STRUCTURE, DUCTILE THRUSTING AND MINERALIZATION WITHIN THE PALEOZOIC STIKINE ASSEMBLAGE, SOUTH FORREST KERR AREA, NORTHWESTERN BRITISH COLUMBIA (104B/10, 15)

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KEYWORDS: Structural geology, Stikine assemblage, West Lake thrust, deformation, brittle faults, ductile shear, veins

INTRODUCTION

This report summarizes results of detailed structural mapping completed during the 1991 field season in the north Iskut River region. The study area is located near the boundary between the Intermontane and Coast tectonic belts. Rocks of the Stikine Terrane underlie the area and comprise mid-Paleozoic island-arc successions which are overlain by sediments and volcanics of the Late Triassic Stuhini Group (Kerr, 1948; Souther, 1972; Read *et al.*, 1989; Logan and Koyanagi, 1989; Logan *et al.*, 1990, 1992). Unnamed Early to Middle Jurassic volcanics and sediments overlie Stuhini rocks. The island-arc successions are host to significant precious and base metal mineralization throughout the Iskut River region. These successions are overlain to the east by Middle to Late Jurassic sediments of the Bowser Basin (Wheeler *et al.*, 1988).

Exploration has outlined a number of mineral deposits of varying types which include: gold-bearing veins (Snip and Johnny Mountain), porphyry copper deposits (Schaft Creek and Galore Creek), volcanogenic massive sulphide (Eskay Creek) and skarn mineralization (McLymont).

This paper focuses on the nature and timing of superimposed ductile and brittle shearing within the Paleozoic Stikine assemblage and its relationships to the development of regional shear zones and mineralization in the area located on lower Forrest Kerr Creek straddling the boundary between map sheets 104B/10 and B/15 (Figure 1-16-1).

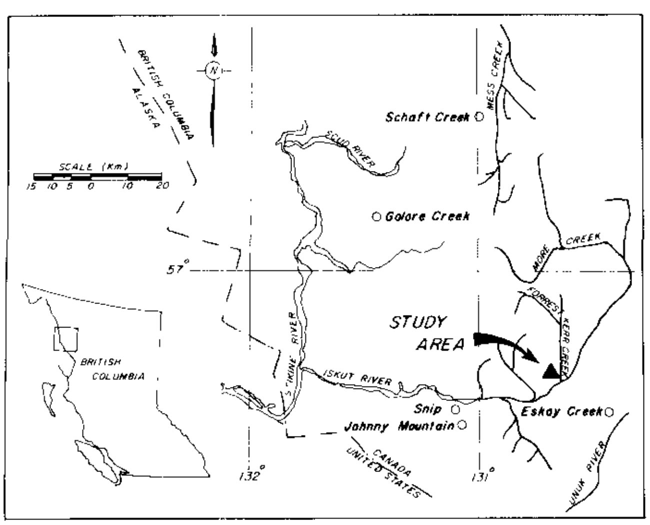


Figure 1-16-1. Location map of the north Iskut region showing position of study area.

REGIONAL GEOLOGY

Souther (1972), Read *et al.* (1989) and Logan *et al.* (1990) described rocks in the Forrest Kerr region as comprising three principal layered stratigraphic assemblages which are intruded by several generations of dioritic and granitoid igneous rock (Figure 1-16-1).

The oldest layered rocks within the study area are polydeformed and metamorphosed volcanics, volcaniclastics, and sediments of the Stikine assemblage. Microfossil data provide age limits which range from the Early Devonian to the Late Permian. Recent dating of extensive granitic and dioritic plutons within the Forrest Kerr area have returned radiometric dates as old as Mississippian (J.M. Logan, personal communication, 1991). These intrusions had previously been mapped as Jurassic in age (Souther, 1972; Logan *et al.*, 1990). Their exact age remains speculative.

Rocks of the Stikine assemblage are often unconformably overlain by deformed volcanics, volcaniclastics and sediments of the Upper Triassic Stuhini Group (Read *et al.*, 1989; Logan *et al.*, 1990, 1992). Where exposed, these rocks are variably deformed, complexly faulted and are nearly always in sharp faulted contact with underlying Paleozoic basement. Recent structural studies in the More Creek area (104G/2) to the north indicate that Stuhini rocks are generally unaffected by at least one early phase of folding only seen in Paleozoic strata (Holbek, 1988; Read *et al.*, 1989; Logan *et al.*, 1992). Most of the deformation recorded in Stuhini rocks is of a brittle nature with occasional scattered discrete high-strain zones of ductile-brittle shearing. Stuhini rocks are intruded by diorites, syenite porphyries and quartz monzonites of various ages. Quartz veins containing sulphides and associated precious metals occur adjacent to these intrusions in structurally favourable zones.

