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Miscellaneous Report 50

ROCKS AND MINERALS FOR THE COLLECTOR

The Alaska Highway; Dawson Creek, British Columbia to Yukon/Alaska border

Ann P. Sabina

DEPARTMENT OF ENERGY, MINES AND RESOURCES 1992

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Abstract

Occurrences of minerals, rocks and fossils are noted and described from localities along and adjacent to the Alaska Highway from Dawson Creek, British Columbia to the Yukon-Alaska border. Occurrences along roads branching from the Alaska Highway are similarly covered; these include the Klondike, Canol, Haines, Cassiar-Dease Lake, Atlin, and Sixtymile roads, and the Campbell Highway.

Our knowledge of mineral occurrences in the area covered by this booklet, is derived from information gathered by explorers, traders, missionaries, miners, and geologists who, in turn, garnered much of their information from their trusted Indian guides. The first mineral deposits to attract attention were the gold placers that were known to the fur traders and missionaries in the early 1860s. The first streams to be worked were the Liard River (1872), those in the Dease Lake-Cassiar area (1873), and the Big Salmon (1881) and Stewart (1883) rivers. The first utilization of minerals was by the Indians who used native copper of the White River area for weapons and tools, and probably the first building stone used was the basalt in the construction of the Hudson's Bay Company trading post, Fort Selkirk, in 1848. Lode metal exploration has been conducted since 1893 when the gold-antimony deposits in the Wheaton district were investigated. Mining operations commenced in 1899 at the Engineer Mine, and in the early 1900s at Atlin-Ruffner Mine, at the Whitehorse copper deposits, and in the Keno Hill-Galena Hill area. The recently discovered producers are the Anvil, Cantung, Cassiar, Churchill, Clinton Creek, Mount Nansen, and Wellgreen mines.

The mineral and rock collecting localities include road-cuts and rock exposures, lakeshores and river-beds, and active and inactive mines. Rock exposures along roads and rivers yield fossils and some minerals (calcite, barite, fluorite, etc.). Pebbles of jasper, chalcedony, epidote-bearing volcanic rocks, and quartzite are found along lakeshores and stream beds. Gold, copper, platinum, siliceous hematite ("black diamond"), scheelite, and cassiterite occur in stream placers. The various mines yield specimens of asbestos, serpentine, copper minerals, tungsten minerals, and ore minerals of lead, zinc, nickel, silver, and gold.

Minerals and rocks suitable for lapidary purposes include jasper, chalcedony, epidote, quartzite, jade (nephrite), serpentine, rhodonite, zoisite, siliceous hematite, and cassiterite ("Yukon diamond"). Gold nuggets are used in fashioning nugget jewellery.

Résumé

L'auteur note et décrit les manifestations de minéraux, les roches et les fossiles que l'on peut trouver le long de la route de l'Alaska, de Dawson Creek, en Colombie-Britannique, à la frontière Yukon-Alaska. Sont aussi comprises les manifestations qui se trouvent le long des routes qui se joignent à la route de l'Alaska comme les routes Klondike, Canol, Haines, Cassiar-Dease Lake, Atlin et Sixtymile de même que la route Campbell.

Les connaissances que nous avons des gisements minéraux de la région décrite dans cette brochure proviennent de renseignements recueillis par les explorateurs, les commerçants, les missionnaires, les mineurs et les géologues, renseignements qu'ils ont pour la plupart obtenus de guides indiens dignes de confiance. Les premiers gisements qui aient attiré l'attention sont les placers aurifères connus des commerçants de fourrures et des missionnaires dès le début des années 1860. Les premiers cours d'eau à avoir été exploités ont été la rivière Liard (1872), les cours d'eau de la région du lac Dease et de Cassiar (1873) et les rivières Big Salmon (1881) et Stewart (1883). Ce sont les Indiens qui ont d'abord utilisé les minéraux. Ils fabriquaient des armes et des outils avec le cuivre natif de la région de White River et la première pierre de taille à être utilisée a probablement été le basalte qui a servi à la construction en 1848 du fort Selkirk de la Compagnie de la Baie d'Hudson. L'exploration minérale se poursuit depuis 1893,

soit depuis le moment où l'on a procédé à l'évaluation des gisements d'or et d'antimoine du district de Wheaton. L'exploitation minière remonte à 1899 (mine Engineer) et au début des années 1900 alors que la mine Atlin-Ruffner exploitait les gisements de cuivre de Whitehorse; d'autres travaux étaient aussi entrepris dans la région de Keno Hill-Galena Hill. Parmi les exploitants d'aujourd'hui, on compte les mines Anvil, Cantung, Cassiar, Churchill, Clinton Creek, Mount Nansen et Welgreen.

Les endroits où l'on peut recueillir des échantillons de minéraux et de roches comprennent des tranchées de route et des affleurements rocheux, les rives des lacs et les lits des rivières, des mines abandonnées et des mines en exploitation. Les affleurements rocheux le long des routes et des rivières renferment des fossiles et quelques minéraux (calcite, barytine, fluorine, etc.). On peut trouver sur les rives des lacs et dans le lit des cours d'eau des cailloux de jaspe et de calcédoine, des roches volcaniques à épidote et du quartzite. On rencontre aussi dans les alluvions de l'or, du cuivre, du platine, de l'hématite siliceuse ("carbonado"), de la scheelite et de la cassitérite. Les diverses mines peuvent donner des échantillons d'amiante, de serpentine, des minerais de cuivre et de tungstène ainsi que des minerais de plomb, de zinc, de nickel, d'argent et d'or.

Parmi les minéraux et les roches qui peuvent servir en joaillerie, on peut trouver du jaspe, de la calcédoine, de l'épidote, du quartzite, du jade (néphrite), de la serpentine, de la rhodosite, de la zoisite, de l'hématite siliceuse et de la cassitérite ("diamant du Yukon"). Les pépites d'or servent aussi à fabriquer des bijoux en forme de pépites.

ROCKS AND MINERALS FOR THE COLLECTOR: THE ALASKA HIGHWAY: DAWSON CREEK, BRITISH COLUMBIA TO YUKON/ALASKA BORDER

INTRODUCTION

This booklet describes mineral, rock and fossil occurrences along and adjacent to the Alaska Highway, and along the main roads branching from it.

Some localities are accessible by automobile, some by 4-wheel drive vehicles only. The condition of roads leading to inactive properties should be checked with local authorities prior to embarking on them. A few localities are accessible by boat or by float-equipped aircraft. Directions to reach each of the occurrences are given in the text, and are designed for use with official road-maps. Locality maps are included where deposits may be difficult to find. Additional detailed information can be obtained from the appropriate topographic and geological maps listed for each locality. These maps are available from the agencies listed on page 101. Unless otherwise stated, all geological maps are published by the Geological Survey of Canada.

Many of the inactive mines have not been operated for several years and entering shafts, tunnels, and other workings is dangerous. Due to safety reasons, collectors are not permitted to visit a few properties; their description is included only as a point of interest to the collector. Some of the occurrences are on private property and are held by claims; the fact that they are listed in this booklet does not imply permission to visit them. Please respect the rights of property owners at all times.

The localities were investigated during the summer of 1971 by the author ably assisted by Frances Gombos. The field investigation was facilitated by information and courtesies received from Dr. D.C. Findlay, Morrisburg, Ontario; from Dr. D.B. Craig, Department of Indian and Northern Affairs, Whitehorse; from Dr. R.G. Garrett, Geological Survey of Canada, Ottawa; from the staff of the Yukon Chamber of Mines, Whitehorse; from the Mining Recorders at Cassiar, Watson Lake, and Whitehorse; and from geologists and mine managers associated with the mines in the area. Information on the Dempster Highway was kindly supplied by Mr. S.P. Baker, Department of Public Works, Whitehorse, and by Mr. S.W. Horrall, Royal Canadian Mounted Police, Ottawa. Mr. C.F. Stevenson of Surveys and Mapping Branch advised on Yukon toponymy. The laboratory identification of minerals was performed by G.J. Pringle and M. Bonardi, Geological Survey of Canada. This assistance is gratefully acknowledged.

A brief geological history

Most of the area traversed by the Alaska Highway is within the Cordilleran Region, a geological province consisting of northwest-trending mountain belts separated by broad valleys and vast plateaux. This region is bordered on the east by the Interior Plains, a fairly flat area extending to the margins of the Canadian Shield; the first 560 km of the Alaska Highway is within this geological region.

In the Cordilleran Region, great thicknesses of sediments were deposited on the existing rocks from late Precambrian to late Mesozoic and early Tertiary times. In the Rocky Mountain

Table 1. Geological history

AGE (millions of years)	ERA	PERIOD	ROCKS FORMED	WHERE TO SEE THEM
	Cenozoic	Quaternary	Gravel, sand, till Volcanic ash	Lakeshores, stream-beds, eskers, moraines Alaska Highway: Whitehorse to White River; Klondike Road
		Tertiary	Coal deposit Basalt, andesite Sandstone, shale, conglomerate Basalt	Coal River (B.C.) Road to Mount Nansen; Amphitheatre Mountain Slopes of Amphitheatre Mountain Miles Canyon, Whitehorse rapids
63	Mesozoic	Cretaceous	Pegmatite Granodiorite, granite Sandstone, shale Basalt, rhyolite, andesite	Seagull Creek topaz occurrence Boundary Ranges; Ruby Ranges; Arctic Caribou Mine Kiskatinaw, Peace, Pine river exposures; Pink Mountain Mount Nansen, Yukon Antimony Mine
		Jurassic	Conglomerate Sandstone, argillite, greywacke	Five Finger Rapids Miners Range
		Triassic	Shale, sandstone, limestone Amygdaloidal basalt Basalt, andesite, volcanic breccia Limestone	Alaska Highway exposure between km 605 and 630 Canyon City area Kluane Ranges, km 1707 to 1759 (Alaska Highway) Whitehorse Copper Mines
240	Paleozoic	Permian	Peridotite Argilite, tuff, basic lava	Canalask, Wellgreen mines; Atlin area Kluane Ranges (Burwash to White River)
		Pennsylvanian	Chert, argilite	Anvil Range
		Mississippian	Sandstone, shale Limestone, argilite	Alaska Highway km 613 (creek exposure) Hills bordering MacDonald Creek; Lower Liard River bridge
		Devonian	Argilite, chert, greenstone Limestone	Cassiar Mine Alaska Highway, km 636, 907, to 916
		Silurian	Limestone Sandstone, limestone	Alaska Highway exposure, km 636.3 Alaska Highway exposure, km 907 to 916
		Ordovician	Shale, chert, limestone Dolomite, limestone, shale	Ogilvie Mountains Richardson Mountains
		Cambrian	Conglomerate Phyllite Limestone	Muncho Lake Faro Mine Cantung Mine
570	Precambrian		Quartzite Argillite Limestone, dolomite, shale	MacDonald Creek area; Alaska Highway km 638 Toad River bridge Mountains on either side of Good Hope Lake

area, these sedimentary rocks (limestone, shale, quartzite) have been folded and faulted, and eroded over a long interval of time (to early Tertiary times) producing the characteristic saw-tooth ridges. In the area west of the Rocky Mountains and of Watson Lake, the sedimentary strata were deformed and intruded by granitic rocks in Mesozoic time producing mountains that were eroded to almost flat surfaces over which lava flows spread during the Tertiary era. The land was subsequently uplifted, then deeply dissected forming mountain ranges and plateaux. The geological activity produced conditions favourable to the formation of the mineral deposits found in the Yukon and adjoining British Columbia.

The Interior Plains region is underlain by flat-lying or gently folded sedimentary rocks deposited during repeated cycles of inundation and sedimentation during the Paleozoic, Mesozoic and Cenozoic eras. These strata contain accumulations of oil and gas.

During the Pleistocene Period, most of the area was over-ridden by great ice sheets that moulded the landscape as we know it today leaving behind accumulations of sand, gravel, clay and till. Other deposits - beach sands, stream detritus, volcanic ash - are of recent times.

The geological history with examples of rocks formed is summarized in Table 1.

How to use this guide

The route is shown in Figure 1; it consists of the British Columbia and Yukon sections of the Alaska Highway, the Klondike Road, and other roads leading from the Alaska Highway.

Information on each locality is systematically listed as follows: km distances (in bold type) with principal mileage points along the highways starting at the beginning of each section; name of locality or deposit; minerals or rocks found in the deposit (shown in capital letters); mode of occurrence; brief notes on the locality with specific features of interest to the collector; location and access; references to other publications indicated by a number and listed at the end of the booklet; references to maps of the National Topographic System (T), and to geological maps (G) of the Geological Survey of Canada, and of the British Columbia Department of Energy, Mines and Petroleum Resources. Unless noted otherwise, geological maps listed are published by the Geological Survey of Canada.

Figure 1. Map showing collecting route.

THE ALASKA HIGHWAY

km **0** Dawson Creek. Mile "0" of the Alaska Highway (Highway 97) is marked by a commemorative plaque at the east end of the town; the road log commences at this point.

km **1.6** Dawson Creek, at the junction of John Hart Highway.

Kiskatinaw River Occurrences

CHALCEDONY, FOSSILS

In sandstone, in shale

White chalcedony nodules occur in a sandstone layer between shale. The shale above and below the chalcedony layer contains microforaminifera fossils of Upper Cretaceous age.

The occurrence is exposed along the upper part of the steep bank of the Kiskatinaw River at a point 1.6 km north of Arras (sec. 15, tp. 78, rge. 17, w. 6th mer.). The Hart Highway bridges the Kiskatinaw River at Arras, 193 km from Dawson Creek.

Pelecypods occur in Cretaceous shale in the banks of the Kiskatinaw River east of Sunset Prairie (in N.E. 1/4 sec., tp. 79, rge. 18, w. 6th mer.).

To reach the occurrences proceed west along the Hart Highway; at a point 12.9 km west of the bridge at Arras, proceed north toward Sunset Prairie for a distance of 7.6 km to a road leading north 2.9 km to the Kiskatinaw River.

Refs.: 108; 118 p. 63-64; 124 p. 212, 217.

Maps: (T): 93 P/15 Sunset Prairie
(G): 19-1961 Dawson Creek, British Columbia (1 inch to 4 miles)
1000A Northeastern British Columbia (1 inch to 10 miles)

Pine River Occurrences

FOSSILS, GYPSUM, PYRITE

In shale, limestone, mudstone

Pelecypods occur in Cretaceous shale on the north side of the Pine River valley, 3.2 km west of the mouth of Bowlder Creek. Pelecypods and brachiopods occur in limestone and shale exposed by railway cuts and roadcuts on the John Hart Highway at the West Pine bridge, 175 km from its junction with the Alaska Highway. Also reported from the Pine River valley, are ammonites in limestone, and gypsum and pyrite in shale and mudstone.

The John Hart highway parallels the Pine River, and bridges Bowlder Creek at a point 24.9 km west of Chetwynd (formerly Little Prairie), 101 km from the Alaska Highway.

Refs.: 65 p. 30, 31, 49; 91 p. 82.

Maps: (T): 93 O/9 Mount Hulcross
93 O/10 Callazon Creek
93 P/12 Commotion Creek
93 O Pine Pass
(G): 1000A Northeastern British Columbia (1 inch to 10 miles)
43-13A Mt. Hulcross - Commotion Creek, British Columbia
(Preliminary map, 1 inch to 1 mile)
Figure 2, Geological map of the Pine Valley area, British Columbia,
Sheets 1, 2 (1 inch to 1 mile, Bull. 52, B.C. Dept. Mines Petrol. Res.)

Plate I

Km 0, The Alaska Highway, in Dawson Creek, British Columbia. (GSC 159516)

km **32.7** Bridge over Kiskatinaw River. Sandstone and shale of Cretaceous age are exposed along the banks of the Kiskatinaw River.

km **41.8** The highway passes over the Kiskatinaw gas field, the first of several gas fields between this point and Fort Nelson.

km **56.3** Bridge over the Peace River at Taylor, a gas processing centre for natural gas from the Fort St. John area gas fields. Sulphur is also produced from the natural gas.

Peace River Valley Occurrences

GYPSUM, FOSSILS, CONCRETIONS

In shale, sandstone

Crystals of gypsum occur along fractures and bedding planes in shale exposed at several locations along the Peace River Valley. Cretaceous fossils, including ammonites and pelecypods, occur in shale at a number of localities along the banks of the Peace and Pine rivers, as indicated on Map 1. Plant fossils have been found in coal in Cretaceous sandstone on the north bank of the Peace River near Bear Flat, 16 km from the Alaska Highway on Highway 29. Concretions containing fossils (ammonites, pelecypods) have been reported from shale along the Peace River below the mouth of Wilder Creek. In the vicinity of Hudson's Hope, ammonites have been reported from Cretaceous shale along the bank of the Peace River upstream from the town and along cliffs of the islands in the Peace River at The Gates, 11 km northeast of Hudson's Hope.

Most of the exposures of the fossil-bearing rocks are along steep river banks. A road to the mouth of the Pine River leads west from the Alaska Highway just south of the Peace River bridge. Fossiliferous rocks are exposed at the mouth of Pine River, at the mouth of Septimus Creek and on the north bank of Pine River, 3 km further west. Access to the other occurrences is given in the succeeding pages.

Refs.: 8 p. 311; 66; 91 p. 91-92; 103 p. 72-74; 122 p. 96; 24 p. 210-213.

Maps: (T): 94 A/2, Fort St. John
94 A/3 Moberly River
94 A/4 Hudson Hope
94 A/6 Bear Flat
94A Charlie Lake
(G): 17-1958 Charlie Lake, British Columbia (1 inch to 4 miles)
1000A Northeastern British Columbia (1 inch to 10 miles)

km **58.8** Junction, road on left leading west 2.6 km to fossil-bearing shale exposures along the Peace River bank.

km **74.4** Fort St. John, at junction road on left leading south 2.7 km to exposures of fossiliferous shale at a gravel pit. Fossils are also found in the exposures along the north shore of the Peace River opposite the islands east of the mouth of Moberly River (see Map 1).

		Fort St. John, a Hudson's Bay Company trading post was formerly located on the north side of the river approximately opposite the mouth of the Moberly River. It was established in 1805 by Simon Fraser.
km	**75.1**	Turn-off (right) to Fort St. John business district. Several oil and gas fields are located in the vicinity of this centre. Processing plants for natural gas are located in Fort St. John and at the Boundary Lake Field, 45 km west of Fort St. John.
km	**76.3**	Road on left leads south 8.3 km to Fort St. John Historic Park. Fossiliferous shale is exposed along the Peace River west of the park.
km	**88.2**	Junction, Highway 29 to Hudson's Hope.

Road log to fossil occurrences described on page 7:

km	0	Junction, Alaska Highway and Highway 29; proceed along Highway 29 toward Hudson's Hope.
	14.5	Viewpoint overlooking the Peace River Valley at Bear Flat. Fossils occur in the exposures below the viewpoint. The highway descends to Bear Flat and passes over the Bear Flat gas field.
	62.1	Bridge over Farrell Creek.
	65.0	Bridge over creek. Fossils occur in the exposures up this creek.
	67.9-73.2	Fossils occur in the rock exposures on the north side of the Peace River, and along the to cliffs of the islands in the river. The openings between the islands are known as the Gates or Hells Gates.
	79.0	Hudson's Hope, a former trading post established by Simon Fraser in 1805. Fossils are found in the rocks exposed along the Peace River, 4.8 km south of Hudson's Hope. Highway 29 parallels the river at this point. West of Hudson's Hope, the Peace River flows through the treacherous Peace River Canyon.

Peace River Valley Deposits

GOLD, PLATINUM, COAL

In placers; in sedimentary rocks

Fine gold and platinum were found in a flat, known as Branham Flat, on the north side of the Peace River approximately 48.3 km west of Hudson's Hope. The Peace River Gold Dredging Company tested the deposit in 1923 and the yield was reported to be about 50 cents a cubic yard.

This portion of the Peace River was flooded by the W.A.C. Bennett Dam.

Bituminous coal was formerly mined on the east and west slopes of Portage Mountain which is on the north side of the Peace River Canyon, 19 to 24 km southwest of Hudson's Hope. The coal seams occur in sedimentary strata of Cretaceous age.

Coal was first observed along the walls of Peace River Canyon by the explorer Alexander MacKenzie in 1793. Initial production from the deposit was recorded in the 1920s. With the opening of the Alaska Highway, several mines came into production and the coal was transported by truck to Dawson Creek and Fort St. John. The mines discontinued operations when natural gas replaced coal as a fuel.

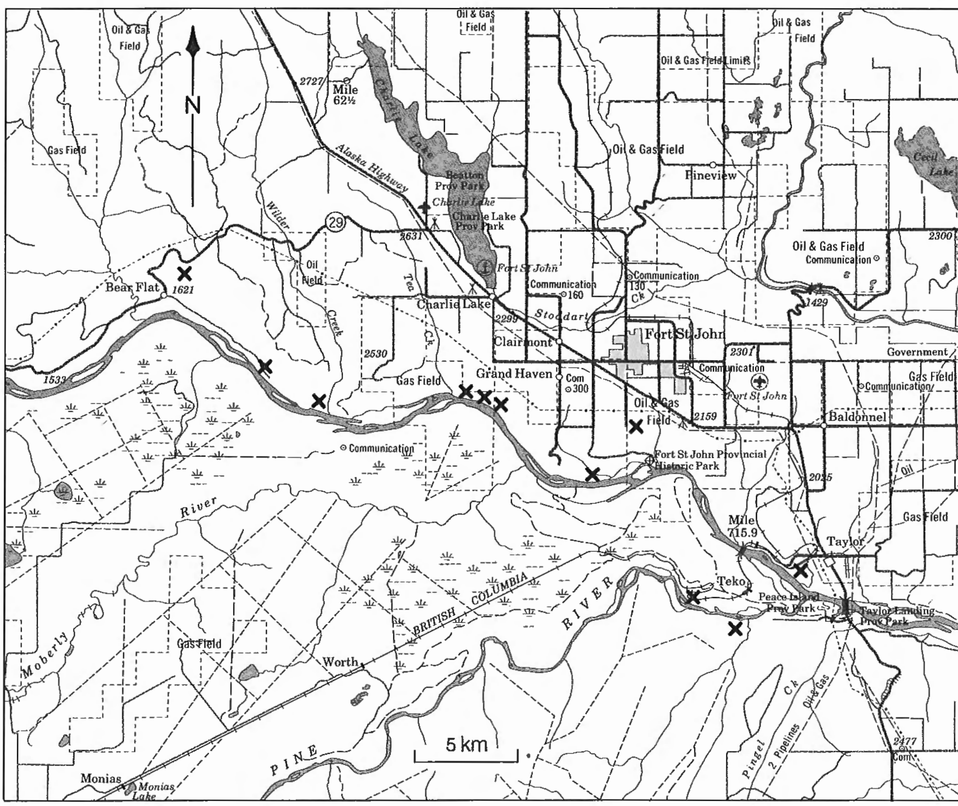
Ref.: 91 p. 140-141, 143, 150-151, 154-176.

Maps: (T): 93 O/16 Portage Mountain
(G): 1000A Northeastern British Columbia (1 inch to 10 miles)

The road log along the Alaska Highway is resumed.

km	**88.2**	Junction, Highway 29 to Hudson's Hope. From this point to km 233, the Alaska Highway follows the height of land between Cameron River to the west and Blueberry and Beaton rivers to the east; the underlying rocks are sandstone, shale and conglomerate of Cretaceous age.
km	**231.8**	Sandstone quarry on right; the rock was used in the construction of the Alaska Highway.

Part of 94 A



Map 1. Peace River Valley occurrences.

km	**236.5**	Bridge over Beaton River. Deposits of bog iron occur along the Beaton River at two localities: one is 0.4 km south of the river at a point 3.2 km upstream (west) from the bridge; the other is on the north side of the river 8 km upstream from the bridge (Ref.: 59 p. 20).
km	**241**	Pink Mountain is visible on left. The mountain is an anticlinal structure outlined by quartzitic sandstone. This rock is more resistant to erosion than the shales of the surrounding area resulting in a relief of 975 m. The summit is at an elevation of 1800 m. The rocks are of Cretaceous age.
		To about **km 322** the Alaska Highway was built along a plateau-like scarp that parallels the mountains to the west and was dissected by streams and rivers (Beatton, Sikanni Chief, Buckinghorse, Prophet rivers). From a distance, these deeply incised valleys have a mesa-like appearance. The scarp is composed of sandstone and shale of Cretaceous age. (Ref.: 59 p. 1-3, 14-15).
km	**259.8**	Bridge over Sikanni Chief River. Cretaceous sandstone and shale are exposed along the Highway at the bridge. The Alaska Highway begins a gradual ascent from the bridge at an elevation 812 m to 1261 m at the summit of Trutch Mountain at **km 306**, the highest point on the highway.
km	**281.9**	Bridge over Buckinghorse River.
km	**314.9**	Viewpoint overlooking Minaker River valley below, and Rocky Mountains in the distance. Road-cut opposite the viewpoint exposes sandstone and shale of Cretaceous age. Rusty brown concretions measuring several cm in diameter and consisting of a mixture of quartz and goethite are common in the shale.
km	**332.6**	Bridge over Beaver Creek.
km	**362**	The Highway follows the east side of the Prophet River valley to **km 471.** Prophet River is a preglacial stream (as are the major stream valleys along the Highway) so that the course of the river today is very much as it was before glaciation in Pleistocene time. Outcrops of bedrock consisting of Cretaceous shale and sandstone have been exposed by the river cutting through the thick deposit of glacial material and into the old river bank (Ref.: 59 p. 13).
km	**475.5**	Junction, road (on right) to Clarke Lake and Yoyo-Kotcho gas fields. Natural gas is produced and processed at Clarke Lake, the largest gas processing plant in British Columbia accounting for approximately one-third of the province's output. A pipeline transporting the gas to southern points joins the pipeline from Fort St. John west of Dawson Creek.
km	**477.2**	Bridge over Muskwa River. From Trutch Mountain, the Highway has descended to its lowest elevation of 305 m above sea level at this bridge.
km	**483**	Fort Nelson, originally established as a fur trading post, is now an important centre serving the natural gas industry.
km	**522.3**	Bridge over Raspberry Creek. In the distance to the right are the Poplar Hills.
km	**539**	Bridge over Kledo River.

km 560 At about this point the Alaska Highway completes its course through the Interior Plains physiographic region which is underlain by Cretaceous shale and sandstone. For the next 80 km it traverses the Rocky Mountain Foothills belt which is characterized by nearly flat-lying shale and sandstone of Cretaceous age in the eastern part, and folded and faulted sedimentary formations of Triassic and Paleozoic age in the western portion. A number of flat-topped, mesa-like hills – remnants of former land surfaces – are conspicuous topographical features visible from the highway. The most prominent is Steamboat Mountain with an elevation of 1464 m. These mountains are capped by Cretaceous sandstone and conglomerate which resisted the erosion suffered by the more susceptible

Plate II

Concretions in sandstone, shale beds, **km 315**. (GSC photo 159513) shales which form the lower more rounded mountains and the deep valleys in between. The conglomerate is composed of pebbles of chert, quartz and quartzite (Ref.: 23 p. 3-6, 10).

km **570** The Highway begins a semicircular course around Teepee Mountain (on right), a fairly flat-topped hill rising to an elevation of 1310 m.

km **575.2** Sandstone exposure on right. This rock is also represented in the lower part of Teepee Mountain.

km **580** On right is Steamboat Mountain with its overhanging cliff on the east side. A little farther to the northwest is Table Mountain, another of the plateau-topped hills belonging to the same range as Steamboat and Teepee Mountains and capped by the same resistant rocks. The Alaska Highway parallels Tetsa River for the next 30 km.

km **581.5** Bridge over Mill Creek. Just before reaching this bridge, there is a view of Table Mountain featuring, near its eastern face, a large cube-shaped block of conglomerate positioned on one of its corners. The block has separated from the main mass of conglomerate capping the mountain. This separation is due to the erosion of the soft clay shale interbedded with sandstone that underlies the conglomerate. The same weathering process produced cliffs and precipices, and separated blocks extending from Steamboat Mountain to Table Mountain. (Ref.: 123 p. 24-25.)

km **604.2** Road-cut on right exposes coal-bearing shale with siltstone and sandstone. The rocks are Cretaceous age.

km **605.6** Road-cuts expose Triassic shale, sandstone and limestone. Ammonite and pelecypod fossils have been found in some of the exposures. (Ref.: 91 p. 38; 123 p. 22.)

Plate III

Mesa-like topography, **km 570**. (GSC 159523)

km	**611-613**	On the south side of Tetsa River fossiliferous limestone and shale are exposed along the river bed. Corals and brachiopods of Carboniferous age occur in the rocks. (Ref.: 109 p. 28-30.) At **km 613.8** limy sandstone and shale of Mississippian age are exposed along the valley of a small creek entering Tetsa River. Brachiopods occur in the rock exposed a short distance north of the Highway. (Ref.: 123 p. 20.)
km	**616.7**	No. 1 bridge over Tetsa River.
km	**619.3**	No. 2 bridge over Tetsa River.

Tetsa River Ornamental Quartzite Occurrence

In the river beds below the Tetsa River bridges, there are numerous pebbles and boulders of quartzite in various tones of red to maroon and white to cream. Many are banded and attractively patterned. The fine grained specimens take a good polish and are suitable for ornamental purposes. Also occurring in the river beds are boulders of grey limestone containing abundant fossil corals.

km	**626.1**	Road-cut on right exposes Triassic shale and limestone. Pelecypods and brachiopods occur in the rock.
km	**630.6**	Bridge over the north fork of Tetsa River. Boulders and pebbles of quartzite similar to those found in Tetsa River at **km 616.7** and **km 619.3** and of coral-bearing limestone occur in the river at the bridge. At about **km 629** the Highway begins its 15-km course through the Front Range of the Rocky Mountains. The rocks conspicuously exposed along the slopes and in 1.5 km-long road-cut (**km 635**) are grey limestones of Silurian and Devonian age.
km	**631**	Summit Lake on left. Summit Pass, the highest point along the Alaska Highway at an elevation of about 1280 m, comprises a 1.6 km section of road between this lake and a smaller one to the west. The peak on right is Mount St. Paul (2129 m) and the one behind Summit Lake is Mount St. George (2263 m). The highest peaks of the northern Rockies are 15 to 25 km to the south with elevations close to 2745 m. This range of mountains is known as the Stone Range.
km	**634.6**	Hoodoos on wooded slope on right. Erosion of the glacial till along the slope produced these pillars. Terraces of glacial till flank the lower slopes of the mountains to elevations of 213 m above the level of the Highway. Boulders of quartzite similar to those found along Tetsa River occur in the flats between the Highway and the ridges.
km	**636.3**	The Highway descends through a rock-cut to MacDonald Creek which it parallels for the next 22 km. Limestone of Silurian and Devonian age is exposed in the cut.

km	**638.4**	Bridge over 107 Creek. The stream bed on right exposes coral reef limestone of Devonian age along with underlying white to yellowish Precambrian quartzite. Nearby cliffs expose limestone containing coarse cleavable masses of white calcite (cleavages up to 20 cm across) and tiny cavities lined with transparent "micro" quartz crystals. Above the falls, erosion of the sedimentary strata has produced deep crevices in the rock.
km	**638**	The low rounded hills bordering MacDonald Creek are composed predominantly of shale, argillite, chert and sandstone of Devonian and Mississippian age.
km	**639**	Waterfall in gully on right. White massive barite occurs in a white calcite vein cutting grey limestone. Transparent purple fluorite is associated with the barite. The occurrence is exposed in the bed of the stream and on the left side of the gully about 30 m from the Highway.
km	**643.6**	Road-cut. White calcite coated with yellow jarosite occurs in the limestone on right.
km	**645.0**	Junction, road to Churchill Mine.

