GEOLOGY OF THE THAUTIL RIVER MAP AREA (93L/6)

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KEYWORDS: Regional geology, Jurassic stratigraphy, Hazelton Group, Telkwa Formation, Telkwa Range, structure, Skeena Group, Bowser Lake Group, Ashman Formation, Smithers Formation, Thautil River sediments, Bulkley intrusions, Topley intrusions.

INTRODUCTION

This report discusses the geology and mineral occurrences of the Thautil River map area (93L/6). These observations are based on 1:50 000 mapping conducted as part of the Telkwa project (Figure 1-10-1) in 1989. The project area includes the Babine and Telkwa ranges; approximately five 1:50 000 map sheets have now been completed.

The Ashman, Skeena and Thautil River sedimentary units were studied by Julie Hunt, as part of an M.Sc thesis study at The University of British Columbia; her observations are included in this report.

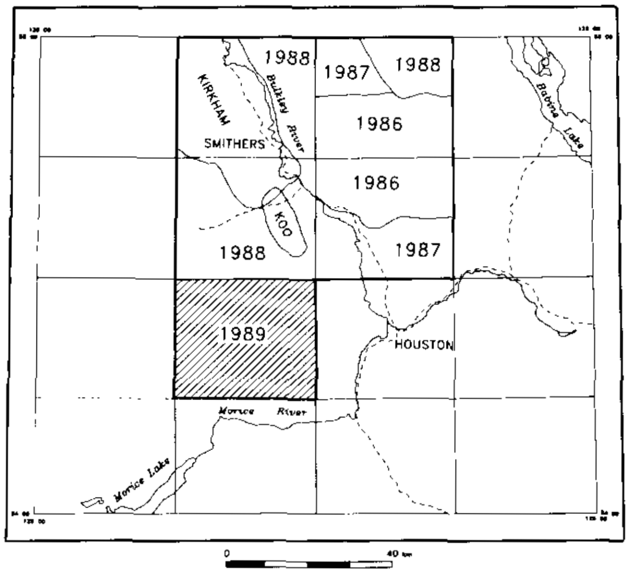

Figure 1-10-1. Location of the Thautil River map sheet, NTS 93L/6 relative to the area covered by the Babine and Telkwa projects to date.

REGIONAL GEOLOGIC SETTING

West-central British Columbia is part of the Stikine Terrane. This terrane, which is believed to have migrated northward from low paleolatitudes in late Cretaceous or early Tertiary time, includes: submarine calcalkaline to alkaline volcanic island arc rocks of the Late Triassic Takla Group; subaerial to submarine calcalkaline volcanic, volcaniclastic and sedimentary rocks of the Early to Middle Jurassic Hazelton Group; Late Jurassic and Early Cretaceous successor basin sedimentary rocks of the Bowser Lake, Skeena and Sustut groups; and Late Cretaceous to Tertiary calcalkaline continental volcanic arc rocks of the Kasalka, Ootsa Lake and Goosly Lake groups. The younger volcanic rocks occur sporadically throughout the area, mainly in subsided fault blocks and grabens that may be the remains of cauldron subsidence complexes.

Potassium-argon isotopic dating has defined three major magmatic events. These are the Late Triassic to Early Jurassic Topley intrusions, the Middle to Late Cretaceous Bulkley intrusions and the Eocene Babine intrusions (Carter, 1981). Mineral deposits in the area are associated with emplacement of these intrusions. The most economically important exploration targets are porphyry copper and molybdenum deposits and related mesothermal and epithermal precious metal veins. A few small massive sulphide occurrences have also been discovered (MacIntyre *et al.*, 1989).

TECTONIC HISTORY

The tectonic history of the area is divisible into three distinct periods. From Early to Middle Jurassic time an extensive calcalkaline island arc evolved, with a possible back-arc basin located to the east. This was followed from late Middle Jurassic to Early Cretaceous time by development of the Bowser and Nechako successor basins. Thick deposits of molasse derived from an uplifted Skeena arch and Omineca crystalline belt accumulated within these basins. A major plate collision in Middle Cretaceous time resulted in uplift of the Coast Range and extensive folding of rocks to the east. Debris was shed eastward across the area from the rising metamorphic-plutonic complex and this was followed by the growth of a north-trending Andean-type volcanic arc in Middle to Late Cretaceous time. A transtensional tectonic regime in Late Cretaceous to Early Tertiary time produced the basin-and-range geomorphology that controls the current map pattern of the area. The latest tectonic event appears to be northeast shearing and tilting of fault blocks to the southeast. This shearing has offset northwest-trending grabens that developed in Late Cretaceous to Early Tertiary time (MacIntyre *et al.*, 1989).

LITHOLOGY OF THE STUDY AREA

The generalized geology of the Thautil River area is shown in Figure 1-10-2. The map area is underlain by a series of uplifted and tilted fault blocks containing rocks ranging from Early Jurassic to Eocene in age. In general the fault blocks are tilted to the southwest (Figure 1-10-3). The youngest rocks are probably Tertiary and are preserved within a north-trending graben which follows the Thautil River. Cretaceous rocks occur as downthrown blocks in the centre and the southeast part of the map area. A generalized stratigraphic column is shown in Figure 1-10-4.