Unnamed Lower and Middle Jurassic and Middle to Upper Jurassic Bowser Lake Group rocks comprising sediments, volcanics and volcaniclastics unconformably overlie the Stuhini Group. These lithologies are brittly deformed and faulted and are intruded by minor dioritic sills and dikes with scattered syenite porphyry dikes injected along high-angle fault zones.

The above stratigraphy is cut by several generations of north-northeast-trending ductile and brittle fault zones. Four major fault or shear zones have been mapped in the Forrest Kerr area and have formed at different times in response to differing regional stress regimes. One of these, the West Lake thrust, an early ductile shear zone, trends through the study area and is the main focus of this report.

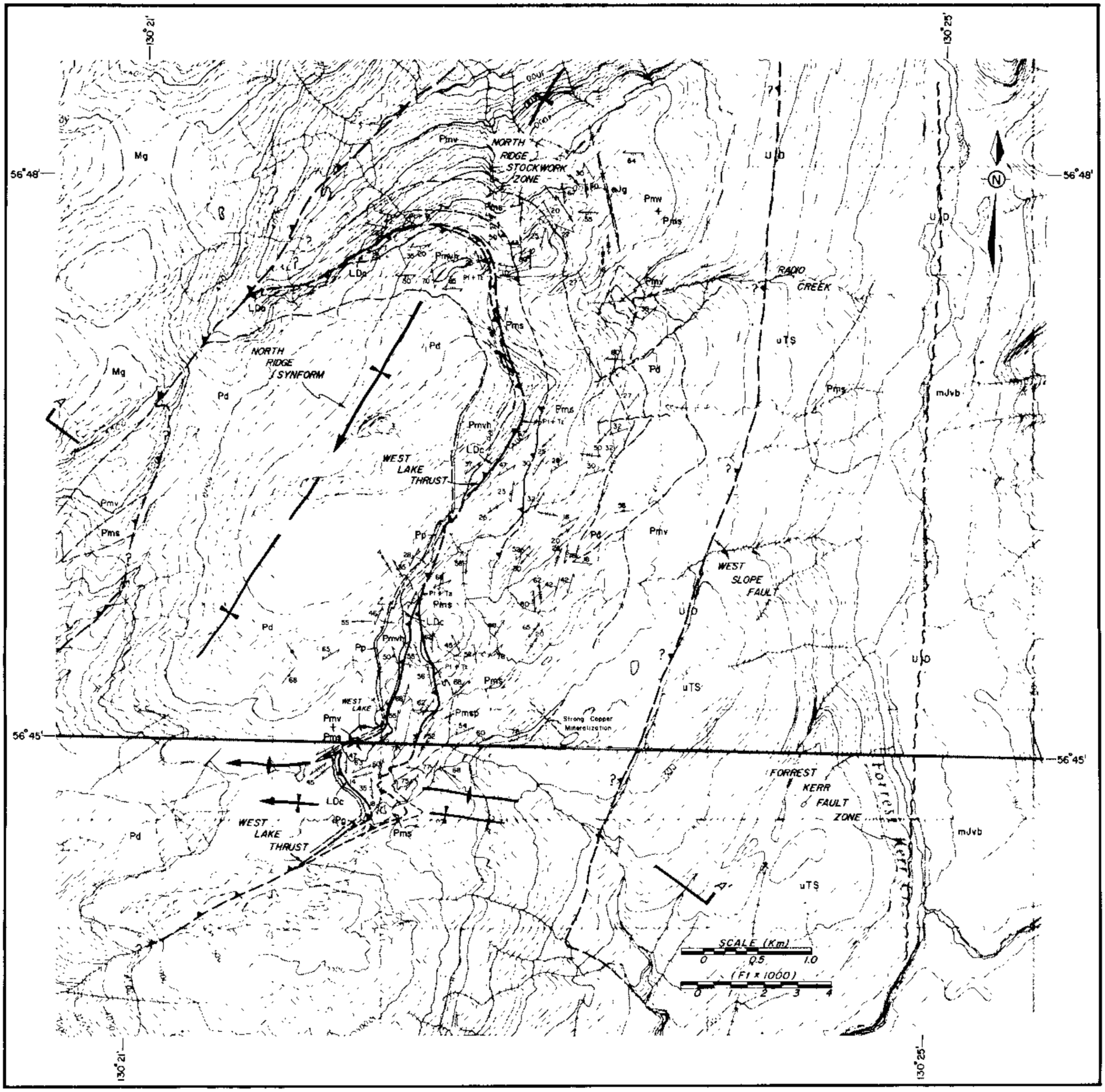


Figure 1-16-2. Geology map of the West Lake area. See facing page for legend.