Plate IV

Hoodoos on mountain slope, **km 635**. Pebbles and boulders of quartzite in foreground. (GSC 159520)

Churchill Mine

CHALCOPYRITE, PYRITE, DOLOMITE, QUARTZ CRYSTALS, MALACHITE, ARAGONITE, MICA, AZURITE

In veins cutting sheared slate and calcareous siltstone

Massive chalcopyrite is the ore mineral. It occurs with pyrite in quartz-dolomite veins. Curved rhombohedral and platy crystals of colourless to white dolomite are associated with colourless terminated quartz crystals; tiny tetrahedrons of chalcopyrite were noted on the dolomite crystals. A bright green encrustation of malachite occurs on the vein minerals and on the associated rocks; on and near the malachite, aragonite has formed colourless to white aggregates

Plate V

Eroded clefts in limestone, **km 638**. White quartzite is exposed in the stream-bed, and boulders of quartzite and of limestone (coral reef) are strewn in foreground.
(GSC 159519)

of microscopic acicular crystals. Massive bluish green mica occurs with massive white quartz. Azurite has also been reported.

The deposit was discovered in about 1945 by Albin Larson of **km 656**, Alaska Highway and staked by him and William Lembke, also of **km 656**, in 1957. It was originally explored by Magnum Consolidated Mining Company Limited, and underground development by an adit was commenced in 1967 by Churchill Copper Corporation Limited. The mine and mill (located 21 km from the mine) came into production in 1970. The ore averaged between 3 and 4 per cent copper. Operations were suspended in 1971 and were resumed for 15 months beginning in January 1974.

The mine is located at the headwaters of Delano Creek, about 4 km southwest of Yehde Lakes and 8.8 km northwest of Mount Roosevelt. A 53 km road connects the mine to the Alaska Highway at km 645. The mill and camp are located near the mouth of Delano Creek on the Racing River, 32 km from the Highway, and from there the road follows Delano Creek. About 24 km almost due south of the camp is Churchill Peak which, at 3202 m, is the highest mountain in the northern Rockies. It is capped by glaciers and ice-fields.

Refs.: 62 p. 21; 131 p. 95-96.

Maps: (T): 94 K/11 Racing River
94 K Tuchodi Lakes

km	**660.2**	Bridge over MacDonald Creek. Quartzite, limestone and shale are exposed beneath the bridge. Cavities in massive white quartz cutting the limestone are lined with "micro" crystals of quartz.

Plate VI

Muncho Lake viewed from the north end with Terminal Range of Rocky Mountains in background. (GSC 159518)

From here to **km 695** there are numerous exposures of Paleozoic shale and limestone cut by veins of calcite and quartz. The Highway follows the gorge of Toad River (**km 690-km 710**) with the Sentinel Range of the Rocky Mountains on either side. The highest peaks (elevations to 3000 m) of the northern Rockies are in this range, south of the Highway.

km **673.7** Bridge over Racing River. The valley of this river forms the boundary between the Sentinel Range and the Stone Range. Both ranges are composed of folded and faulted Paleozoic and Mesozoic sediments and the valley consists of relatively low, gently folded Paleozoic strata.

Toad River Hot Springs

About fifteen small pools fed by hot springs are located 20 m north of the Toad River at a point 2.5 km beyond its junction with the Racing River (13 km east of the Highway).

Access is by boat down the right bank of Racing River, then up the left bank of the Toad River.

Ref.: 91 p. 148.

Map: (T): 94 K/14 Toad Hot Springs

km **703.9** Bridge over Toad River. A road-cut on the west side of the bridge exposes argillite cut by veins of coarsely crystalline white dolomite. The rock is of Precambrian age and is associated with quartzite and slate which also form the peaks to the south.

km **709.9** Road-cut on right exposes grey limestone cut by veins of white calcite which, on exposed surfaces, has a layer of light brown calcite that fluoresces pale yellow under ultraviolet rays ("long" rays more effective than "short").

The Highway swings north and follows a valley formed by the upper waters of Toad River, by the river itself, and by Muncho Lake. The Sentinel Range parallels the east side of the road.

km **725** Road-cut exposes buff-coloured calcareous sandstone.

km **734.5** Muncho Lake on left with the Terminal Range of the Rockies flanking its western shores. The lake, at an elevation of 818 m, is 12 km long and up to 1.5 km wide. Its emerald-green colour contrasts with the red conglomerate exposed along the west shore; beyond it to the west, limestone peaks reach altitudes of about 2165 m. The conglomerate consists of a red shale matrix with boulders of reddish quartzite, and is of early Paleozoic (possibly Cambrian) age. (Ref.: 123 p. 14-15.)

km **746.9** Viewpoint; Muncho Lake is viewed from its north end.

km **775.7** Exposure on left. White massive calcite occurs in grey limestone that is associated with black cherty rock. Also present are colourless crystals of calcite that fluoresce white when exposed to ultraviolet rays.

km	**790**	Bridge over Washout Creek. The Highway, in resuming a westerly course, leaves the Northern Rockies and follows the bench of Liard River for the next 80 km. This river forms the northern boundary of the Rockies. In the first 30 km (to Smith River), the Highway traverses Liard Plateau, an area of broad rolling valleys separating truncated ridges (to elevations of 1370 m) that extend north from the Rockies. The hills are composed of Paleozoic and Mesozoic sedimentary formations, and thick deposits of glacial silt cover the valleys. The valley of the Liard is heavily timbered and rock exposures along the road are few.
km	**797.7**	Bridge over Lower Liard River. Beneath the bridge, rock exposures include limestone and argillite of Mississippian age. Brachiopods and gastropods have been reported from the argillite, brachiopods and pelecypods from the limestone. (Ref.: 78 p. 1617; 123 p. 18.) Nodules of pyrite measuring up to 3 cm in diameter and white fibrous calcite occur in the limestone.
km	**798.9**	Junction, road to Liard River Hot Springs.

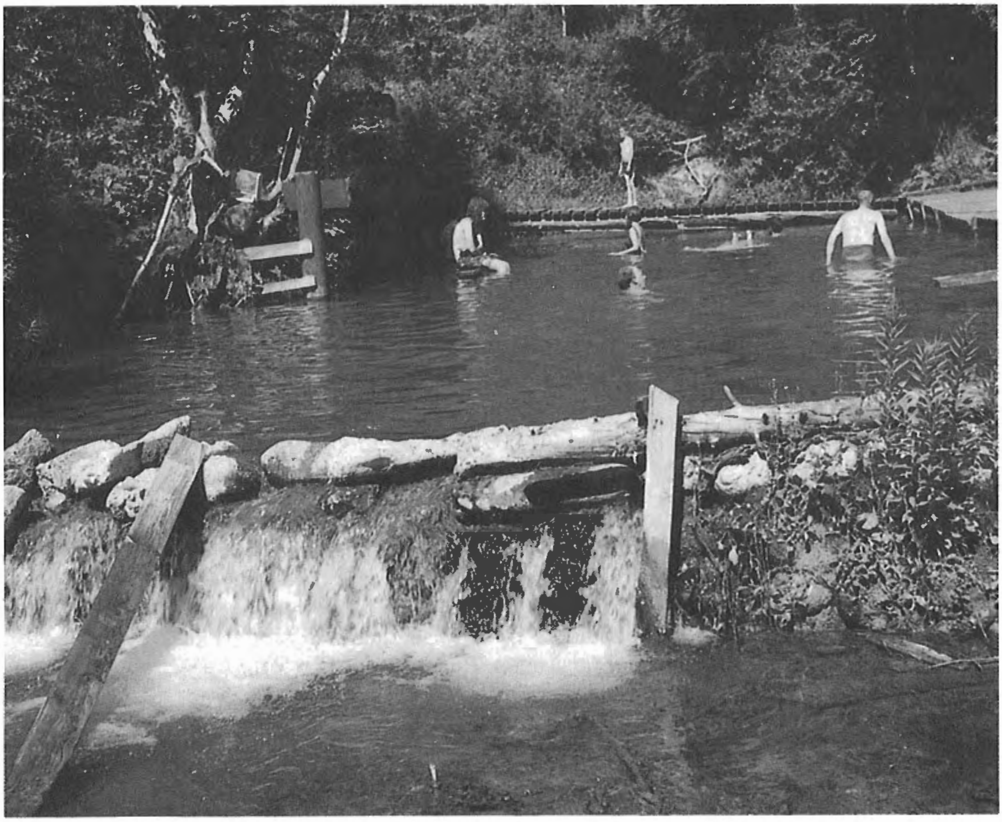


Plate VII

Liard River Hot Springs. (GSC 159511)

Liard River Hot Springs

Several mineral springs with temperatures of up to 50°C occur in this part of the Liard Valley now designated as a park area. Deposits of calcareous tufa in the vicinity of the springs are derived from the mineral water which is rich in sulphur and calcium but also contains magnesium, sodium, silicon and strontium. The smaller pool (near the dressing-house) is the hotter one, while the large one (90 m by 45 m) to the north has a temperature of 43°C.

Access is by automobile to the parking lot (about 155 m from the Highway), then by a footpath across a beaver pond to the springs.

This particular spot has been referred to as Tropical Valley where a trapper, Tom Smith, lived and gardened several plots of land. His cabin was replaced by a dressing-house.

Ref.: 123 p. 2, 8, 31-32.

Maps: (T): 94 M/8 Vents River
(G): 1000A Northeastern British Columbia (1 inch to 10 miles)

km	**801**	Fluorite occurs in limestone about 11 km north of the Highway. The deposit was explored by Jorex Limited and Conwest Exploration Company in 1971; a truck road connects it to the Alaska Highway at **km 801**. (Ref.: 33 p. 1, 16.)
km	**807.3**	Bridge over Teeter Creek.
km	**815.4**	Rock exposure on right. Black coral reef limestone of Silurian age containing coarse cleavable masses of white calcite is exposed.
km	**826.9**	Bridge over Smith River. This river forms the eastern boundary of the Liard Plain, a drift-covered rolling plateau with low rounded hills and deep valleys; this physiographic province comprises most of the Liard River valley and the Highway is within it to about **km1095**. Sedimentary Paleozoic and Tertiary rocks underlie the drift.

Smith River Occurrence

JAROSITE, GYPSUM, ALUNOGEN, CALCITE

In shale

Secondary minerals have formed along the black shale exposure giving it a rusty appearance. Jarosite occurs as a dull rust-coloured to yellow coating. Associated with it are encrustations of: gypsum, as colourless to white flat microscopic crystals and as silky white flakes; alunogen, as, waxy white botryoidal aggregates; and calcite, as a greyish white powder.

The rock is exposed along the side of a ridge on the southeast side of the bridge over Smith River.

Ref.: 123 p. 8-19.

Maps: (T): 94 M/9 Teeter Creek
(G): 1000A Northeastern British Columbia (1 inch to 10 miles)
44-28A (Prelim. map) Alaska Highway, Fort Nelson to Watson Lake, British Columbia and Yukon (1 inch to 8 miles).

Liard River Placers

GOLD

In placers

Placer gold was mined from the bars of the Liard River near the Hudson's Bay Company's former trading post of Fort Halkett located at the mouth of Smith River. It was found in the gravels as far down as 13 km below the mouth of the Coal River.

The discovery of gold here in 1872 by two explorers, McCulloch and Thibert, marked the first time gold had been found in the Cassiar district and led to a prospecting rush that resulted in richer discoveries in the Dease Lake and Cassiar areas. The latter two deposits were worked for several years, but the Liard placers proved to be of little value.

Refs.: 42 p. 84B-85B; 70 p. 39A; 123 p. 27.

Maps: (T): 94 M/9 Teeter Creek
94 M/10 Grant Lake
94 M/11 Lower Kechika
(G): 1000A Northeastern British Columbia (1 inch to 10 miles)
44-28A (Prel. Map) Alaska Highway, Fort Nelson to Watson Lake, British Columbia and Yukon (1 inch to 8 miles)

km	**857.9**	Bridge over Coal River. Chunks and masses of dark brown lignite coal and fragments of lignitized wood occur in the river bars beneath the bridge. It is derived from a coal seam along the bank of Coal River and in the bed of the river forming a rapid about 10 km due north of the bridge. The deposit is Tertiary in age. (Ref.: 123 p. 9, 25-26). Coal River joins the Liard River just south of the bridge. During the building of the Highway, the coal was used for fuel.
km	**866.4**	Turn-off (left) to Whirlpool Canyon camp-site. Tilted shale formation of Paleozoic age is exposed at the rapids of the Liard River at the camp-site.
km	**877.1**	Road-cut on right (at bend) exposes a banded rock consisting of interbedded light brown siltstone and black shale. White massive quartz with small cavities lined with "micro" quartz crystals and others filled with clay occurs in buff-coloured sandstone that is also exposed in the road-cut.
km	**880.1**	Bridge over Army Creek.
km	**897.8**	Bridge over Legull Creek.
km	**907.8-916.8**	Road-cuts on right expose buff-coloured calcareous sandstone and grey limestone. The rocks are of Silurian and Devonian age. (Ref.: 123 p. 9, 19). Coarsely cleavable white calcite occurs in the limestone at **km 916.8.**
km	**917**	Allen's Lookout onto the Liard River valley.
km	**945.3**	Shale cut by white cleavable calcite is exposed on right.
km	**946.3**	Bridge over Contact Creek. The creek is so named because it was at this point in 1942 that the northern section of the Highway from Alaska was joined to the southern section beginning at Dawson Creek.

km	**974.9**	Bridge over Hyland River.
km	**997**	Lower Post. A Hudson's Bay Company trading post was located here on the Liard River near the mouth of the Dease River. In the 1870s prospectors for gold followed the Dease River route to the placers in the Dease Lake and Cassiar areas.
km	**1008.2**	Yukon Territory border.
km	**1022**	Watson Lake, at the junction of Campbell Highway (Highway 4) leading to Ross River.

The Campbell Highway

The highway leads north from Watson Lake leaving the Liard Plain near the Simpson Lake camp ground; it then traverses Yukon Plateau, an undulating upland area dissected by deep river valleys and bordered by the Selwyn Mountains to the north and the Pelly Mountains to the south. The last 65 km of the section to Ross River is within the Tintina Trench which is a broad valley extending about 640 km in a northwesterly direction from near Ross River through Dawson City and into Alaska. The trench is the result of profound faulting and erosion. The highway has been built along the valleys of the Frances, Finlayson, and Pelly rivers and, between Frances Lake and Finlayson Lake, it parallels the east side of the Campbell Range which has peaks reaching elevations up to 1830 m. The valleys are thickly wooded and covered with unconsolidated glacial and alluvial deposits; exposures of rock near the road are few.

Cantung Mine

SCHEELITE, PYROXENE, GARNET, ACTINOLITE, EPIDOTE, TITANITE, AXINITE, TOURMALINE, ANTIGORITE, CHALCOPYRITE, CUBANITE, SPHALERITE, PYRRHOTITE, QUARTZ, CALCITE, MICROCLINE, BIOTITE, CHLORITE, FLUORITE, APATITE, PLAGIOCLASE, BISMUTH

In skarn zone in marble at contact of chert

Scheelite, the ore mineral, occurs in the rock as cream-white, medium to coarse grains distinguished from other white minerals by their white fluorescence under ultraviolet radiation. Associated minerals in the skarn include: dark green pyroxene (diopside-hedenbergite), reddish brown to pink garnet (grossularite-andradite), actinolite, epidote, titanite, axinite, tourmaline, antigorite, chalcopyrite, cubanite, pyrrhotite, quartz and calcite. Quartz veins cutting the skarn contain scheelite, microcline, biotite, chlorite, fluorite, apatite, garnet, actinolite, plagioclase and calcite. Specks of native bismuth have been reported from the vein material.

The deposit was discovered in 1958 by the Mackenzie Syndicate. Prospecting methods included panning and ultraviolet lamp-testing of the outcrops. In 1959, Canada Tungsten Mining Corporation Limited was formed to develop the orebody. Prior to the completion of the all-weather road to Watson Lake in 1962, supplies and equipment were flown in by float- and ski-equipped aircraft and helicopters. A camp was built in the Flat Creek Valley. Mining was conducted by an open pit restricted to the summer months until 1974 when underground operations began. The mill commenced operations in 1962; tungstic oxide (WO_3) and copper were produced. The mine ceased operations in 1986.

The mine is located on the northeast side of a mountain range that forms the boundary between Yukon Territory and Northwest Territories; it is within the Logan Mountains at an elevation of about 1677 m and overlooks the Flat River Valley. A 200 km road (Nahanni Range Road) connects it to the Campbell Highway at km 108. It follows the Hyland River valley and the east side of the Logan Mountains crossing the range at Harrison Pass a few km from the townsite of Cantung.

Refs.: 7 p. 28-29; 23 p. 510-513; 121 p. 390-393; 131 p. 74-75.

Maps: (T): 105 H Frances Lake
(G): 4-1967 Geology vicinity of the Canada Tungsten mine, Yukon Territory and District of Mackenzie (1 inch to 800 feet)
6-1966 Frances Lake, Yukon Territory and District of Mackenzie (1 inch to 4 miles)

King Jade Mines

NEPHRITE JADE

In serpentinite

A nephrite deposit found in situ in the Campbell Range of the Pelly Mountains near Frances Lake was staked in 1971 by Roy Sowden and Karl Ebner of Fort St. John. Two locations were staked: at the 1677 m level about 4.8 km due west of km 135 on the Campbell Highway and, at the 1677 m level approximately 11 km due west of the Campbell Highway at km 156. The jade occurs at the contact of a body of serpentine with Paleozoic sediments. Botryoidal jade occurs with the massive nephrite.

Ref.: 78a p. 37-38.
Maps: (T): 105 H/3 Klatsa River
(G): 6-1966 Frances Lake, Yukon Territory and District of Mackenzie (1 inch to 4 miles)

km 1033.9 Bridge over Upper Liard River. Lignite coal occurs on the bank of the Liard River at localities approximately 6 and 10 km downstream from the bridge; it is associated with clay, shale and sandstone. (Ref.: 79 p. 19.)

The Highway continues along Liard Plain, a relatively flat drift- and gravel-covered area with elevations between 610 and 915 m.

km 1044.1 Junction, Cassiar Road (Highway 37).

Side trip to the Cassiar and Dease Lake areas

km 0 Proceed south from the Alaska Highway onto Cassiar Road. For the first 48 km the road traverses Liard Plain.

km 33.0 Bridge over Blue River. Boulders and pebbles of amygdaloidal basalt occur in the bed of the river beneath the bridge. Some of the vesicles are filled with light greenish yellow transparent olivine.

km	48	The road begins its course through Dease Plateau, an area of low to moderate relief with elevations of up to 1525 m. The underlying rocks are of Paleozoic age. The road has been built along the drift-covered Dease River Valley.
km	64	From about this point southward for several km, the Horseranch Range is visible in the distance to the left. It forms a prominant ridge resembling a giant hogs back and extends in a north-south direction for 48 km. Its peaks reach elevations of up to 2226 m and there are numerous cirques along its flanks. The ridge is underlain by metamorphosed sedimentary rocks of Paleózoic age.
km	84	The road begins its course through the Stikine Range of the rugged Cassiar Mountains. A batholithic intrusion of granitic rocks, believed to have been emplaced in Mesozoic time, forms the backbone of these mountains for many km to the southeast and northwest. As seen from the road, the rocks are exposed above timberline (about 1372 m) in the jagged, saw-tooth peaks reaching elevations of 2287 m from Cassiar southward to within 16 km of Dease Lake. Cirques on the mountain slopes are visible from the road.
km	98	Good Hope Lake on left. The mountains rising from the lake are composed of red and green limestone, shale, slate and siltstone of Proterozoic age. Weathering of these rocks along the mountain slopes produces the attractive muted tones of red, brown and green as seen from the road.
km	104.8	Trail on left to the former Hudson's Bay Company post of McDame at the junction of Dease River and McDame Creek.
km	109.4	1st North Fork bridge. The abandoned settlement of Centreville was located in this area.
km	116.6	Hot Creek bridge.
km	123.6	Snowy (Snow) Creek bridge.
km	123.9	Junction. Cassiar-Stewart Road begins on left; road straight ahead proceeds to the Cassiar Mine (page 24) and to the town of Cassiar, a distance of about 13.5 km. The road log continues along Highway 37.
km	230	Dease Lake on right. The lake is 38 km long, less than 1.5 km wide, and its deepest point at Steamboat Point at the northern end is about 116 m. It is at an elevation of 811 m and it dissects Stikine Plateau – an irregular upland area separating the Cassiar Mountains from the Coast Mountains. The plateau in the Dease Lake area has elevations between 915 and 1220 m with isolated peaks to 1830 m, and it is deeply dissected by Dease Lake, Thibert, and Dease creeks, and by many other streams. Its approximate boundary is Canyon Creek to the north of Dease Lake and Little Eagle River to the west of the lake. The area on the east side and to the west of Dease Lake is underlain by Paleozoic sediments. The Arctic Divide is located about 1.5 km south of Dease Lake: streams on the north side flow to the Arctic Ocean, those on the south side to the Pacific. (Refs.: 53 p. 6-7, 11-18, 21-23, 88-90; 70 p. 44A-46A; 73 p. 77A-79A.)

Cassiar Asbestos Mine

ASBESTOS, JADE, GARNET, MAGNETITE, ANTIGORITE, PICROLITE, TREMOLITE, MAGNESITE, CALCITE, CLINOZOISITE, CHOLORITE, TALC, MICA, PLAGIOCLASE, GALENA, GARNIERITE

In serpentinite

Light greyish green cross-fibre chrysotile asbestos with fibres measuring up to 8 cm long, occurs in a massive serpentine rock intruding argillite, chert, quartzite and greenstone. Nephrite jade, varying from medium greyish green to a fairly bright green, is associated with the serpentine. Small grains of bright green transparent grossular are disseminated through the nephrite; on the polished surface they appear as emerald-green spots in a more subdued green matrix. Some microscopic grains of magnetite occur in the jade. Other minerals associated with the deposit are: antigorite (light green to almost black massive, and dark green platy) and picrolite (greyish

Plate VIII

Cassiar Mine in Cassiar Mountains, 1971. (GSC 159508) green columnar) varieties of serpentine; white tremolite, as fibrous aggregates with fibres several cm long; white columnar masses of magnesite; massive light pink garnet; massive white calcite that fluoresces deep pink when exposed to ultraviolet rays ("long" rays more effective than "short"); light smoky brown prismatic aggregates of clinozoisite; chlorite; green to white foliated talc; mica, and plagioclase feldspar. The ore-bearing massive serpentine contains crystals of antigorite, pseudomorphs after orthopyroxene; they are known as bastite. Fibrous magnetite occurs in a shear zone along with other fibrous minerals such as picrolite and magnesite. Zoisite is associated with tremolite in altered greenstone. Galena and garnierite have also been reported from the deposit.

The asbestos deposit was found as an outcrop between 1830 m and 1952 m on the western flank of McDame Mountain which reaches an elevation of 2074 m. It was staked in 1950 by V.A. Stittler, R.L. Kirk, and H.H. Nelson of Fort Nelson, and R.W. Kirk of Lower Post, and development commenced shortly after by Conwest Exploration Company. In 1951 Cassiar Asbestos Corporation (now Cassiar Mining Corporation) began mining operations. Original mining was done by processing the asbestos fibre that formed a talus along the slope of the mountain in the outcrop area. Subsequent mining has been done by the open pit method. A mill began operations in 1953. The mine was connected to the mill (at an elevation of 1067 m) by a 10 km road and by a 5 km aerial tramway. The fibre was transported by truck to Whitehorse, then by rail to Skagway and finally by boat to warehouses in Vancouver. Another deposit to the southeast of the Cassiar Mine, was developed by adits driven into McDame Mountain. The mine was closed in 1992.

Refs.: 53 p. 123-126; 82 p. A211-A214; 96 p. A207-A212; 99; 107 p. 49-53; 138 p. 35-36.

Maps: (T): 104 P/5 Cassiar
104 P McDame
(G): 1110A McDame, Cassiar District, British Columbia (1 inch to 4 miles)

Snowy Creek Jade Occurrence

JADE, RHODONITE

Jade (nephrite) and rhodonite are recovered from the gravels of Snowy Creek in the vicinity of the Cassiar Road which bridges the creek at km 123.6. (See road log on page 23.) The occurrence has been staked by Mrs. Mary Fentie of Watson Lake. Visitors to the area are reminded that collecting is not permitted where the claims are in good standing.

Maps: (T): 104 P/5 Cassiar
104 P McDame
(G): 1110A McDame, Cassiar District, British Columbia (1 inch to 4 miles)

McDame Creek Jade Occurrence

JADE, RHODONITE, GOLD

In placers

Jade (nephrite), rhodonite and gold are recovered from the gravels of McDame Creek at Centreville. The deposit was staked by Mr. George Zimick and is operated by Centerville Placers Limited of Cassiar.

A road to the camp leads south from the Cassiar Road at the 1st North Fork bridge (km 109.4). (See road log on page 23.)

Maps: (T): 104 P/6 Good Hope Lake
104 P McDame
(G): 1110A McDame Cassiar District, British Columbia (1 inch to 4 miles)

Cassiar Gold Occurrences

GOLD

In placers

Placer gold was discovered on McDame Creek in 1874 during a gold rush to the Cassiar district following the discovery of gold on Liard River (1872) and in the richer placers in the Dease Lake area (1873). A nugget valued at $1,300 was found on McDame Creek in 1877; the total production from this stream was about $1,172,000 most of it being obtained prior to 1900 (gold was then worth about $17 an ounce) making this the second most productive stream in the Cassiar-Dease Lake area. Most of the mining was done on the north side of McDame Creek at Centreville and near the mouths of its tributaries; smaller yields were obtained from Hot Creek, Snowy Creek and from Quartzrock (Quartz) Creek. The gold was mined from gravels on benches of pre-glacial channels and from present stream gravels. It is believed to have originated in the gold-quartz veins cutting Paleozoic rocks in the mountains to the north.

In the early days, hand methods of mining were employed and, in about 1900, hydraulic mining was introduced. In 1949, Moccasin Mines Limited used a floating washing plant at its McDame Creek operation between the 1st North Fork and the McDame trail. A road was built from the Alaska Highway to McDame Creek in the winter of 1946-47 by Moccasin Mines Limited and the British Columbia government. Prior to that, access was via the Stikine River from the Pacific Coast to Telegraph Creek, then by truck road to Dease Lake and by boat to McDame Creek. A Hudson's Bay Company trading post was maintained until 1943 at McDame which is located at the mouth of McDame Creek on the Dease River. A paddle-wheel steamer operated briefly in about 1940 along the Dease River between McDame and Lower Post.

Highway 37 bridges 1st North Fork Hot Creek and Snowy Creek (see road log on page 23). The Cassiar Road bridges Quartzrock Creek at a point 5.5 km west of it's junction with Highway 37. The former operations are indicated on G.S.C. Map 1110A.

Refs.: 42 p. 82B-86B; 53 p. 2-3, 110-112; 60 p. 1-2, 12-13; 61 p. 59; 70 p. 33A-44A.

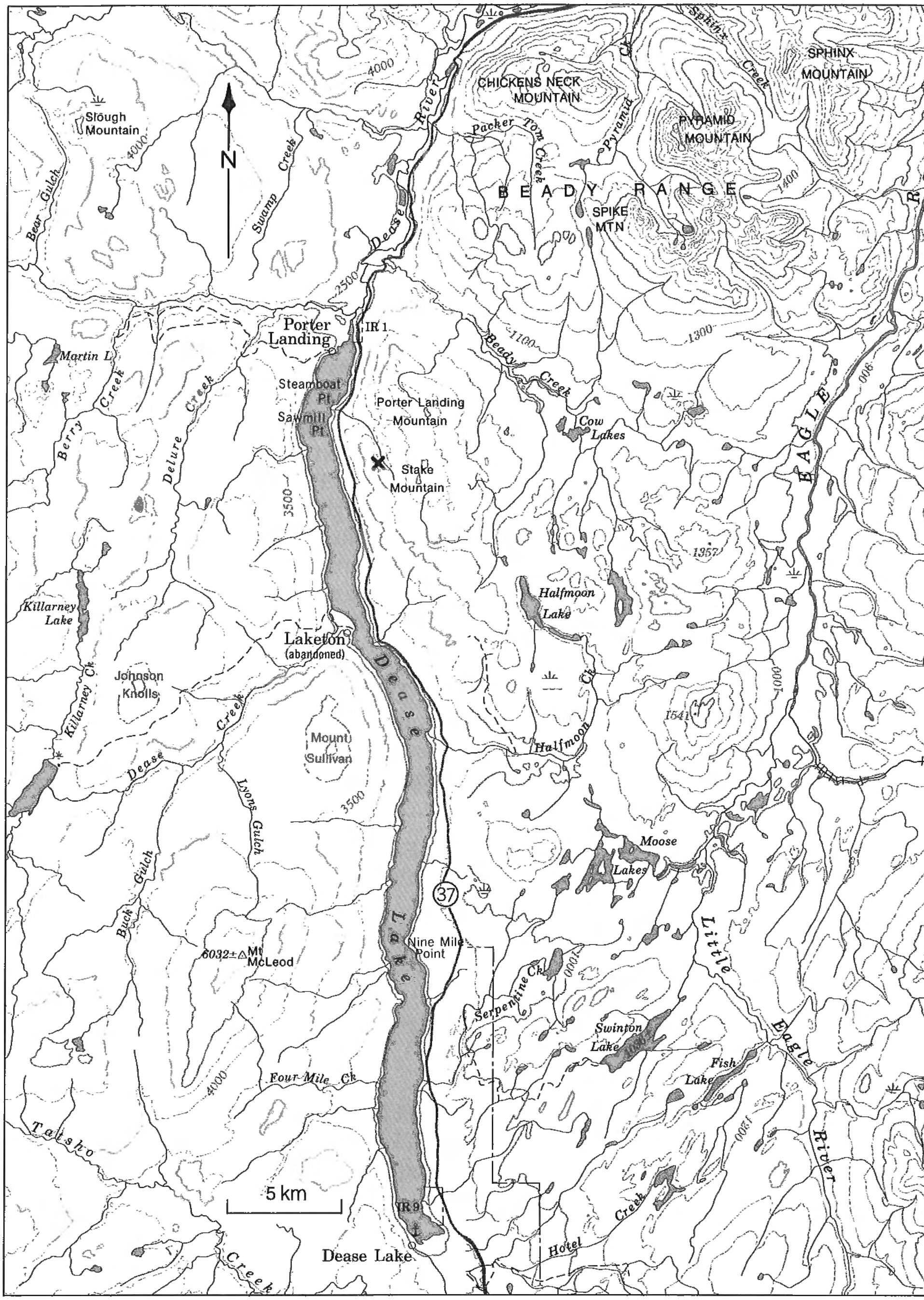
Maps: (T): 104 P/5 Cassiar
104 P/6 Good Hope Lake
104 P McDame
(G): 1110A McDame, Cassiar District, British Columbia (1 inch to 4 miles)

Dease Lake Area Placers

GOLD, PLATINUM, COPPER

In placers

Gold was obtained from the gravels of Dease, Thibert, Mosquito, and Deloire creeks on the west side of Dease Lake, and on Goldpan and Wheaton creeks to the east of the lake. Dease Creek was the most productive in the Cassiar district with a yield of $2,000,000, over half being obtained in the period 1874-75. The gold was mined from high-level benches of old (probably preglacial) channels and from the low beaches of present streams. Early mining methods



Map 2. Dease Lake area: jade occurrence.

included sluicing, drifting, open-cuts, tunneling and hydraulicking. Platinum was found on Thibert Creek, and native copper on Boulder Gulch (on Thibert Creek). A 396 g gold nugget was found on Depot Creek, a tributary from the south of Canyon Creek. Chromite, ilmenite, magnetite and manganese carbonate have also been reported from the gold placers; serpentine is abundant in some creeks.

