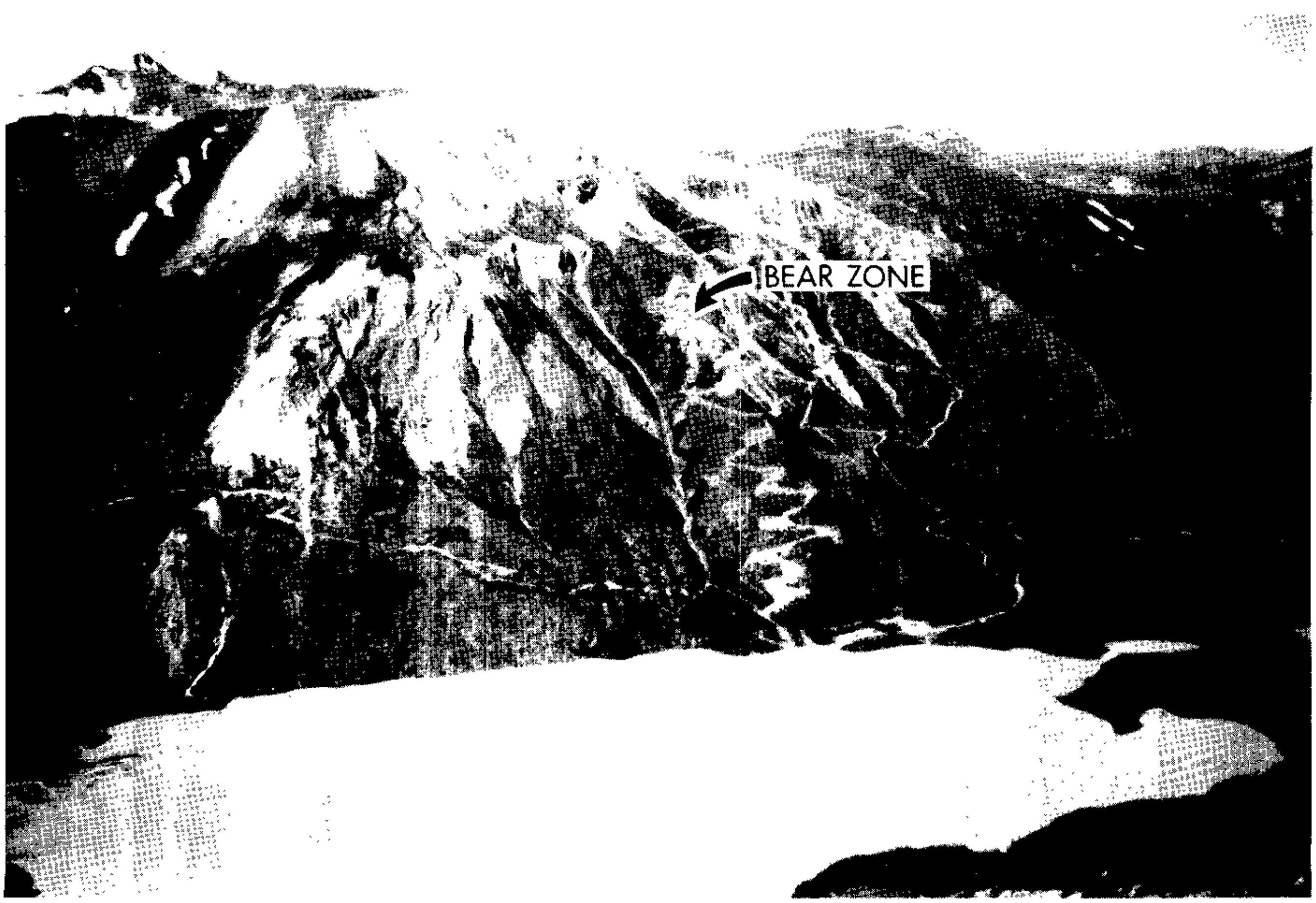

Plate 25-1. View northerly over Muddy Lake toward Bear Main Zone

bedding at 085/23 south was preserved as were remnants of isoclinal folds. The dolomite locally displays a quartz stockwork with resistant veinlets of quartz. The southern portion of the 'pod' is strongly brecciated; the breccia zones commonly have relatively sharp contacts and occur between the silicified dolomite and altered tuff. Two varieties of breccia exist:

(1) **Heterolithic breccia**: contains fragments of fuchsite-bearing tuff, white-grey limestone, black carbonaceous siltstone, white to grey quartz, and black limestone in a dolomitic matrix.