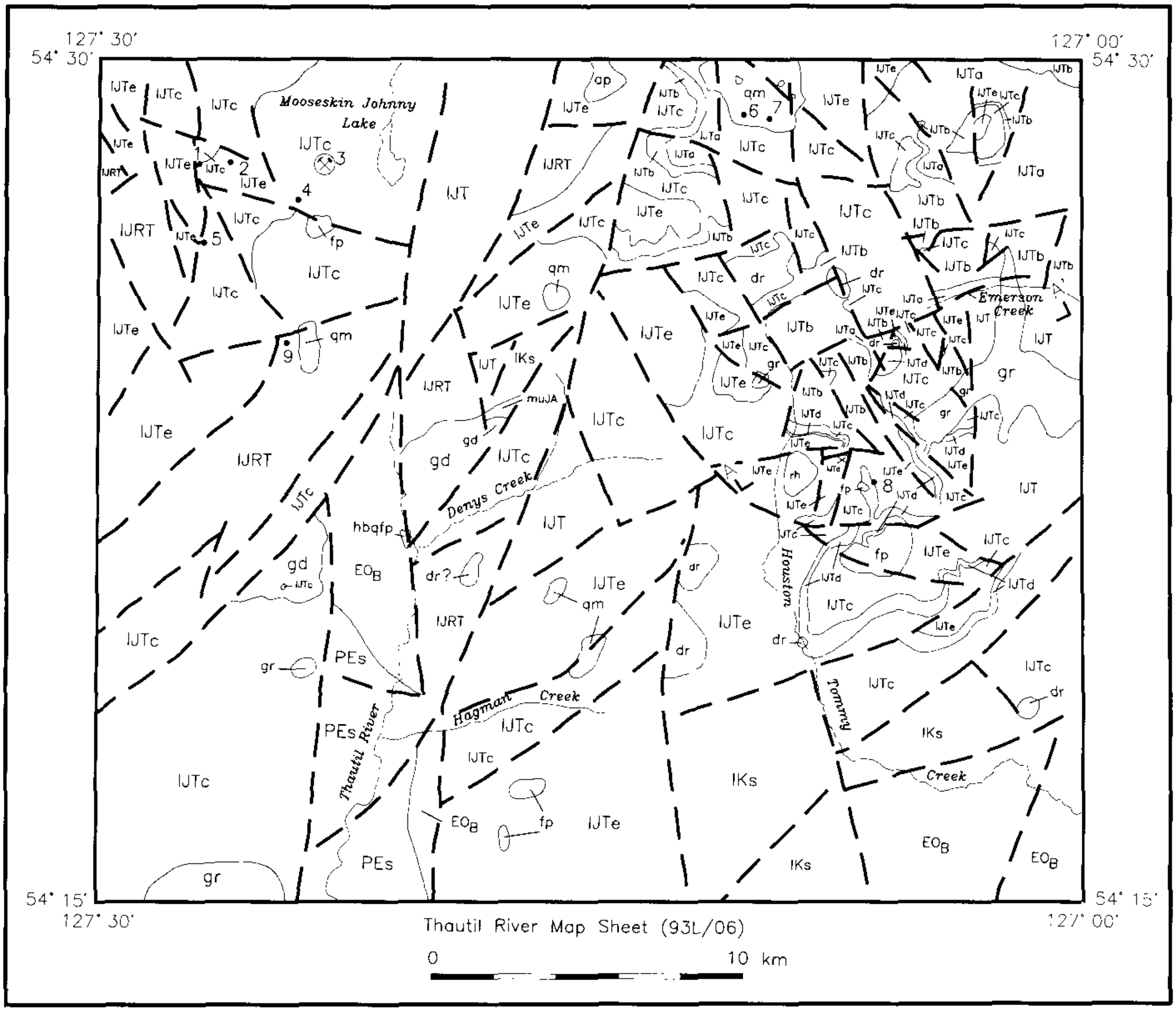

Figure 1-10-2. General geology of the Thautil River area, NTS 93L/6.

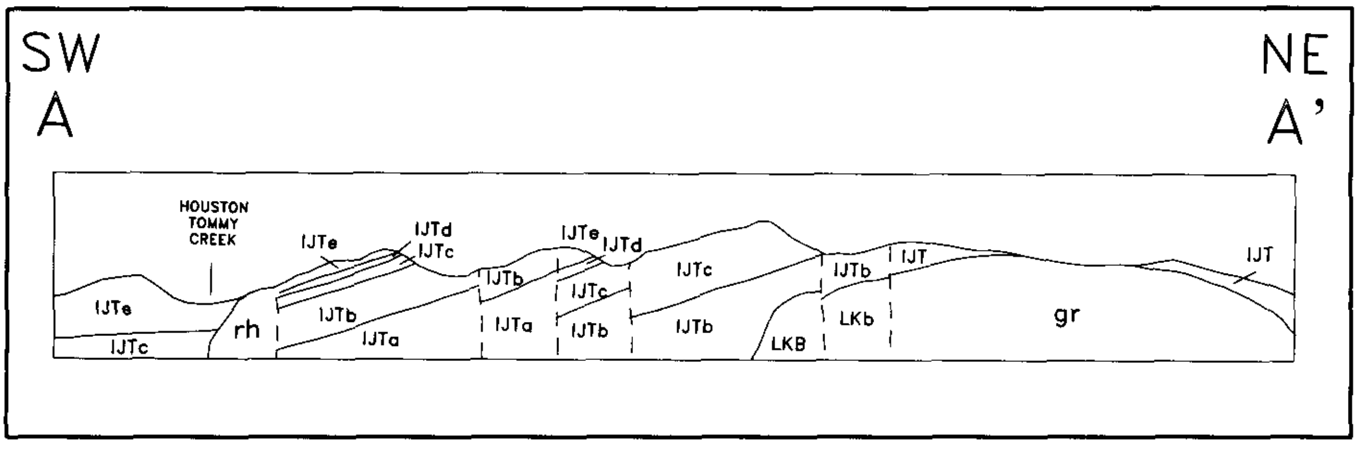

Figure 1-10-3. Cross-section through the Emerson Creek–Houston Tommy Creek area showing typical structural style of the map area. See Figure 1-10-2 for location of section.