This area was explored in the 1830s by the Hudson's Bay Company which set up trading posts on Dease Lake and on the Stikine River. Placer gold was discovered on Stikine River in 1861, and in the Dease Lake area in 1873. The latter was discovered by Henry Thibert who came up from the Red River country in Manitoba, met McCulloch and prospected with him on the Liard, then proceeded via the Dease River to Dease Lake. The Discovery claim is on Thibert Creek, 5 km above its mouth. The Dease Creek placers were discovered in the same year and other discoveries were made shortly after. As a result, the population rapidly rose to 2,000, the settlement of Laketon (on the west side of Dease Lake at the mouth of Dease Creek) came into being, a pack trail from Telegraph Creek to Dease Lake was opened by the British Columbia government, and beef cattle were introduced to the region from the upper Fraser Valley. Production declined steadily after reaching a peak in 1875 in spite of additional discoveries to the east of Dease Lake. Interest in the district was revived in 1897-98 during the rush to the Klondike because two of the overland routes (one from the Pacific via Telegraph Creek, the other from Edmonton via the Finlay River) passed through the area bringing an influx of prospectors. Attention was again renewed when the gold placers of Goldpan Creek were discovered in 1924. Hydraulic mining was applied to former workings, and the Provincial government rebuilt the pack trail from Telegraph Creek into a truck road to assist development. Another discovery was made at Wheaton (Boulder) Creek in 1932 but gold production in the district continued its decline.

The placers were worked at the following locations: Dease Creek, from its mouth on the west side of Dease Lake to Lyons Gulch; Thibert Creek, from its mouth on Dease River (north of Porters Landing) to Berry Creek, and in the mouths of its tributaries – Deloire and Mosquito creeks; Goldpan Creek, near its mouth on Little Eagle River, 15 km east of Dease Lake; and Wheaton Creek, near its mouth on Turnagain River, 56 km east of Dease Lake.

Access to the localities on the west side of Dease Lake is by boat from Dease Lake on the Cassiar-Stewart Road. There are no motor roads to the east of Dease Lake.

Refs.: 42 p. 61B-64B, 80B, 82B; 60 p. 13-14; 61 p. 56-61; 70 p. 33A-36A, 39A-69A; 73 p. 98A-99A; 97 p. 76-77.

Maps: (T): 104 J/9 Little Dease Lake
104 J/16 Porter Landing
104 J Dease Lake
104 I Cry Lake
(G): 21-1962 Dease Lake, British Columbia (1 inch to 4 miles)
29-1962 Cry Lake, British Columbia (1 inch to 4 miles)
2104 Dease Lake area, Cassiar district, British Columbia (1 inch to 2 miles)

Dease Lake-Cry Lake Jade Occurrences

JADE

Nephrite jade was first found in the Dease Lake-Cry Lake area in 1938 when W.J. Storie located jade boulders in Wheaton Creek while placer mining for gold. A boulder estimated to weigh 9t was reported from the stream. Wheaton Creek was soon after staked for jade, as were a number of other localities. The jade is believed to be derived from serpentinite associated with peridotite rocks in the district. Originally, the jade was found only as boulders; later it was found in bedrock at Seywerd Creek near the north end of Dease Lake and in the Provencher Lake area, south of Cry Lake. The host serpentinite rocks occur in a belt extending 50 km southeastward from the south end of Englehead Lake to Kutcho Creek.

Jade has been produced from Wheaton Creek midway between its mouth and its junction with Alice Shea Creek, from King Mountain, Provencher Lake, Provencher Mountains, Letain Lake and from claims near the head of Seywerd Creek which enters the northeast end of Dease Lake at Sawmill Point, 2.4 km south of Porter Landing. Jade boulders have been reported from west of Dease Lake at Thibert and Delure creeks. Claims have been staked at these locations and, before collecting in the area, a check should be made with the Mining Recorder in Victoria to determine the status of the claims; collecting is not permitted in deposits for which the claims are in good standing. Wheaton Creek is located about 60 km (by air) east of the south end of Dease Lake. Access is by air from Dease Lake.

Refs.: 63 p. 119-126; 132 p. 498; 78a p. 31-35.

Maps: (T): 104 I/6 Snowdrift Creek
104 I/7 Letain Lake
104 J/16 Porter Landing
(G): 21-1962 Dease Lake, British Columbia (1 inch to 4 miles)
29-1962 Cry Lake, British Columbia (1 inch to 4 miles)

The road log along the Alaska Highway is resumed.

km 1105.7 Bridge over Lower Rancheria River. The Highway proceeds westward along the deeply incised valley of the Rancheria River that dissects the rugged Cassiar Mountains. A granitic intrusion emplaced in Mesozoic time constitutes the core of the mountain system, and the granitic exposures can be seen from various points along the Highway. The peaks at this, the (northern) end of the Cassiars reach elevations of nearly 2135 m.

km 1128.9 Bridge over Boulder Creek (George's Gorge).

Fiddler Yukon Mine

WOLFRAMITE, QUARTZ CRYSTALS, GALENA, SPHALERITE, CHALCOPYRITE, FLUORITE, SCHEELITE, MICA, MALACHITE, AZURITE, CASSITERITE

In quartz veins cutting crystalline limestone and phyllite

Dark brown blade-like crystal aggregates of wolframite occur in quartz that contains vugs lined with quartz crystals measuring up to 4 cm in diameter. Minerals associated with the wolframite include galena, sphalerite, chalcopyrite, green fluorite, scheelite and greenish mica. Secondary minerals – malachite and azurite – are also present. Tiny crystals of cassiterite have been reported to occur in fractures in quartz.

The deposit was originally staked in 1943 as a tungsten prospect for the Consolidated Mining and Smelting Company of Canada, Limited. The property was acquired by the Yukon Tungsten Corporation Limited in 1951; between 1951 and 1953, the company explored the deposit by trenches and an adit, and installed a mill. There was no production. Native Minerals Limited did further trenching in 1961-62.

The deposit is located at about 1555 m level of a ridge north of Boulder Creek.

Road log from the Alaska Highway at **km 1128.9** (see page 29):

km 0 Proceed north onto a rough road.

4.3 Bridge over Boulder Creek; after crossing the bridge follow the right fork of the road. This part of the road is very steep and 4-wheel drive is required.

8.4 Mine.

Refs.: 55 p. 80-82; 79 p. 16-17.

Maps: (T): 105 B/1 Spencer Creek
105 B Wolf Lake
(G): 44-25A Alaska Highway, Watson Lake to Teslin River, British Columbia and Yukon (1 inch to 4 miles)
10-1960 Wolf Lake, Yukon Territory (1 inch to 4 miles)

km 1162 The Great Divide. The rivers on the west side of the divide, including the Morley and Swift rivers, flow westward into the Yukon River system, while the Rancheria River flows eastward into the Mackenzie River system.

km 1180 Bridge over Seagull Creek.

Seagull Creek Occurrence

TOPAZ, FLUORITE, COLUMBITE, TOURMALINE

In pegmatite

Transparent crystals of topaz have been found in a pegmatite dyke on the north face of a 1800-m mountain on the east side of Seagull Creek. The crystals obtained varied from colourless, light blue, yellow to reddish; some were of gem quality. Specimens from this locality have been acquired by several museums, including the National Museum of Canada. Associated with the topaz are light green fluorite and crystals of black tourmaline and black columbite. The deposit was a small one and is now thought to be exhausted. It was discovered and staked in about 1960 by the late Jack Shields.

The locality is approximately 7 km north of **km 1180.**

Ref.: 114 p. 570.

Maps: (T): 105 B/3 Seagull Creek
105 B Wolf Lake
(G): 10-1960 Wolf Lake, Yukon Territory (1 inch to 4 miles)

km 1188 Road-cut exposes shale and argillite traversed by white quartz veinlets. "Micro" crystals of pyrite and white and colourless gypsum occur along fracture surfaces of the rocks. A rusty powdery coating on the rocks is due to ankerite. Graphite has developed along planes in shear zones.

km 1209 Swan Lake, formed by the widening of Swift River, is on left. Simpson Peak (2175 m), the highest peak of the northern Cassiars, is to the south of Swan Lake.

km 1220 For the next 65 km the Highway is within the Yukon Plateau, an undulating upland area incised by deep interlocking valleys; the rounded hills reach elevations of up to 1525 m. Precambrian and/or Paleozoic limestone, quartzite, greenstone, gneiss and schist outcrop in the vicinity of the Highway between Smart River and **km 1260**, and for the next 19 km the area is underlain by granitic rocks of Mesozoic age. (Ref.: 79 p. 6, 12.)

km 1292 Bridge over Nisutlin Bay.

km 1294 Teslin (formerly Teslin Post). From here to Johnsons Crossing the Alaska Highway is sandwiched between Teslin Lake on the left and the Big Salmon Range on the right. Teslin Lake is 95 km long, 2.5 to 3.2 km wide and 683 m above sea level. The Big Salmon Range with elevations of about 1980 m is part of the Pelly Mountain system. Extending westward from Teslin Lake is an upland formed of rounded summits visible from the Highway. The valley in which the Highway was built is drift-covered.

km 1308 Teslin Lake; Mackinaw Camp site. Jasper and chalcedony occur as pebbles along the shoreline of Teslin Lake.

km 1345 Junction, Canol Road (Highway 6). This road was constructed in 1944 as a World War II military project by the United States Army to service pumping stations along the pipeline that transported oil from the Normal Wells oil fields to Whitehorse. The road was originally 804 km long but the portion from the Yukon border in the Mackenzie Mountains to Camp Canol on the Mackenzie River opposite Norman Wells has not been maintained for travel; the Yukon portion is maintained for summer travel only, and except for Ross River, there are no facilities along the route.

Side trip along Canol Road to Ross River

km 0 Junction, Canol Road and the Alaska Highway; proceed north along the Canol Road. In the first 45 km of its scenic course, the highway cuts through the Big Salmon Range. Between this range and km 180, the highway traverses an area underlain by Precambrian schists, quartzites, slates, marbles, greywacke, greenstone and andesite; these rocks have, in places, been intruded by granitic rocks of Mesozoic age. The latter form the core of the Big Salmon Range and of the mountains to the west of Quiet Lake. Since the highway was built along the heavily drift-covered valleys of the Nisutlin, Rose, and Lapie rivers, rock exposures adjacent to the road are few.

km 16 Mountain pass at 1232 m. The highway begins its descent to the valley of Nisutlin River which it parallels to Quiet Lake.

km 47 Bridge over Sidney Creek. Placer gold was formerly obtained from the gravels of Iron Creek, a tributary of Sidney Creek, 14 km northwest of the bridge.

km 64 Bridge over Cottonwood Creek. Placer gold was obtained from this creek.

km	96	Campsite at Quiet Lake. This lake is 30 km long and up to 3 km wide. To the west of the lake, peaks of the Salmon Range rise to elevations of over 1830 m.
km	100	Mountain pass at 976 m; the 3 km descent to the Rose River valley begins. Placer gold was found prior to 1935 in Brown Creek, which flows into Sandy Lake, about 9 km west of the highway.
km	127	Cirques are visible on the mountains to the west.
km	129	In the course of the next 27 km, the highway passes over a belt of granitic rocks that form the backbone of the high jagged summits of the Pelly Mountains on either side of the road; the mountain peaks reach elevations of over 2135 m.
km	158	Rose Lake on right. Rose Lake and the Lapie Lakes are kettle-holes or depressions that resulted from the melting of stagnant masses of ice during Pleistocene time. An esker extending from the west side of Rose Lake to the west side of the southernmost of the Lapie Lakes is crossed by the highway at km 158. Other examples of glaciation in the area are terraces of sand, gravel and boulders along the valley walls.
km	161	Mountain pass at an elevation of 1098 m.
km km	162- 167	Lapie Lakes on left.
km	180	Sedimentary rocks (shale, sandstone, limestone and dolomite) of Paleozoic age underlie the area between km 180 and km 206, and form the St. Cyr Range of the Pelly Mountains on either side of the road.
km	185	Barite Mountain on left. Barite was found in veins, 30 cm to 3 m wide, traversing Paleozoic limestone on Barite Mountain, 2 to 3 km west of km 185. The barite is white, coarsely crystalline in some places, and finely granular in others. The occurrence is on the southwest side of a steep ravine between an elevation of 1464 m and the top of the mountain (elevation 1860 m).
km	188	Bridge over Fox Creek. Fox Mountain, the crowning peak of the Pelly Mountains at 2405 m is approximately 24 km west of this point.
km	190	Pyrite and galena occur in a quartz vein that cuts a shear zone in shale. The quartz vein is exposed along the road and along the steep bank of Lapie River on the right side of the road.
km	195	Glaicer Creek. The new mineral *lapieite* was originally found in a glacial erratic located along this creek about 100 m upstream from the highway (Ref. 60a).
km	206	The road descends into a northwest-trending trough-like depression known as the Tintina Trench or Tintina Valley. It is about 640 km long and, where crossed by the Canol Road, 13 km wide. It is the result of profound faulting and differential erosion. The Pelly, Stewart, Klondike and Yukon rivers occupy segments of the valley.
km	221	Pelly River. Placer gold was discovered in the Pelly River in 1882. Only fine gold was obtained and the productive streams were those entering the Pelly from the south between Lapie River (9.6 km west of the Canol Road crossing) and Hoole Canyon (29 km east of the crossing).

Plate IX

Atlin Lake looking south from the village. Pebbles of jasper and of serpentine occur on the beach. (GSC 159507)

km 222 Ross River. This settlement, at the confluence of the Pelly and Ross rivers had its beginnings as a trading post.

Ref.: 75 p. 5-7, 11-12, 15, 18, 21-22, 23, 25-26.

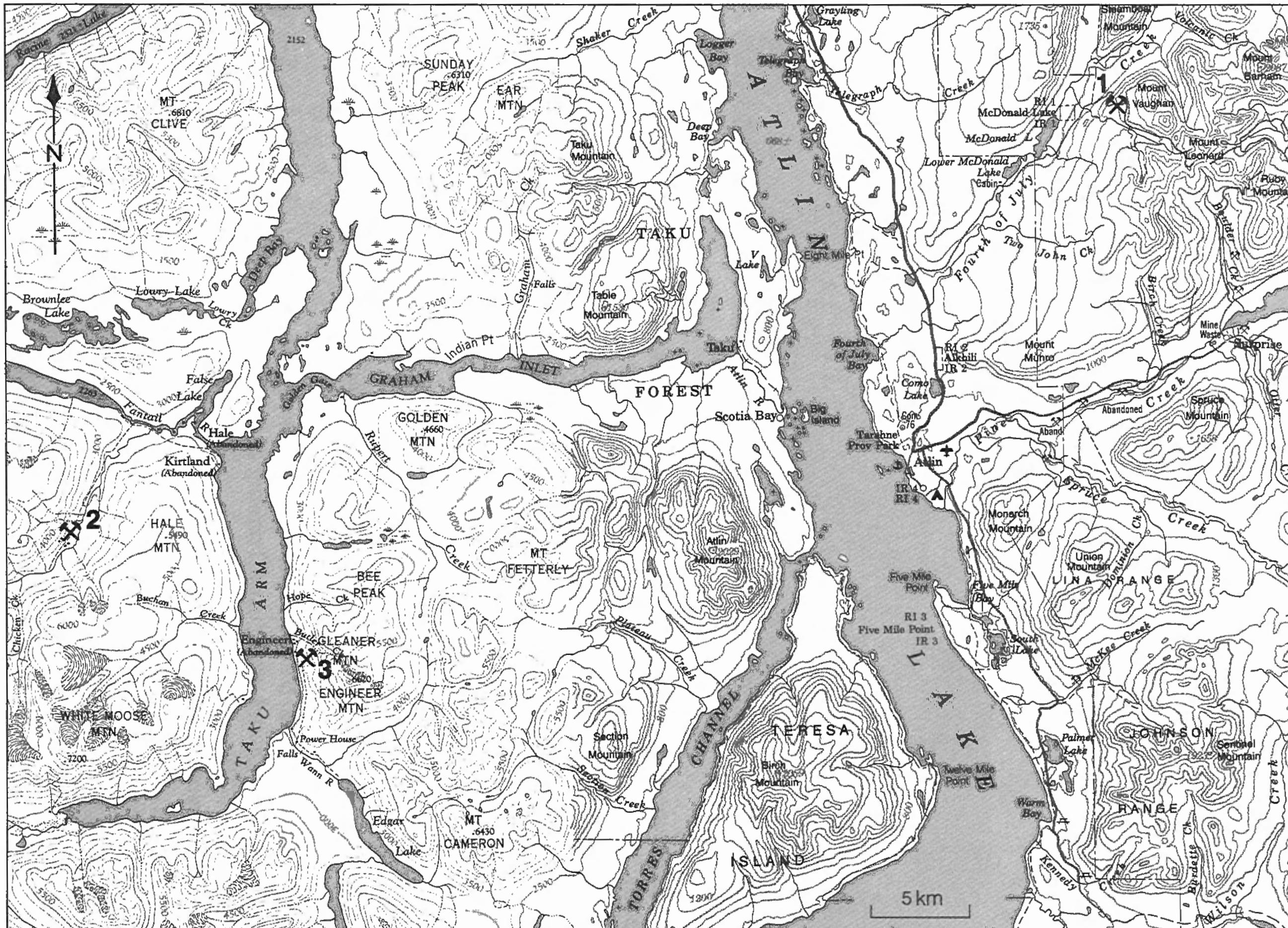
Maps: (T): 105 C Teslin
105 F Quiet Lake
(G): 45-21A Canol Road, Teslin River to MacMillan Pass, Yukon
(1 inch to 4 miles)
1125A Teslin, Yukon Territory, (1 inch to 4 miles)
7-1960 Quiet Lake, Yukon Territory (1 inch to 4 miles)

The main road log along the Alaska Highway is resumed

km **1345.9** Johnson's Crossing and bridge over Teslin River. The Highway, having skirted the Pelly Mountain region, returns to the Yukon Plateau which it follows for the duration of its course in the Yukon. Between Teslin Lake and Whitehorse, its route is along heavily drift-covered valleys separating peaks that rise 600 to 900 m above the valley floors.

km **1393** Junction, road to Atlin (Highway 7).

Parts of 104 N and 104 M



Map 3. Atlin area

1. Atlin-Ruffner Mines 2. Bighorn occurrence 3. Engineer Mines

Side trip to Atlin, British Columbia

km	0	Junction of the Alaska Highway and Highway 7; proceed south along Highway 7.
km	1.6	Junction; take the road on the left to Atlin Lake (road on right leads to Carcross). The entire 95 km road to Atlin Lake is within the Yukon Plateau. The road follows the east shore of Little Atlin Lake, then the valley of Lubock River, and finally the east shore of Atlin Lake. Mountains along the road reach elevations of about 1372 m near Little Atlin Lake, and close to 2135 m at Atlin Lake. Between the Alaska Highway and the northern end of Atlin Lake, the mountains are composed of Paleozoic sedimentary rocks while granitic rocks of Mesozoic age comprise the mountains along the northern half of Atlin Lake.
km	5-8	Road-cuts on left expose buff-coloured, compact limestone. Little Atlin Lake is on right.
km	42	Atlin Lake on right.
km	86.7	Junction, road on left to Fourth of July Creek and to Atlin-Ruffner Mine.
km	88.6	Bridge over Fourth of July Creek.
km	97.3	Atlin, at junction. The road on left leads to the shore of Atlin Lake. The rugged Boundary Ranges of the Coast Mountains form a back drop at the south end of the Lake. Also visible is the giant Llewellyn Glacier that sprawls for a distance of over 30 km from the south end of Atlin Lake to the Alaska border. To continue the road log, turn left at the junction.
km	97.7	Junction. The road straight ahead leads to Surprise Lake; turn right.
km	100.1	Bridge over Pine Creek.
km	113.3	Bridge over McKee Creek. Grey chalcedony and red and greyish jasper pebbles and boulders occur in the bed of the creek.
km	113.4	Road on left leads 1.6 km to the McKee Creek placer gold workings (see page 36).
km	120.3	Warm Bay. Hot springs are located about 6 km by trail south of Warm Bay.

Atlin-Ruffner Mine

GALENA, SPHALERITE, ARSENOPYRITE, CHALCOPYRITE, PYRITE, QUARTZ, CALCITE, ANKERITE

In shear zone in lamprophyre dykes

Galena, sphalerite and arsenopyrite occur with minor chalcopyrite and pyrite in a matrix of quartz, calcite and ankerite.

The deposit has been known since 1901 and was worked between 1921 and 1933; exploration work has since been done by various concerns including Atlin-Ruffner Mines Limited and Interprovincial Silver Mines Limited. The workings consisted of several shafts, adits and open-cuts. Gold, silver, lead and zinc were produced.

The mine is located at the 1190 m level on the northwestern slope of Leonard Mountain; it overlooks Fourth of July Creek. Access is by a rough 16 km road leading east from the Atlin Road at km 86.7 (see page 35).

Refs.: 2 p. 71-72; 3 p. 266-270; 38 p. 15A-24A; 131 p. 202.

Maps: (T): 104 N/12 Atlin
104 N Atlin
(G): 1082A Atlin, Cassiar district, British Columbia (1 inch to 4 miles)

Atlin Placer Deposits

GOLD, IRIDOSMINE, WOLFRAMITE

In placers

Gold has been produced from the stream gravels in the Atlin Lake area since 1898. The gravels of the following streams have yielded gold: Pine, Spruce, McKee, Birch, Ruby, Otter, and Wright creeks, and O'Donnel River. All localities are on the east side of Atlin Lake. Mining was done by pits, shafts and by hydraulic methods. Most of the activity was concentrated on Pine, Spruce and Birch creeks. The largest nuggets were obtained from Spruce and Birch creeks; nuggets weighing 2581 and 1120 g each were recovered from Spruce Creek. Iridosmine was reported from the black sand of Ruby Creek, and wolframite was recovered from Boulder Creek. In the period 1898 to 1945 Pine Creek was the highest producer with a yield of slightly over 4 000 000 kg for a value of 2.25 million dollars. Boulder Creek ranked second with about one half the yield, followed closely by Ruby and McKee creeks. The peak years of production were between 1900 and 1910. The discovery of gold in the Atlin area is credited to two prospectors from Juneau, Fritz Miller and Kenneth McLaren. Both the discovery and initial work were on Pine Creek, but other streams were soon being worked as a result of a prospecting rush that occurred a few months after the original discovery. By 1899 the population of Atlin included about 4,000 miners along with some 1,000 non-miners; various commercial operations owed their existence to the mining boom. The production of gold in the area has declined since 1946 and at present only a few operators work the deposits.

The gold-bearing creeks are indicated on Map 3. The most accessible of the old workings are those of Pine Creek along the road to Surprise Lake.

Road log from Atlin

km	0	Junction at Atlin; proceed east toward Surprise Lake.
km	0.3	Junction; continue straight ahead.
km	5.6	Junction; road on right leads to the Spruce Creek placers. Follow road on left.
km	8.8	Discovery. This is a former gold-mining centre which in the early days was known as Pine City. A few buildings dating back to 1898-99 remain on the site amid gravel tailings of former mining operations.

Refs.: 2 p. 74-77; 5 p. 121-179; 97 p. 80-81.

Maps: (T): 104 N/5 Teresa Island
104 N/11 Surprise Lake
104 N/12 Atlin
(G): 1082A Atlin, Cassiar district, British Columbia (1 inch to 4 miles)

Atlin Lake Occurrence

JASPER, SERPENTINE

Along lake shore

Pebbles of red and brownish red jasper, and of dark green serpentine were noted along the shore of Atlin Lake in the vicinity of Atlin village. The serpentine is veined with chrysotile and contains tiny grains of magnetite.

Maps: (T): 104 N Atlin
(G): 1082A Atlin, Cassiar district, British Columbia (1 inch to 4 miles)

Engineer Mine

GOLD, CALAVERITE, ANTIMONY, PYRITE, CHALCOPYRITE, LIMONITE, QUARTZ CRYSTALS, CALCITE, ALLEMONTITE, ROSCOELITE

In veins cutting shale and greywacke

Native gold in the form of grains, scales and leaves (measuring up to 2 cm in diameter) was formerly mined from this deposit. It was associated with calaverite, native antimony, pyrite, chalcopyrite and limonite in quartz-calcite veins. Slender crystals of quartz were found in vugs and calcite crystals in cavities in the veins. Large reniform masses of allemontite and flaky masses of green roscoelite have been reported from the underground workings.

The mine was originally worked from 1899 to 1906 by the Engineer Mining Company. Although rich pockets of gold were encountered, the mine was never an important producer. It was worked spasmodically until 1952 by various individuals and companies including: Captain James Alexander, Neil Forbes, T.J. Kirkwood and Walter Sweet; Engineer Gold Mines Limited. The property was mined by several tunnels and shafts and a mill was installed at the mine-site. Gold and silver were extracted from the ore.

An occurrence of native gold (flakes measuring up to 30 mm across) on Bighorn Creek was explored by adits in about 1910. Gold is associated with galena, chalcopyrite and pyrite in quartz veins cutting amphibolite.

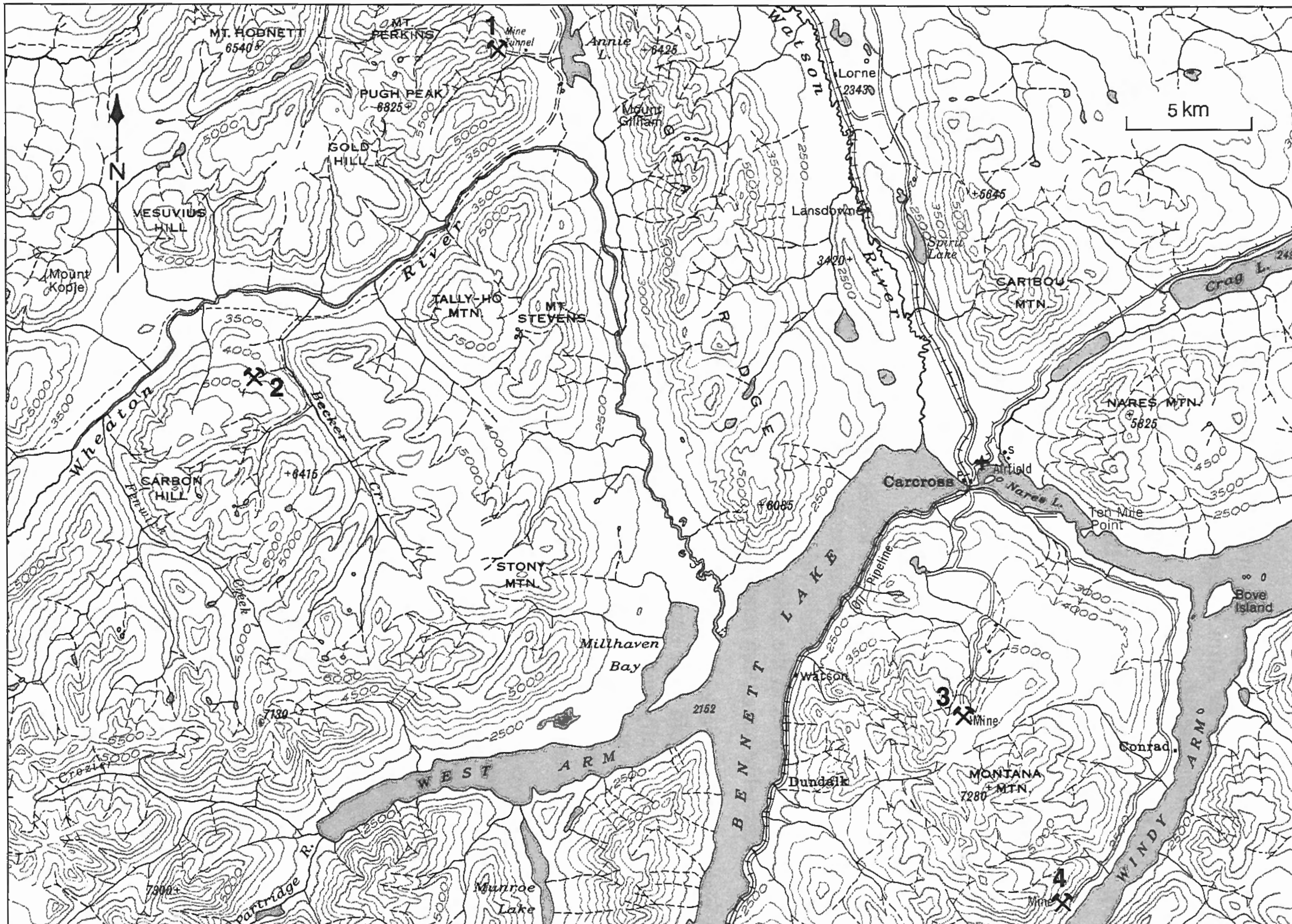
The Engineer Mine is on the east shore of Taku Arm of Tagish Lake, 48 km from Atlin. The workings begin at the shore and extend 800 m eastward. Some of the old buildings remain on the site. Access is by boat from Atlin.

Refs.: 28 p. 74-99; 40 p. 13-14; 54 p. A60-A61; 69 p. C112-C114; 111 p. 95-101; 127 p. A39.

Maps: (T): 104 M/8 Edgar Lake
104 M Skagway
(G): 94 A Taku Arm, Atlin district, British Columbia (1 inch to 4 miles)

This is the last occurrence in the Atlin area; the road log along the Alaska Highway is resumed.

Part of 105 D



Map 4. Carcross area

1. Union Mines 2. Yukon antimony Mine 3. Arctic Caribou Mines 4. Venus Mine

km	**1393**	Jake's Corner; junction, road to Atlin (Highway 7).
km	**1456**	Junction, road to Carcross (Highway 2).

Side trip to Carcross

km	0	From **km 1456** Alaska Highway, proceed south along the Carcross Road.
km	18	Junction, Annie Lake Road to the Union Mines and to Yukon Antimony Mine (see page 40); road log continues straight ahead.
km	50	Junction; road on left leads 53 km to **km 1393** on the Alaska Highway. Continue straight ahead.
km	51.2	Junction; road on right leads to the Arctic Caribou Mine (see page 40). Road log continues along road on left.
km	68.1	Conrad. A few log buildings at the road-side mark the site of a former town that existed during mining activity in the Montana Mountain area. Stores, churches, several hotels and restaurants, and a mining recorder's office served the district. When active mining ceased in about 1912, Conrad became a ghost-town.
km	70.8	Venus Mine mill (on left) on the shore of Windy Arm.
km	72.4	Venus Mine. (See page 41).