(2) **Monolithic breccia**: consists of silicified white limestone fragments in a grey, silicified limestone matrix.

Both varieties of breccia contain vuggy quartz and pyrite up to 10 per cent by volume.

The hangingwall fault (Bear fault) cuts the tuffaceous rocks and is marked by a zone of black gouge. A thick section of ash, lapilli and crystal tuffs, and what appear to be local mafic flows, occur above the hangingwall. The only marker observed is a chalcopyrite 'zone' within the lapilli tuff. Slickensided fractures have attitudes of 045/48 northwest. A 1-metre dyke of black basalt (Tertiary ?) intrudes silicified dolomite and altered tuff on Bear Main zone.

Near the north end of the main outcrop (elevation 1 520 metres, Fig. 25-3) soil and talus drape over the silicified and/or dolomitized limestone.

FLEECE BOWL ZONE

The West Wall and Black faults bound the Fleece Bow zone on the west and east respectively (*see* Fig. 25-2). The Black fault occurs in a graphitic, siliceous siltstone and dips to the east; the fault zone ranges from 6 to 20 metres in width. Late-stage calcite veinlets cut the rock which is locally vuggy. The hangingwall zone consists of fuchsite-bearing tuff with trace arsenopyrite in quartz veinlets. The West Wall fault cuts silicified limestone and silicified dolomite and dips steeply to the east. A slice up to 12 metres wide with strong, north-striking foliation consists of fuchsite-bearing tuff with quartz-carbonate veining, and breccia containing angular fragments of fuchsite-bearing tuff, and silicified limestone up to 15 centimetres in diameter is exposed in a north-south trench (Fig. 25-2). The rocks contain 1 to 2 per cent pyrite as disseminations and fracture fillings. The hangingwall fault in this 'slice' is marked by black gouge which contains anomalous gold values. The hangingwall sequence consists of well-banded silicified limestone and dolomite.

Diamond drilling encountered a 'felsic' dyke which consists of fine-grained white quartz eyes in a pervasively sericitized groundmass and contains up to 10 per cent pyrite as fine disseminations and fracture fillings. The dyke is anomalous in gold (Chevron personnel, personal communication).

TOTEM SILICA ZONE

A large (1 100-metre by 200-metre) zone of intense silicification with or without dolomitization occurs on the northern portion of the property (Fig. 25-2). The host rocks are well-bedded, locally intensely folded limestones with some dolomites; they occupy the core of a north-trending anticline. The limestone beds have local, stratabound breccia zones.

Two phases of folding are prominent: phase 1 consists of tight, isoclinal, commonly recumbent folds that are consistently S-shaped, when viewed southerly down the plunge; phase 2 consists of broader, open anticlinal folds that trend northerly, as do regional, broad anticlinal folds at the northwest end of Tatsamenie Lake. Local minor folds occur on the limbs of phase 2 folds.

Strong, late-stage northeasterly trending crossfracturing is prominent. 'Boudinaging' of quartz in banded silicified limestone is locally well developed, as are breccias with large, quartz-lined vugs around silicified limestone fragments. In vuggy quartz-calcite breccias in 'sandy' limestones, rhombs of calcite grow on quartz crystals. Pyrite occurs in trace amounts within the silicified limestone and locally occurs as 'wispy' rims around white silicified limestone fragments in breccias.

The southwest side of the zone is characterized by silicified dolomite with quartz stockworks that are weakly mineralized with tetrahedrite occurring as disseminations and on fractures.

On the west side of the Totem Silica zone, which is on the west limb of the anticline, bedding is steep near the fault contact between silicified limestone and interbedded fuchsite-bearing tuff and carbonaceous siltstone. This fault zone strikes north and dips east; it is brecciated with hematite-rich slickensides plunging 45 degrees to the south, indicating that the west side moved down.

The hangingwall section both east and west of the Totem Silica zone consists of foliated hornblende tuff, chloritic tuff, and fine-grained greenstone with hematitic fractures. A foliated hornblende diorite intrudes the rocks on the east. Hornblende-feldspar porphyry dykes of intermediate composition that trend southwest and dip steeply, cut silicified diorite. These dykes have been altered to epidote, chlorite, and clay minerals.