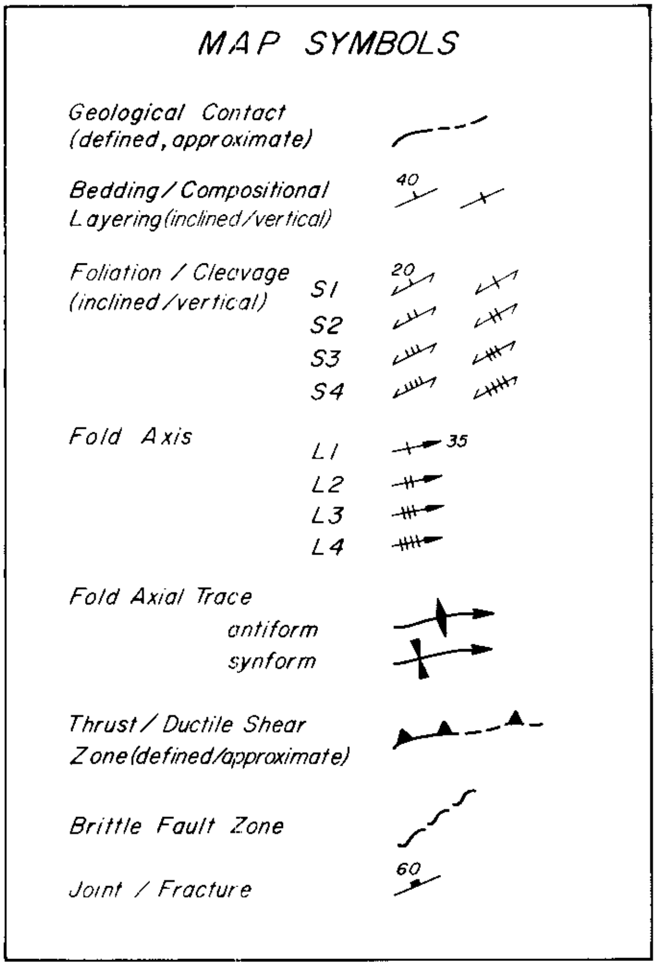
LITHOLOGY

All layered rocks in the study area included in the Paleozoic Stikine assemblage are deformed by at least four phases of folding. Two principal lithologic packages have been defined within the area and are separated by the moderately to gently west-dipping West Lake thrust zone. Hangingwall rocks comprise a strongly deformed and metamorphosed Early Devonian and younger(?) package of volcanics, volcaniclastics and sediments containing distinctive carbonates. These deformed carbonates have been structurally emplaced over a footwall assemblage of Permian and older metavolcanics, metavolcaniclastics and metasediments. Both successions are intruded by quartz diorite of probable Paleozoic age (Read *et al.*, 1989; Logan *et al.*, 1990). In some areas, this intrusion is disturbed by the thrusting.

HANGINGWALL ASSEMBLAGE

LOWER DEVONIAN CARBONATES — LDc

Light grey to black, thin-bedded, strongly foliated marble, limestone and calcareous argillite and phyllite define



LEGEND

LAYERED ROCKS

MIDDLE TO UPPER JURASSIC

mJvb — PILLOW BASALT, FLOW BRECCIA, HYALOCLASTITE

UPPER TRIASSIC STUHINI GROUP

uTS — UNDIVIDED VOLCANICS AND SEDIMENTS

PALEOZOIC METAMORPHIC ROCKS (STIKINE ASSEMBLAGE)

LOWER DEVONIAN AND YOUNGER (?) HANGINGWALL ROCKS

Pp — FOLIATED GREY-GREEN PLAGIOCLASE PORPHYRY, MINOR BLACK PHYLLITIC SILTSTONE

Pmvh — FOLIATED VOLCANICS-VOLCANICLASTICS: LAPILLI, BLOCK, ASH TUFF SCHISTS AND PHYLLITES, ANDESITE FLOWS, SERICITE-QUARTZ SCHIST

LDc — THIN BEDDED FOLIATED GREY TO BLACK RECRYSTALLIZED LIMESTONE AND MARBLE, MINOR PHYLLITIC SILTSTONE

PERMIAN AND OLDER (?) FOOTWALL ROCKS

Tz — THRUST ZONE: BLACK SERICITE-QUARTZ SCHISTS AND MYLONITES

Pt — TAN BROWN TO GREY SERICITE-QUARTZ SCHISTS AND MYLONITES, BLACK CALCAREOUS-SERICITIC MYLONITES

Pms — GREY AND PURPLE SCHISTS, GREEN RIBBON CHERT, LAPILLI TUFF SCHIST, (IN THIN-BEDDED METASILTSTONE/SANDSTONE; GREY TO BLACK GRAPHITE-SERICITIC PHYLLITE Pmsp)

Pmv — FOLIATED GREEN AND PURPLE PYROXENE-PHYRIC ANDESITE FLOWS, SCHISTOSE LAPILLI TUFF

INTRUSIVE ROCKS

EARLY JURASSIC

eJg — HORNBLENDE-BIOTITE K-FELDSPAR MEGACRYSTIC GRANITE, MINOR K-SPAR SYENITE PORPHYRY DIKES

PERMIAN AND OLDER (?)