LAYERED ROCKS

PALEOCENE TO MIOCENE

EOB	*basalt flows, breccia*
PEs	*Thautil River Sediments: heterolithic, poorly sorted conglomerate, sandstone, siltstone, minor coal*

LOWER CRETACEOUS (ALBIAN)

SKEENA GROUP

lKS	*sandstone, siltstone, shale, micaceous greywacke, coal bearing*

JURASSIC

BOWSER LAKE GROUP

MIDDLE TO UPPER JURASSIC (CALLOVIAN TO OXFORDIAN)

muJA	*Ashman Formation marine black shale, siltstone, greywacke; fossiliferous*

HAZELTON GROUP

MIDDLE JURASSIC (BAJOCIAN TO CALLOVIAN)

mJS	*Smithers Formation: feldspathic sandstone, greywacke, siltstone, shale, minor pebble conglomerate, very fossiliferous*

LOWER JURASSIC (PLEINSBACHIAN TO TOARCIAN)

lJRT	*Nilkitkwa Formation, Red Tuff Member: red, well-bedded air fall tuff, minor ash flow tuff*

LOWER JURASSIC (SINEMURIAN TO LOWER PLEINSBACHIAN)

lJT	*Telkwa Formation: undivided andesite, dacite, rhyolite, basalt, flows and pyroclastics*
lJTe	*Basalt-Red Tuff Unit: well-bedded, recessive, brick red air fall tuffs and related epiclastics with sporadic amygdaloidal basalt flows; minor grey welded tuff*
lJTd	*Shallow Marine Sedimentary Unit: well-bedded limestone, calcareous sandstone, siltstone; interbedded with epiclastics and air fall tuff; fossiliferous*
lJTc	*Siliceous Pyroclastic Unit: well bedded quartz-feldspar phyric ash flows, ignimbrite, breccia, siliceous air fall tuff, red tuff, basalt, rhyolite flows.*
lJTb	*Basaltic Flow Unit: massive maroon to green augite-feldspar phyric to aphyric basalt flows; minor maroon tuff between flows; flow top breccia common; locally amygdaloidal*
lJTa	*Andesitic Pyroclastic Unit: andesitic air fall tuff, breccia, feldspathic epiclastics, minor welded lapilli tuff*

INTRUSIVE ROCKS

LATE CRETACEOUS TO EOCENE

KEg	*gr - undivided granitic intrusions; gd - granodiorite; qd - quartz dioritie; dr - diorite; rh - rhyolite; fp - feldspar porphyry; bfp - biotite-feldspar porphyry; hfp - hornblende-biotite-feldspar porphyry; ap - augite feldspar porphyry; qm - quartz monzonite*

EARLY JURASSIC

EJT	*Topley Intrusions: undivided granitic intrusions*

Occurrence	Name	Minfile No.
1	Duchess	066
2	Evening	064
3	Santa Maria	063
4	War Eagle	062
5	Princess	061
6	Sunsets Creek Showing	045
7	Sunsets Creek Showing	046
8	Erin Claims	---

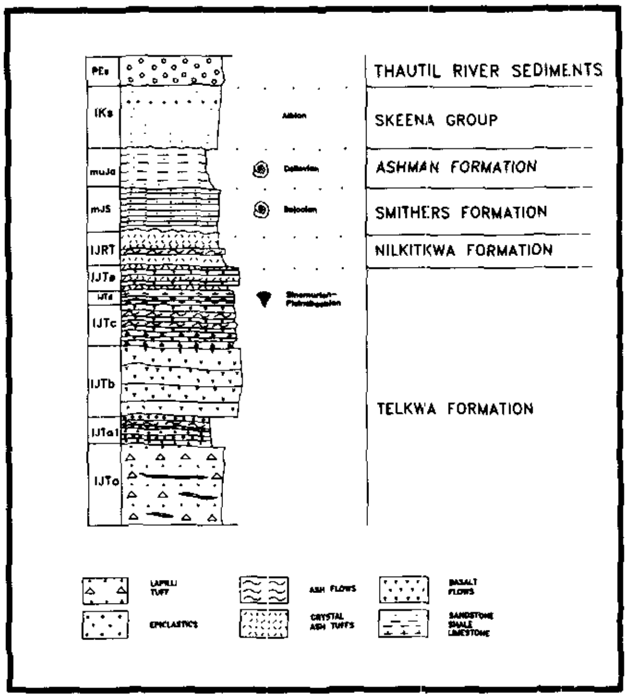

Figure 1-10-4. Generalized stratigraphic column for the Thautil River map area. See legend Figure 1-10-2 for explanation of symbols.

HAZELTON GROUP

The Hazelton Group (Leach, 1910) is a calcalkaline island arc assemblage that evolved in Early to Middle Jurassic time. Tipper and Richards (1976) divide the group into three major formations in the Smithers map area (93L). These are the Sinemurian to early Pliensbachian Telkwa Formation, the early Pliensbachian to middle Toarcian Nilkitkwa Formation and the middle Toarcian to early Callovian Smithers Formation. For simplicity's sake we have adopted this terminology. However, our mapping in the type area of the Telkwa Formation suggests there are a number of lithostratigraphic map units that could stand alone as formations. Consideration should be given to raising the Telkwa Formation to group status and the Hazelton Group to supergroup.

TELKWA FORMATION

In the Telkwa Range, a thick section of Early Jurassic volcanic rocks constitutes the type area for the Telkwa Formation of the Hazelton Group. Tipper and Richards (1976) describe the typical lithology as "reddish, maroon, purple, grey and green pyroclastic and flow rocks". The formation varies from marine to nonmarine and ranges from Sinemurian to early Pliensbachian in age.