STRUCTURE

Three main episodes of tectonic activity have occurred in the region: (1) Mid-Triassic Tahltanian Orogeny, (2) Upper Jurassic; and (3) Eary Tertiary. Monger (1977) stated that "the Stikine assemblage was emplaced by poorly understood, complex motions that involve transcurrent movement, subduction on both sides of a narrowing basin floored by 'trapped' oceanic crust and, in the final stages of closure, eastward obduction of the basin floor". A prominent northerly to northwesterly trending fault zone, locally referred to as the Ophir Break zone, extends through the property and has been traced on the surface and by drilling from Muddy Lake northward to Tatsamenie Lake — a distance of more than 10 kilometres (*see* Fig. 25-1). The zone is about 3 500 metres wide and defined by areas of intense fracturing, abundant slickensiding, areas of carbonaceous and siliceous black siltstone and gouge, and linear Fe-carbonate, quartz ± fuchsite-bearing tuff (listwanites) and quartz-dolomite alteration zones. The zone is bounded on the west by the West Wall fault and on the east by the Ultramafic fault so named because it contains elongated serpentinite pods. Several minor fault structures occur within the Ophir Break zone. Locally slices of fuchsite-bearing tuff belonging to the pre-Upper Triassic greenstone package occur within Permian limestone, such as in the bluffs immediately northwest of Bear Main zone.

Two directions of younger crossfaulting have been observed. One strikes northwesterly and shows left-lateral movement of up to 100 metres between limestone and greenstone west-northwest of Bear Main zone (*see* Fig. 25-2); the other strikes northeasterly and shows right-lateral offset within silicified dolomite in Bear Main zone.

As described for Totem Silica zone, two phases of folding exist: Mid-Triassic age, isoclinal, commonly recumbent, S-type folds; and Late Jurassic broad, open folds, similar to those at Tatsamenie Lake. The cores of anticlines occasionally contain crackle breccias (for example, Ram/Tut property). Phase 1 and phase 2 folding are prominent in Totem Silica zone, and phase 1 is a minor feature in Bear Main zone. The quaternary debris flow with slump blocks or detached slices was discussed previously.

ALTERATION

Two dominant alteration types occur:

(1) Quartz-dolomite, which occurs primarily in the limestone unit.

(2) Quartz-iron carbonate-pyrite fuchsite (listwanites), which occur in the tuff unit.

Both types are most intensely developed adjacent to or in fault zones and both appear to increase in intensity toward the hangingwall.

The quartz-dolomite alteration consists of massive fine-grained quartz, quartz breccia, and lesser dolomite. Outward from a zone of intense silicification, with or without brecciation, silica decreases gradually from massive quartz to vein quartz to stringer quartz in a dolomite matrix. Further out, alteration grades into dolomitic limestone and finally to unaltered limestone. This sequence of alteration is well developed in the footwall of The Bear Main zone and less so in the Fleece Bowl and Totem Silica zones. Heterolithic and monolithic breccias are locally well developed in the quartz-dolomite alteration zone (Fig. 25-3). Abundant replacement dolomite and carbonate veining may result from release of magnesium and some calcium from the greenstone unit or from a deep-seated ultramafic source.

The listwanitic quartz-iron carbonate-pyrite fuchsite alteration assemblage is restricted mainly to tuffaceus rocks of the greenstone unit. The zones range in width from 1 metre to 20 metres and are strongly foliated. Carbonate minerals noted include ferroan dolomite, ankerite, calcite, and aragonite. X-ray determination of the clay-sized fraction shows mainly illite and sericite and traces of sodium-rich alunite. The rocks also have kaolinite veinlets and gypsum coating fractures. Other accessory minerals identified in the listwanitic zones include talc, chlorite, hematite, and pyrite, which occur as veinlets, breccia fillings, rimming clasts, and as fine laminations. Jarosite is conspicuous on silicified dolomite bluffs at the southern end of Bear Main zone. A spectrographic analysis of listwanite collected from Fleece Bowl gave the following results: Si >10%, Al >10%, Mg 4.5%, Ca 7.0%, Fe 8.0%, Pb -, Cu 0.3%, Zn 0.05%, Mn 0.08%, Ag -, V 0.06%, Ti 0.5%, Ni 0.06%, Co 0.02%, Na <0.3%, K >2.0%, W -, Sb 0.25%, Cr 0.2%, and trace As, Ga, Mo, Zr, Sr, Ba, B, Rb, Nb, and P.

The process of listwanitization corresponds to a CO_2-Ca metasomatism of ultramafic rocks, with addition of potassium in fuchsite-rich listwanites. Gold values are randomly distributed within listwanite lenses at Muddy Lake, as is the case in similarly mineralized areas around the world. A strong positive correlation exists between gold, arsenic, and sulphur. Fuchsite formation involves transfer of Si and Fe^{3+}? from the zone altered to listwanite to the 'ore' zone; Mn, Ca, K, and C are introduced and other elements including Cr, are redistributed.