Union Mines

GALENA, ARSENOPYRITE, SPHALERITE, PYRITE, CHALCOPYRITE, QUARTZ CRYSTALS

In quartz-calcite veins cutting greywacke

Arsenopyrite and galena are the most common minerals at this former silver-lead mine. The galena occurs in massive form and as aggregates of tiny cubes. Dark brown sphalerite and small amounts of pyrite and chalcopyrite are associated with the galena and arsenopyrite. Vugs in massive quartz are lined with transparent crystals of quartz.

The deposit was staked in 1908 by W.F. Schnabel and Mr. Northrop, and was worked briefly from a 41 m crosscut at the 1067 m level on the east side of Idaho Hill which overlooks Annie Lake. The mine was connected by an aerial tramway to the camp on Schnabel Creek at an elevation of 884 m.

Access is by a steep 1.6 km trail leading west from the Annie Lake road at a point 21.7 km from its junction with the Carcross road at km 18 (see above road log).

Refs.: 27 p. 129-139; 120 p. 135-136.

Maps: (T): 105 D/6 Alligator Lake
105 D/7 Robinson
(G): 1093A Whitehorse, Yukon Territory (1 inch to 4 miles)

Yukon Antimony Mine

STIBNITE, GALENA, SPHALERITE

In shear zone in granitic and volcanic rocks

Stibnite, in massive form and as crystals measuring several cm long, occurs at this property. It is associated with quartz and is also found in a grey to black clayey material. Minor amounts of galena and sphalerite are associated with the ore.

The deposit is located on the east slope of Carbon Hill at an elevation of 1555 m near the head of Conglomerate Creek, a tributary of Becker Creek. The earliest exploratory work on the Carbon Hill deposits was performed in 1893 by two prospectors from Juneau, Frank Corwin and Thomas Rickman, who are also credited with the discovery of the Union Mines. These prospectors died shortly after their discoveries and the exact locations of the deposits were unrecorded. In 1906, the old workings were relocated and staked by H.E. Porter, and a prospecting rush ensued. The deposit was later staked by Theodore Becker and Howard Cochran. Intermittent development work was done exposing the deposit by trenches, stripping and tunnelling. The most recent work was conducted by Yukon Antimony Corporation Limited in 1965-66.

Road log from km 18 (see page 39) of Carcross Road (Highway 5):

km	0	Turn right onto the road to Annie Lake.
km	21.7	Turn-off to Union Mines; continue straight ahead.
km	27.0	Wheaton Creek crossing; from this point the road may be impassable for motor vehicles. The road follows the Wheaton River.
km	37.8	Becker Creek crossing; turn left and proceed along Becker Creek.
km	42.6	The road leaves Becker Creek and turns to the right (west).
km	46.7	Mine.

Refs.: 27 p. 3-4; 31 p. 43-49; 55 p. 52-55; 120 p. 132; 130 p. 380.

Maps: (T): 105 D/3 Wheaton River
105 D/6 Alligator Lake
(G): 1093A Whitehorse, Yukon Territory (1 inch to 4 miles)

Arctic Caribou (Big Thing) Mine

ARSENOPYRITE, PYRITE, GALENA, CHALCOPYRITE, STIBNITE, SPHALERITE, SCORODITE, QUARTZ CRYSTALS

In veins cutting granodiorite

Arsenopyrite, as finely to coarsely crystalline masses, occurs with minor pyrite and galena in quartz veins which in places contain vugs lined with small quartz crystals. Chalcopyrite, stibnite and sphalerite have also been reported. Scorodite is common.

The deposit was worked for gold and silver at various intervals since 1905 when Col. J.H. Conrad commenced work on this and other properties in the Windy Arm area. The original openings consisted of a 137 m inclined shaft and a 708 m adit. The most recent work was done in 1965 by Arctic Gold and Silver Mines Limited (formerly Arctic Mining and Exploration Limited). Some of the old workings were reopened, a new adit was driven and some trenching was done. A mill near the mine commenced production in 1968. Operations ceased in 1971.

The mine is located above timber line at an elevation of about 1708 m on the west side of Sugarloaf Hill, a peak on the north side of Montana Mountain. A rough road that leaves the Carcross Road at km 51.2 (see page 39) leads 6 km to the mill and continues for another 6 km to the mine. Visitors may collect specimens from the dumps, but the underground workings are dangerous and should not be entered.

Refs.: 25 p. 24-25; 55 p. 55-62; 20 p. 127; 131 p. 37.

Maps: (T): 105 D/2 Carcross
(G): 1093A Whitehorse, Yukon Territory (1 inch to 4 miles)

Venus Mine

ARSENOPYRITE, PYRITE, GALENA, SPHALERITE, CHALCOPYRITE, CHALCOCITE, JAMESONITE, MALACHITE, YUKONITE, CERUSSITE

In quartz-carbonate veins cutting volcanic rocks

Arsenopyrite, pyrite and galena are the most common minerals in the deposit; sphalerite, chalcopyrite and chalcocite occur in minor amounts. Jamesonite, malachite, yukonite, cerussite and antimony ochre were found during early mining operations. The arsenopyrite carries values in gold, the galena carries silver.

This deposit was originally exploited by Col. J.H. Conrad in 1905. Ore was obtained from adits driven into the eastern slope of Montana Mountain above Windy Arm (Tagish Lake) and was transported to a mill on the shoreline by an aerial tramway. The ore was then carried by boat to the railway at Carcross. Between 1905 and 1915, 5442 t of ore are reported to have been mined and shipped to smelters. Underground work was resumed in 1966 by Venus Mines Limited. A mill was installed and commenced operations in 1970. The mine was closed in 1971. It is located on Highway 2 at km 72.4 (see page 39).

Refs.: 25 p. 25; 50 p. 62-64; 120 p. 129-130; 131 p. 386.

Maps: (T): 105 D/2 Carcross
(G): 1093A Whitehorse, Yukon Territory (1 inch to 4 miles)

The road log along the Alaska Highway continues.

km	**1455.8**	Junction Carcross Road (Highway No. 5).
km	**1467.1**	Turn-off (right) to Miles Canyon. The Yukon River flows through Miles Canyon, a gorge 915 m long and 27 m wide; in passing through the canyon, the river drops 5 m. The rocks exposed along the almost vertical walls of the canyon are basalt. From the Robert Lowe footbridge that bridges the canyon, the well-developed columnar jointing of the basalt can be observed. Pebbles of nephrite jade have been reported from the gravels of the Yukon River in the vicinity of Miles Canyon (Ref.: 42 p. 38B).
km	**1468.7**	Turn-off (left) to Whitehorse copper mines.

Whitehorse Copper Mines

CHALCOPYRITE, BORNITE, TETRAHEDRITE, CHALCOCITE, CUPRITE, MELACONITE, COVELLITE, NATIVE COPPER, VALERIITE, CHRYSOCOLLA, MALACHITE, AZURITE, BROCHANTITE, POSNJAKITE, PYRITE, MAGNETITE, HEMATITE, MOLYBDENITE, PYRRHOTITE, ARSENOPYRITE, STIBNITE, GALENA, SPHALERITE, EPIDOTE, GARNET, DIOPSIDE, PLAGIOCLASE, SERPENTINE, TREMOLITE-ACTINOLITE, CALCITE, SCAPOLITE, WOLLASTONITE, STILBITE, LAUMONTITE, CHABAZITE, VESUVIANITE, TALC, ARAGONITE, CHLORITE, QUARTZ CRYSTALS, JAROSITE, GOETHITE, TITANITE, PEROVSKITE, ORTHOCLASE, ZOISITE

In a skarn zone at the contact of limestone and granitic rocks

Chalcopyrite and bornite are the chief ore minerals of the Whitehorse copper deposits which consist of a number of properties that extend along a northwest-trending belt for 30 km, from the Cowley Lakes to Porter Creek. Other copper minerals associated with the deposits are tetrahedrite, chalcocite, cuprite, melaconite, covellite, native copper and valeriite. Colourful specimens of secondary copper minerals can be found on the dumps; included are: chrysocolla, as bright blue and bright green porcelain-like crusts and botryoidal encrustations; malachite, as dull to bright green finely granular and acicular aggregates; azurite, as bright blue powdery coatings; brochantite, as bright green crusts; posnjakite, as greenish blue powder. The brochantite was found at the War Eagle Mine, the posnjakite at the Copper King Mine. Metallic minerals are: pyrite, magnetite, hematite (specularite), molybdenite, pyrrhotite, arsenopyrite, stibnite, galena and sphalerite. Of these, magnetite and hematite are the most common. A number of nonmetallic minerals occur in the skarn zone. The most abundant are light yellow to yellowish green prismatic crystals and crystalline aggregates of epidote, yellowish to reddish brown massive garnet, green diopside, plagioclase, yellowish green to olive-green serpentine, grey and light to dark green tremolite-actinolite and white and salmon-pink calcite. Scapolite, as white columnar aggregates (fluoresces pink under "short" ultraviolet rays), and wollastonite, as colourless to light yellow and white prismatic aggregates, are less abundant. The following have also been identified from the deposit: stilbite, as colourless and white, radiating blade-like and botryoidal aggregates; laumontite, as white, striated flat crystal aggregates on feldspar; chabazite, as tiny transparent rhombs in cavities in a garnet-epidote matrix; vesuvianite, in light brown transparent massive form; talc, as white flaky masses; aragonite, as a white waxy crust on garnet and pyroxene; dark green chlorite; "micro" crystals of colourless quartz in cavities; colourless to light brown mica; yellow powdery jarosite; rusty brown powdery goethite; titanite, as dark brown grains associated with garnet; perovskite (rare), as shiny black grains in serpentine and calcite; and pink orthoclase. Attractive pink massive zoisite was found in the dumps of the Little Chief mine; it is intimately associated with white plagioclase and green pyroxene, producing a mottled effect. It takes a good polish and can be used for jewellery. Blotches of brown garnet are scattered throughout this rock. Massive greenish yellow serpentine speckled with magnetite grains also occurs at the Little Chief Mine; it is suitable for ornamental purposes. At the Pueblo Mine dumps, specimens of specular hematite and of secondary copper minerals (chrysocolla, malachite) are abundant. Wollastonite, garnet and serpentine (yellow-green, olive-green, amber) are common in the dumps of the Copper King Mine.

Outcrops of copper-bearing rocks in the Whitehorse copper belt where first noted by miners en route to the Klondike during the gold rush of 1897. The first claim was staked in 1898 by Jack McIntyre on the Copper King deposit. Other claims staked in 1898 were the Ora by John Hanly, the Anaconda by W.A. Puckett, and the Big and Little Chief by Wm. McTaggart and Andrew Oleson. In 1899, the Pueblo, Best Chance, Arctic Chief, Grafter, Valerie, War Eagle and others were claimed, and development of the Copper King, Anaconda and Pueblo commenced. The first shipment of ore was made in 1900 by Messrs McIntyre and Granger from the Copper King

Plate X

Miles Canyon, Yukon River; basalt is exposed along the vertical canyon walls. (GSC 159528)

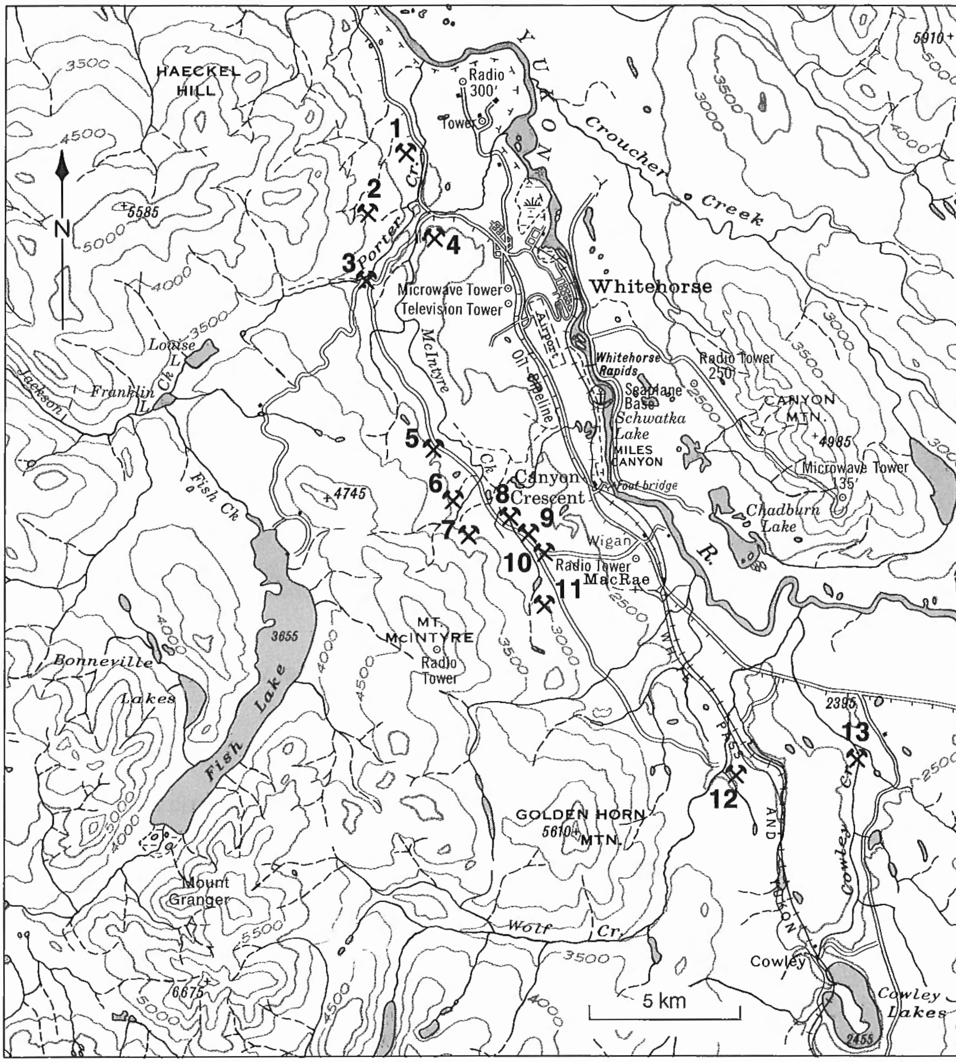
Mine. In the next four years, production was also recorded from the Valerie and Arctic Chief mines, and development work was performed on several other properties. A 20 km railway spur was built in 1909 from McRae to the Pueblo Mine to connect the mines to the White Pass and Yukon Railway. Production was recorded from the mines from 1929 to 1930. In 1963, New Imperial Mines Limited (renamed later as Whitehorse Copper Mines Limited) commenced work on several of the old properties; work consisted of open pits at the Little Chief, Arctic Chief, Black Cub and War Eagle properties, and underground development of the little Chief and Middle Chief orebodies. A mill near the Little Chief Mine began operations in 1967, and a road was built connecting it to the War Eagle pit. Operations closed at the end of 1982 due to ore exhaustion.

The mill is located 3.7 km by road from **km 1468.7** of the Alaska Highway (see page 41).

Road log to Copper King Mine and Pueblo Mine from **km 1479** of the Alaska Highway:

km	0	Junction of the Alaska Highway and the road to Fish Lake; proceed onto road to Fish Lake.
km	1.3	Copper King Mine on left just before the bridge over McIntyre Creek.
km	4.2	Intersection; continue straight ahead.
km	4.5	Junction; turn right.
km	4.7	Pueblo Mine.

Part of 105 D



Map 5. Whitehorse copper belt properties.

1. Anaconda
2. War Eagle
3. Pueblo
4. Copper King
5. Best Chance
6. Grafter
7. Arctic Chief
8. Big Chief
9. Middle Chief
10. Little Chief
11. Valerie
12. Keewenaw
13. Cowley Park

Refs.: 39 p. 48-49; 50 p. 49-54; 55 p. 50-51; 57 p. 33-39; 88 p. 1-3, 20-58; 120 p. 137-142; 131 p. 267-268.

Maps: (T): 105 D/10 MacRae
105 D/11 Whitehorse
105 D/14 Upper Laberge
(G): 1093A Whitehorse, Yukon Territory (1 inch to 4 miles)
49-1962 Whitehorse Copper Belt (1 inch to 1 mile)

km 1476 Turn-off to Whitehorse. The city of Whitehorse is situated in the broad valley of the Yukon River. Here, the valley is about 6 km wide and is bordered on the east by a long limestone ridge known as Canyon Mountain which reaches an elevation of 1520 m above sea level. On the west side, are granitic peaks with elevations of about 1677 m, including Golden Horn Mountain, Mount McIntyre and Haeckel Hill. (The treeline is at 1311 m above sea level). Between these ridges and the Yukon River, deposits of silt and boulder clay form walls that are remnants of the valley occupied by the Yukon River in preglacial times. After the ice retreated, the river incised the old valley floor to a depth of 61 m and resumed its course along the old channel except for a section above Whitehorse, from Miles Canyon to the Whitehorse Rapids, where it cut a new channel through basalt (Ref.: 88 p. 3-6).

The section of the Yukon River from Marsh Lake to Lake Laberge was formerly known as the Lewes River; in 1949 it was officially named the Yukon River by the Canadian Board on Geographical Names. The name Yukon was first applied in 1846 by Mr. J. Bell of the Hudson's Bay Company to the portion below the mouth of the Porcupine River at Fort Yukon as it was the name used by the local Indians. The portion above Fort Yukon was referred to as the Pelly or the Lewes; in maps resulting from an expedition on the Yukon River in 1883, explorer Frederick Schwatka referred to the river from its mouth to its source as the Yukon. The Yukon, being navigable from the Bering Sea to Whitehorse Rapids played a vital role in early exploration and was used by stern-wheel steamers to transport supplies to Dawson during the Klondike gold rush and until 1948 when the Alaska Highway was completed. The distance from Whitehorse to Dawson is 724 km and to the Bering Sea, 3253 km (Ref.: 42 p. 14B-21B; 88 p. 3).

Whitehorse Rapids Occurrence

ARAGONITE, CALCITE, OLIVINE

In basalt

Vesicles in basalt contain white radiating tufts of acicular aragonite crystals and white botryoidal calcite. Dog-tooth crystals of calcite occur with the botryoidal calcite, and brownish yellow olivine occurs as small masses in the amygdules.

The basalt is exposed along the Yukon River at the rapids at the Whitehorse power dam in Whitehorse.

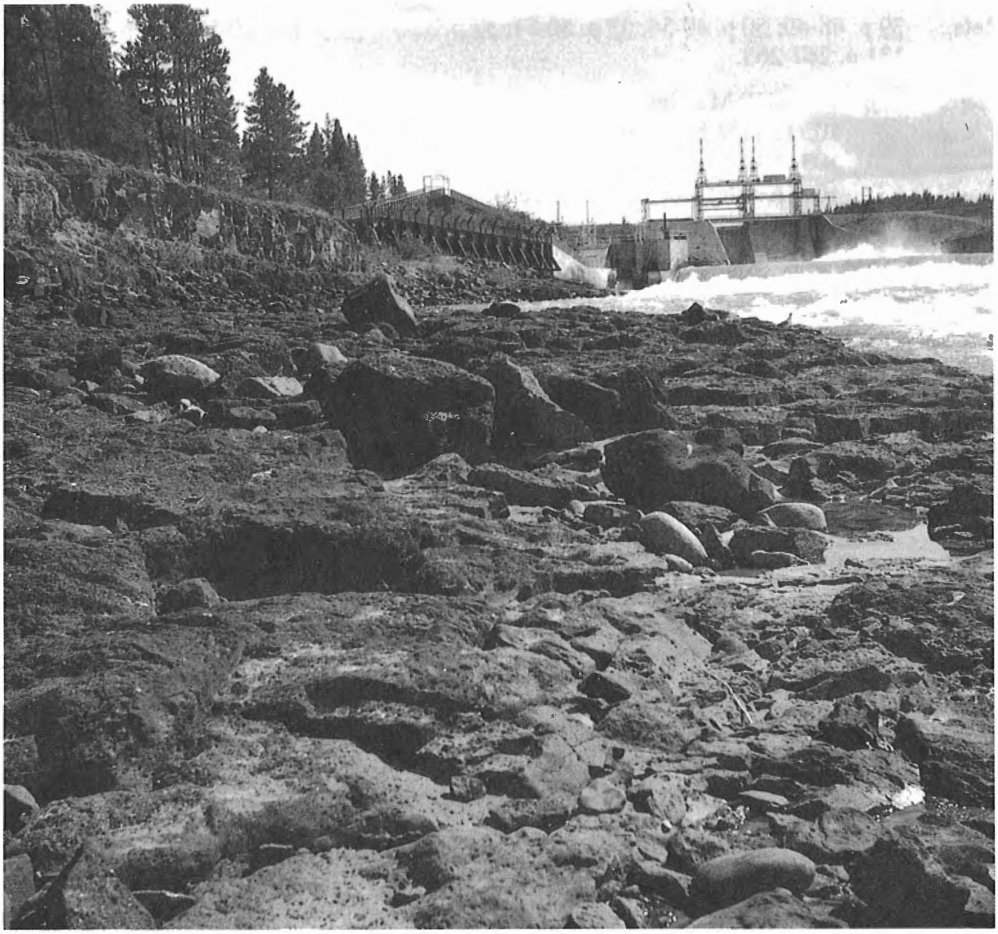


Plate XI

Amygdaloidal basalt exposures on Yukon River at Whitehorse Rapids. (GSC 159529)

Maps: (T): 105 D/11 Whitehorse
(G): 1093A Whitehorse, Yukon Territory (1 inch to 4 miles)

km	**1479**	Junction (left), road to Fish Lake. Access to the Pueblo and Copper King mines is from this junction.
km	**1480**	Junction (left), road to War Eagle Mine. The mine is 2.2 km from this point.

Road-cut at km 1480

MALACHITE, CHRYSOCOLLA, AZURITE, BORNITE, MOLYBDENITE, GARNET, SERPENTINE

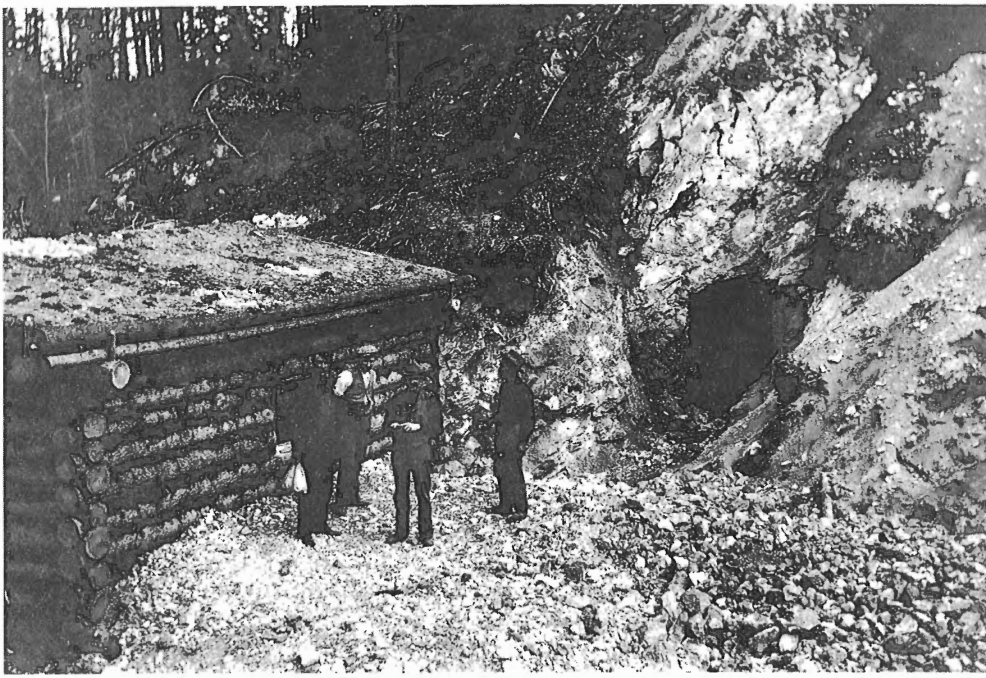


Plate XII

Copper King Mine, Whitehorse, c. 1900. (National Archives of Canada/PA 122786).

In limestone

Vividly coloured secondary copper minerals occur midway up a steep road-cut which marks the northern extension of the Whitehorse copper belt (see page 42). This occurrence is part of the Anaconda property. The copper minerals include: malachite, as bright green radiating fibres forming tiny hemispheres; chrysocolla, as light blue finely fibrous and blue-green finely granular masses; azurite, as bright royal blue finely fibrous and granular aggregates; and massive bornite. Molybdenite, light brown massive garnet and greenish yellow to dark green massive serpentine are associated with the copper mineralization. The road-cut is about 80 m beyond the junction at **km 1480**.

Maps: (T): 105 D/14 Upper Laberge
(G): 1093A Whitehorse, Yukon Territory (1 inch to 4 miles)

km 1488 Junction Klondike Road (Highway 2). At about this junction, the Alaska Highway leaves the Yukon River valley and, as it proceeds westward along the valley of the Takhini River, the northern extension of the Boundary Ranges (elevations to 2135 m) of the Coast Mountains is visible to the south, and the south end of the Miners Range (elevations to 2045 m) can be seen north of the Highway. The route is within the Yukon Plateau, an upland area that is cut by valleys and that encloses some mountain ridges; it follows the old Whitehorse-Kluane wagon road built in 1904. For the road log along the Klondike Road see page 74.

km **1506** This point marks the crossing of the old Dawson road over Takhini River. The old Dawson road followed the west side of the Miners Range and was joined by the present Whitehorse-Stewart Crossing Road at **km 95**.

km **1522.6** Bridge over Takhini River.

km **1541** Junction, road to Kusawa Lake. Takhini River and Kusawa Lake form the northern border of the Boundary Ranges that extend southeastward along the east side of the British Columbia-Alaska border to Stewart. Granitic rocks form the core of these mountains.

On the north side of the Highway, deposits of sand and gravel are exposed along the lower slopes of the mountain ridges; these deposits are remnants of an old shoreline of a glacial lake that developed from glacial meltwaters towards the close of Pleistocene time when glacial ice covered the entire region except for peaks above 1830 m. As the Highway continues its course westward to Haines Junction, deposits of stratified silts can be seen along road-cuts and river banks. These deposits settled at the bottom of a glacial lake (upon which the Highway has been constructed) and were deeply incised by several streams including Mendenhall, Aishihik and Dezadeash rivers. A conspicuous white layer of volcanic ash can be observed at numerous places along the sides of the Highway and near the surfaces of road-cuts and of stream banks (Ref.: 76 p. 14-17).

km **1557** Bridge over Mendenhall River.

km **1567** Champagne, at the intersection of the historic Dalton Trail, formerly used by miners en route to the Klondike during the gold rush. This trail leads south along Dezadeash Lake and thence to Haines, Alaska; north from Champagne it follows the valley of Nordenskiold River and connects to the Whitehorse-Stewart Crossing Road at **km 23**. Champagne was established as a trading post in 1902 and is now an Indian community. It is situated on the west side of a north-trending ridge 6 km long, 500 to 1500 km wide and 30 to 60 m high. The ridge is composed of sand, gravel, and boulders, and is believed to be a terminal moraine formed by the retreat of a glacier. It is mantled by sand dunes resulting from Recent geological activity. Indian artifacts have been found in the dunes south of the village. The Alaska Highway traverses the moraine across its width. (Ref.: 76 p. 3, 8, 20, 24.)

km **1602** Junction, Aishihik Road. This road leads north along the valley of Aishihik River and to the northern end of Aishihik Lake. Otter Falls, a scenic attraction on the Aishihik River 27 km from this junction, is a picturesque scene that resembles the one formerly featured on the Canadian five dollar currency. At the falls, the water tumbles over granitic rocks at the outlet of the Aishihik River on Canyon Lake. The rounded hills forming a backdrop to the falls rise to elevations of about 1525 m and are composed of metamorphic and granitic rocks.

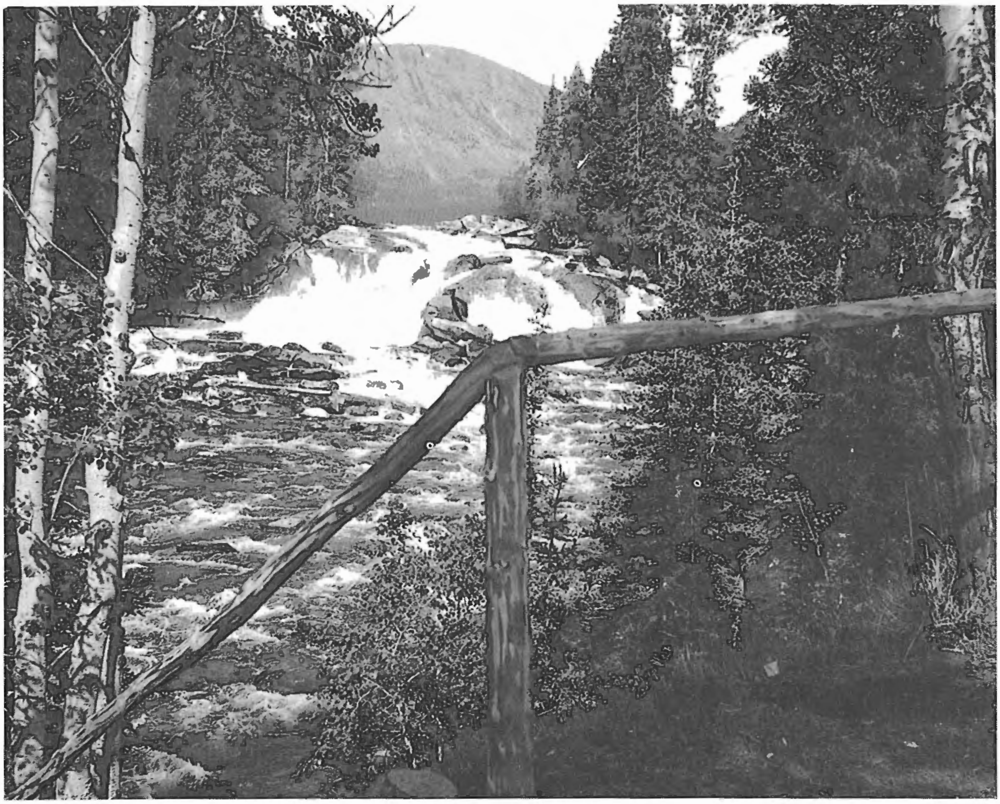


Plate XIII

Otter Falls, Aishihik River. (GSC 159485)

Aishihik Lake Area Occurrences

AGATE; CHALCOPYRITE, MALACHITE

In basalt; in skarn

Pale blue agate occurs in geodes in basalt at localities immediately north of Vowel Mountain (61°17′N, 136°58′W), and on the east flank of Mount Cooper (61°14′N, 136°09′W). The geodes are reported to weather readily from the basalt. Vowel Mountain is located on the west side of Nordenskiold River about 48 km east of Aishihik Lake, and Mount Cooper is on the south side of the river, about 32 km east of the south end of Aishihik Lake.

Colourful chalcopyrite and malachite specimens are found in skarn near Hopkins Lake (61°17′N, 136°58′W).

Ref.: Pers. Comm., D.J. Tempelman-Kluit (G.S.C.)