Pd — FOLIATED HORNBLENDE-QUARTZ-DIORITE, GRANITE, FINE GRAINED BASALTIC DIKES

Mg — MISSISSIPPIAN (?) HORNBLENDE-BIOTITE GRANITE

the oldest and structurally lowest units within the study area (Figure 1-16-2). The carbonates range to in excess of 200 metres thick, are commonly fossiliferous and have been dated Early Devonian (Read *et al.*, 1989). This unit outcrops as a narrow, discontinuous north-trending, northwest-dipping band except in the north where large-scale synformal folding has changed this orientation to northeast (Figure 1-16-2). It structurally overlies and is separated from Permian and older metavolcanics and metasediments by narrow zones of ductile shearing and thrusting.

Thrust contacts dip moderately to gently west to northwest. Compositional layering within the carbonates is generally strongly folded and transposed parallel to early foliations related to thrusting. Intrafolial isoclinal folds are common and original stratigraphic directions are indeterminate due to the high degree of transposition and recrystallization. Minor quartz veining is prominent adjacent to the lower thrust contacts and represents at least two generations of hydraulic fracturing and fluid mobilization.

PALEOZOIC METAVOLCANICS (Pmvh)

Conformably overlying the Lower Devonian carbonates is a package of up to 500 metres of strongly flattened and sheared metavolcanics, metavolcaniclastics and metasediments of Early Permian to Early Devonian and older(?) age (Read *et al.*, 1989). The exact age and relationship of these strata to footwall Unit Pp of Read *et al.* (1989) and its equivalent, Unit Pmv of Logan *et al.* (1990) is uncertain. There is a possibility that Units Pmvh and Pmv are of different ages and they are therefore described separately. Strata generally dip to the southwest, vary from dark green to tan and grey-brown, and comprise phyllitic to schistose lapilli and block-tuffs, volcanic debris-flows phyllitic to schistose ash-tuff units, pyroxene-phyric andesitic flows, minor argillite and quartz-sericite schists. Layering within these units has been complexly folded and often transposed parallel to early foliations. These rocks are intruded and locally hornfelsed by a large body of Paleozoic(?) hornblende quartz diorite (Read *et al.*, 1989; Logan *et al.*, 1990). High-strain states during deformation and metamorphism have produced local mylonite zones related to thrusting in quartz-sericite schists.

FOLIATED FELDSPAR PORPHYRY — Pp

Foliated grey-green plagioclase porphyry containing minor black inclusions of phyllite occurs as a thin discontinuous unit separating Paleozoic metavolcanics from the large hornblende quartz diorite intrusion (Figure 1-16-2). This unit ranges to 20 metres in thickness and is typically strongly sheared and silicified along its trace. Both upper and lower contacts are often obscured by extensive iron carbonate alteration zones and are frequently interfoliated with Lower Devonian carbonates and Paleozoic metavolcaniclastics. The porphyry may represent a sheared, altered and recrystallized chilled margin of the diorite, though its genesis remains uncertain.

HORNBLENDE QUARTZ DIORITE — Qd

A large body of medium-grained equigranular hornblende quartz diorite intrudes all hangingwall units (Figure 1-16-2). Smaller quartz diorite bodies intrude footwall rocks and are classified as peripheral intrusions related to the main quartz diorite (Read *et al.*, 1989; Logan *et al.* 1990). In general, the quartz diorite comprises a heterogeneous mix of granitic and dioritic phases with quartz diorite as the dominant phase. Dark green diabase dikes of random orientation are scattered throughout the intrusion. Its eastern margin is in sharp contact with hangingwall units Pp, Pmvh and LDc. Here, the intrusion is cut by narrow discontinuous northeast-trending foliate zones related to ductile shearing. Locally, the intrusion is characterized by a braided, almost brecciated texture defined by angular amphibolite xenoliths within a sheared, more granitic matrix. The western margin of the quartz diorite is in thrust contact with an extensive granitic pluton of possible Mississippian age (Logan *et al.*, 1990; J.M. Logan, personal communication, 1991; Figures 1-16-2 and 3).

Paleozoic Footwall Assemblage

PERMIAN AND OLDER MAFIC METAVOLCANICS — Pmv

Mafic metavolcanics, primarily of pyroxene-phyric andesite flows and schistose lapilli tuffs ranging to in excess of 1500 metres thick, comprise the structurally lowest unit mapped within the study area. Andesitic flows are generally dark green to purple, moderately to weakly foliated and often massive. Lapilli tuffs are typically mottled green and purple and contain zones of high strain where lapilli are strongly attenuated within an early foliation plane (Logan *et al.*, 1990). Units within this package may be repeated by minor low-angle thrusting and include chlorite-sericite schists, grey phyllite, and minor recrystallized limestones.