MINERALIZATION

Mineralization is of the 'no-seeum' gold type with minor silver values. Metallic mineralogy consists of 0.1 to 5 per cent pyrite, trace amounts of arsenopyrite and scorodite, native gold with values up to 27.8 grams per tonne gold and silver up to 67 grams per tonne (Schroeter, 1984), pyrrhotite, chalcopyrite in amygdules in lapilli and altered fuchsite-bearing tuff, Sb-bearing tetrahedrite, and hessite. The latter two minerals are listed in a private report by Chevron.

Tetrahedrite occurs in fractures in silicified dolomite on the west portion of the Totem Silica zone. Native gold is micron to submicron size (Chevron personnel, personal communication) and very erratic in distribution, a characteristic of listwanitic deposits. Locally within the Bear Main zone, gypsum is associated with mineralization. Pyrite occurs in at least two distinct stages: as late-stage veinlets; and as earlier breccia matrix filling, fragments within breccias, 'wispy' rims on silicified limestone fragments in breccia, and local laminations in fine bleached tuff. The younger, fine-grained pyrite veinlets rarely offset older breccia or lamination pyrite.

Two main 'zones' of mineralization have been identified: Bear Main and Fleece Bowl (Fig. 25-2). The Bear Main zone crops out in a fault bounded silicified and listwanitized block which has been traced by drilling along a strike length of nearly 1 kilometre, across an average width of 10 metres, and to a depth of at least 200 metres. The host rocks in the Bear Main zone include silicified dolomitized limestone and breccia and carbonatized tuffs (listwanites). The gold:silver ratios are high, greater than 2 to 1, and silver is rarely more abundant than gold in individual assays. Mineralization in the Fleece Bowl zone does not crop out; it has been intersected only in drill holes. Several short mineralized sections associated with quartz veining exist, as well as mineralization associated with a 'felsic' dyke which locally contains up to 10 per cent pyrite as disseminations and fracture fillings. The dyke contains white quartz eyes and has been extensively sericitized.

There is a positive correlation between Hg-As-Sb-Au and Ag in mineralized zones. The only sulphides identified to date on the Totem Silica zone are pyrite in the silicified limestone and tetrahedrite in the silicified dolomites. Assays of samples taken during a visit to the property in 1984 are shown in Schroeter (1985). Assays from samples collected during the 1985 study will be available at a later date.

To date, no reserve figure has been released for the Muddy Lake gold deposit.

AGE DATING

Only limited age dating has been done in the area. The Late Triassic to Early Jurassic age of the foliated diorite is inferred from K/Ar whole rock dates obtained from two granitic boulders in the Takwahoni Formation. Chevron has obtained a whole rock K/Ar date of approximately 177 Ma from sericite from the Muddy Lake prospect (H. Wober, personal communication).

Hewgill (1985) obtained a K/Ar whole rock date of 171 ± 6 Ma from albitite on the Ram/Tut property, located approximately 10 kilometres northwest of Muddy Lake. The albitite apparently represents the latest stage of hydrothermal activity of a Jurassic calc-alkaline quartz diorite to tonalite intrusion. Hewgill has determined strontium isotopic initial ratios for albitite of 0.7029 to 0.7038, ratios that would be typical of a mature island arc formed at a convergent margin. Several other samples were collected by the writer during 1985 for age dating including a hornblende diorite dyke adjacent to mineralization at the Nie (2 Oz. Notch) showing (Fig. 25-1); an intermediate hornblende-feldspar porphyry dyke cutting foliated hornblende diorite on the east side of Totem Silica zone (Fig. 25-2); and samples of several schistose sericitic and/or chloritic fault zones within Bear Main zone (Fig. 25-3).

OTHER PROPERTIES

A number of other brief property visits in the region were conducted. Following are brief remarks about some of these properties:

NIE (Lat. 58°21′ Long 132°18′; 104K/8W)

The Nie claims contain the Nie or "2 Oz. Notch" showing (Fig. 25-1) which consists of a quartz vein more than 1 metre wide with abundant disseminated and massive pyrite and minor pyrrhotite veins adjacent to a hornblende diorite dyke of suspected Middle Jurassic age. Both the vein and dyke occur along the trace of the West Wall fault, which extends between Tatsamenie and Muddy Lakes. North of the showing, also along the trace of the West Wall fault, the most northerly known slice of limestone is in contact with fuchsite-bearing tuff. Post-Middle Jurassic quartz monzonite stocks and hornblende diorite dykes also occur. To the east of the showing, fault-bounded, altered ultramafics crop out, as do flat-lying Miocene plateau basalts. To the south there is a small asbestos showing noted on Souther's (1971) map (Fig., 25-1).