Maps: (T): 115 H/1 Mount Cooper
115 H/7 Hopkins Lake
115 H/8 Vowel Mountain
(G): 192 A Aishihik Lake area, Yukon (1 inch to 4 miles)

km	**1620**	Bridge over Marshall Creek. Small grains of pink garnet occur in biotite schist occurring as pebbles along the bed of the creek. The rock is derived from the metamorphic rocks forming the Ruby Range on the north side of the Highway.
km	**1635**	Haines Junction, at the junction of Haines Road (Highway 3).

The Haines Road

The Haines Road links the Alaska Highway to the Pacific Ocean at Haines, Alaska. It passes through parts of Yukon Territory, British Columbia and Alaska.

Road log along the Haines Road:

km	0	Junction Haines Road and the Alaska Highway at **km 1635**. The Haines road is within the Shakwak Valley to km 63, and is bound on the west side by the Kluane Ranges to km 82.
km	11	Junction, bush road on left to Kathleen River asbestos occurrence (see page 52).
km	25.4	Bridge over Kathleen River.
km	27.3	Junction, road on right to Johobo Mine (see page 52).
km	27.7	Junction, road to Kathleen Lakes. A valley glacier emanating from Lowell Glacier (in the St. Elias Mountains) entered the Shakwak Valley in Pleistocene time via Kathleen Lake. The ice-carved basin of this lake was later dammed by the deposition of sand and gravel at the mouth of Victoria Creek resulting in the formation of two lakes – the Kathleen Lakes. The larger of the two is near the Haines Road, and the smaller is west of it (Ref.: 76 p. 14). The Kluane Ranges on either side of the lakes reach elevations of about 2290 m above sea level.
km	38	The road parallels the west side of Dezadeash Lake for the next 16 km.
km	54.7	Junction, road on right to Shorty Creek and Beloud Creek placer deposits. (See page 52).
km	58	The ridges along both sides of the road are eskers composed of gravel, sand and boulders left by glaciers.
km	63	From about this point to Haines, the highway more or less follows the old Dalton Trail, a pack trail cut by Jack Dalton in the 1890s. It was an overland route to the Klondike.
km	65.1	Junction, road on left to Klukshu village. For the next 16 km the Haines Road parallels Klukshu River which separates the Kluane Ranges from the Boundary Ranges of the Coast Mountains. A batholithic mass of granitic rocks of Cretaceous age underlies the Coast Mountains (Ref.: 76 p. 25). The Boundary Ranges extend south to Stewart, British Columbia.
km	85.3	Junction, road on right to Silver Creek and Squaw Creek placers (see page 52) and to Dalton Post, a trading post established in 1892 on the Tatshenshini River by Jack Dalton, explorer and pioneer.

km	92	Eskers (narrow ridges of sand and gravel) lie along the road; they are 15 to 30 m high and up to 3 km long, and form parallel clusters on the west side of the road.
km	95	For the next 22 km, the road follows the broad, drift-filled valley of Tatshenshini River which separates the Alsek Ranges of the St. Elias Mountains on the west side of the road from the Boundary Ranges on the east side. This river as well as succeeding river valleys that the Haines Road parallels to Alaska, has entrenched its course in a northwest-trending plateau, the Duke Depression, which extends from Alaska to and along the southwestern side of the Kluane Ranges.
km	105	Yukon-British Columbia border.
km	114.2	Junction, road on right to Squaw Creek placers. From this point to Rainy Hollow, the Dalton Trail follows an old footpath used by the Chilkat Indians as a trade route from Klukwan, Alaska to the Yukon.
km	115	For the next 15 km most of the area traversed by the highway is untimbered; the elevation ranges from about 884 to 915 m above sea level. A similar stretch is encountered between km 146 and km 167.
km	132	The highway crosses a gravel fan with abandoned stream channels built up by Datlasaka Creek and the headwaters of Nadahini Creek. Kelsall Lake is on the east side of the highway, and 2379 m Mount Kelsall at its northeastern end is the highest peak along the British Columbia portion of the highway. The Datlasaka Range (Alsek Ranges) on the west side of the road contains numerous large glaciers.
km	138	The remaining section of the Haines Road is entirely within the Alsek Ranges, the southeastern front of the St. Elias Mountains. Their peaks, mantled with ice and snow, reach elevations close to 2745 m.
km	151	Chilkat Pass, at an elevation of 1065 m above sea level.
km	164	Three Guardsmen Pass and Three Guardsmen Mountain (on left) with its three granite peaks reaching elevations of over 1830 m.
km	167	From this point to about km 175, the highway passes through Rainy Hollow, a broad forested depression occupied by Klehini River and its tributary, Seltat Creek.
km	172.2	Junction, road (on right at hairpin turn) to Mineral Mountain-Copper Butte mines (see page 53). From about this junction to km 193, the road parallels the valley of Klehini River. Gold was found in the gravels of the river, but not a paying quantities (Ref.: 119 p. 39).
km	191	British Columbia-Alaska boundary at Pleasant Camp.
km	256	Haines, Alaska.

Maps: (T): 115 A Dezadeash
114 P Tatshenshini River

Kathleen River Asbeston Occurrence

ASBESTOS, SERPENTINE

In peridotite

Slip-fibre asbestos occurs with massive serpentine in peridotite; the fibre is commonly 1 cm long but occurs up to 5 cm in length.

The deposit is located at an elevation of 839 m between two knolls situated 4 km northwest of Kathleen River at the mouth of Quill Creek. Asbestos float was discovered there in 1953 by V. Noble of Whitehorse. The deposit was exposed by trenches and bulldozer cuts.

Access is via a bush road, 10.5 km long, leading east from the Haines Road at km 11 (see page 50).

Ref.: 57 p. 29-31.

Maps: (T): 115 A/11 Kathleen Lakes
(G): 1019 A Dezadeash, Yukon Territory (1 inch to 4 miles)

Johobo Mine

BORNITE, CHALCOPYRITE, PYRITE, MALACHITE, CHALCOCITE

In faults and shear zones in andesite

Bornite and chalcopyrite occur as lenses, veinlets, and disseminated grains in andesite. Minor amounts of pyrite, malachite and chalcocite are associated with the copper ore minerals.

Bornite was discovered at an elevation of 1083 m on the south side of Bornite Creek (5.6 km southwest of Kathleen Lakes) in 1953 by Dr. E.D. Kindle of the Geological Survey of Canada during a geological investigation of the area. It was staked by H. Honing and associates in 1958; small-scale mining was conducted in 1958-59. A similar deposit was discovered by Honing in 1959 at a locality 3915 m north of Bornite Creek. In the same year, Johobo Mines Limited operated the deposit and shipped 680 t of ore averaging about 15 per cent copper. A further shipment to Japan of 7011 t of ore averaging 26.5 per cent copper and 62 g of silver per tonne was made in 1961. The ore was mined from open-cuts. In 1961 the property was optioned to Dominion Explorers Limited which explored the deposit with two adits and diamond-drilling.

A 29 km truck road connects the mine to km 27.3 (see page 50) on the Haines Road; it follows the south side of the Kathleen Lakes, crossing Goat and Victoria creeks.

Refs.: 76 p. 57-58; 105 p. 28-30; 106 p. 27-29.

Maps: (T): 115 A/5 Cottonwood Lakes
115 A Dezadeash
(G): 1019A Dezadeash Yukon Territory (1 inch to 4 miles)

Dezadeash Area Placers

GOLD, COPPER

In placers

Placer gold has been recovered intermittently from the streams southwest of Dezadeash Lake since 1898. It was discovered by miners travelling along the Dalton Trail to the Klondike in the 1890s. Gold was recovered from Tatshenshini River and its tributaries, Silver and Squaw

(Dollis) creeks; from Beloud, Victoria, Goat and Shorty creeks; from Bates River and its tributaries, Iron and Wolverine creeks; and from Mush and Shaft creeks. The most productive creeks have been Shorty, Beloud and Squaw creeks. Coarse gold was found on Squaw Creek in 1927 by Paddy Duncan of Klukshu. In a prospecting rush that followed, a number of claims were staked and worked by Indians from Klukshu and Champagne. In the British Columbia portion of the creek, numerous nuggets weighing 124 to 280 g were found; one nugget weighing a little over 1430 g was found in 1937 by E. Peterson and B. Turbitt. At Beloud Creek, copper nuggets ranging in weight from a few grams to 12.6 kg were recovered by B. Beloud of Whitehorse during placer operations in 1938-39.

Access to the Shorty Creek and Beloud Creek placers is by a road leading west from km 54.7 (see page 50) on the Haines Road; to the Silver Creek, Squaw Creek and Tatshenshini River placers by the road leading to Dalton Post from km 85.3 (page 50) on the Haines Road. An alternate road to Squaw Creek leaves the Haines Road at km 114.2.

Since panning is prohibited on staked claims, the status of the placers should be determined by consulting the Mining Recorder, Indian and Northern Affairs Canada at Whitehorse, or the Gold Commissioner, Department of Energy, Mines and Petroleum Resources at Victoria.

Ref.: 76 p. 48-54.

Maps: (T): 114 P Tatshenshini River
115 A/6 Mush Lake
115 A/3 Dalton Post
115 A Dezadeash
(G): 1019A Dezadeash, Yukon Territory (1 inch to 4 miles) Squaw Creek-Rainy Hollow Area, northwestern British Columbia (B.C. Dept. Mines, Petrol. Res., 1 inch to 2 miles)

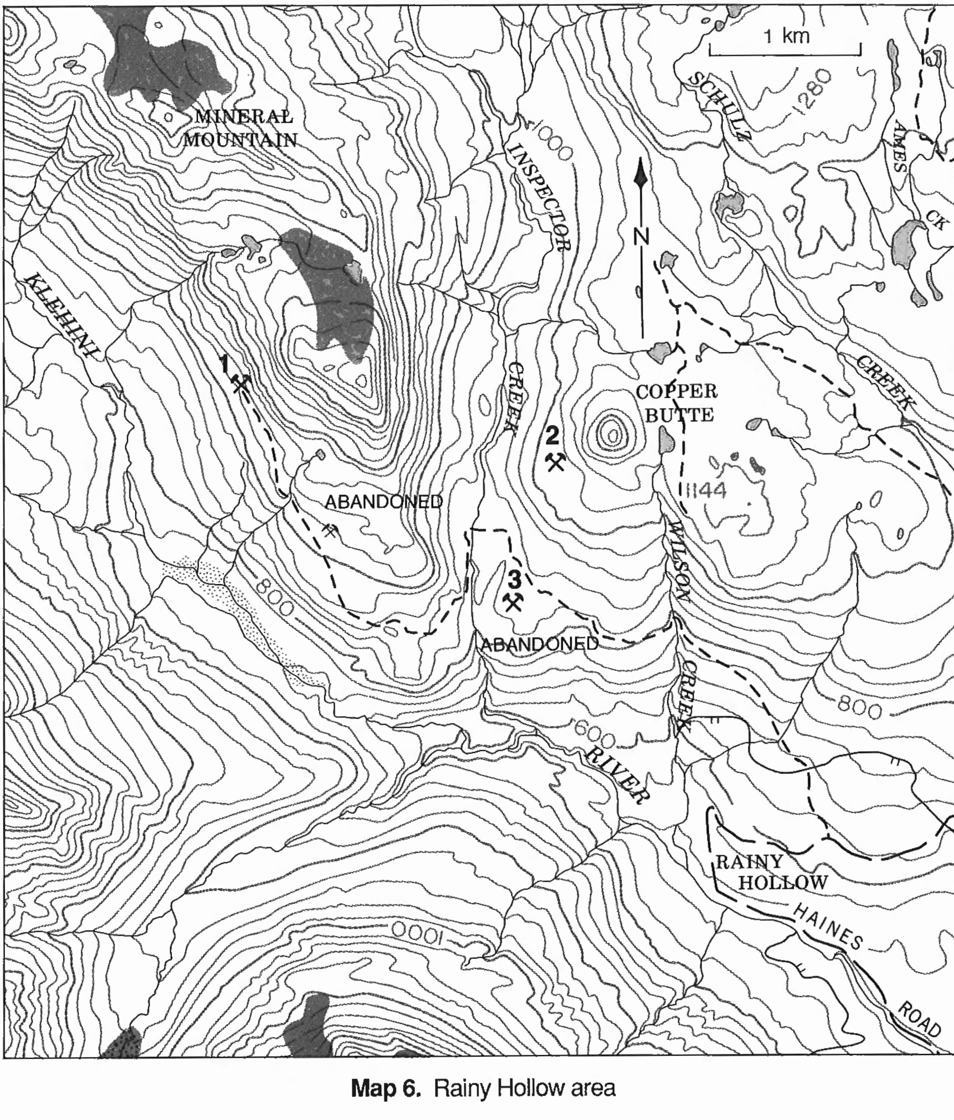
Mineral Mountain-Copper Butte Mines

BORNITE, CHALCOCITE, CHALCOPYRITE, SPHALERITE, GALENA, MAGNETITE, WITTICHENITE, PYRRHOTITE, PYRITE, COVELLITE, MALACHITE, AZURITE, GARNET, MONTICELLITE, ZOISITE, WOLLASTONITE, DIOPSIDE, CLINOZOISITE, VESUVIANITE, ANORTHITE, GAHNITE, TITANITE, CALCITE

In a skarn zone at the contact of marble with argillite, quartzite, gneiss or schist

Copper-silver and lead-zinc mineralization occurs in deposits on Mineral Mountain and on Copper Butte located northwest and north respectively of the hairpin turn at km 172.2 (see page 51) on the Haines Road. The ore minerals are bornite, chalcocite, chalcopyrite, sphalerite (dark brown to black) and galena; they occur as veinlets, lenses and disseminations in skarn. Magnetite, wittichenite, pyrrhotite, covellite and pyrite are associated with the ore, and malachite and azurite form stains and crusts on the copper minerals. The minerals comprising the skarn include yellowish green and brown garnet (andradite), white monticellite, medium to dark green zoisite, white to grey wollastonite, white diopside, light brown clinozoisite, pink and green vesuvianite, anorthite, blue gahnite, titanite and calcite. Most of the skarn rock is medium-grained. The small, high-grade deposits were explored on the steep southwest side of Mineral Mountain and on the west side of Copper Butte; the former is a long, iron-stained ridge with an elevation of 1562 m above sea level, the latter a low rounded dome.

Copper float was found at Rainy Hollow near the Dalton Trail in 1898 by miners enroute to the Klondike. Numerous claims were staked in that and in the following year on Mineral Mountain and Copper Butte. Exploration of the deposits continued from about 1908 to 1922, and shipments of lead-silver ore were made from the Maid of Erin Mine between 1911 and 1922, Part of 114 P/10



Map 6. Rainy Hollow area

1. Maid of Erin Mines 2. State of Montana Mine 3. Victoria Mine

and from the State of Montana Mine in 1908 and 1909. Most of the work was done on the Maid of Erin Mine which yielded 349.46 kg (77.658 pounds) of copper, 181921 g (5,849 ounces) of silver and 187 g (6 ounces) of gold from 142 t of sorted ore. The mine, located at an elevation of 1100 m on the steep southwestern slope of Mineral Mountain, consisted of an incline, two short adits,a vertical shaft and open cuts. A trial shipment of a few t of ore was made from the State of Montana Mine located at an elevation of 1067 m at the western base of Copper Butte; the workings consisted of a trench, open cuts and an adit. Both the Maid of Erin and State of Montana mines are above timberline. The Victoria Mine, about 800 m south of the State of Montana Mine, was explored by an adit and surface cuts; shipments were not recorded from this nor from several other properties in the area.

Access to the mines is by an overgrown old tractor road that leaves the Haines Road at the hairpin bend at km 172.2 (see page 51). About 3 km from the junction, the road forks; one fork crosses Inspector Creek and continues 2.5 km to the Maid of Erin Mine, the other leads northeast for a distance of 800 m above timberline to the State of Montana Mine. The Victoria Mine is on the northeast side of the trail just before reaching the fork.

Refs.: 89 p. 30-32; 119 p. 11-13, 10-57.

Maps: (T): 114 P/10 Nadahni Creek
114 P Tatshenshini River
(G): Squaw Creek-Rainy Hollow area, northwestern British Columbia (B.C. Dept. Mines, Petroleum Resources,1 inch to 2 miles)

The Polaris-Taku Mine, the Tulsequah Chief Mine and the Big Bull Mine are located in the Taku River area, northwestern British Columbia and are accessible by air or by a water route from Juneau. The descriptions of them follow.

Polaris-Taku Mine

ARSENOPYRITE, PYRITE, STIBNITE, PYRRHOTITE, MAGNETITE, FUCHSITE

In sheared volcanic rocks

Gold-bearing arsenopyrite and pyrite are finely disseminated in quartz-carbonate veins; the arsenopyrite commonly occurs as needle-like crystals. Stibnite occurs as coarse bladed crystals. Small amounts of pyrrhotite and magnetite are associated with the arsenopyrite and pyrite. Fuchsite, a green chrome mica, is a conspicuous constituent of the veins.

The Polaris-Taku Mine is a former gold producer. The deposit was discovered and staked in 1929 by Art Hedman, Ray Walker, Ray Race and associates of Juneau. Initial exploration of the property was conducted by the N.A. Timmins Corporation in 1930-32 and by the Alaska Juneau Gold Mining Company in 1932-34. In 1936, the Polaris-Taku Mining Company Limited acquired the property and brought it into production in 1937. Operations were suspended in 1942, reopened in 1946, and closed in 1950. The mill was installed in 1937. The mine was developed by four adits at elevations of 177 m, 111 m, 75 m and 41 m above sea level, and by a shaft sunk from the adit at the 75 m level. It produced 7 203 579 g of gold, 365 771 g of silver and 79 853.5 kg of copper.

The mine is on the southern slope of Whitewater Mountain in the Coast Mountains of British Columbia. It is on the west side of Tulsequah River about 10 km upstream from its mouth on Taku River which in turn is about 95 km via the Taku River and Taku Inlet from Juneau. A 10 km road along the west side of Tulsequah River connected the mine to Taku River; during mining operations, barges transported the concentrates from the end of the road to deep-sea freighters at the head of Taku Inlet. The settlement of Tulsequah was located at the mouth of the Tulsequeh River. This river is characterized by a broad, steep gravel base and a continually changing course; it is fed by Tulsequah Glacier and every few years it is flooded by a sudden draining of Tulsequah Lake through a channel beneath Tulsequah Glacier.

The mine is 65 km by air from Juneau; it is the property of New Taku Mines Limited.

Refs.: 6 p. A62-A68; 74 p. 1-2, 4, 63-65; 80 p. B19-B28; 104 p. 65-69; 107a p. 53-55.

Maps: (T): 104 K/12 Tulsequah River
104 K Tusequah
(G): 931A Taku River, British Columbia (1 inch to 2 miles)
1262A Tulsequah and Juneau, Cassiar district, British Columbia
(1 inch to 4 miles)

Tulsequah Chief, Big Bull Mines

SPHALERITE, CHALCOPYRITE, PYRITE, GALENA, BORNITE, TENNANTITE, HEMATITE, JASPER

In sheared volcanic rocks

The Tulsequah Chief Mine and the Big Bull Mine were formerly worked for zinc, copper and lead. The most abundant ore minerals were sphalerite (light brown to yellow), chalcopyrite and pyrite. Galena was intimately associated with sphalerite. Bornite and tennantite were also present. Hematite and jasper occurred at the Big Bull Mine.

The Tulsequah Chief deposit was staked prior to 1923 by W. Kirkham of Juneau; the brownish yellow stain on the bluffs attracted prospectors to the outcrops which were at an elevation of 488 m (above sea level) on the steep slope that forms the northeast side of the Tulsequah Valley. The mine is 12 km above the mouth of the river. The Big Bull deposit was discovered in 1929 by V. Manville and is at the foot of Mount Manville on the east side of Tulsequah River and 8 km southeast of Tulsequah Chief Mine. The properties were explored intermittently by various interests and were brought into production by Tulsequah Mines Limited in 1951. The mine workings consist of shafts and adits. The ore was processed at the mill at the Polaris-Taku Mine on the opposite side of the river. The concentrates were shipped by barge to ocean freighters at Taku Inlet. Operations ended in 1957. The mines produced a total of 2 931 582 g of gold, 105 774 211 g of silver, 12 325 162 kg of copper, 12 197 414 kg of lead, 5 648 586 kg of zinc and 205 658 kg of cadmium.

The Tulsequah Chief Mine is located about 5 km northeast of the Taku-Polaris Mine, the Big Bull Mine 6 km southeast of it. Roads connected the mines to the Tulsequah River.

Refs.: 6 p. A68-A70; 67 p. 7-16; 74 p. 6-7, 58-63; 107a p. 53-55.

Maps: (T): 104 K/12 Tulsequah River
104 K Tulsequah
(G): 931A Taku River, British Columbia (1 inch to 2 miles)
1262A Tulsequah and Juneau, Cassiar district, British Columbia
(1 inch to 4 miles)

The road log along the Alaska Highway is resumed.

km 1635 Haines Junction, at the junction of Haines Road. The Alaska Highway enters Shakwak Valley which it follows to White River. The valley is a geological fault zone, 3 to 15 km wide and 320 km long; it extends in a northwesterly direction from the westernmost point of Kusawa Lake to and beyond White River, and it separates the geologically younger rock formations of the St. Elias Mountains to the south from the older rocks of the Yukon Plateau on its north side. The Shakwak Valley is mantled with Pleistocene and Recent deposits of till, gravel, sand, silt and volcanic ash; it encloses Kluane, Kathleen and Dezadeash lakes and is incised by numerous streams (Refs.: 15 p. 5, 8-9; 76 p. 11-12).

The St. Elias Mountains

Visible in the distance from the Highway (to the southwest), are the broad, rugged, snowy summits of the Ice Field Ranges of the St. Elias Mountains, Canada's highest mountains, crowned by 6054 m Mount Logan. These mountains are described by Dr. H.S. Bostock of the Geological Survey of Canada (Ref.: 14 p. 92): "Above a sea of lesser peaks and wide ice-fields the great peaks stand solitary or in compact, isolated groups. Besides their colossal size, this individual aloofness adds much to the impressiveness of their vast, wild, and icy beauty, and contrasts them sharply with the jumbled rivalry of summits around many of the main peaks of the coast, Rocky, and Mackenzie Mountains, and other mountains of the Canadian Cordillera. Many of these individual peaks and groups are block-like in form, rising on nearly every side with precipitous cliffs, not to pinnacle-like tops, but to broad, still steep, though relatively gentler, summit areas. This gives them an appearance of stupendous massiveness from all directions. Another outstanding feature is the mantle of snow and ice that even in summer cloaks a great part of them. It spreads unbroken over their gentler, summit areas, smoothing the contours of their upper slopes and concealing bedrock. As the slopes steepen downward, it overhangs the edges of precipices in great cliffs of ice from which it cascades in mighty avalanches thousands of feet to the broad fields of snow and ice below, where it feeds the glaciers that lead away from between the peaks. Almost the only exposures of rock in all the vast expanse of white and blue around the great peaks are in their precipices. Below these dazzling monarchs a sea of lesser peaks, mighty themselves in other company, form a jagged and rocky platform. such is a general picture of the dominant features of these great mountains beside which the better known ranges of Canada are dwarfed to relative insignificance."

The mountain system derives its name from Mount St. Elias which was discovered and named on July 20, 1741 (St. Elias being the patron saint of that day) by Vitus Bering and Alexei Cherikof while exploring the Pacific Coast for Russia. At the time, and for many years thereafter, it was believed to be the highest mountain of the system. In 1890, a three-man expedition led by I.C. Russell and sponsored by the National Geographic Society and the United States Geological Survey, investigated the St. Elias Mountains, and discovered and named Mount Logan, the highest peak in the range. The first description of the mountain was made by Dr. Russell: "The clouds parting toward the northeast revealed several giant peaks not before seen, some of which seem to rival in height St. Elias itself. One stranger, rising in three white domes far above the clouds, was especially magnificent. As this was probably the first time its summit was ever seen, we took the liberty of giving it a name. It will appear on our maps as Mount Logan, in honor of Sir William E. Logan, founder and long director of the Geological Survey of Canada." (Ref.: 100 p. 58, 141.)

In 1967, a mountain range in the St. Elias Mountains was designated by the Canadian Permanent Committee on Geographical Names as the Centennial Range to mark the centenary of the Canadian Confederation. The range straddles the Alaska-Yukon boundary and extends in an easterly direction for about 35 km from it. Its peaks (about 3050 to 3660 m above sea level) have been named for each of the ten provinces, for the two territories, and one peak was named Centennial Peak; their location in the range from west to east corresponds to the geographical position of the provinces and territories they represent. The valley along the north side of the range is occupied by Chitina Glacier, the valley along the south side by Walsh Glacier. Mount Lucania is located immediately northeast of the range.

Maps: (T): 115B & 115C Mount St. Elias
M.C.R. 7 Centennial Range

Plate XIV

St. Elias Mountains viewed from 3 750 m looking southeast up Slims River which is bridged by the Alaska Highway at km 1705. (National Air Photo Library T6-119L)

km	**1635**	**The Kluane Ranges** Adjacent to the Highway, on the south side, between Haines Junction and White River, are the Kluane Ranges which constitute the outer front of the St. Elias Mountains. From the Highway, the ranges have the appearance of a steep, wall-like, serrated ridge of fairly uniform elevation (up to 2440 m) with slopes furrowed by talus-ridden valleys and containing small alpine glaciers; they are dissected by mountain streams, some carrying gold in their gravels. The Kluane Ranges are composed predominantly of volcanic and sedimentary formations with some granitic rocks. The Ruby Range which borders the north side of the Highway from the Aishihik River (**km 1602**) to the Kluane River (**km 1791**) is underlain by granitic rocks, schists and gneisses. In contrast to the rugged Kluane Ranges, the Ruby Range presents a more subdued topography with peaks reaching elevations of up to 2290 m above sea level; some of its streams have been worked for placer gold. The limit of forest growth in both ranges is at an elevation of 1220 m.
km	**1640**	A Dominion Experimental Farm was formerly located on left.
km	**1644.5**	Trail to Sugden Creek on left, just west of the bridge over Bear Creek.

Dezadeash River Olivine Occurrence

OLIVINE, DIOPSIDE

In peridotite

Crystals of olivine measuring 7 to 10 cm in length occur with light green tabular crystals of diopside in peridotite. The olivine is blackish green due to the inclusion of microscopic particles of magnetite.

The peridotite occurs along the mountain slope on the west side of Dezadeash River. The Sugden Creek trail, which leads south from the Alaska Highway, passes the occurrence at a point 12.9 km from **km 1644.5**. Access is possible in late summer by vehicles equipped with 4-wheel drive. The trail continues an additional 11 km to the Sugden Creek placer deposits that were worked for gold and platinum.

Ref.: 76 p. 37-38, 48, 54.

Maps: (T): 115 A/10 Mount Bratnober
115 A Dezadeash
(G): 1019A Dezadeash, Yukon Territory (1 inch to 4 miles)

km	**1657-1660**	Lying astride the Highway are a series of ice-block ridges left by ice sheets that moved in a northeasterly direction during Pleistocene time. The ridges are only a few m high, up to 300 m long, and are composed of gravel, sand and silt (Ref.: 76 p. 21.)
km	**1689**	Boutillier Summit. This is the highest point (elevation 1000 m) on the Alaska Highway west of Whitehorse.
km	**1695**	Bridge over Silver Creek, at the south end of Kluane Lake.

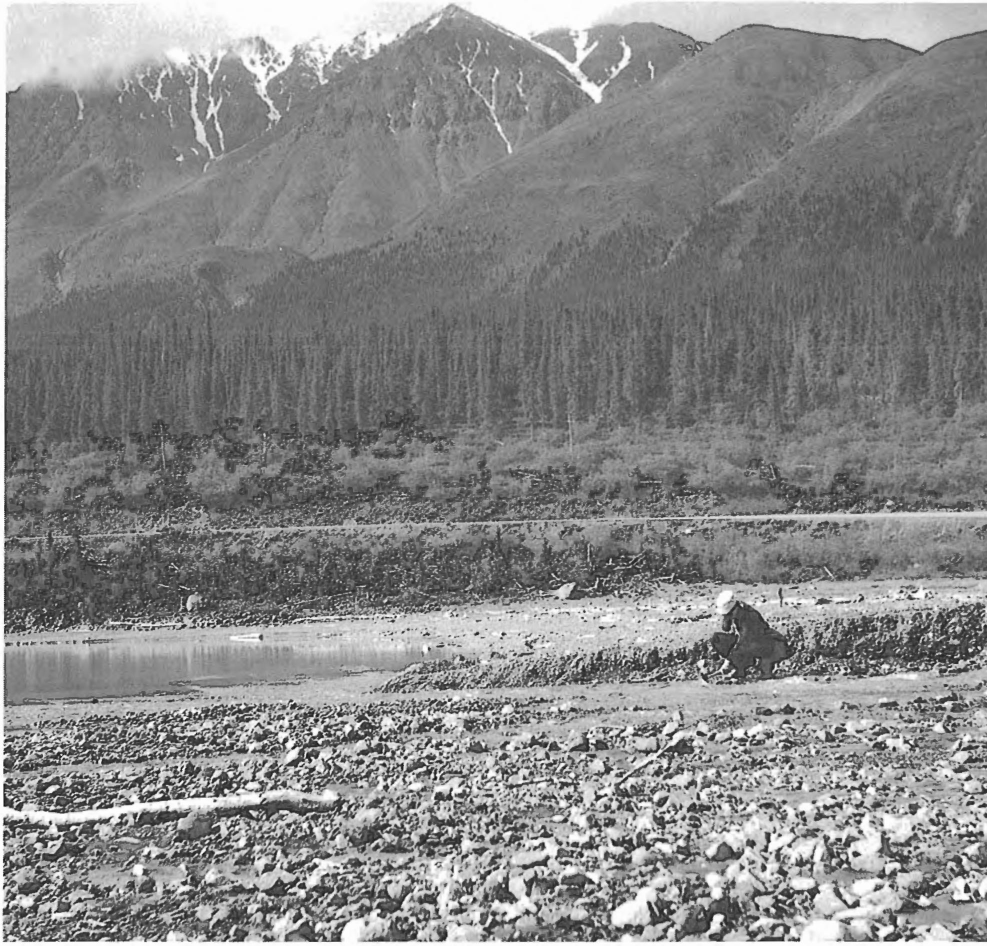


Plate XV

Williscroft Creek, **km 1716**, with the Kluane Ranges behind the Alaska Highway. (GSC 159481)

Kluane Lake Placers

GOLD

Kluane Lake, measuring about 65 km in length and 3 to 10 km in width, is the largest lake in the Yukon and is the deepest part of Shakwak Valley. Its elevation is 785 m above sea level and it is drained into the Bering Sea via Kluane, Donjek, White and Yukon rivers. Near the mouth of Silver Creek, a settlement known as Kluane or Silver City was at one time the centre of activity serving the mining district of Kluane; it sprang up as a result of the discovery of placer gold in the area.