PERMIAN AND OLDER METASEDIMENTS — Pms

Structurally and stratigraphically overlying the metavolcanics is a package of mixed metasedimentary and metavolcaniclastic rocks up to 700 metres thick. Strata within this unit are variable and discontinuous and comprise moderately west-dipping black graphitic and sericitic phyllites (Pmsp), green ribbon cherts, grey and purple phyllite and schists, grey to tan thin-bedded siltstone and sandstone, sericite-quartz phyllites and schists, siliceous ash-tuffs, purple schistose lapilli tuff and phyllitic to schistose volcanic breccia and debris flows. Original layering within most lithologies has been sheared and often transposed along early foliation planes, although bedding is preserved in scattered localities. Facing directions indicate these rocks are right way up.

SYENITE PORPHYRY DIKES — eJg (?)

Late-stage coarse felsic dikes containing porphyritic to megacrystic potassium feldspar outcrop randomly throughout the area. The age of these rocks is uncertain, but they may be related to Unit eJg of Logan *et al.* (1990), a potassium feldspar megacrystic granite which outcrops immediately south of the study area.

STRUCTURE

All layered rocks within the study area have been deformed and metamorphosed to lower to subgreenschist facies (Read *et al.*, 1989; Logan *et al.*, 1990). Four regionally significant phases of folding and shearing can be discerned locally. It is the superposition of these phases within areas of varied lithology which has produced the transposition of compositional layering and significant tectonic shortening observed throughout the area. Figures 1-16-2 and 3 illustrate map and cross-section geometry; Table 1-16-1 outlines the primary characteristics of each deformation event.

Folding

D_1 DEFORMATION

The geometry of the D_1 deformation is characterized by a northeast-trending penetrative transposed foliation, S_1,

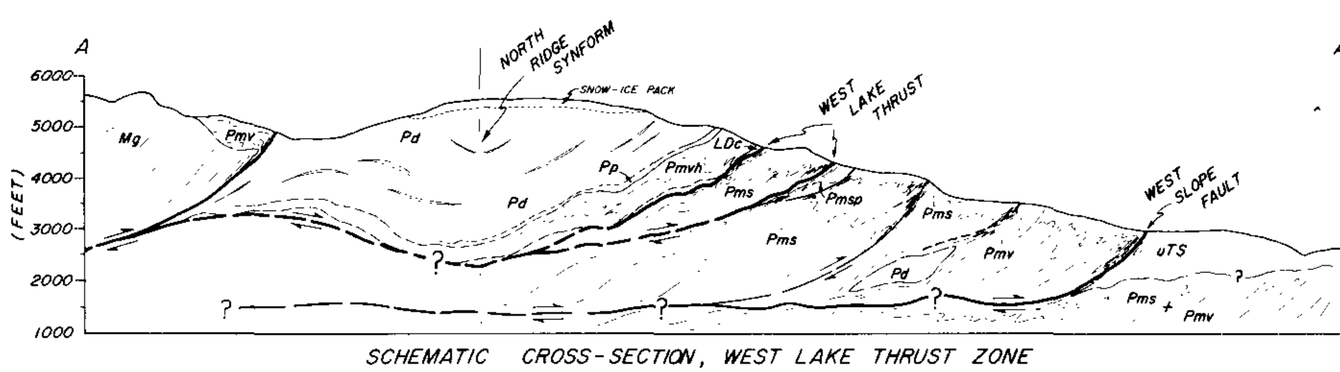


Figure 1-16-3. Cross-section, partly schematic, through the West Lake area.

which is axial planar to intrafolial isoclines and larger mesoscopic tight to isoclinal folds outlined by S_0 (Plate 1-16-1; Table 1-16-1). This early deformation is associated with regional metamorphism which has produced a recrystallized-mica fabric parallel to S_1. Axial planes generally dip moderately to gently northwest with shallow to moderately southwest-plunging fold axes. Phase-one minor folds are often asymmetrical from which a general southeast sense of vergence is deduced. Some minor folds display opposing senses of rotation which may indicate the presence of large-scale structures.

Approaching the West Lake thrust, F_1 folds and associated S_1 foliation are gradually rotated through nearly 30° into parallelism with the thrust zone, as a result of D_2 deformation (Figure 1-16-2).

D_2 DEFORMATION

The second phase of folding and its related foliation, S_2, are developed along a northeast trend and deform all earlier structures (Plate 1-16-2; Table 1-16-1). Axes of minor F_2 folds plunge gently to the southeast within moderately to gently northwest-dipping axial planes. Discrete zones of high ductile strain, in which F_1 and F_2 folds become progressively appressed, strongly attenuated and often transposed within S_2, are associated with the folding. Away from these zones, F_2 folds become more open and often display an asymmetry related to a southeast-directed sense of vergence.