MISTY (Lat. 58°19′ Long. 132°17.5′; 104K/1W)

The Misty claims are underlain by pre-Upper Triassic volcanic rocks which have been intruded by Middle Jurassic dioritic to granodioritic stocks. Minor skarn mineralization, consisting of magnetite, chalcopyrite, pyrrhotite, iron carbonate, and hematite, has been noted.

RAM/TUT (Lat. 58°17′ Long. 132°25′; 104K/8W)

The Ram/Tut property is underlain by a section of pre-Upper Triassic rocks overlying Permian limestones and dolomites that have been intruded by albitite. The limestone unit consists of massive to well-bedded grey limestone with local beds and 'boudins' of chert and/or pyrite. Locally limestone beds exhibit stratabound brecciation, and are silicified and vuggy. Mineralization noted in the silicified limestone units includes fracture-controlled and disseminated tetrahedrite and an isolated massive sulphide 'pod' 1 metre in diameter containing galena, sphalerite, pyrite, and arsenopyrite. Isoclinal phase 1 and open phase 2 folds occur in the limestone unit. Crackle breccia occurs near the core of a phase 2 anticlinal fold. Lying conformably above the limestone unit and locally in fault contact with it is phyllite of the pre-Upper Triassic sequence. The albitite intrudes the section and is locally mineralized with pyrite, boulangerite (Hewgill, 1985), and tourmaline. Another showing occurs where silicified and/or dolomitized limestone is in contact with both Miocene basalt and Cretaceous (?) dykes in a fault zone that trends 080 degrees. Here pyrite and scorodite (?) occur in a silicified zone. To the south, several small veins of stibnite exist on the property.

Mineralization on this property, and also regionally, might involve solutions ascending up a fault through the limestone units and into the overlying phyllitic package. The mineralizing solutions may have travelled outward along stratabound breccia in the silicified and/or dolomitized limetone beds beneath the 'impermeable' contact with a minor amount of 'leakage' into the phyllites. The age of mineralization may be related to the albitization event at about 171 Ma.

SLAM (Lat. 58°14′ Long. 132°07′; 104K/1E, 8E)

The Slam property consists of silicified zones in limestone and carbonaceous siltstone cut by clay-altered feldspar porphyry dykes. Resistant silica-rich knobs are anomalous in gold.

ORO AND TAN GROUPS (Lat. 58°10′ Long. 132°18′; 104K/1)

An undivided sequence of 'greenstone', including coarse pyroclastics, underlies both claim groups. Minor intermeditae dykes cut the sequence as do minor pyritic altered zones. Trace amounts of chalcopyrite have been reported associated with the pyritic altered zones.

OUTLAW (Lat. 58°33′ Long 132°44′; 104K/10E)

The Outlaw property is located approximately 7 kilometres northwest of Trapper Lake. Two types of mineralization were observed:

(1) Arsenopyrite, tourmaline, stibnite, and pyrite with gold and silver values that occur in quartz veinlets associated with highly sericitized feldspar porphyry.

(2) Strong psilomelane and minor pyrite in a quartz vein (Mancuso vein) that cuts pre-Upper Triassic rocks.

INLAW (Lat. 58°28′ Long. 132°44′; 104K/7E)

The Inlaw property is also located approximately 7 kilometres west of Trapper Lake. Quartz-calcite veinlets with galena, sphalerite, and pyrite occur in a 7-metre-wide, silicified, northwesterly trending zone in Stuhini Group pyroclastics. Silicification is both pervasive and patchy.

ORE DEPOSITION MODEL

The main ore depositional event which produced the Bear Main gold deposit is postulated to have resulted from large-scale, low-temperature circulation of gold-bearing hydrothermal solutions during the late stages of listwanite alteration of the greenstone unit. The tectonic contacts in the Bear fault zone between silicified limestone-dolomite and/or breccia and altered fuchsite-bearing tuff acted as channelways for CO_2-Ca-rich brines which were responsible for the carbonatization process. Acidic, gold-bearing solutions precipitated silica-pyrite arsenides and free gold in silicified rocks, breccias, and altered tuffs, including listwanites when gold transporting complexes became unstable when they entered the reducing and alkaline environment of the carbonatized rocks.