The Lower Jurassic volcanics in the study area are predominantly air-fall tuffs and basalt flows and constitute the Howson subaerial facies of the Telkwa Formation. The transition between this facies and the Babine shelf facies to the east trends through the map area and is defined by the western limit of late Sinemurian marine sedimentary rocks.

Our mapping in the Telkwa Range suggests the Telkwa Formation is divisible into five major lithostratigraphic units, each representing distinct cycles of arc volcanism. These units are characterized by their predominant lithologies although internal facies variations are common. In ascending stratigraphic order they are: (1) an andesitic pyroclastic unit comprised of thick-bedded, massive, maroon andesitic lapilli, crystal and ash tuffs with minor interbeds of siliceous banded ash flows and grey welded lapilli tuffs; (2) a flow unit which is predominantly massive, cliff forming, augite-feldspar-phyric to aphyric, dark green to maroon basalt; (3) a siliceous pyroclastic unit that is well bedded and includes felsic epiclastics, welded lapilli tuffs, flow-banded ash flows, feldspathic breccias, pebble conglomerates, lahars, sandstones, air-fall lapilli and crystal-lithic tuffs; (4) a shallow marine sedimentary unit characterized by well-bedded, near-shore, fossiliferous limy sandstone, siltstone, conglomerate, grey bioclastic and massive limestone; and (5) a recessive unit of well-bedded and maroon to red crystal, lapilli and ash tuff and associated epiclastics with lesser flows of amygdaloidal augite-feldspar-phyric basalt. A similar stratigraphic sequence underlies the Middle Jurassic Smithers and Ashman formations on Ashman Ridge, 60 kilometres northwest of the map area.

ANDESITIC PYROCLASTIC UNIT (lJTa)

Andesitic pyroclastics and flows are the predominant lithologies of the lower part of the Howson facies of the Telkwa Formation. These rocks are well exposed in valleys along the east edge of the map area where the exposed thickness is in excess of 1000 metres. This unit is predominantly thick-bedded, massive maroon andesitic lapilli, crystal and ash tuff, volcanic breccia and associated epiclastics. Minor grey ash flows occur throughout the section. Maroon and green volcanic clasts predominate in a feldspathic matrix. Toward the top of the section the unit is characterized by thin beds of maroon, feldspar-phyric andesite flows, grey welded lapilli tuffs, rubbly weathering volcanic conglomerates and feldspathic sandstone, siliceous, banded ash-flow tuffs and grey welded lapilli tuffs.

Tipper and Richards (1976) describe a measured section from the Loljuh Creek area that we believe transects the upper contact of this unit. We would place the boundary between this unit and the overlying basaltic flow unit at the base of the first amygdaloidal basalt flow.

The upper contact of Unit lJTa is also exposed in the northeast corner of the map area. Here, as elsewhere, it is overlain by massive basalt flows. Unit lJTa also underlies the Howson Creek headwaters but here the top of the unit is not exposed.

Nowhere in the map area is the base of the Telkwa Formation exposed. However, a basal conglomerate has been recognized in the Babine Range (MacIntyre *et al.*, 1986). The andesitic pyroclastic unit is probably in excess of 1000 metres thick.

BASALTIC FLOW UNIT (lJTb)

A distinctive unit of massive basalt flows with minor interflow maroon tuff overlies the andesitic pyroclastic package. This unit, which is up to 500 metres thick, forms the prominent cliffs and higher peaks of the Telkwa Range, particularly at the headwaters of Emerson and Dockrill creeks. It becomes progressively thinner to the south and southwest of Emerson Creek.

The basaltic flows that characterize the unit are fine to medium grained, dark green to maroon and aphyric to augite-feldspar phyric. Flow tops are typically amygdaloidal and brecciated with zeolite-calcite-epidote cement. Maroon crystal and lapilli tuff beds occur between flows.

Orientation of the basalt flows varies somewhat, possibly due to the influence of paleotopography. In general the flows dip moderately to the southwest. This unit is faulted off to the west and is missing in the area near the headwaters of Howson Creek and north of Starr Creek; it is restricted to the east and northeast part of the map area.

SILICEOUS PYROCLASTIC UNIT (lJTc)

A well-bedded unit of siliceous ash flows with lesser amygdaloidal basalt flows, epiclastics and air-fall tuffs overlies the massive basalts. This unit, which varies from less than 10 to greater than 200 metres thick, is typically well bedded and consists of a mixture of maroon, pink and grey welded lapilli tuffs, flow-banded ash flows, minor green and maroon feldspathic volcanic-clast breccias, pebble conglomerate, lahars and volcanic sandstone. A channel filled with coarse volcanic debris cuts into well-bedded tuffs just south of Sunsets Creek. It is approximately 150 metres wide and trends perpendicular to the cliff south of the Creek.

The siliceous pyroclastic unit is widespread within the Thautil River map area where it varies from very thin or absent in the northeast corner to several hundred metres thick in the core of the Telkwa and Howson ranges. In adjacent map areas this unit is only locally present. These thickness variations may reflect proximity to eruptive centres. Figure 1-10-5 illustrates the thickness variations of the major lithostratigraphic units perpendicular to the trend of the Telkwa Range.