Several major D_2 ductile strain zones define the northwest-dipping West Lake thrust (Figures 1-16-2 and 3). The thrust zone comprises discrete shear zones, 20 centimetres to 1 metre wide, in which both hangingwall and footwall units are completely transposed and have mylonite fabrics (Plate 1-16-3). The main zone and splays are flanked by subparallel bands of sericite-quartz schist, 3 to 10 metres thick, which contain isoclinal F_2 folds. East-vergent folding becomes progressively more open away from these bands. Other less sericitic shear zones occur throughout footwall rocks, but are not well developed in the hangingwall stratigraphy. Studies of deformed L_1 linear structures within F_2 folds indicate that the D_2 shear direction trends to the southeast at a high angle to F_2 hinge-lines. Based on these observations and previous work of Read *et al.* (1989) and Logan *et al.* (1990), the West Lake thrust is interpreted as having its latest movement directed to the southeast during late D_2 deformation.

D_3 DEFORMATION

Phase-three folding deforms the West Lake thrust with a trend almost orthogonal to F_1 and F_2 structures (Table 1-16-1). Phase-three folds and their related cleavage are developed along an east to southeast trend with steeply south-dipping axial planes and gently east and west-plunging fold axes. A non-penetrative spaced cleavage typifies the S_3 fabric. Strong shearing along S in the area

TABLE 1-16-1
DEFORMATION CHARACTERISTICS AND NOMENCLATURE FOR THE WEST LAKE AREA

Event	Characteristics	Nomenclature	Orientation (Original)
D_0	Compositional layering/bedding	S_0	variable, NE trending, generally NW dipping
D_1	Mesoscopic tight to isoclinal and intrafolial folds outlined by S_0, flattened, sheared, appressed; generally southeast verging	F_1	NE trending, NW dipping, variable
	Poorly developed mica-edge lineations, minor fold axes	L_1	SW plunging, 25/220
	Transposed regional axial-planar foliation associated with low-grade regional metamorphism	S_1	020-060/30 NW, variable
D_2	Mesoscopic, disharmonic shear folds outlined by S_0/S_1; generally planar limbs with thickened hinge regions; limbs are often sheared out along S_2 shear zones; generally southeast verging	F_2	NE trending, NW dipping
	Minor fold axes, mica-edge and mineral lineations	L_2	SW plunging 30/210, variable
	Well-developed penetrative axial-planar foliation and minor ductile shear zones	S_2	020-040/35 NW, variable
	— formation of low-angle thrust zones and associated mylonites, West Lake thrust		
	— associated with C and S-band microfabric development and peak metamorphism		
	— rotation of F_1 folds into parallelism with S_2 shear zones		
D_3	Mesoscopic to macroscopic upright, open to tight ductile-brittle folds, kink bands and crenulations	F_3	E to SE trending, variably N-S dipping, mod. to steep
	— macroscopic folding of the West Lake thrust		
	Minor fold axes, intersection lineations, S_1, S_2 with S_3	L_3	15/090, 270
	Nonpenetrative spaced cleavage, fracture cleavage	S_3	090-120/80 N-S
	— scattered vein mineralization along related fault and fracture zones		
D_4	Mesoscopic to macroscopic upright, open brittle buckle folds, and steep brittle faulting, minor chevron folds	F_4	NE to NW trending, variable steep E-W dip
	— synformal folding; warping of the West Lake thrust		
	Minor fold axes	L_4	20/360, 180
	Nonpenetrative fracture cleavages and brittle fault zones	S_4	160-200/80 E-W
	— scattered vein mineralization along related fault and fracture zones		

Plate 1-16-1. F_1 minor folds in sericite-graphite schist (footwall); looking northeast.

Plate 1-16-2. F_2 minor folds in thin-bedded metacherts and siltstones (footwall); view down-plunge, looking south.

surrounding West Lake has deformed the West Lake thrust and associated splays into upright, moderately open mesoscopic folds (Figure 1-16-2). In more competent lithologies, D_3 deformation is represented by kink banding and spaced fracture cleavages which provide structural control for localized iron carbonate alteration and vein mineralization. This deformation represents a ductile-brittle transitional phase associated with north-south compression.

D_4 DEFORMATION

Phase-four folds have an open, upright style and steeply dipping axial surfaces which trend almost orthogonal to F_3 structures (Figure 1-16-2; Table 1-16-1). All rock types and the West Lake thrust are involved in the northeast-trending, gently southwest-plunging North Ridge synform (Figure 1-16-3). Minor folds produce open buckling in more competent rocks and chevron folds in finer grained lithologies. S_4 is developed as a steep variably east to west-dipping fracture cleavage and as steep, minor brittle faults that locally provide structural control for polymetallic and precious metal bearing quartz veins and iron carbonate alteration.