On July 4, 1903, Dawson Charlie of Cariboo Crossing (now Carcross) staked the discovery claim on Fourth of July Creek in the Ruby Range, 24 km to the northeast. A prospecting rush ensued and by 1905 most of the gold placers now known had been staked. Except for Gladstone, Cultus and Fourth of July creeks, the gold placers were in the streams to the south of the

Shakwak Valley, including Sheep, Bullion, Burwash and Arch creeks and Koidern River (Edith Creek). Although mining activity was of short duration, the interest was revived in the 1912-14 period when gold was discovered in the Chisana district of Alaska. Intermittent production of gold has been realized from the Kluane district since that time. The locations of the placer workings are indicated on Map 1177A, Kluane Lake (Geological Survey of Canada); those accessible from the Alaska Highway are mentioned in the road log on pages 63, 65.

Refs.: 15 p. 40; 92 p. 1-3, 105-108).

Maps: (T): 115 G and 115 F Kluane Lake
(G): 1177 A Kluane Lake, Yukon Territory (1 inch to 4 miles)

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km 1705 Bridge over Slims River. Slims River is a swiftly flowing mountain stream fed by the Kaskawulsh Glacier located in a valley of the Icefield Range to the southwest. Fine glacial silts that mantle the river flats are whipped up into dust clouds by prevailing winds, and the valley becomes a funnel through which the silt is transported and deposited in the mouth of the river and at the southern end of Kluane Lake. This accumulation is a continuing phenomenon and has resulted in a shifting of the shoreline at this end of the lake: as seen from the bridge, dry mud flats occupy the former lake shore (Refs.: 15 p. 6-8; 92 p. 2-3).

Although the Alaska Highway parallels the shore of Kluane Lake to **km 1759**, the lake is visible from it for only the next 32 km. The Ruby Range forms a backdrop to the north side of the lake. The longest unbroken ridge of the Kluane Ranges borders the left (southwest) side of the Highway and Kluane Lake, from Slims River to **km 1767** where it is interrupted by the broad valleys of the Duke River and Burwash Creek; this is the highest section of the Kluane Ranges and contains several alpine glaciers. The road-cuts along the Highway at **km 1707** and the outcrops on the peninsula at **km 1709** expose volcanic rocks of Triassic age.

km 1712.6 Turn-off (on right) to Horseshoe Bay Camp-site. Pebbles of grey chert, maroon and brownish yellow jasper, and a brownish red volcanic rock streaked with green epidote are found along the shoreline at the camp-site.

km 1716.0 Bridge over Williscroft Creek. Pebbles of brown to red jasper and epidote rock (epidote and quartz in grey and purplish volcanics) occur in the bed of the creek and along the shore of the lake.

km 1718-1725 **Kluane Lake shoreline**
Pebbles of red jasper are common along the shore and in the bed of Congdon Creek (**km 1724.4**). Small black specks of hematite occur in some jasper pebbles. Some grey chert and epidote-quartz pebbles were also noted. The jasper pebbles are most numerous at the Goose Bay Camp-site at **km 1725**.

km 1734.8 Bridge over Nines Creek. Pebbles of red, orange-red, maroon-red and brown jasper occur in the bed of the creek along with pebbles composed of quartz and epidote, calcite and epidote, and purple and grey andesite and basalt containing blotches and veinlets of epidote. Epidote commonly occurs in amygdules in grey and maroon volcanics that are also found as pebbles along the creek.

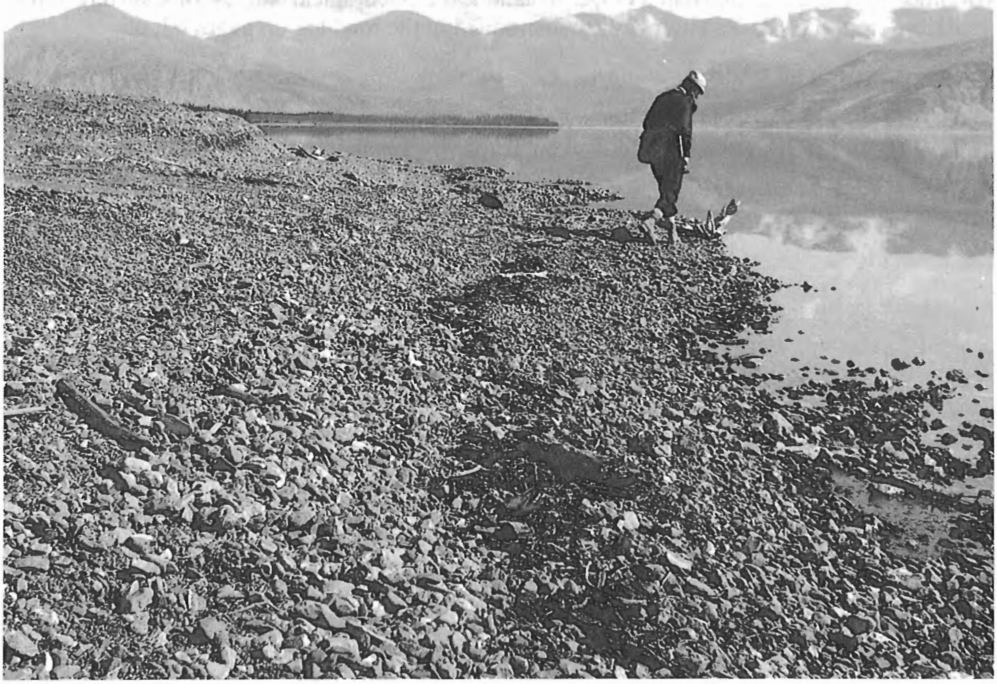

Plate XVI

Kluane Lake shoreline, **km 1719**, with the Ruby Range in the background. Jasper pebbles are abundant along the shore. (GSC 159479)

km	**1735.8**	Bridge over Mines Creek.
km	**1738.2**	Bridge over Bock's Creek. Pebbles, similar to those occurring at Nines Creek, are found in the beds of Mines and Bock's creeks.
km	**1758**	Kluane Historical Society Museum on right. Local rock and mineral specimens and artifacts are displayed in the Museum.
km	**1767.5**	Bridge over Duke River. Pebbles of epidote (in quartz matrix) and of amygdaloidal basalt occur in the broad flats near the bridge.
km	**1772**	On the left side of the Highway, the Donjek Range can be seen through a wide gap in the Kluane Ranges. The gap is occupied by the valleys of Duke River and Burwash Creek separated by an upland area. Conspicuous in the foreground of the Donjek Range, is Amphitheatre Mountain with its flat cap of Tertiary volcanic rock overlying Tertiary sedimentary strata. Coal (lignite) seams occur in light brown and grey shale that outcrops along the slopes below the lava cap; fossil leaves occur

in the shale. The Donjek Range contains small glaciers along its slopes which rise to peaks 2440 m to 3050 m high; the range parallels the Kluane Ranges and separates them from the Icefield Ranges, the backbone of the St. Elias Mountains. The Duke River drains the Donjek Range and carries unconsolidated sediments to its mouth on the Kluane River. At times the accumulation is large and clogs the Kluane River thus choking the outlet of Kluane Lake and causing a rise in the level of the lake; fluctuations of up to 3 m in the mean annual level have been reported (Refs.: 15 p. 6; 92 p. 81, 84, 113).

km 1776.2 Bridge over Burwash Creek. Pebbles composed of epidote with quartz, of purple volcanic rock containing irregular patches of green epidote, and of amygdaloidal basalt containing epidote, calcite, quartz and chalcedony in the cavities are found in the bed of the creek. The epidote and volcanic pebbles are colourful and take a good polish.

km 1776.2 Trail on left leading up Burwash Creek.

Burwash Creek Placers

GOLD, PLATINUM, SILVER, COPPER

In placers

Coarse gold was found in 1904, in the lower canyon and for 12 km above it; a 155 g nugget and several nuggets weighing about 30 g were recovered. Platinum, native silver and native copper have been reported from the concentrates. The gold and platinum occurred as flat plates and nuggets. Burwash Creek was worked at intervals since the discovery of gold there in 1904 by Messrs. Altamose, Ater, Smith and Bones. It has been the most productive placer creek in the Kluane district and it exceeded the combined total of gold from all other streams in the district. Until 1914, total production from the creek was estimated at between $30,000 and $40,000. After 1914, mining activity declined. Since 1945 mining has been conducted by Burwash Mining Company Limited between the lower end of the canyon and the mouth of Tatamagouche Creek, as well as along the latter creek. A sluicing plant is used to recover the gold. For a brief period (1948-51), Kluane Dredging Company operated a floating separation plant on the lower part of Burwash Creek.

A 10-km road leads to the deposit from the Alaska Highway. Panning the placers of this stream or of any other stream is permitted only in locations not held by claims; details of ownership can be obtained from the Mining Recorder, Indian and Northern Affairs Canada, Whitehorse.

Refs.: 29 p. 22-24; 50 p. 112-113; 55 p. 120-121; 85 p. 1A, 15A-16A; 92 p. 106-107; 97 p. 108-111.

Maps: (T): 115 G/6 Duke River
(G): 1177A Kluane Lake, Yukon Territory (1 inch to 4 miles)

km 1787.6 Turn-off on left to Wellgreen Mine.

Plate XVII

Edith Creek, **km 1845**, with Kluane Ranges in background. Pebbles of jasper, chalcedony, and volcanic rock occur in bed of stream. (GSC 159474)

Wellgreen Mine

PYRRHOTITE, PENTLANDITE, CHALCOPYRITE, SPHALERITE, VIOLARITE

In serpentinized peridotite

The sulphide minerals occur as solid masses closely associated with each other in the host rock. The ore contains, in addition to copper and nickel, values in platinum and palladium. The deposit was discovered and staked by W.B. Green and C.A. Aird in 1952, and later acquired by the Hudson-Yukon Mining Company. Underground work consisting of an adit and shafts was conducted by the company and a mill was constructed near the Alaska Highway (**km 1787.6**), about 16 km by road from the mine. The mine is located on a slope of the Kluane

Ranges overlooking Nickel Creek, a tributary of Quill Creek. It produced nickel, copper, cobalt and platinum metals from May to July, 1972.

Refs.: 32 p. 953-959; 92 p. 110-111; 131 p. 189, 190.

Maps: (T): 115 G/5 Steele Creek
(G): 117A Kluane Lake, Yukon Territory (1 inch to 4 miles)

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km 1789 Bridge over Quill Creek. Pebbles and boulders of jasper in various shades of red and green occur along the creek. Jasper and grey chalcedony occur as masses about 5 cm across in amygdaloidal basalt which occurs as small boulders. Also occurring are pebbles of fine grained purple volcanic rock containing veinlets and irregular masses of epidote, and of epidote in a matrix of quartz; these pebbles as well as the jasper pebbles are attractive when polished and can be used for ornamental purposes. Epidote also occurs in granitic rock pebbles.

km 1791 Kluane River on right. For the next few km, the Highway follows the west bank of Kluane River. Pebbles similar to those occurring at Quill Creek are found in the broad river flats.

On the north side of the Highway, moraines formed of glacial drift are a feature of the topography between the Kluane and Donjek rivers; the mountains from this point to White River reach elevations of up to 1830 m.

km 1822.2 Bridge over Donjek River. Geodes filled with chalcedony and quartz occur among the gravels and boulders in the river flats.

The Donjek River is fed by Donjek Glacier and by Steele Glacier, known locally as the Galloping Glacier because of its 488 m surge in one month in 1966-67. The river deposits large accumulations of gravel, sand and silt on the ever-shifting channels that carve the valley-floor which in Pleistocene time was occupied by a large glacier. The valley with its broad flood plains cuts a conspicuous intermontane gap in the Kluane Ranges and marks the western boundary of the Donjek Range. To the south, beyond the opening, are the snow-covered Icefield Ranges with their numerous glacier-filled valleys. As in the Slims River valley, off-glacier winds whip up the fine silts creating great dust-clouds in the valley of the Donjek River.

The Highway continues in a northwesterly direction in its final course along the Kluane Ranges; a series of sluggish streams and quiet lakes occupy a low-lying area on the left (southwest) side of the Highway. The steep wall-like front of the Kluane Ranges is composed of volcanic and sedimentary rocks of Paleozoic age, while the mountains on the right are underlain by older granitic and metamorphic rocks including schists, gneisses and quartzites. (Refs.: 92 p. 2-3; 136 p. 1a.)

km 1844.9 Bridge over Edith Creek (Koidern River). Pebbles, similar to those found at Quill Creek, occur in the bed of this creek in the vicinity of the bridge. Placer gold has been recovered at various times from this stream. (Ref.: 15 p. 40.)

Plate XVIII

White River at Canalask Mine, Miners Ridge on right and the Nutzotin Mountains in distant background. (GSC 159475)

km	**1878**	Koidern.
km	**1879.1**	Junction, road on left to Canalask Mine.

Canalask Mine

PYRRHOTITE, PENTLANDITE, CHALCOPYRITE, SPHALERITE, PYRITE, MARCASITE, ZOISITE, GYPSUM, MALACHITE, BROCHANTITE, CHRYSOCOLLA, HEXAHYDRITE, ROZENITE, SERPENTINE, MICA

In altered volcanic rocks

The sulphide minerals - pyrrhotite, pentlandite, chalcopyrite, sphalerite, pyrite, and marcasite - occur as fine disseminations and as small massive lenses; they are associated with a carbonate-zoisite matrix. Secondary minerals are common on specimens occurring in the rock dumps, the most abundant being gypsum and malachite. Gypsum occurs as transparent, colourless striated tabular crystal aggregates, elongated plates, rounded encrustations, and as fine granular masses; it is closely associated with malachite and is commonly stained light green or blue. Malachite forms light to medium dark green, powdery to finely crystalline coatings on the specimens. Other secondary minerals identified from the deposit include: brochantite, as bluish green crusts; chrysocolla, as light blue vitreous encrustations on calcite; hexahydrite, as white sugary crusts and spherical aggregates; rozenite, as a white powder. Olive-green serpentine and dark brown to black mica were also found in the rock dumps.

The deposit was discovered in 1952 by Prospectors Airways Company Limited. In 1954, it was acquired by Canalask Nickel Mines Limited which conducted exploratory work on the property until 1958. An adit was driven into the east bank of the White River at the 820 m level. Subsequent surface exploration was performed by various companies but there was no production. The deposit is located on the east side of the White River overlooking Miners Ridge and the Nutzotin Mountains (Kluane Ranges).

Access is by a single lane 4.5 km road leading south from the Alaska Highway at **km 1879.1**.

Refs.: 50 p. 65-68; 92 p. 111.

Maps: (T): 115 F/15 Canyon City
(G): 1177A Kluane Lake, Yukon Territory (1 inch to 4 miles)
1012A Northwest Shakwak Valley, Yukon Territory (1 inch to 4 miles)

Canyon City Copper Deposit

NATIVE COPPER, CHALCOCITE, CUPRITE, CHALCOPYRITE, BORNITE, COVELLITE, NATIVE SILVER

In amygdaloidal basalt

Large slabs of native copper have been found at this locality; one is reported to measure 2.5 m by 1 m and 12 cm thick, and to weigh 1165 kg. In the winter of 1957-58, it was transported to Whitehorse where it is displayed outside the Yukon Historical Society's MacBride Museum. The copper slabs are believed to have weathered out of fractures in Triassic basalt. Native copper also occurred as bunches and small masses. The host rock is traversed by calcite veins carrying chalcocite, native copper, cuprite and chalcopyrite. Bornite, covellite and native silver also occur in the rock.

Original reports of copper in the upper White River district were made by the Indians who utilized the metal for utensils and weapons, and who related to explorers the occurrence of masses of copper the size of a log cabin. Native copper was subsequently found by prospectors, although not in these sizes. The first reported occurrence of native copper was made by C.W. Hayes of the United States Geological Survey, who with Lieutenant Frederick Schwatka and prospector Mark Russell visited the region in 1891 on their way from Fort Selkirk, at the confluence of Pelly and Yukon rivers, to the Alaskan coast. They found small nuggets on Kletsan Creek, 15 to 25 km southwest of Canyon City. Using caribou horns, the Indians extracted from the rock copper nuggets averaging several grams in weight; the odd nugget weighed up to 4.5 kg. The bedrock copper deposit at Canyon City was discovered in May 1905 by Solomon Albert who staked it along with Joseph R. Slaggard and M.C. Harris. It was known as Discovery Copper grant and was located on the southeast bank of the Upper Canyon of White River nearly opposite the mouth of Boulder Creek and 2.5 km upstream from the abandoned settlement of Canyon City.

Plate XIX

Native copper slab with Joseph Slaggard, at its source near Canyon City, 1913. (GSC 25598)

Early work consisted of three adits, and some open-cuts and trenches on the steep valley wall 30 to 60 m above the river. Between 1967 and 1975, Silver City Mines Limited explored the deposit and discovered a new copper showing near the old adits. There was no production during this time. A 32 km tote-road was built; this branches off from the Canalask Mine road at a point 3 km south of the Alaska Highway. Native copper was also found in the gravels of Generc River, and in streams on the Alaska side of the boundary.

Refs.: 30 p. 4-5; 133-141; 50 p. 68-70; 86 p. 25; 92 p. 108-110; 131 p. 343.

Maps: (T): 115 F/15 Canyon City
(G): 1177A Kluane Lake Yukon Territory (1 inch to 4 miles)
1012A Northwest Shakwak Valley, Yukon Territory (1 inch to 4 miles)

km 1880.3 Junction, road on right to White River flats. Small boulders of amygdaloidal basalt are common in the dry river flats. The amygdules are filled with stilbite, prehnite, chalcedony, quartz, calcite, serpentine and plagioclase feldspar. Other boulders are composed of a mixture of quartz and epidote, and of quartz and chlorite. Charcoal-grey and red marble containing crinoid fossils was also found.

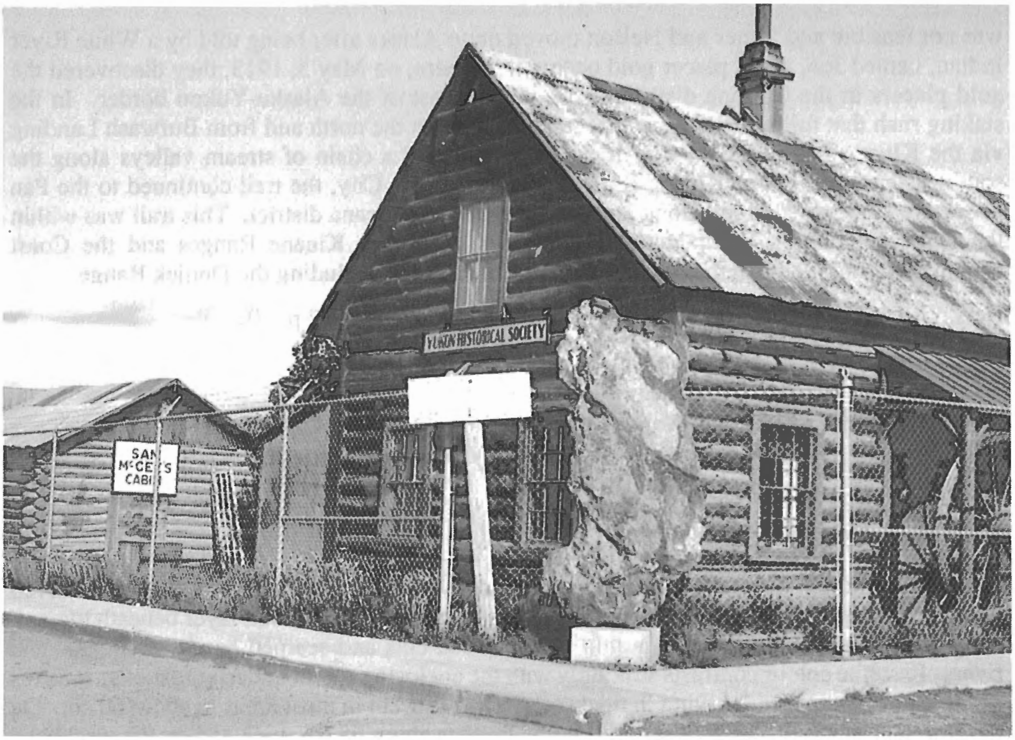

Plate XX

The same slab at the MacBride Museum, Whitehorse. (GSC 159491)

km 1881.2 Bridge over White River, at the Lower Canyon. The river was so named in 1850 by Robert Campbell of the Hudson's Bay Company because of its milky colour. Its waters originate in the Klutlan Glacier to the south and in the Russell Glacier in Alaska; fine silt and white volcanic ash suspended in the water give it the white turbidity. The steep river banks cut through the Kluane Ranges on the south side of the bridge, and on the north side, the river enters a broad flood plain characterized by shifting bars and quick sands. (Ref.: 30 p. 4, 59.)

Upper White River Gold Deposits

NATIVE GOLD

In placers

Gold was formerly obtained from the placers of Pan, Bowen and Hidden creeks which drain the southwestern side of the Nutzotin Mountains, about 15km west of the White River bridge. Although some coarse gold has been found in these creeks, they were not considered to be economic.

The gold-bearing placers of Pan Creek were discovered in the winter of 1912-13 by William E. James, Peter Nelson and Frederick Best of Dawson City. Because of water problems, mining was not feasible and James and Nelson moved on to Alaska after being told by a White River Indian, named Joe, about placer gold occurrences there; on May 3, 1913, they discovered the gold placers in the Chisana district, about 50 km west of the Alaska-Yukon border. In the staking rush that followed, prospectors stampeded from the north and from Burwash Landing via the Kluane Lake-Canyon City trail which followed a chain of stream valleys along the southwestern edge of the Kluane Ranges. From Canyon City, the trail continued to the Pan Creek area placers and then along Beaver Creek to the Chisana district. This trail was within the Duke Depression – a plateau-like area separating the Kluane Ranges and the Coast Mountains from the main mass of the St. Elias Mountains, including the Donjek Range.

Refs.: 14 p. 95; 15 p. 10-11; 29 p. 11, 29-30; 30 p. 125-133; 92 p. 107.

Maps: (T): 115 F/15 Canyon City
115 K/2 Dry Creek
(G): 1177A Kluane Lake, Yukon Territory (1 inch to 4 miles)
1012A Northwest Shakwak Valley, Yukon Territory (1 inch to 4 miles)

Volcanic Ash

White volcanic ash occurs throughout most of southern Yukon Territory. It can be observed as a mantle covering road-sides and lower slopes of mountains, as a thin layer beneath top-soil and rooted in vegetation, and as a thin band in road-cuts and scarped bands of streams and rivers. Its white colour contrasts strikingly with the enclosing soil or underlying rocks. It forms a single horizontal layer varying in thickness from a few cm in most areas to about 60 cm. On the east side of Grafe Creek (**km 1844.4**), the layer is about 58 cm thick and on the west bank of Donjek River, about 30 cm. It forms a conspicuous snow-white covering along the ditches and between trees and shrubs along the Alaska Highway between Pickhandle Lake (**km 1866**) and Whitehorse, and along the Whitehorse-Stewart Crossing Road between **km 113** and **km 145** (page 75).

The ash is composed of pumice that resembles white sand; fragments of pumice up to 10 cm long have been reported. The deposit is believed to have originated from a volcanic explosion in the vicinity of the Natazhat Glacier at the head of Kletsan Creek, about 48 km southwest of the White River bridge. At the source, dunes of ash several hundred m high were noted by geologists. At the time of the eruption, winds distributed the ash over two elongated lobe-shaped areas: one extending north along the International Border to the Ogilvie Mountains, the other east to the Mackenzie Mountains. The thickness of the deposit decreases progressively with increase in distance from the source. Because of its fairly uniform distribution over a wide area, geologists believe that the ash was deposited tranquilly as in a gentle snowfall, and that the fall was of short duration lasting not more than a few days at most. The event is believed to have taken place less than 2,000 years ago.

The occurrence of volcanic ash in the Yukon was first reported by Frederick Schwatka during his exploration of the Yukon River in 1883. Along the steep banks of the river between Five Finger Rapids and Fort Selkirk, he observed "a conspicuous white stripe some two or three inches in width" which he identified as volcanic ash. It has since been recorded by geologists investigating the Yukon Territory.

Refs.: 15 p. 36-39; 30 p. 107-111; 42 p. 43B-46B; 92 p. 90-92; 102 p. 196.

Maps: (T): 115 K/2 Dry Creek
(G): Figure 1, Map of upper Yukon River basin in Yukon Territory, and adjacent parts of Northwest Territories and northern British Columbia, showing distribution and thickness of Recent volcanic ash deposit.
(In G.S.C. Memoir 267).

km	**1889**	Horsecamp Hill, on right, is composed of sedimentary and granitic rocks.
km	**1895**	Bridge over Sanpete Creek. Pebbles of epidote mixed with quartz, and pebbles of a deep red volcanic rock cut by veinlets of epidote occur in the bed of this creek, and at Dry Creek and Beaver Creek. The Alaska Highway completes its long course within the Shakwak Valley and enters the Yukon Plateau which it traverses to the Yukon-Alaska border. The Shakwak Valley extends northwestward along the Nutzotin Mountains (Kluane Ranges) into Alaska, and the Yukon Plateau occupies a wide area as far north as Dawson City.
km	**1900**	Dry Creek No. 1 bridge.
km	**1905**	Dry Creek. Siwash Ridge on right. Between Dry and Snag creeks, the Highway is within the Wellesley Basin – a lowland with scattered, irregularly contoured knobs, ridges and small mountains rising 150 to 460 m above its floor which decreases in elevation from about 730 m (above sea level) in the southern part to 580 m in the north. The hills and ridges are composed mostly of resistant volcanic and granitic rocks, and schists, gneisses and quartzites; their slopes and the basin floor are thickly mantled with glacial deposits of sand, gravel, till and silt. The lowland is traversed by the White and Donjek rivers, and by Sanpete, Dry, Beaver and Snag creeks. Numerous small lakes and ponds occupy kettle holes between moraines, ridges, and mounds of glacial debris. Muskeg is a feature of some poorly drained areas. (Refs.: 14 p. 72; 15 p. 10; 30 p. 54-55, 58-60.)
km	**1911**	Snag Junction. A 27 km road leads to Snag on the White River at the mouth of Beaver Creek. A meteorological station was maintained at Snag from 1943 until 1966. Elkland Mountain (1456 m) is prominent to the west of the junction. During the gold rush to the upper White River and Chisana districts, two routes travelled by prospectors and explorers from the north converged at Snag and continued overland to the southwest. One route followed the White River from its mouth on the Yukon River to Beaver Creek; the other was a pack trail from the Yukon River via Coffee Creek and Wellesley Lake to Snag. The shallow, swiftly flowing White River was navigated from its mouth to Beaver Creek by poling-boats and to the Donjek River by river-boats. Year-round roadhouses supplying accommodation and meals were established at regular intervals of 32 to 40 km along the White River and along the trail to the Alaskan gold placers; one was located at Snag which, due to the gold rush, grew rapidly from a two-cabin settlement to one with 250 cabins. A Royal Northwest Mounted Police detachment was established at Snag to patrol the route. (Ref.: 30 p. 11-13, 23-25.)
km	**1923**	Macauley Ridge is on right. It is formed of volcanic rocks.
km	**1932**	Bridge over Beaver Creek.
km	**1934**	Beaver Creek. This is the last settlement on the Canadian section of the Alaska Highway.

km	**1937**	Hill on left is formed of Tertiary rhyolite and latite lavas. (Ref.: 15 p. 35.)
km	**1944**	Bridge over Snag Creek. The creek is so named due to the great piles of driftwood it gathers along its banks during spring floods. Some of the logs become partly lodged in the creek bed producing snags; because of the turbidity of the water, they can not be seen and make navigation treacherous. Snags are also a common feature along Beaver Creek. (Ref.: 30 p. 59-60.) Outcrops of Paleozoic sedimentary rocks (shale, limestone, cherty slate, and sandstone) occur on both sides of the Alaska Highway from the Snag Creek bridge to about km 1951, the rocks are folded and intersected by faults. (Ref.: 30 p. 19.)
km	**1947**	The Alaska Highway emerges from the Wellesley Basin, and the topography to the north is characterized by undulating hills that reach elevations of about 915 m. For the next 8 km, the Highway is bordered by a swampy area occupied by Mirror Creek on the left, and by gentle hills on the right. Thick deposits of glacial drift occur along the road.
km	**1950**	Psilomelane was found in a vein cutting white-bedded rhyolite tuff on the north side of the Alaska Highway approximately 220 m east of **km 1950**. When discovered in 1949, the vein measured 50 cm wide and was exposed over a length of 7.6 m. The deposit was staked by W.T. Batrick and W. Hammond. (Ref.: 15 p. 44-45.)
km	**1955**	The broad area to the north of this point is unglaciated and lacks glacial deposits and other evidence of glaciation. This is because the Pleistocene ice-sheets that originated in the Icefield Ranges and moved into and north from the Shakwak Valley reached their northern limit at about this point.
km	**1965**	Alaska-Yukon border. The Alaska Highway continues to Fairbanks, Alaska where it terminates at Mile 1523.

There's gold, and it's haunting and haunting;
It's luring me on as of old;
Yet it isn't the gold that I'm wanting
So much as just finding the gold.
It's the great, big, broad land 'way up yonder,
It's the forests where silence has lease;
It's the beauty that thrills me with wonder,
It's the stillness that fills me with peace.

From "The Spell of the Yukon",
Robert W. Service

Plate XXI

Rocking for gold, Gold Hill, Bonanza Creek, 1899. (National Archives of Canada/PA 16223)

Plate XXII

Volcanic ash, **km 113** Whitehorse-Dawson Road, appears as white patches on the ground. (GSC 159494)

THE KLONDIKE ROAD

The Klondike Road links the Alaska Highway to Dawson. It consists of two sections: the Whitehorse-Stewart Crossing section, and the Stewart Crossing-Dawson section for a total distance of 540 km. The Klondike Road is within the Yukon Plateau. It leaves the Alaska Highway at **km 1488**, 18 km east of the original Dawson trail. The old Dawson trail proceeds north along the west side of the Miners Range to Carmacks; it is joined by the Klondike Road at **km 95**.

The Klondike Road: Whitehorse-Stewart Crossing Section

km 0 Junction, Alaska Highway at **km 1488**. The road log proceeds along the Klondike Road.

km 4.0 Bridge over Takhini River. The Takhini River flows from Kusawa Lake to the Yukon River; its steep banks expose glacial sand and silt. A thin layer of volcanic ash, about 5 cm wide, forms a white horizontal line which is visible near the top of the river banks.

km 5.9 Turn-off (left) to Takhini Hot Springs. The hot springs are located 10 km from the highway.

km 29 For the next 55 km the highway parallels the eastern flank of Miners Range, so named by G.M. Dawson of the Geological Survey of Canada for the miners ("...good fellows all of them" Ref.: 42 p. 157B) that he encountered during his geological reconnaissance of the Yukon in 1887. Pilot Mountain (at **km 29**), at an elevation of 2055 m, is the highest peak in the Miners Range. These mountains are composed of Mesozoic volcanic rocks. On the east side of the highway, the Yukon River widens to form Lake Laberge which is 50 km long and up to 7 km wide. White limestone of Triassic age is conspicuously exposed along the slopes of hills and ridges on the east side of the lake.

Lake Laberge is a part of the 740 km waterway from Whitehorse to Dawson; sternwheel steamboats formerly maintained a regular service between these centres during the summer months. The lake was named for Michael Laberge of Montreal, an explorer for the Western Union Telegraph Company, who ascended the Yukon River in 1867. (Refs.: 42 p. 142B, 156B; 126 p. 21).