SHALLOW MARINE SEDIMENTARY UNIT (lJTd)

Well-bedded marine sediments and red tuffs overlie and are in part interbedded with volcanics of Unit lJTc. This unit, which varies from 5 to 100 metres thick, includes grey bioclastic to massive limestone and well-bedded near-shore

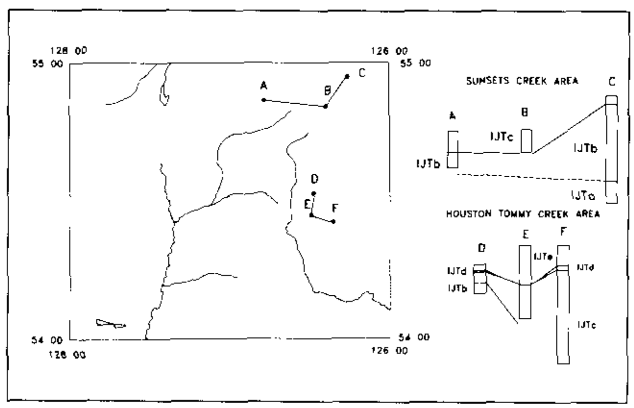

Figure 1-10-5. Stratigraphic sections illustrating unit thickness variations across the Thautil River map area. See legend Figure 1-10-2 for explanation of symbols.

limy sandstones, siltstones, conglomerates and maroon epiclastics. It is typically fossiliferous and is the only good marker bed in the Telkwa Range. Fossils include the late Sinemurian pelecypod *Weyla*. A small coral bioherm discovered by T.A. Richards and H.W. Tipper while mapping the Smithers area in 1971 to 1973 occurs just east of Houston Tommy Creek (Plate 1-10-1). The reef sits at the same stratigraphic position as the well-bedded late Sinemurian marine sediments. Dr. Terry Poulton of the Geological Survey of Canada, recently publish a description of the reef (Poulton, 1989) which is believed to be the only true Lower Jurassic bioherm reef in North America and perhaps the world. Dr. George Stanley, professor at the University of Montana and an expert on ancient reefs, examined the reef in detail during the 1989 field season.

The Sinemurian marine sediments are confined to the southeast part of the map area, particularly east of Houston Tommy Creek, where the most northerly occurrence is just south of the headwaters of Emerson Creek and extends over 9 kilometres to the south. These sediments are probably correlative with those exposed in the area east of Webster Creek as discussed in a previous report (MacIntyre *et al.*, 1989).

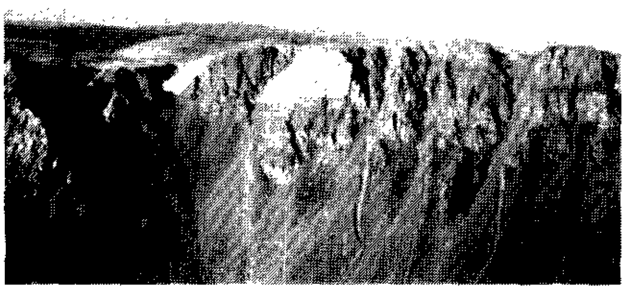

Plate 1-10-1. View looking west toward Houston Tommy Creek. White-weathering unit is a Lower Jurassic biohermal reef within Unit lJTd of the Telkwa Formation.

Basalt Red Tuff Unit (lJTe)

Overlying and in part interbedded with the marine sedimentary unit is a poorly exposed unit of tuffs, epiclastics and minor flows of variable thickness. This unit is characterized by medium to thin-bedded, brick-red to maroon crystal, lapilli and air-fall ash tuffs with local green amygdaloidal basalt flows, grey welded lapilli tuffs and associated epiclastics. Graded bedding and crossbedding are common in tuffs and epiclastics. Tuff beds are recessive and often badly decomposed.

The red tuff–basalt flow unit occurs mainly within the western half of the map area where it stratigraphically overlies and is in part interfingered with the marine sedimentary or siliceous pyroclastic units. A lateral facies change occurs south of Emerson Creek where a section of epiclastics, lithic red tuffs and minor basalt flows grades into mainly basalts and minor limestone over an 8-kilometre strike length.

Basalt flows are most common near the base of the unit up-section it is predominantly brick-red air-fall tuff and epiclastics. In some areas this unit has been mapped by Tipper and Richards (1976) as the Red Tuff member of the Nilkitkwa Formation; elsewhere it has been included with the Telkwa Formation. In this study the Red Tuff member is restricted to well-bedded red tuffs and epiclastics that lack amygdaloidal basalt flows.

Age of the Telkwa Formation

The Telkwa Formation is Sinemurian or older based on sporadic fossil fauna within the stratigraphic succession (Tipper and Richards, 1976). In the map area, which covers part of the Skeena arch, the granitic Topley intrusions cut the formation. These intrusions give K-Ar ages between 195 and 205 Ma (Carter, 1981) This is further evidence that the Telkwa Formation is predominantly Sinemurian or older (MacIntyre *et al.*, 1989). Fossils collected from marine sedimentary rocks near the top of the formation are late Sinemurian to early Pliensbachian in age.

Nilkitkwa Formation – Red Tuff Member

The Red Tuff member of the Nilkitkwa Formation is comprised of medium to thin-bedded red to maroon ash, crystal and lapilli air-fall tuff and related epiclastic rocks, with subordinate beds of grey ash-flow tuff. It is exposed on the ridges south of Sunsets Creek and just west of Denys Creek. It appears to be conformable with underlying strata of the Telkwa Formation.

Middle to Late Jurassic Sedimentary Rocks

Heterolithic conglomerate and coarse-grained sandstone containing Jurassic ammonites and bivalves crops out on the western edge of the Thautil River map area near Denys Creek. The conglomerate is matrix supported with approximately 30 per cent subangular clasts which vary from 5 to 10 centimetres in diameter. Clasts are primarily fine-grained purple, grey or flow-banded volcanics. The matrix is composed of coarse-grained, poorly sorted, angular sand and pebbles up to 10 millimetres long and averaging 5 millimetres long. Fossiliferous feldspathic sandstone underlies the conglomerate. Sandstone contains bivalves, ammonites and trace fossils together with carbonized wood fragments and minor amounts of mica. These rocks underlie Cretaceous Skeena Group sediments and therefore are probably correlative to the Ashman Formation as defined by Tipper and Richards (1976). However, lithologically these rocks are similar to the shallow-marine sediments of the Smithers Formation.