Mineralization is of the 'no-seeum' type and is very erratic. Nevertheless, it tends to be concentrated in silicified 'pods' or slices of silicified dolomitized limestone and/or altered, fuchsite-bearing tuff. A possible genetic association with a Middle Jurassic hornblende diorite intrusive event is suggested but more data are required to support this hypothesis.

Regionally, a similar fault control is envisaged with the added possibility of stratabound mineralization being associated with stratabound zones of silicification and brecciation in the limestone unit underlying the phyllite unit.

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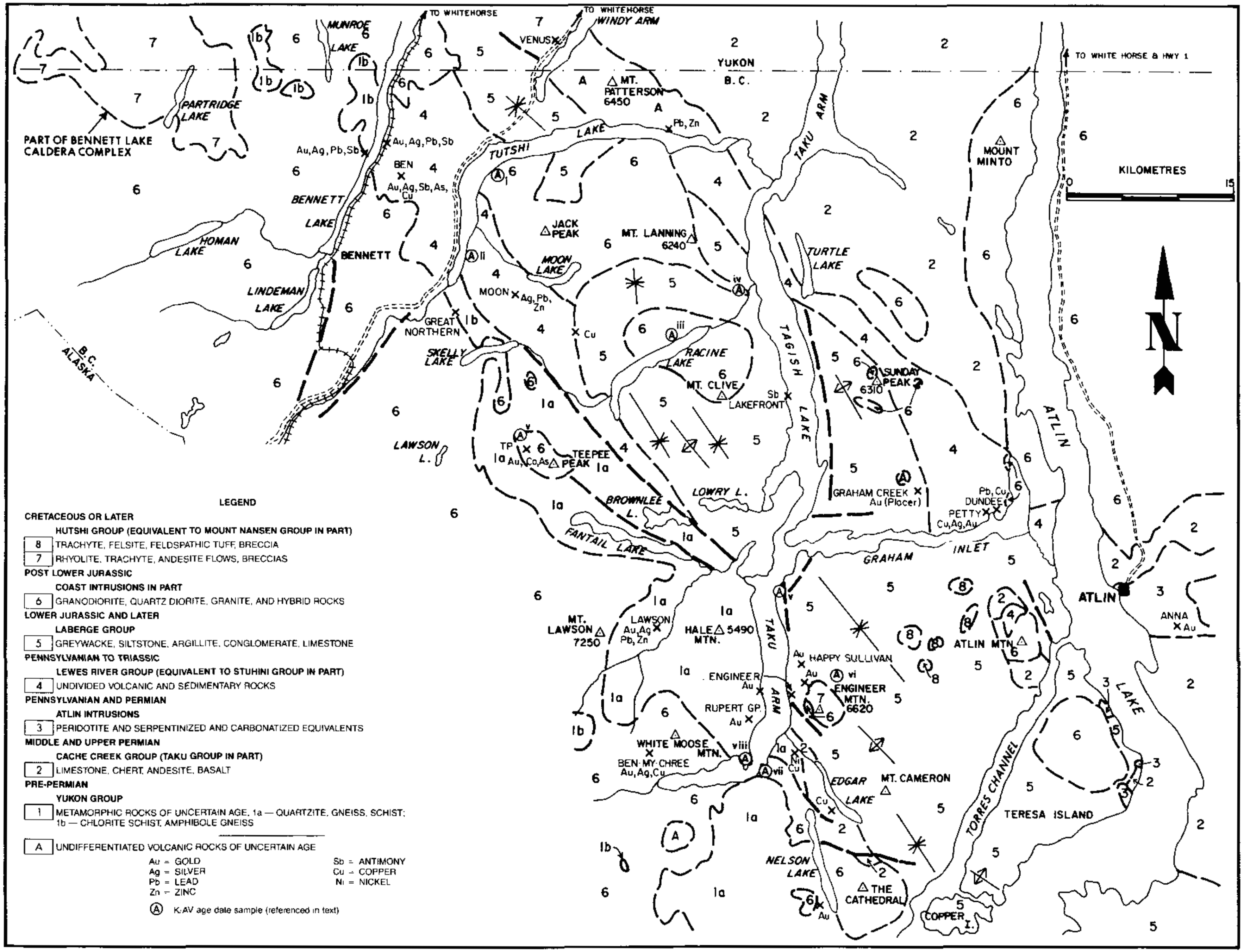

Figure 26-1. Compilation of geology, structure, and mineral deposits, Bennett area.