FAULTING

With the exception of thrust faulting along the West Lake zone, little significant faulting was recognized within the map area. Several northwest-trending faults near Radio Creek have displaced quartz diorite contacts and are sites of scattered quartz and minor sulphide veining (Figure 1-16-2).

METAMORPHISM AND MICROFABRICS

All rock units within the area have undergone low-grade regional metamorphism to the lower greenschist facies. Muscovite and sericite laths are preferentially developed along S_1 and S_2 surfaces with only occasional weak alignment along S_3. Metamorphism initiated during D_1 deformation reached its peak late in the D_2 deformation. Fine-grained sericite schists contain the assemblage sericite-muscovite-chlorite-calcite-epidote. Early quartz veins are strongly deformed and recrystallized.

Microfabrics within thrust zones record a history of strong ductile shearing, mylonite development and dynamic recrystallization. Schists adjacent to the West Lake thrust contain prominent C fabrics defined by sericite and muscovite. Angular relationships between C and S_2 fabrics within these rocks vary between 5° and 10° with S_1 often completely transposed parallel to S_2. Polygonized and extremely attenuated quartz porphyroclasts outlined by sericite, define anastomosing elliptical shape-fabrics which define the S_2 foliation.

Deformed quartz occurs primarily within early hydraulic fractures and shows pronounced slip along incipient kink-band boundaries and the beginnings of ribbon-grain

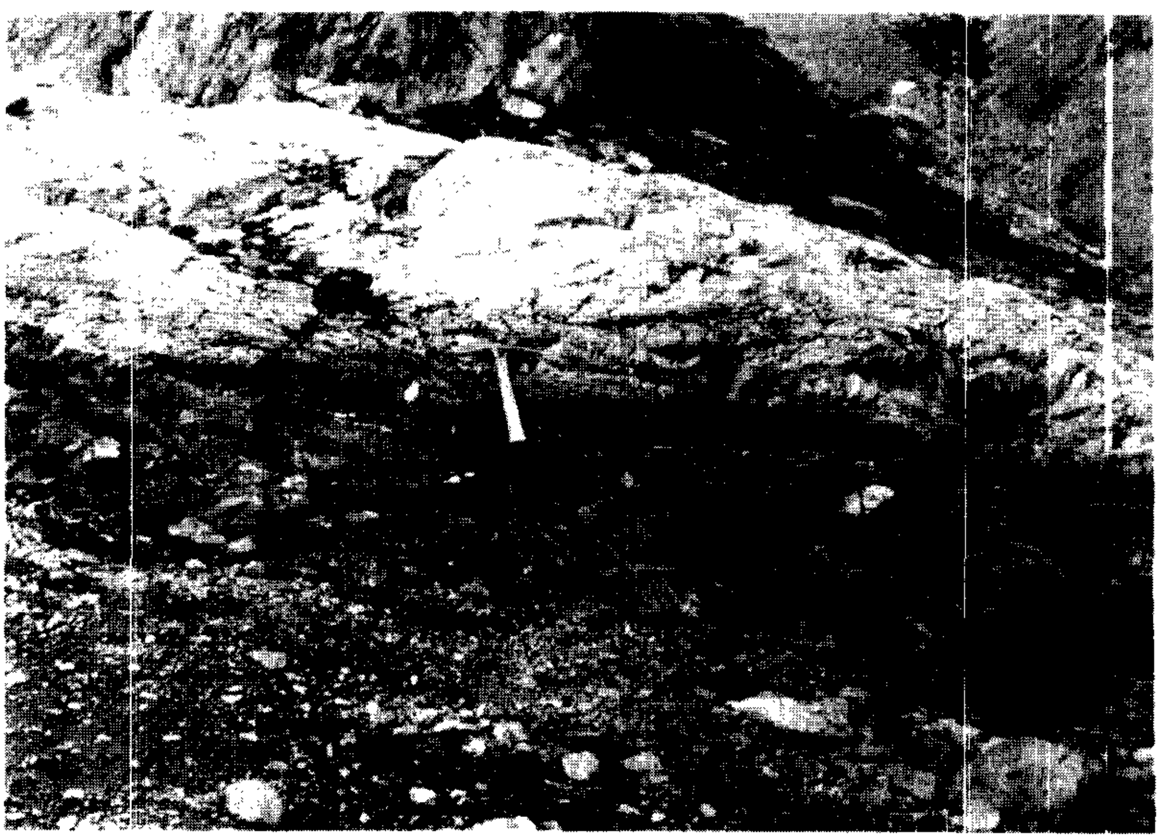


Plate 1-16-3. West Lake thrust zone; gently west-dipping hangingwall Lower Devonian carbonates structurally over the footwall Permian and older sericite schists; looking west.

development. Strong recrystallization and recovery processes (diffusion-climb) have also polygonized quartz into subgrains outlined by sutured boundaries with individual subgrains having undulose extinction and mismatched birefringence.