Skeena Group

Cretaceous Skeena Group sediments crop out in Houston Tommy Creek and near Denys Creek. Sedimentary strata consist of marine, transitional marine and nonmarine interbedded sandstone, siltstone, shale and coal. Cretaceous sediments, approximately 60 metres thick in total, occur in the Denys Creek area They grade upward from medium-grained sandstones to interbedded siltstone, sandstone and coal. Sandstone is well sorted, pale grey-green and micaceous, weathering to a dark green or rusty brown colour. Sandstone is thinly bedded with individual beds varying from 0.5 to 2 centimetres thick. Beds are planar-laminated and often contain carbonized plant fragments and discontinuous siltstone lenses, especially along bedding planes. Overlying the medium-grained sandstone is an interbedded sequence of 60 per cent siltstone, 40 per cent sandstone. Here the sandstone is fine grained and beds vary from 2 to 4 centimetres thick. The siltstone is fine grained and dark grey, weathering to a rusty brown. It is also micaceous, carbonaceous and thinly bedded, with beds varying from 1 to 2 centimetres thick. The interbedded sequence contain two(?) coal seams. The lower seam is approximately 0.5 metre thick and highly deformed by numerous fractures and tiny folds. The upper seam outcrops at a number of places and appears to be similar to the lower seam.

In Houston Tommy Creek, Skeena Group sediments are approximately 50 metres thick and in fault contact with Hazelton Group volcanics. The lower 20 metres of section is made up of interbedded sandstone and shale. Sandstone varies from fine grained, pale grey and well sorted to pale grey, poorly sorted pebbly sandstone with angular clasts up to 3 centimetres in diameter, composed of chert and pale pink or maroon feldspathic volcanics. Shale is fine grained and dark grey. The upper 30 metres of the section is composed of shale with minor sandstone beds. Shale is fine grained, dark grey-brown and weathers to a pale grey or rust colour. Shale beds average 3 metres thick. Sandstone occurs in thin beds approximately 0.3 metre thick and is seen primarily as concretions(?) up to 40 centimetres in diameter. Banded dull coal occurs in a seam approximately 0.5 metre thick, with approximately 85 per cent dull and 15 per cent bright bands. Bright bands average 1 centimetre thick and dull bands vary from 1.5 to 3 centimetres in thickness.

Thautil River Sediments

A distinctive unit of clastic sedimentary rocks crops out in the Thautil River valley. Here the strata consist of friable conglomerate, sandstone, siltstone and minor coal. These rocks are distinct from the Early Cretaceous Skeena Group rocks and are believed to be Late Cretaceous or Tertiary in age. The predominant lithology is heterolithic, clast-supported, poorly sorted conglomerate. Clasts are subangular to subrounded and vary from 5 to 20 centimetres in diameter. Approximately 60 per cent of clasts are fine-grained or amygdaloidal basalt, 20 per cent are maroon volcanics, 10 per cent are augite porphyry and 10 per cent are chert and sandstone. The conglomerate matrix is coarse grained, poorly sorted muddy sandstone.

The finer sediments, sandstone, siltstone and coal, occur as beds or lenses within the conglomerate. Sandstone varies greatly along the length of Thautil River. In the southern part of the river, friable, fine grained, grey, poorly sorted feldspathic sandstone containing carbonized material is interbedded with very fine grained, dark grey micaceous siltstone and coal. Coal is black, glassy and very friable, occurring as laminations, blebs and thin beds approximately 3 millimetres thick within the siltstone.

In the central reaches of Thautil River interbedded sandstone and siltstone occur as small lenses within the conglomerate. Sandstone is medium grained, pale grey, well sorted and lithified. Siltstone is fine grained, grey and friable. Both sandstone and siltstone contain carbonaceous material. Farther up stream sandstone is coarse grained, dark green-brown, micaceous, well sorted and poorly lithified. Here sandstone is thinly bedded with individual beds approximately 1 centimetre thick. Still farther upstream conglomerate is overlain by sandstone. This sandstone is medium grained, light grey-brown, well sorted, fairly well lithified and contains approximately 2 per cent magnetite. The sandstone has been brecciated to form a very angular homolithic breccia in which average fragment diameter is 5 centimetres. In the northern part of Thautil River the sediments are cut by amygdaloidal basalt dikes and eventually come into contact with fine-grained, black, amygdaloidal basalt farther upstream. This basalt is also mapped as Tertiary.

The age of the sediments exposed in the Thautil River graben is not well established, but they are most likely younger than the Skeena Group. Tipper and Richards (1976) assigned a Paleocene to Eocene age, based on palynology dates from samples taken by Dr. W.S. Hopkins for the Geological Survey of Canada, Calgary (H.W. Tipper, personal communication, 1989).

Intrusive Rocks

Quartz monzonite (qm), granodiorite (gd), diorite (dr), granite (gr), feldspar porphyry (fp), hornblende-biotite-quartz-feldspar porphyry (hbqfp), augite-feldspar andesite porphyry (ap), and rhyolite (rh) intrusions are recognized within the Thautil River map area.

Two quartz monzonite plutons intrude Lower Jurassic stratigraphy in the Telkwa Range. The largest of these is exposed just north of Sunsets Creek and a smaller stock underlies the area north of Hagman Creek. These intrusions are medium to coarse grained, equigranular to porphyritic with a feldspar-rich groundmass.