Big Salmon River Placers

GOLD

In placers

Gold was discovered in the bars of Big Salmon River by G. Langtry, P. McGlinchey and two other prospectors in 1881. Gold was subsequently found and worked in placers of Lewes (Yukon) and Teslin rivers, and Livingstone, Summit, Lake, Cottoneva, Little Violet and other creeks. The Livingstone Creek placers were the most productive with a high proportion of nuggets weighing over 30g, and one weighing 590g; native copper, magnetite, garnet and cinnabar were associated with the gold. Production from the district declined after 1920. A 64 km trail leads northeast from the east side of Lake Laberge (opposite Jackfish Bay), to the gold placers of the Livingstone Creek area in the Big Salmon Range.

Refs.: 20 p. 22-27; 42 p. 180B-181B.

Maps: (T): 105 E Laberge
372A Laberge sheet, Yukon Territory (1 inch to 4 miles)

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km **32.7** Junction, single lane road to the Lake Laberge camp-site.

km **56** Fox Lake is on left with Miners Range in the background. The lake and the ridges adjacent to the highway are underlain by Jurassic sedimentary rocks consisting of conglomerate, sandstone, argillite, greywacke. (Ref.: 20 p. 13-14).

km **89** Junction, road to Braeburn Lake. The highway follows the valley of Klusha Creek for the next 30 km.

km **95** The old Whitehorse-Dawson Road joins the Klondike Highway at this point.

km **96** Conglomerate Mountain (1025 m) on the right is representative of the broad rounded mountains that rise from the fairly flat upland surfaces of Yukon Plateau. The mountain is composed predominantly of conglomerate of Jurassic age. (Ref.: 26 p. 33-34).

km **113** A layer of white volcanic ash can be observed as a white line or band near the top of gravel banks at the side of the highway for the next 30 km. It is also seen as a white carpet in adjacent forests.

km **115** Emerald (Twin) Lake.

km **123** The Dalton Trail from Champagne joined the old Dawson Road about here. From this point to Carmacks, the highway parallels the broad, steep-walled valley in which the Nordenskiold River cuts a meandering course isolating numerous oxbow lakes. This river was named by explorer Frederick Schwatka of the United States for Arctic explorer Baron von Nordenskiöld of Sweden. Lieutenant Schwatka, in the course of his 1883 expedition of the Yukon River from its source to its mouth, named numerous geographical features in honour of other explorers and geographers. (Ref.: 102 p. 190).

km **124** Montague roadhouse was formerly operated here to provide accommodation for miners and explorers using the Dalton Trail and the Whitehorse-Dawson Road. Other roadhouses, located at 30-40 km intervals, included one at the north end of in Braeburn Lake, at Emerald (Twin) Lake, at Carmacks, and at Minto.

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km	**135**	Montague Mountain on right. Sedimentary rocks form the lower slopes near the highway, and andesite forms the upper slopes as well as Andesite Mountain to the north. A series of similar hills border the east side of the highway to Carmacks.
km	**140**	Porter Mountain, on the right side of the highway, is formed predominantly of syenite porphyry.
km	**150**	Bushy Mountain on right.
km	**156**	Mount Berdoe is on right. Bushy Mountain and Mount Berdoe are underlain by basalt and tuffs of Tertiary age.
km	**164**	Bridge over the Yukon River at Carmacks. The town was named in honour of George Carmack, a discoverer of gold in the Klondike.
		From Carmacks to Minto the highway follows the east bank of the Yukon River departing from the course of the old Dawson Road which was along the west bank.

Dawson Range Mines

GOLD, ARSENOPYRITE, PYRITE, TOURMALINE, GALENA, SPHALERITE, FREIESLEBENITE, ACANTHITE, NATIVE SILVER, ANDORITE, TETRAHEDRITE, STIBNITE, SCORODITE; CHALCEDONY

In quartz veins cutting granitic and metamorphic rocks; in volcanic rocks

Gold and gold-silver deposits occur in the Mount Nansen-Freegold Mountain area at the eastern end of the Dawson Range, west of Carmacks. Lode gold was discovered on Freegold Mountain in 1930 by prospector P.F. Guder of Carmacks, and T.C. Richards of Whitehorse worked the Laforma Mine on the southern slope of Freegold Mountain in 1939-40. The gold occurs with arsenopyrite, pyrite and tourmaline in quartz veins. The workings at the mine consisted of three adits at elevations of 1190, 1106 and 1081 m; a mill was installed in 1938 and 2613g of crude gold (with a 20 per cent silver content) was recovered and made into a brick, believed to be the first gold brick made from a lode-gold deposit in the southern Yukon. Between 1939 and 1940, 44695g of gold were recovered.

The gold-silver properties are located on a ridge between Nansen and Victoria creeks. The quartz veins carry arsenopyrite with pyrite, galena, sphalerite, native silver, stibnite and the silver-bearing minerals freieslebenite, acanthite, andorite and tetrahedrite. Green scorodite, as a stain on the veins, was also reported. The gold-silver mineralization was discovered in 1962 by prospector, G.F. Dickson of Whitehorse. Mount Nansen Mines Limited and Brown-McDade Mines Limited opened the deposits by means of a number of adits. A mill was installed and operated by Mount Nansen Mines Limited from 1968 to 1969; gold, silver and lead were produced.

From Carmacks, a 68 km rough road leads to Freegold Mountain, and a 64 km road to the Nansen Creek-Victoria Creek area leaves the Freegold Mountain road about 65 km west of the Nordenskiold River bridge in Carmacks.

Along the old Mount Nansen road, leading south from about km 50 of the Freegold Mountain road, chalcedony geodes occur in volcanic rocks. An occurrence was staked by P.F. Guder at a point 6.4 km from the Freegold Mountain road.

Refs.: 10 p. 22-26; 50 p. 35-38; 55 p. 29-31, 34-38; 56 p. 8; 105 p. 33-36.

Maps: (T): 115 I/3 Mount Nansen
115 I/6 Stoddart Creek
(G): 340A Carmacks, Yukon Territory (1 inch to 4 miles)

km	**166.7**	Junction Campbell Highway (Highway 4).

Anvil Mine

GALENA, SPHALERITE, PYRITE, PYRRHOTITE, CHALCOPYRITE, MARCASITE, MAGNETITE, TETRAHEDRITE, BOURNONITE, ARSENOPYRITE, ANGLESITE, GOETHITE, GYPSUM

In phyllitic rocks

The ore consists of a massive assemblage of pyrite, pyrrhotite, galena and sphalerite with minor chalcopyrite, marcasite and magnetite. Other minerals reported from the deposit include tetrahedrite, bournonite, arsenopyrite, marcasite, anglesite, goethite and gypsum.

The deposit was discovered in 1965 by Dynasty Explorations Limited using geophysical and geochemical surveys and geological mapping. In 1965 Anvil Mining Corporation Limited was formed to continue the exploration and to bring the deposit into production. The ore was estimated to contain 9.1 per cent combined lead-zinc, and 37.3g of silver per ton with reserves of 57 million t. Mining was from an open pit. The mill began production in 1969, and the lead-zinc concentrates were shipped to West Germany and Japan. The concentrates were transported by truck to Whitehorse thence by rail to Skagway where they were transferred to ships. From 1975 to 1982, Cyprus Anvil Mining Corporation operated the deposit. Curragh Resources Inc. was the operator from 1986 to 1991 when the mine was closed.

The mine is located in the Anvil Range at an elevation of about 1220 m near Faro Creek, a tributary of Rose Creek. As a result of mining activity, the new town of Faro came into existence.

Road log from the Whitehorse-Stewart Crossing Road at **km 166.7**:

km	0	Proceed east onto the Campbell Highway. This road successively follows the valleys of the Yukon, Little Salmon, Magundy and Pelly rivers to Ross River settlement.
km	27	The highway follows the Salmon River Valley.
km	84	Little Salmon Lake on right. The lake is 34 km long and about 2.5 km wide. The ridges that rise abruptly from both sides of the lake are composed of schist, quartzite, limestone, greenstone and argillite of Paleozoic age. The ridges reach elevations of about 1960 m. Little Salmon Range, a unit of the Pelly Mountains, parallels the north shore of the lake, and its south shore marks the northern boundary of the Big Salmon Range.
km	119	The highway continues eastward between Magundy River and the southern end of the Glenlyon Range of the Pelly Mountains. Glenlyon Peak (Mount Hodder) at 2191 m and Truitt Peak at 2074 m (opposite km 122) are the highest peaks of the range which is underlain by a granitic batholith of Mesozoic age.

km 170 Faro Junction, and turn-off to Faro and to the Anvil Mine. The road leads 29 km to the mine. At about this point the highway enters the Tintina Valley which it follows to Ross River which separates the Anvil Range on its northeast side from the St. Cyr Range on its southwest side.

Refs.: 1 p. 400-405; 33 p. 39, 40, 42-43, 71-72; 50 p. 43-44; 110 p. 43-52; 112 p. 39; 131 p. 36; 138 p. 127.

Maps: (T): 105 K/6 Mount Mye
(G): 13-1961 Tay River, Yukon Territory (1 inch to 4 miles)

The road log along the Whitehorse-Dawson road continues below.

km 167 Tantalus Butte on right.

Tantalus Butte Mine

COAL

High volatile bituminous coal has been produced intermittently from this mine since about 1923. The coal seam ranges in thickness from 2.5 to 6 m and occurs in a rock formation consisting of conglomerate with some sandstone and shale. The rocks are of Mesozoic age and form the butte into which an adit was driven to extract the coal. The portal overlooks the Yukon River and is visible from the highway.

The mine was originally operated to supply coal for domestic heating in Dawson; it was later operated by the Anvil Mining Corporation Limited for use in its operations at the Anvil Mine in Faro.

Refs.:9 p. 59-62; 50 p. 114.

Maps:(T):115 I/1 Carmacks

(G):340 A Carmacks sheet, Yukon Territory (1 inch to 4 miles)

km 172 For the next 8 km, the highway circles the eastern half of Five Finger Mountain which is underlain by volcanic rocks of Tertiary age. Its elevation is 897 m above sea level. At the northern base of the mountain on the east bank of the Yukon River, the Five Finger coal mine was formerly operated. (Ref.: 9 p. 62-63).

km 187 **Five Finger Rapids**
The rocks beneath the rapids are conglomerate and sandstone of Jurassic age. The rapids are caused by these resistant strata which have a braking effect on the swiftly flowing (estimated at about 6.5 km per hour) Yukon River, above and below the rapids the river maintains an unobstructed course through a heavily drift-filled valley. Friable shale is associated with these rocks in exposures along the steep river banks and in the cliffs forming the shoreline of the islands. Fossils including shells and plants, and flat cherty concretions measuring up to 25 cm long, occur in the shale. Ammonites and pelecypods have been found in the shale lying beneath the sandstone and conglomerate on the east side of the river, just above

Plate XXIII

Five Finger Rapids, Yukon River; Dawson Range in the backgorund. (GSC 159527)

the rapids. These rapids were considered to rank second only to the Whitehorse Rapids in the dangers they presented to navigation along the Yukon River. In the distant background (looking west from the highway viewpoint) is the smooth-topped Dawson Range with elevations to about 1982 m. (Refs.: 9 p. 21-27; 42 p. 144B-147B).

km 204 The highway meets the original Dawson-Whitehorse Road and follows its course to Minto. The old Dawson Road crossed the Yukon River at Yukon Crossing, the site of the roadhouse.

Volcanic ash is visible along the highway from about this point to Minto. The ridge bordering the highway is underlain by volcanic and granitic rocks. The resistant volcanic rocks form the highest peaks of the Dawson Range to the southwest. (Ref.: 9 p. 29-30).

km 238 Minto. The old Dawson Road continued along the Yukon River to Pelly River and then to Dawson. The ill-fated Hudson's Bay Company post of Fort Selkirk was located at the junction of the Yukon and Pelly rivers, 37 km downstream from Minto. The post was established in 1848 by Robert Campbell on a point of land between the Pelly and Yukon rivers but, due to spring floods at this location, it was moved to the opposite (south) side of the river in 1852. The construction was nearly completed when the post was pillaged and burnt by hostile Coast Indians in spite of the vigilance of friendly local Indians. Parts of the old buildings and chimneys, built of basalt blocks, mark the site on the south side of the Yukon River about 2.5 km downstream from the Pelly River. Although at the time this was the Company's most important post west of the Rockies, it was not re-established. (Refs.: 9 p. 1; 42 p. 135B-136B, 139B; 95 p. 46).

The Yukon River upstream from Fort Selkirk was until 1949 known as the Lewes River. It was named in 1842 by Robert Campbell in honour of John Lee Lewes, an official of the Hudson's Bay Company.

The highway leaves the Yukon River Valley and proceeds north along a drift-filled depression occupied by Von Wilczek Creek and Von Wilczek Lakes named by Schwatka in honour of Graf von Wilczek of Vienna. (Ref.: 102 p. 200).

km 270 Pelly Crossing. The Pelly River was named by Robert Campbell for Sir John Henry Pelly of the Hudson's Bay Company. On the south side of the river and east of the highway is 1493 m. Ptarmigan Mountain underlain by mica schist and granite gneiss with some limestone on the northeastern side. (Refs.: 9 p. 16; 42 p. 137B). On the west side of the highway between Pelly and Stewart rivers, the Willow Hills form a ridge with elevations between 1190 m and 1372 m above sea level. In the distance, east of **km 328**, Grey Hunter Peak, at 2216 m, is the highest summit of the McArthur Group mountains which are formed of granitic rocks of Mesozoic age. These rocks have intruded older strata consisting mainly of slate. (Ref.: 12).

km 330 Junction, road to Ethel Lake. The highway crosses the Tintina Valley.

km 343 Bridge over Stewart River at Stewart Crossing. A rock-cut at the north end of the bridge exposes metamorphic rocks believed to be of Precambrian or early Paleozoic age (Ref.: 18). These rocks form the ridges to the northwest and northeast of the bridge. From Stewart Crossing to Dawson the highway route is within the Tintina Valley.

The Stewart River is one of the principal tributaries of the Yukon River; it was named for James G. Stewart of the Hudson's Bay Company who explored it in 1849. It was navigable for river-boats for a distance of 320 km from its mouth to Fraser Falls, about 65 km upstream from Mayo.

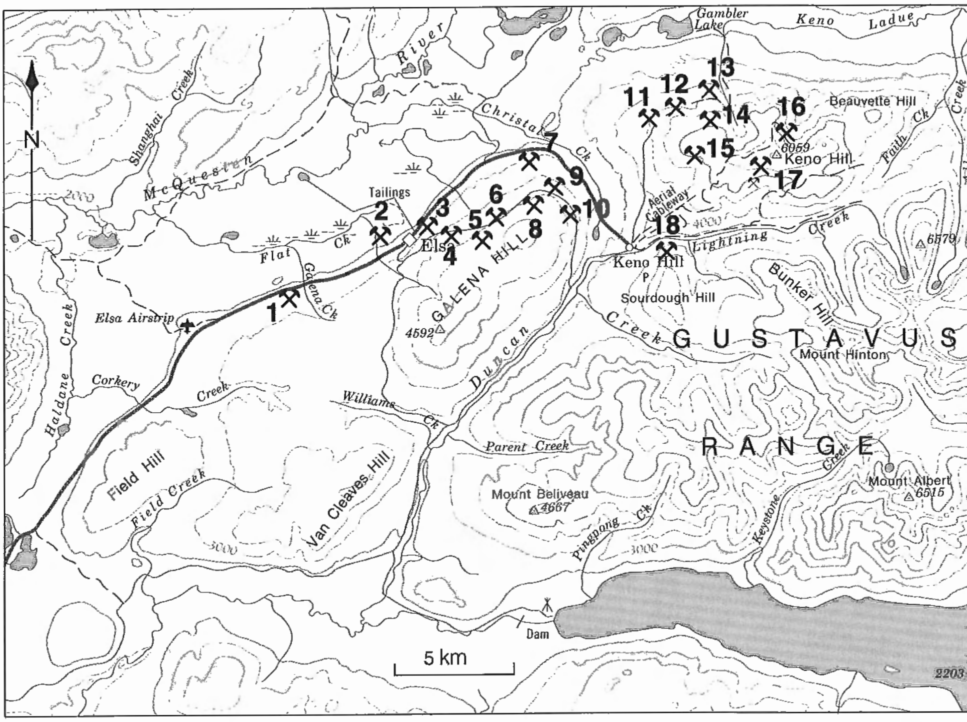
Galena Hill-Keno Hill Mines

GALENA, SPHALERITE, FREIBERGITE, QUARTZ CRYSTALS, ARSENOPYRITE, PYRITE, SIDERITE, MARCASITE, CHALCOPYRITE, PYRRHOTITE, PYRARGYRITE, ACANTHITE, BOULANGERITE, JAMESONITE, BOURNONITE, MENEGHINITE, STEPHANITE, POLYBASITE, NATIVE SILVER, NATIVE ZINC, NATIVE GOLD, COVELLITE, CHALCOCITE, LIMONITE, WAD, ANGLESITE, CERUSSITE, MALACHITE, AZURITE, AURICHALCITE, BROCHANTITE, GYPSUM, PLUMBOJAROSITE, ROZENITE, GUNNINGITE, SENARMONTITE, BEUDANTITE, BINDHEIMITE, DUNDASITE, SCORODITE, SZOMOLNOKITE, SZMIKITE, ILESITE, HAWLEYITE, ARAGONITE, BARITE, TOURMALINE, KAOLINITE, MICA, MINIUM, STIBNITE

In fault veins cutting quartzite, phyllite, schist and greenstone

Galena, sphalerite and freibergite are the principal ore minerals of the silver-lead-zinc deposits in the Elsa-Galena Hill-Keno Hill area. Galena and amber to dark brown sphalerite occur as fine grained and coarsely crystalline aggregates, as groups of crystals, and as individual crystals. Dark grey to almost black metallic freibergite is generally found as grains and small irregular masses in the galena and sphalerite. Quartz, arsenopyrite, pyrite and brownish white to dark

Part of 105 M



Map 7. Galena Hill-Keno Hill mines.

1. Silver King
2. Husky
3. Elsa
4. Dixie
5. Hector-Calumet
6. Arctic
7. Formo
8. Galkeno
9. Bluebird
10. Tin Can
11. Ladue
12. Sadie-Friendship
13. Lucky Queen
14. Lake
15. Shamrock
16. Nabob
17. No. 9
18. Mount Keno

brown and black siderite are commonly associated with these minerals, and in places occur as well-developed crystals occupying vugs. A number of metallic minerals occur less commonly in the ore zones. These include: marcasite, chalcopyrite, stibnite (rare), pyrrhotite, pyrargyrite (in cleavages in galena), acanthite (small fibrous masses and films associated with pyrargyrite and native silver), and the sulphosalts, boulangerite, jamesonite, bournonite, meneghinite, stephanite and polybasite. The sulphosalts are generally indistinguishable in the hand specimen. Native silver has been found in leaf, scale, arborescent and filament form in ice, and associated with quartz crystals in some of the underground operations that reach the zone of permafrost. Native zinc (rare), as tiny grey metallic plates was found with siderite, limonite and wad at the Elsa Mine. Grains, scales and tiny nuggets of native gold have been obtained by panning the residual soils of the area. Covellite and chalcocite have been reported as rare alterations of chalcopyrite. Limonite is common as yellow to brown earthy to botryoidal masses. Wad, an intimate intergrowth of hydrous manganese oxides (pyrolusite, psilomelane,

Plate XXIV

Husky Mine, Elsa. Mount Haldane in left background and foothills of Ogilve Mountain in right background. (GSC 159525)

manganite), occurs as black dendritic films and as coatings and botryoidal masses on vein minerals and on the host rocks. Secondary minerals forming coatings or encrustations include: light to dark grey banded anglesite on galena; white to grey cerussite, as earthy and tabular crystal aggregates associated with anglesite; malachite, azurite, aurichalcite (rare) and brochantite associated with freibergite and chalcopyrite; gypsum, as colourless to white crystal aggregates; yellow to rust-coloured earthy plumbojarosite; dull white rozenite, on pyrite; finely powdered white gunningite, on sphalerite; greyish to white earthy senarmontite, on jamesonite; greenish to yellowish brown beudantite, associated with galena, freibergite and other lead minerals; greenish yellow to brownish yellow bindheimite, associated with freibergite, jamesonite, galena and boulangerite; white to yellowish dundasite, as felt-like crusts and radiating crystals; yellowish to greyish and brownish green scorodite and yellowish green to yellowish brown pharmacosiderite, associated with arseonopyrite; and the sulphates szomolnokite, szmikite and ilesite. Hawleyite occurs as a bright yellow powdery coating on sphalerite, galena and siderite, it was first (1955) described from the Hector-Calumet Mine. Transparent crystals of gypsum associated with aragonite crystals (rare) line cavities in siderite, and crystals of barite have been found in cavities in dolomite. Other minerals reported from the deposit include tourmaline, kaolinite, mica and minium.

The rich silver-lead deposits of the Galena Hill-Keno Hill area were for a number of years Canada's most important source of these metals. The original discovery of argentiferous galena was made in 1906 on Galena Creek by H.W. McWhorter; this deposit became the Silver King Mine which was worked from 1913 until 1918. The discovery of a similar deposit near the summit of Keno Hill by Louis Beauvette in July, 1918, led to a prospecting rush which resulted in the staking of a number of claims in the area. The first production from the Keno Hill deposits was realized in 1920-21 by Keno Hill, Limited. During a 20-year period beginning in 1921, the Treadwell Yukon Company under geologist Livingston Wernecke, brought into production the Ladue, Sadie-Friendship and Lucky Queen mines on Keno Hill, and the Hector-Calumet, Arctic and Mastiff, Elsa, and Silver King mines on Galena Hill. In 1946, the present operator, United Keno Hill Mines, Limited, acquired the properties and since then has been almost the sole producer in the area, the others being MacKeno Mines, Limited on Galena Hill (1953-58) and Bellekeno Mines, Limited on Sourdough Hill (1952-54). Later, geologists of United Keno Hill Mines, Limited discovered the Husky and several other ore-bodies. The deposits are worked by open pit and underground methods. Over the years, large quantities of silver, lead, zinc and cadmium have been produced, and the district has been one of the leading producers of silver in Canada.

Visitors wishing to collect specimens from the mine dumps must apply to the personnel office of the Company at Elsa.

Road log from bridge over Stewart River at Stewart Crossing:

km	0	Proceed onto the road to Mayo (Highway 11). The highway parallels the north side of the Stewart River for 50 km.
km	53	Junction; turn left. The road on right leads to Mayo.
km	58	Junction, road on left, to the hydro-electric dam.
km	70.6	Junction, Minto Lake Road on left.
km	70.7	Junction, Mayo Lake Road on right. The lake is about 30 km from this junction. The lake, the river that drains it, and the town were named for Frank Mayo by Alexander McDonald, a miner and explorer who prospected in the Mayo area in 1887. Mr. Frank Mayo was a partner in the trading firm of Harper, McQuesten and Company.
km	78.3	Junction, road on left to Mount Haldane; continue straight ahead to Elsa.
		On the northwest side of Mount Haldane, at an elevation of 1067 m, galena-bearing veins similar to those at the Galena Hill-Keno Hill deposits were developed in 1918-20; the location is shown on topographical map 105 M/13.
km	94.6	Silver King Mine on right, overlooking the valley of the South McQuesten River and the foothills of the Ogilvie Mountains.
km	97.8	Elsa, at a junction. The road on right leads to the mine offices; to reach Keno Hill, turn left.
km	103.6	Junction, McQuesten-Hansen Lakes Road; continue straight ahead.
km	106.8	Formo Mine on right. On left to the north of Mount Haldane is a distant view of the Ogilvie Mountains. The mountains were named in honour of William Ogilvie, a Canadian government surveyor who surveyed much of the Yukon in the 1880s.
km	110.2	Galkeno Mill road. Straight ahead is a view of the Gustavus Range (elevation to 2044 m) which borders the north side of Mayo Lake.
km	112.3	Keno City, at a junction. The road on right leads to the Bellekeno Mine, the road on left to the Keno Hill mines.

Refs.: 22 p. 1-2, 7, 79, 113-164; 36 p. 3-5; 50 p. 20-24; 131 p. 380-381.

Maps: (T): 105 M/13 Mount Haldane
105 M/14 Keno Hill
(G): 1147A Keno Hill-Galena Hill area, Yukon Territory (1 inch to 4 miles)

Mayo Area Placer Deposits

GOLD, SCHEELITE, WOLFRAMITE, CASSITERITE, TOURMALINE, SCORODITE, NATIVE BISMUTH, HEMATITE, CINNABAR, GARNET

In placers

Numerous gold-bearing creeks were discovered between 1898 and 1903 when hundreds of prospectors stampeded into the Mayo area in search of the rich gold placers rumoured to exist in the vicinity of the Stewart River. The Haggart Creek placers had already been discovered in 1895, and those of the Stewart River prior to that date. Prospecting activity was accelerated after the discovery of the Duncan Creek placers in 1898 by the Gustaveson family (father and two sons), pioneers of the district; the gold was found in the canyon of the creek in the Gustavus Mountains and in its tributary, Lightning Creek. Gold was also recovered from the placers of Dublin Gulch, Secret Creek and Lynx Creek, all tributaries of Haggart Creek; from Minto Creek, Minto Lake (the northeastern end), McLagen Creek, a tributary of Minto Lake, and Highet Creek, a tributary of Minto Creek; from Johnson Creek, a tributary of McQuesten River; from Thunder Gulch, a tributary of Lightning Creek; and from Ledge and Davidson creeks, near Mayo Lake. Coarse nuggets have been reported including some the size of lima beans, and one weighing about 124g was found at Duncan Creek. Gold has been won from some of the streams in the district each year since 1898; the coarse gold is purchased by jewellers for use in the manufacture of attractive gold nugget jewellery.

Scheelite occurs as a white sand in the gold concentrates. It first became an important byproduct of gold mining during World War I when tungsten was in short supply, and its production has continued. For a number of years Dublin Gulch was the principal source of tungsten in the Yukon; other scheelite-bearing placers include Haggart, Lynx, Secret, Johnson, Scheelite, Sabbath (Swede) and Highet creeks. Wolframite is associated with the scheelite in some of the placers.

In addition to gold and tungsten ores, the creeks of the district have yielded the following minerals: yellowish to greenish brown tourmaline-cassiterite nodules (with sugary texture) measuring up to several cm in diameter, at Dublin Gulch and at Haggart and Arizona creeks; scorodite, as green bunches and irregular masses, at Dublin Gulch; native bismuth, as small grains and cleavage pieces, at Dublin Gulch and at Haggart Creek; cassiterite at Ledge Creek; siliceous hematite (Black Diamond) pebbles, at Dublin Gulch; pebbles of siliceous hematite containing jasper, at Duncan and Lightning creeks; cinnabar, at Canyon Creek; and garnet, at Dublin Gulch. The cassiterite-tourmaline nodules are derived from a vein deposit that has been trenched near the top of a hill overlooking Haggart Creek and Dublin Gulch.

Before panning in any of these placers, visitors should check with the Mining Recorder at Mayo to determine whether claims on them are held. Access to the creeks in the Minto Lake area is via the Minto Lake Road, to the Highet Creek-Johnson Creek area via a road branching off from the Minto Lake Road, to the Dublin Gulch-Haggart Creek area via a road branching off from the South McQuesten Road, to the Sourdough Hill area (Thunder Gulch, Duncan Creek, etc.) via a road leading south from Keno City.

Refs.: 11; 17 p. 19-30; 22 p. 84-85, 139-141, 163-164; 31 p. 13-26; 50 p. 106-112; 57 p. 74-82; 71 p. 18-20, 25-41; 101 p. 13-14.

Maps: (T): 105 M Mayo
106 D Nash Creek
105 P McQuesten
(G): 1147A Keno Hill-Galena Hill area, Yukon Territory (1 inch to 4 miles)

The Klondike Road: Stewart Crossing-Dawson Section

km 0 Junction, at the bridge over Stewart River; proceed onto the road to Dawson. From this junction to the Clear Creek bridge, the highway parallels the Stewart River which has entrenched its course in the heavily drift-covered floor of the Tintina Valley, a broad trench across the Yukon Plateau. On the southwest side of the Stewart River, the uniform, rolling upland is broken by the White Mountains which project over 300 m above the surface, and on the opposite side of the river, long ridges border the highway; a network of deep valleys cut the plateau on both sides of the highway. The rocks comprising the ridges bordering the northeast side of the highway as far as **km 7.5** are predominantly interbedded quartz-mica schist and quartzite; similar metamorphic rocks forming the White Mountains have been intruded by basic rocks that cap the peaks. (Ref.: 13 p. 4, 9).

km 47 Bridge over the McQuesten River. This river bears the name of Leroy Napoleon McQuesten, a trader originally with the Hudson's Bay Company, and later with the Alaska Commercial Company. (Ref.: 102 p. 281, 284).

The McQuesten River joins the Stewart River about 1.5 km west of the bridge; formerly, a detachment of the Royal North-West Mounted Police was located at the mouth. Opposite the mouth, Chest Mountain rises from the river level (457 m) to an elevation of 1188 m; it is underlain by granitic rocks.

Stewart River Placer Deposits

GOLD

In placers

The Stewart River was one of the first rivers in the Yukon to attract gold miners. Gold was recovered in paying quantities from its bars for many years beginning in 1883; the production reached a peak between 1885 and 1887. The bars were auriferous from the mouth of Mayo River to almost the mouth of the Stewart. Steamboat Bar, about 6 km below the mouth of McQuesten River, was the richest placer on the Stewart and was reported to yield $140 per day per man using a rocker. In 1886, a few of the miners sluiced the gravels using water pumped up by engines from the "New Racket" steamboat; each miner earned $1,000 in less than a month, after paying an equal sum to the owners of the boat. In 1910 and 1911, two dredges worked the bars but this operation proved to be financially unsuccessful.

The gold was fine and was localized in small areas near the head of each bar; the gold-bearing gravels were shallow, less than 60 cm thick.

Refs.: 31 p. 10, 13-14; 72 p. 5C-6C; 94 p. 40-43.

Maps: (T): 115 P McQuesten
(G): 1143A McQuesten, Yukon Territory (1 inch to 4 miles)

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km	**54**	Partridge Creek. A hot spring is located on the east side of Partridge Creek approximately 25 km upstream from the highway. The temperature of the water issued by the spring is 24°C.
km	**57.4**	Turn-off (left) to airstrip on the shore of Stewart River opposite Steamboat Bar.
km	**60.5**	Bridge over Clear Creek. Placer gold has been recovered from the placers in the upper sections of Clear Creek since 1895. Clear Creek Placers Company Limited operated a dredge on their claims in the 1940s. (Refs.: 13 p. 10-11; 17 p. 19; 72 p. 5C).
km	**76.1**	Junction, Clear Creek Road leading approximately 40 km to the Clear Creek placers. Before proceeding to this area, visitors should check with the Mining Recorder at Dawson to determine whether claims are held; panning in such claims is prohibited.
km	**89**	Gravel Lake on right. Beyond the lake, in the distance to the northwest is a view of the snow-clad, serrated ridges of the Ogilvie Mountains whose foothills rise abruptly from the northeastern side of the Tintina Valley. The peaks of these mountains are fairly uniform in elevation reaching up to about 2135 m above sea level. Between Gravel Lake and the Klondike River (**km 129**), Tintina Valley is occupied by Flat River; in this section, the valley reaches its maximum width of about 22 km. The southwest side of the valley is bordered by the Klondike Plateau, a unit of the Yukon Plateau.
km	**120**	The highway begins a 10 km descent to the mouth of Flat Creek on the Klondike River; it drops from an elevation of 760 m at **km 119** to 460 m at Flat Creek.
km	**129.5**	Bridge over Flat Creek. From the Flat Creek bridge, the highway parallels the south bank of the Klondike River to its mouth on the Yukon River at Dawson. On the left (south) side of the highway, rounded, dome-shaped hills rise to elevations of about 760 m to 915 m. They are underlain by metamorphic rocks (schists, gneisses and quartzites) of Precambrian or early Paleozoic age.