Calcite within the main thrust zones and hangingwall carbonates is typically twinned and kinked with slip occurring along twin boundaries. The development of closely spaced twinning and incipient buckling of the twins is indicative of high stress. Minor zones of polygonization and subgrain development within larger calcite grains are also present.

ECONOMIC GEOLOGY

Mineral prospects and alteration zones are scattered throughout the study area, but are most concentrated in footwall metavolcanics. Quartz-vein stockworks and individual quartz veins with associated precious metal bearing sulphides occur in several localities and are the main exploration targets within the area (Figure 1-16-2). Iron carbonate alteration is widespread and occurs most prominently within D_3 and D_4 brittle fractures, along thrust-zone boundaries and in association with sulphide-bearing quartz vein systems. Numerous sigmoidal tension gashes filled with calcite and occasional quartz occur in all rock types and are indicative of progressive and complex deformation history.

VEINS

Strong fracturing and brittle shearing within metavolcanics provide structural control for iron carbonate alteration and quartz stockwork veining, the North Ridge stockwork zone, in the region north of Radio Creek (Figure 1-16-2). Many of the veins contain minor malachite, chalcopyrite, arsenopyrite, pyrite, azurite, galena, bornite, sphalerite and hematite.

Two generations of quartz veining are present: an early, deformed barren phase, and a later post-folding phase associated with iron carbonate alteration and sulphide precious metal mineralization. Early quartz vein systems, which are observed throughout the field area, crosscut bedding and are deformed by all four phases of folding. Microfabrics indicate significant pre to syn-F_1-F_2 hydraulic fracturing and incipient quartz veining. Quartz veins are strongly recrystallized and often transposed within S_1 and S_2 fabrics. Silica-rich fluid migration probably resulted from nearby Paleozoic intrusions and early dewatering and metamorphism of Paleozoic rocks.

Later quartz, sulphide and iron carbonate veining is controlled by orthogonal joints and brittle shears associated with F_3 and F_4 folding. S_4 fractures are pervasive in this area due to its position near the hinge zone of the North Ridge synform. Veins trend northeast, are typically undeformed and probably resulted from hydrothermal fluid convection from nearby intrusions. Similar quartz-sulphide veins and associated iron carbonate alteration occur in isolated late brittle joints and fault zones.

CONCLUSIONS

Paleozoic island-arc rocks in the south Forrest Kerr area are affected by an early phase of folding which is not seen in neighbouring Upper Triassic and Jurassic island-arc cover rocks. Phase-one folds are characterized by a transposed foliation and widespread east-vergent recumbent structures probably related to regional east-west compression during the Late Paleozoic to pre-Late Triassic. During this event metamorphism was initiated and as deformation progressed, was accompanied by the formation of low-angle ductile-brittle fault zones which accommodated localized strain in areas of varied lithology. This resulted in the formation of fault-bounded panels which remained relatively unstrained in comparison to more deformed rocks. This is a feature observed throughout the Forrest Kerr, More Creek and Mess Creek areas (Holbek, 1988; Read *et al.*, 1989; Logan *et al.*, 1990, 1992).

As deformation progressed into the Late Triassic and Jurassic, east-vergent F_2 folds were accompanied by increasing metamorphism and ductile shearing along established D_1, low-angle fault zones and F_2 axial plane surfaces. Shear directions during D_2 deformation trend southeast at a high angle to F_2 fold axes. Ductile fault zones such as the West Lake fault and numerous other thrusts developed subparallel to D_1 geometry and mylonite formed along their traces. The West Lake and West Slope faults place older Paleozoic stratigraphy over younger Paleozoic rocks, and Paleozoic rocks over Upper Triassic lithologies, respectively. Read *et al.* (1989) suggest an Early Cretaceous age for these faults. Estimates of movement along these structures remain ambiguous due to the lack of marker horizons.

Subsequent deformation records moderate to strong north-south compression that superimposed upright F_3 folding and fracturing on all rock types. This deformation represents a ductile-brittle transition during the last stages of waning metamorphism. Fourth-phase folding and faulting records a stress reorientation back to a dominantly east-west compression regime. This deformation produced widespread, inhomogeneous mesoscopic and macroscopic folds in cover rocks and more homogeneous folds in the Paleozoic stratigraphy. Deformation and recovery during this time may be associated in part with movement along large-scale regional faults such as the Forrest Kerr fault zone to the east of the study area.

Mineral prospects occur throughout the Iskut-Stikine region and in scattered locations within the field area. Quartz veins and stockworks derived from Jurassic and possibly older intrusives are controlled by F_3 and F_4-related joints and fractures. Sulphides and associated economic gold mineralization often accompany the quartz veining.

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NOTES