There are many small feldspar and augite-feldspar porphyry plutons in the northwest, west and southeast parts of the map sheet. The largest occurs east of Mooseskin Johnny Lake; smaller intrusions occur southwest of the lake, just north of Starr Creek and east of Thautil River. These are typically medium to coarse grained, grey, commonly with potassium feldspar phenocrysts. The matrix is fine grained with locally minor amounts of accessory magnetite. Many are pyritic and gossanous and are cut by basaltic dikes and shear zones. Clay and sericite alteration occurs locally.

Diorite and granodiorite-diorite intrusions are common in the area east of Howson and Starr creeks. These rocks are medium to coarse grained and equigranular. In some areas the mafic minerals are altered to chlorite. Minor amounts of magnetite and pyrite are locally present. Most intrusions are subcircular stocks; a thick dioritic sill occurs west of the headwaters of Houston Tommy Creek. A pluton south of the Holland Lakes has both a granodiorite and monzonite phase.

A plug of siliceous feldspar porphyry with a fine grained, flow-banded groundmass occurs east of Houston Tommy Creek. It is the only rhyolitic intrusion exposed in the map area.

A dark maroon hornblende-biotite-quartz feldspar porphyry intrusion with a fine-grained groundmass is exposed along the Thautil River near the mouth of Denys Creek. It is most likely part of the Eocene Babine plutonic suite.

A large granitic intrusion underlies the area south of Emerson Creek. Its upper contact appears to be relatively flat. Overlying rocks are silicified and pyritized and contain minor chalcopyrite.

STRUCTURAL STYLE

The structural style of the Thautil River map area is typical of the Telkwa Range as described in a previous report (MacIntyre *et al.*, 1989). Extensive block faulting in Tertiary time has produced a typical basin-and-range geomorphology. Within the study area, fault blocks are generally tilted to the southwest with progressively higher stratigraphic levels exposed in this direction. Locally beds have been domed around major intrusions such as the Sunsets Creek pluton. Elsewhere, such as near the headwaters of Howson Creek, fault blocks have been rotated, resulting in divergent bedding attitudes between adjacent fault blocks. Such rotations may also be due to emplacement of intrusive bodies and later modification by Tertiary block faulting.

MINERAL DEPOSITS

As discussed in a previous report (MacIntyre *et al.*, 1987), mineral deposits in the Smithers area can be subdivided into four groups: (1) mesothermal and epithermal gold-silver-bearing quartz veins; (2) copper-silver veins and pods in mafic volcanic rocks; (3) copper-zinc-silver massive sulphide deposits associated with bimodal submarine volcanics; and (4) porphyry copper-molybdenum deposits associated with quartz monzonite to granodiorite intrusions.

The showings on the Thautil River map sheet are mostly Type 2 copper-silver veins and pods in mafic volcanic rocks which may in part be associated with porphyry copper mineralization at depth and Type 4 porphyry copper-molybdenum deposits.

The preferred host rocks for copper-silver occurrences, as elsewhere in the region, are the amygdaloidal basalt flows of the upper Telkwa Formation. Intense epidote-calcite-chlorite alteration is often associated with this type of occurrence.

Several showings occur in the area near the headwaters of Howson Creek. The country rocks are flows and pyroclastics of Units lJTa, lJRT and lJTc of the Telkwa Formation; numerous basic and acid dikes cut the volcanics.

DUCHESS (MINFILE 93L 066)

The Duchess showing consists of a northerly trending shear zone mineralized with chalcopyrite, pyrite, hematite, and quartz containing tetrahedrite. The mineralized zone is up to 4 metres wide. The shear zone lies near the contact between fine-grained green epidotized andesite to the west and fine-grained purplish brown to olive-brown tuff to the east. Highly broken and sheared, buff-coloured feldspar porphyry dikes cut the volcanic rocks and carry only very minor amounts of sulphides. North-trending faults cut this area and mineralization is spatially associated with them. These fractures may have served as conduits for hydrothermal fluids as indicated by the formation of skarn along and near the main fault and by the concordance in attitude between the fault and the mineralized shear zones. Post-mineral movement is indicated by a northwest-trending and southwest-dipping fault that truncates the main lode. A northeast-trending fault which dips 45° to the southeast is exposed a few metres west of the portal and probably represents a set of fractures which displace the mineralized veins. A lower adit was driven on the supposed location of the vein as projected from above but it and several crosscuts failed to intersect the lode.

EVENING (MINFILE 93L 064)

The Evening showing is characterized by irregular shears and quartz-sulphide veins in strongly epidotized and chloritized buff, reddish, and green fine-grained andesitic tuffs and flows of Unit lJTa of the Telkwa Formation. The mineralized shears trend northeast to east and dip at moderate angles to the north.

SANTA MARIA (MINFILE 93L 063)

The Santa Maria showing is a northwest-trending, southwest-dipping quartz vein carrying chalcopyrite, pyrite, chalcocite and bornite. The quartz vein follows a zone of intensely altered and sheared pyroclastic rocks of Unit lJTc of the Telkwa Formation. Buff, cream and brick-red rhyolite porphyry dikes subparallel the vein structure. Saussurite alteration, sparsely distributed silicification, and sulphide mineralization occur on both sides of the shearing.

WAR EAGLE (MINFILE 93L 062)

Easterly trending feldspar porphyry dikes, some intensely epidotized and sparsely mineralized, cut volcanic rocks at the War Eagle showing. Narrow northeasterly and northwesterly trending shear zones are mineralized with pyrite, chalcopyrite, hematite, bornite and locally low-iron sphalerite.

PRINCESS (MINFILE 93L 061)

The Princess showing is characterized by narrow mineralized shear zones and veinlets of hematite, iron-rich sphalerite and chalcopyrite in a gangue of white calcite and quartz. The hostrock is strongly sheared and epidotized fine-grained greenish flows of Unit lJTc of the Telkwa Formation (Preto, 1967).

SUNSETS CREEK SHOWINGS (MINFILE 93L 045, 46)

A large pluton occurs in the centre of the Telkwa Range north of Sunsets Creek. It has domed the surrounding pyroclastic rocks of the Telkwa Formation which dip away from the pluton in all directions. The rocks are predominantly lapilli to fine-grained tuffs. Dark greenish grey tuffs grade laterally into maroon tuffs outside the limits of hornfelsing. Close to the pluton the rocks have been altered to mosaics of secondary plagioclase, actinolite, quartz, opaque minerals and garnet. Hornfels grades outward in a concentric pattern through a biotite zone to a chlorite zone.

The pluton is a homogeneous body composed entirely of porphyritic quartz monzonite of nearly constant composition and texture. A pyritic gossan surrounds the stock and roughly corresponds to the area of intense hornfelsing. Pyrite is sparse yet the rocks weather an intense rusty colour. Widely spaced, banded, drusy quartz veins up to 2 centimetres wide occur within the pluton. The veins contain pyrite, chalcopyrite and minor molybdenite. In the hornfels, near the southwestern contact, there are isolated concentrations of chalcopyrite, pyrite and specular hematite in some garnet-epidote skarn bands that parallel bedding.

In the interior of the stock there are two altered zones associated with mineralization. The larger one to the west consists of a broad crescentic area, measuring 700 by 1000 metres, in which all rocks are abnormally pyritic. The pyrite is disseminated and also occurs as coatings on joints and irregular fractures. Chloritization of biotite and hornblende and a sericitization of feldspars are associated with pyrite. The core of the crescent is a zone of much more intense alteration with some rocks locally converted to aggregates of quartz, muscovite and pyrite. Molybdenite mineralization occurs in part of the southern arm of the crescent. Quartz veinlets in the joints are common and might be considered to be a wide-spaced stockwork. Veinlets and small faults and fractures contain abundant pyrite and molybdenite. The better mineralized joints are fairly flat gently dipping. The hostrocks are granitic and show some evidence of recrystallization and alteration of feldspars (Sutherland Brown, 1967)

MSJ PROSPECT (MINFILE 93L 241)

A quartz monzonite porphyry intrusion north of Starr Creek is gossanous and mineralized with pyrite and variable amounts of tenorite, malachite, chalcopyrite and chalcocite. Mineralization is both disseminated and coatings on fracture planes. Showings to the north may represent halo mineralization surrounding the MSJ porphyry prospect. A small aeromagnetic low coincides with the area of most intense hydrothermal alteration. Hostrocks are mainly andesitic crystal-lapilli tuff and minor welded tuff of Unit lJRT. The country rock is cut by basalt, feldspar porphyry and feldspar quartz porphyry dikes and sills.

ERIN CLAIMS (MINFILE 93L 227)

The Erin claims are located east of Houston Tommy Creek. Trenches on the central plateau, east of the creek, expose mineralized veins as well as pervasive manganese staining and minor rhodochrosite in basalt over a wide area. Copper mineralization is hosted within narrow veins cutting amygdaloidal basalts of Unit lJTc and carbonate-rich volcaniclastics of Unit lJTd. The carbonate-rich volcaniclastics locally contain various bivalves and ammonites. The veins carry massive bornite and chalcopyrite with trace amounts of chalcocite and tetrahedrite. Malachite is a prominent weathering product.

Mineralization appears to be related to an intrusive body which fractured the country rock during emplacement. These fractures host the copper mineralization. Podiform mineralization of chalcopyrite and specular hematite are associated with the carbonite-rich volcaniclastics close to the intrusive. Alteration is locally present as patchy epidote in basalt with or without irregular quartz and carbonate veinlets.

DISCUSSION

The Telkwa stratigraphic succession indicates that Early Jurassic volcanism began with widespread deposition of predominantly andesitic air-fall pyroclastic material on a post-Triassic erosion surface. This volcanic cycle was followed by a short period of erosion and deposition of epiclastic beds prior to widespread eruption of basaltic lava and deposition of air-fall tuff. Eruption of lavas gradually diminished and was followed by explosive volcanism and deposition of well-bedded ash flows, air-fall tuffs, and related epiclastics with thick accumulations occurring near major vents.

Marine sedimentary strata containing late Sinemurian to early Pliensbachian fossils onlap the Early Jurassic volcanics. Biohermal reefs developed locally. These reefs may have formed chains around volcanic islands. Shallow-marine sediments are interbedded with air-fall tuffs and associated epiclastic rocks, indicating active volcanism and erosion accompanied the marine transgression.

The final volcanic-sedimentary cycle began with alternating eruptions of amygdaloidal basalt flows and deposition of red air-fall tuffs and grey felsic ash flows. The red tuff beds are onlapped by the Bajocian to Callovian marine sediments of the Smithers and Ashman formations.

Early Jurassic plutons are exhumed along the axis of the Skeena arch and in the Howson Ranges. These plutons probably formed at depth beneath major Early Jurassic eruptive centres.

SUMMARY

The major conclusions from fieldwork completed in 1989 are:

- The Telkwa Formation is divisible into five lithostratigraphic units in the map area. In ascending stratigraphic order they are andesitic pyroclastics; basalt flows and minor tuffs; siliceous pyroclastics, epiclastics, and air-fall tuffs; well-bedded shallow-marine sediments, and basalt flows and tuffs.
- Lower Jurassic volcanics of the Telkwa Range are proximal to eruptive centres.
- The Early Jurassic volcanics of the Telkwa River area are relatively undeformed and unaltered. Uplift and tilting of fault blocks rather than folding and thrust faulting are the predominate structural styles.
- Mineralization is associated with emplacement of granitic plutons.

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