Plate XXV

The Royal Northwest Mounted Police taken after their return from their search for Inspector Fitzgerald and party, Dawson, 1911. From left to right: Constable F. Twiner, Corporal W.J.D. Dempster, Constable J.F. Fyfe (R.C.M.P. Photo Library 4314).

km 142 **The Dempster Highway**

This 720 km highway links Arctic Red River at about km 1450 of the Mackenzie Highway and Inuvik to **km 142** on the Dawson-Stewart Crossing Road. The highway crosses the Ogilvie Mountains, the Taiga Ranges of the Mackenzie Mountains, and the Richardson Mountains. Initially, the road parallels the North Klondike River and crosses the Tintina Valley before entering the Ogilvie Mountains at about km 25. It reaches an elevation of about 1330 m at the North Fork Pass at km 80.

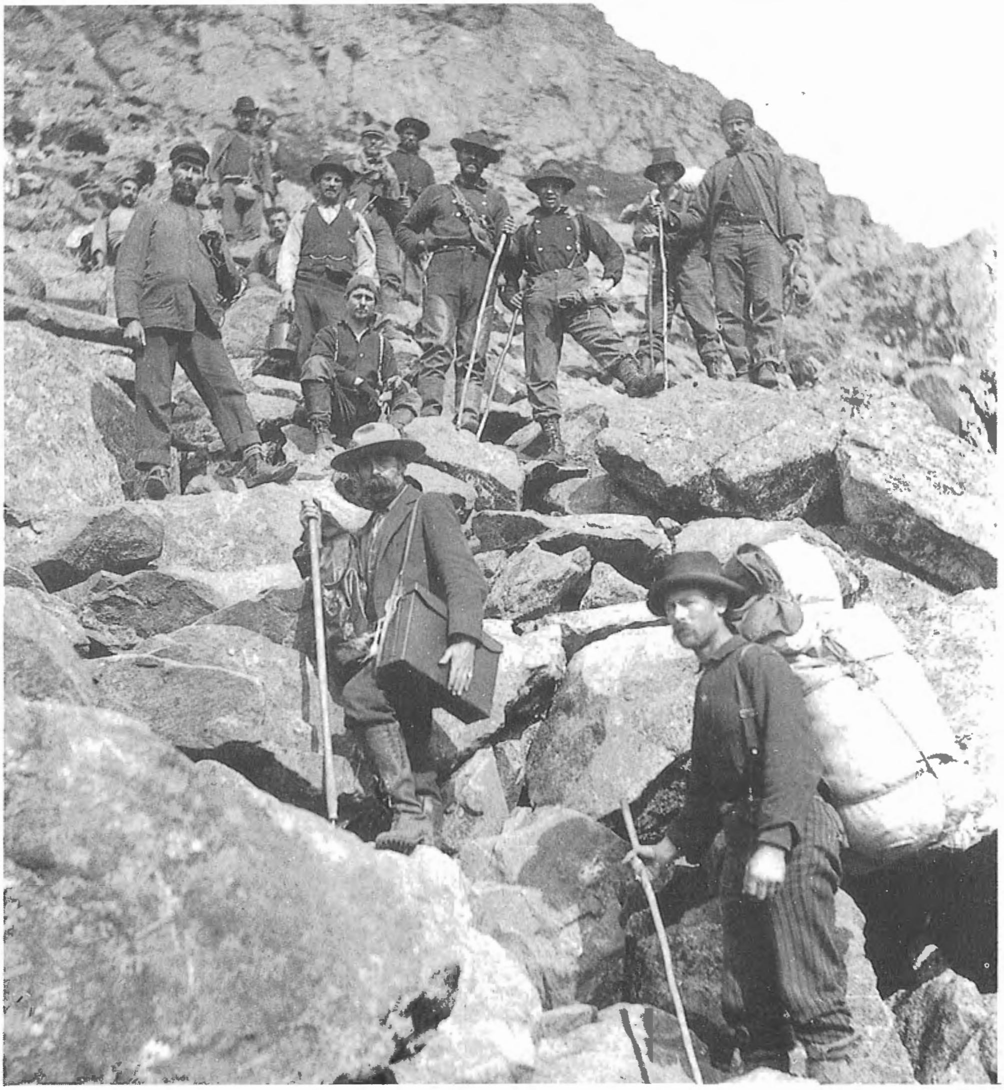

Plate XXVI

Prospectors and miners on a mountain slope near Chilkoot Summit enroute to the Klondike, c 1897. (National Archives of Canada/C 28646)

Plate XXVII

Mining operations at Grand Forks, a settlement that flourished during the Gold Rush and was located at the junction of Bonanza and Elodorado creeks; sluice boxes and timber shafts in foreground. (National Archives of Canada photo C-14544).

The peaks near the road are about 2135 m above sea level, and a 2364 m peak about 16 km southwest of the pass is the highest peak of the Ogilvie Mountains. Sedimentary strata intruded by granitic rocks comprise these mountains. From the pass, the highway descends to the valley of Blackstone River, bridges it at km 117, then proceeds past Chapman Lake and along Blackstone River. The section along Blackstone River (about 50 km) follows the route of an old trail formerly used by Indians in trading with Dawson, and for trapping and hunting in the vicinity of the Blackstone, Hart and Wind rivers. During construction of the highway, a number of Indian graves were discovered there (Pers. comm.: S.P. Baker). The trail was also used by the Royal North-West Mounted Police on their regular patrol from Dawson to Fort McPherson; the patrols reported caribou, mountain sheep, moose, ptarmigan and rabbits in the area.

Before reaching the Ogilvie River at km 198, the highway crosses the Taiga Ranges (elevations 1525 to 1738 m above sea level) via Windy Pass at km 160, and enters Porcupine Plateau. From km 177, permafrost conditions were encountered by the construction crew. Porcupine Plateau, a vast region of smoothly rounded hills and ridges with a maximum relief of 275 m, separates the mountains to the south and to the west from the Richardson Mountains. Within the plateau, the highway follows the valleys of the Ogilvie and Peel rivers, then heads in a northerly direction, bridges Eagle River, and crosses the Arctic Circle before proceeding through the Richardson Mountains and into the Peel Plateau to Fort McPherson. Between the plateau, the rugged Richardson Mountains rise abruptly to elevations of about 1220 m above sea level; the mountain system is 257 km long and 25 to 80 km wide, and is composed of folded sedimentary rocks. The final section of the highway is through the low-lying, lake-dotted Peel Plain (30 to 60 m above sea level) to Arctic Red River settlement at the mouth of the Arctic Red River on the Mackenzie River, then to Inuvik.

The highway was named in honour of Inspector W.J.D. Dempster who, as an officer of the Royal North-West Mounted Police, served at various posts in the Yukon from 1898 until 1934. From 1907 until 1911, he was a member of the Dawson-McPherson dog-sled patrol which left Dawson once each winter transporting mail to and from Fort McPherson, Herschel Island, Kittygaruit and Arctic Red River; the outgoing trip took 4 to 5 weeks, the return 3 to 4 weeks. The 765 km route followed the Yukon and Twelvemile rivers to Seely Pass, then proceeded along Blackstone River to the Hart, Wind and Peel rivers to Fort McPherson. It was also used as a trade route by the Indians, some preferred to trade at Dawson, others at Fort McPherson. Inspector Dempster is remembered in the Yukon for his arduous search in 1911 for the ill-fated "Lost Patrol", a McPherson-Dawson patrol that was lead by Inspector F.J. Fitzgerald but failed to reach Dawson; the tragic patrol had lost its way and perished, and was found by Dempster's patrol only about 50 km from Fort McPherson.

The first post established by the North-West Mounted Police (since 1920, the Royal Canadian Mounted Police) was at Fortymile in 1895; the force has since maintained law and order at various posts in the Yukon. Their intimate knowledge of the country, gained in the course of their patrols, was freely passed on to grateful miners, prospectors and explorers venturing into the unknown land. Their reports contain observations on prospecting and mining activity, on the native population, on game and timber, on traders, explorers and missionaires, and on trails and routes of accessibility – valuable information for the various concerns engaged in opening the North.

Refs.: 19 p. 20, 21, 23, 24, 25; 43 p. 248-253; 44 p. 245-251; 45 p. 232-239; 46 p. 256-262; 47 p. 293-301; 48 p. 200-209; 51 p. 44-47; 52 p. 2-3, 4; 81 p. 66-69; 117 p. 326-332; 134.

Maps:	(T):	116 B and 116 C	Dawson
		116 G and 116 F	Ogilvie River
		116 H	Hart River
		116 I	Eagle River
		116 P	Bell River
		106 M	Fort McPherson
		106 N	Arctic Red River
		107 B	Aklavik
	(G):	900 A	Principal mineral areas of Canada (1:7,603,200)

The road log along the Klondike Road is resumed

km **165.7** Bridge over Hunker Creek. Between Hunker Creek and Bonanza Creek, extensive tailings from former placer operations line the highway. The Klondike Hills parallel the south side of the highway from Hunker Creek to the Yukon River.

km **166.5** Junction, Hunker Creek Road leading to the Dominion Creek area placers.

km **171.1** Junction, Bear Creek Road.

km **179.5** Junction, Bonanza Creek Road. This road leads to the Bonanza Creek-Eldorado Creek placers.

km **180.2** Bridge over the Klondike River.

km **182** Dawson, at the junction of the Klondike river with the Yukon River. Formerly the capital of Yukon Territory, it sprang into existence during the Klondike gold rush, rapidly attaining a population of 30,000; some of its buildings are now National Historic Sites. Dawson, or Dawson City, was surveyed by William Ogilvie and named by him in honour of Dr. George Mercer Dawson, the third director of the Geological Survey of Canada, and leader of the Yukon Expedition of 1887-88 which combined geological (under Dawson and R.G. McConnell) and surveying (under William Ogilvie) investigations that laid the groundwork for our knowledge of the geography and geology of much of Yukon Territory. The report of Dr. Dawson's explorations provided vital information to the miners and prospectors who stampeded to the Klondike in search of gold.

Plate XXVIII

A miner of the late 1890's at his shaft on a hill opposite Claim 58 below Bonanza Creek. (National Archives of Canada photo PA-16945)

Klondike Gold fields

GOLD, CASSITERITE, SILICEOUS HEMATITE

In placers

The phenomenally rich placer goldfields of the Klondike district ranked among the greatest in mining history. The Klondike creeks accounted for most of the Yukon Territory's placer gold production which, from 1866 to the end of 1970, was estimated (by the Dominion Bureau of Statistics) at 345243 kg valued at nearly 262 million dollars; over one-third of this value was realized in the period from 1898 to 1903. Production from the Klondike declined steadily after 1900, and dropped sharply when dredging operations ceased in 1966. In recent years, the annual production has been 187 to 250 kg obtained by hydraulicking and by sluice operations; the coarse nuggets are used by jewellers in the Yukon for fashioning into attractive gold nugget jewellery, and related articles.

The gold-bearing creeks are located southeast of Dawson in an area bound by the Yukon River on the west, the Klondike River on the north, Flat and Dominion creeks on the east, and Indian River on the south. They radiate from King Solomon Dome, on the Hunker Creek Road about 30 km south of the Klondike Road; some, including Bonanza, Eldorado, Bear and Hunker creeks flow into the Klondike River, and others including Quartz, Dominion, and Sulphur creeks flow into the Indian River. The most productive creeks have been Bonanza, Eldorado, Hunker and Dominion creeks. Eldorado creek was regarded as one of the richest placer creeks ever discovered and its first thirty-seven claims (each 152 m long and numbered from the mouth) yielded in the first 5 years an estimated value of 20 to 25 million dollars; the gold was coarse with numerous nuggets valued at 400 to 1,000 dollars each (assay value of $15.50 to $15.75 per ounce). At Hunker Creek, along a 1.6 km stretch, the yield was about $3,000 per running metre of the valley; nuggets were numerous in places. The original discoveries of large quantities of gold were made on Bonanza Creek, and a yield of nearly half a million dollars

Plate XXIX

Dredge and tailings, Bonanza Creek, 1971. (GSC 159500)

was reported from some of the richer claims on Dominion Creek. Other streams that have yielded gold in paying quantities include Bear, Allgold, Sulphur, Gold-Run, Last Chance, Gold Bottom, Quartz, Eureka and Adams creeks, and many of their gulches and pups. Most of the gold was in the form of flakes, grains and nuggets; it was alloyed with silver and its grade varied from $12.50 to $17.50 per ounce. The highest values were reported from Allgold Creek.

Cassiterite pebbles measuring up to 3 cm in diameter have been found in the gravels of Hunker, Dominion, Bonanza and Sulphur creeks; the pebbles are light to medium brown with black bands. They are known as wood-tin or "Yukon diamonds". Siliceous hematite ("Black diamond") occurs as pebbles at Hunker and Bonanza creeks. Both the cassiterite and the hematite take a high polish and are used locally for jewellery. Tusks of fossil mammoths and of bisons have been found in the gravels of Bonanza and Eldorado creeks.

The gold is believed to be derived from quartz veins and stringers associated with the mica and quartz schists comprising the country rocks that underlie the stream gravels. During a long unbroken period of erosion since Tertiary times, the quartz veins and the enclosing rock disintegrated and the gold accumulated in concentrations in the beds of streams and along their valley slopes. Since the Klondike area was not glaciated, the gold accumulations remained undisturbed until their discovery by miners. The auriferous gravels occur in the valley bottoms and on the benches along the lower valley slopes; the bench gravels are composed mostly of white quartz and are referred to as the "White Channel" gravels. Most of the gold was found in the gravels within 60 cm of bedrock and in crevices in the bedrock. The gravel is mantled with a layer of muck or peat usually from 1 to 2.4 m thick, but in places 15 m thick.

Plate XXX

Tourists' gold-panning operations, Bonanza Creek. (GSC 159503)

The original mining methods were by sinking a shaft to bedrock and by open-cuts. Because permafrost extends to 60 m or more in the Dawson area, the gravels had to be thawed before the gold-bearing gravels could be extracted. Thawing was achieved in the bottom of the shaft by various methods including wood fires, hot stones, steam thawers and water pumps; the thawed gravels were hoisted up and sluiced. The layer of muck insulated the underground workings preventing collapse of the walls; large chambers could thus be excavated, and one on Dominion Creek was reported to measure 42 by 70 m with no pillars for support. In the open-cut method, the muck was removed by directing naturally flowing water over a desired area in the spring, causing it and the gravels beneath to thaw. Hydraulicking was also used but lack of a water supply hindered operations. In about 1900, a dredge from the Lewes (Yukon) River was put into operation on Bonanza Creek. In 1923 the Yukon Consolidated Gold Corporation Limited was formed from 8 companies operating in the Klondike placers, and until 1966 it mined various creeks using electrically-driven dredges and bulldozer-sluicing plants. One of the dredges remains on Bonanza Creek and has been designated an Historic Site. Since 1966, placer mining has been conducted by individual operators, mostly by sluicing.

Plate XXXI

Yukon gold nugget bracelet. (GSC 202514-Z)

The discovery of spectacularly rich gold placers in the Klondike sparked a world-wide interest in the area, and drew the greatest stampede of miners and prospectors in the history of mining in Canada. Miners abandoned their placer operations in other parts of the Yukon and Alaska, and were joined by hundreds of others who made the long hazardous journey from more distant points to share in the wealth of the Klondike. Although the rush began in 1896, miners worked the bars of Indian Creek as early as 1894 and recovered gold from Quartz Creek in 1895. In the summer of 1896, Robert Henderson, who began prospecting in the area in 1894, found his richest yield in a stream he named Gold Bottom Creek, and invited a miner - George W. Carmack - to prospect the creek; the latter did so, but not being encouraged by the results, returned to Klondike (a settlement, now abandoned, at the mouth of the Klondike River) pausing on the way to prospect some of the creeks. He and his two Indian associates, Tagish Charlie and Skookum Jim, made a rich strike on Muffler Creek (later named Bonanza Creek by the miners); on August 17, 1896 he staked the Discovery Claim, a double claim, for himself and one for his companions, and related the news to miners at Forty Mile. As a result of these discoveries, claims were rapidly staked along the whole of Bonanza Creek, its tributaries and gulches, and in other creeks in the area. By 1899, most of the gold placers in the district were discovered, and the town of Dawson City became the commercial, social and mining centre of the area. The Discovery Claim on Bonanza Creek has been designated a Historic Site by the Department of Indian and Northern Affairs.

Most of the miners made their way to the Klondike along the Trail of '98: from Skagway on foot across the Boundary Ranges of the Coast Mountains via the Chilkoot Pass to Lake Bennett where they embarked on the Yukon River to take them to Dawson; lacking a local supply of boats, the earliest miners constructed their own craft from pine and spruce trees at Lake Bennett. The sudden demand for transportation services resulted in a ship-building boom at the settlement of Bennett, in the installation of river-boat services from Bennett Lake to Dawson, and in the construction of the White Pass and Yukon Railway from Skagway to Whitehorse. With the completion of the railway in 1900, Bennett became a ghost-town and the stern-wheel steamer route to Dawson originated at Whitehorse. A network of roads connected the placer operations to Dawson City.

Before panning any of the placers, visitors should check with the Mining Recorder in Dawson to determine whether claims are held. A check should also be made on the condition of the roads. Access to the creeks is as follows: Allgold Creek, from Flat Creek at **km 129.5** on the Dawson - Stewart Crossing Road; Hunker, Dominion, Gold Run, Sulphur, Eureka, Quartz, Gold Bottom and Last Chance creeks, from the Hunker Creek Road; Bonanza, Eldorado and Adams creeks, from the Bonanza Creek Road. The dredge on the Bonanza Creek Road is located 16 km from the highway. Tourist facilities for panning gold are set up at points on the Bonanza Creek Road; since the locations may vary from year to year, visitors should consult the local tourist office.

Refs.: 5 p. 147; 21 p. 352-354; 50 p. 91-103; 84 p. 5B-69B; 87 p. 12-14; 90 p. 55A-62A; 95 p. 79, 87-88, 119; 101 p. 13-14; 125 p. 21-22, 36.

Maps: (T): 115 O/10 Granville
115 O/14 Grand Forks
115 O/15 Flat Creek
116 B/3 Dawson
(G): 711A Ogilivy, Yukon Territory (1 inch to 4 miles)
1011 Auriferous gravels on Bonanza and Hunker creeks, Klondike Mining district Yukon (1 inch to ½ mile)
688 Klondike gold fields (1 inch to 2 miles)

The Sixtymile Road

The Sixtymile road links the Klondike Highway to Alaska. Its route is along the crest of a long, flat-topped ridge underlain by schists and quartzites; the ridge separates the Yukon River and Fortymile Creek to the north from Swede Creek and Sixtymile River to the south. Much of the road is above timberline which is at about 1067 m above sea level. It traverses the northern part of Klondike Plateau (a unit of Yukon Plateau), an unglaciated region of widespread discontinuous permafrost. In travelling along the road, a top-of-the-world view unfolds a seemingly endless series of long, flat-topped ridges of fairly uniform elevation, that have been dissected into a maze of deep gently curved V-shaped valleys whose floors are 457 to 915 m below the crests. This topography is the result of long continuous erosion since Tertiary times and the absence of glacial action.

Road log along the Sixtymile Road from Dawson:

km 0 Ferry landing on the west side of the Yukon River, opposite Dawson. The Moosehide Hills form a ridge north of Dawson, and about 10 km downstream, is the site of Fort Reliance, a former trading post on the Yukon River operated by Harper, McQuesten and Company.

km 11 The highway, in reaching the crest of the ridge, has climbed from an elevation of about 335 m above sea level at the ferry landing to 1067 m. Swede Creek is on left, and the Yukon River with the Ogilvie Mountains in the distance on the right.

km 48 The castle-like formation along the north side of the road is composed of quartzite; the less resistant surrounding rocks have been weathered leaving these block-like forms.

km 53 Junction, road to Clinton Creek and Fortymile River (so-named because it is 40 miles from Fort Reliance). The description of the Clinton Creek Mine is given on page 98.

The discovery in the autumn of 1886 of coarse gold on Fortymile River caused a migration of miners from all other camps to the area. Gold was found along a 160 km stretch from the mouth of the river, and some miners were reported to recover nearly $100 worth of gold per day. Platinum was also found. Most of the productive bars were located in the Alaska section of the river.

In the spring of 1887, a trading post was established at the mouth of Fortymile River on the Yukon River by Harper and McQuesten. A town sprang up and included blacksmith shops, and dance, billiard and opera houses, a cigar factory, bakeries, breweries, distilleries, and a detachment of the Royal North-West Mounted Police. It became a ghost town when the Klondike attracted the miners away from the area.

The road log continues along the Sixtymile Road.

km 55 Swede Dome on left.

km 79 Junction, road to the Sixtymile gold fields.

km 92 The road at this point is at an elevation of about 1310 m, the highest in its course.

km 95 Junction, road to Sixtymile goldfields. A description of the Sixtymile goldfields is given on page 99.

km 97 Yukon-Alaska border.

Refs.: 16 p. 69-71; 19 p. 22-23; 24; 37 p. 37-48, 52; 42 p. 181B-182B; 55 p. 105-107; 58 p. 15; 83 p. 139D-140D; 95 p. 72; 125 p. 37, 41.

Maps: (T): 116 B & 116 C Dawson
(G): 1284A Dawson, Yukon Territory (1 inch to 4 miles)

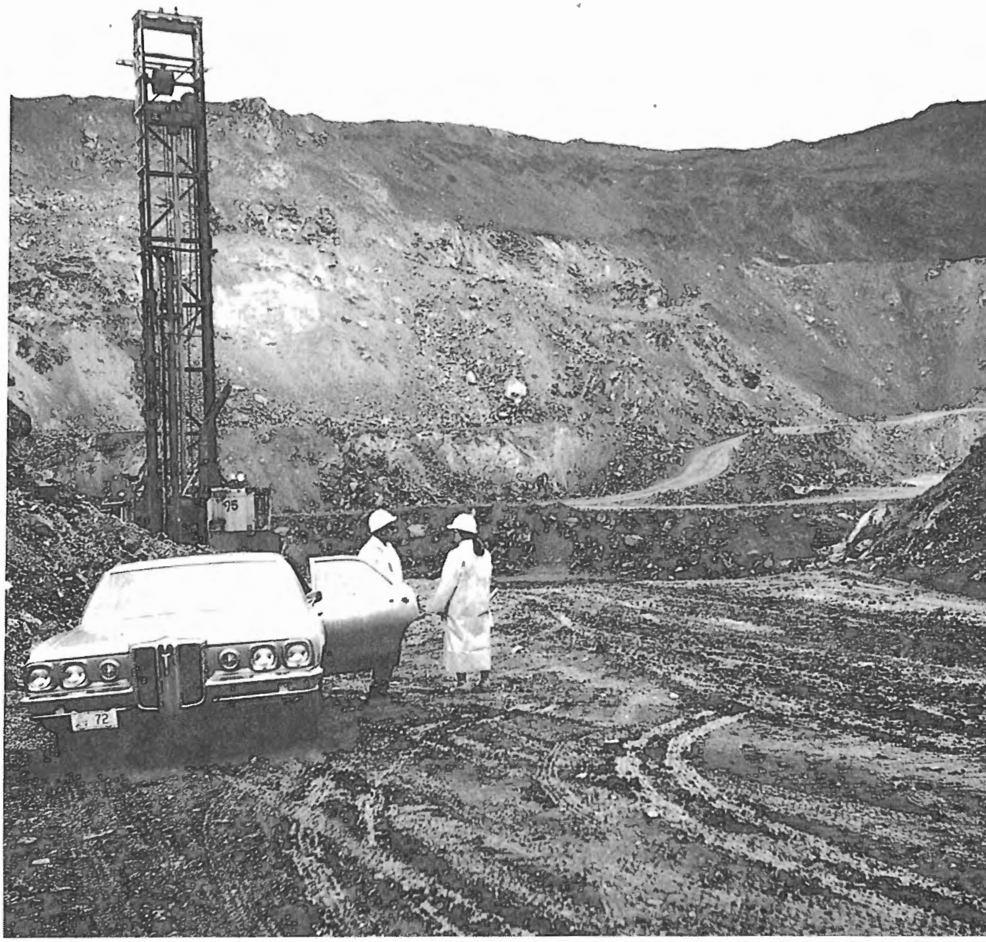

Plate XXXII

Clinton Creek Mine, 1971. (GSC 159495)

Clinton Creek Mine

ASBESTOS, SERPENTINE, MAGNETITE PICROLITE, MAGNESITE, TREMOLITE, HYDROMAGNESITE, BRUCITE, ARAGONITE, PYROAURITE, OPAL, FUCHSITE, CHALCOPYRITE, GARNIERITE

In serpentinite intruding schist, quartzite, gneiss and crystalline limestone

Golden-green cross-fibre asbestos occurs in light to medium green massive serpentine; the fibres measure up to 3 cm long but average much less. Grains, crystals and pods of magnetite occur in the serpentine. Yellowish green picrolite is also present. Other minerals associated with the serpentine are: magnesite, as compact white translucent to chalk-like masses and veins; tremolite, as white to grey radiating fibrous aggregates; hydromagnesite, as white microscopic discs; brucite, as white to greyish white fibrous masses with fibres several cm long; aragonite, as coarse white, vitreous radiating fibrous aggregates; and pyroaurite, as colourless silky, flaky patches on serpentine. Common opal has been found near the surface of the pit; it varies in colour from pea-green to olive-green and from brownish red to brown, and each background colour is mottled with tones of the other colours. Fuchsite, garnierite and chalcopyrite were found in the deposit.

The deposit was discovered in 1957 by G. Walters of Dawson and the staking was financed by the Caleys, also of Dawson. In 1960, Cassiar Asbestos Corporation Limited acquired the property and put it into production from 1967 to 1978. The mine is about 225 km south of the Arctic Circle; it is located at an elevation of 488 m on Porcupine Hill which overlooks Clinton Creek. The mill was situated on Trace Hill, on the opposite side of Clinton Creek, and ore was transported via a 1.6 km aerial tramline. The fibre was transported by truck to Whitehorse, by rail to Skagway, and finally by container-ships to the Company's warehouses in Vancouver. In winter months when ferry service is discontinued on the Yukon River at Dawson, the fibre was unloaded and transported over the Yukon River by an aerial tramline, then reloaded onto trucks. The mine consists of three pits: the main pit which is 272 m deep, the Creek pit which is located 450 m east of the main pit, and the Snowshoe pit, located 360 m east of the Creek pit.

Road log to the mine from Sixtymile Road at km 53 (see page 97):

km	0	Proceed onto Clinton Creek Road.
km	31	Bridge over Fortymile River. The old town of Fortymile was located approximately 5 km downstream from this bridge. The new town of Clinton Creek has been established on the northwest side of the bridge.
km	44	Mine

Refs.: 35 p. 216-220; 50 p. 31-32; 57 p. 19-21.

Maps: (T): 116 C/7 Forty Mile
116 B & 116 C Dawson
(G): 1284A Dawson, Yukon Territory (1 inch to 4 miles)

Sixtymile River Goldfields

GOLD, CINNABAR, GALENA

In placers

Gold was discovered in the Sixtymile district in 1892 by C. Miller on Miller Creek, about 5 km from its mouth. Subsequent discoveries were made at Glacier, Big Gold, Little Gold, Bedrock and Matson creeks, and at Sixtymile River. Both fine and coarse gold were recovered and nuggets valued at up to $8 each were found at the Miller Creek and Sixtymile River placers. Gold at that time was valued at $20.64 per ounce.

Gold was mined from gravels in the Valley bottoms and on benches or terraces along the streams. The workings consisted of opencuts, shafts and dredging. Mining was done at the following locations: Sixtymile River, between the mouth of Miller Creek and the mouth of Big Gold Creek; Miller Creek, for a distance of about 5 km beginning at its mouth; Glacier Creek, about 5 km from its mouth, Matson Creek, near the mouth of Weide Gulch, (about 8 km above the forks of the creek); Big Gold Creek, from the mouth of Glacier Creek to Sixtymile River. Original operations were conducted on Miller Creek by Nolasque Tremblay, Joe Lemay, Joe Roi and Louis Boucher. Production reached a peak in 1895. Two dredges operated in the area, one on Miller Creek (1915-16) and on Sixtymile River (between 1929 and 1941), and the other on Big Gold Creek (between 1947 and 1959). Fragments of cinnabar (measuring up to 1 cm) and galena were recovered from the placers in Sixtymile River near the mouth of Miller Creek. The goldfields are about 16 km from the Sixtymile Road.

Refs.: 16 p. 69-71; 37 p. 37-48, 52; 42 p. 181B-182B; 55 p. 105-107; 58 p. 15; 95 p. 72; 125 p. 37, 41.

Maps: (T): 115 N/9 Matson Creek
115 N/15 Crag Mountain
116 C/2 Sixtymile
(G): 1812 Sixtymile and Ladue rivers, Yukon Territory (1 inch to 4 miles).

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Tourism British Columbia,
1117 Wharf Street,
Victoria, British Columbia,
V8W 2Z2 (604-387-1428 or 1-800-663-6000)

Tourism Yukon,
Government of Yukon,
P.O. Box 2703
Whitehorse, Yukon,
Y1A 2C6 (403-667-5340)

MINERAL, ROCK DISPLAYS

Indian and Northern Affairs Canada,
200 Range Road,
Whitehorse, Yukon.

Kluane Historical Society Museum,
Burwash Landing,
Mile 1093, Alaska Highway,
Yukon.

MacBride Museum,
Whitehorse, Yukon.

Yukon Chamber of Mines,
412 Main Street,
Whitehorse, Yukon.

The Dawson City Museum,
Dawson, Yukon.

Keno Mining Museum
Keno, Yukon.

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GLOSSARY

Acanthite. Ag_2S. H=2-2½. Iron-black metallic, prismatic aggregates. Sectile. Low temperature form of silver sulphide, argentite being the high temperature form. Ore of silver associated with other silver minerals.

Actinolite. $Ca_2(Mg, Fe)_5Si_8O_{22}(OH)_2$. H=5-6. Bright green to greyish green, fibrous or radiating prismatic aggregates. Variety of amphibole.

Allemontite. SbAs. H=3-4. Tin-white to reddish grey metallic, fibrous, lamellar, reniform, mammillary or finely granular masses. Tarnishes to grey or brownish black. Perfect cleavage in one direction. Fuses to a metallic globule. Occurs in veins with other arsenic and antimony minerals, and in pegmatites containing lithium minerals. Renamed stibarsen.

Alunogen. $Al_2(SO_4)_3.17H_2O$. H=1½-2. White fibrous to powdery. Vitreous to silky lustre. Acid, sharp taste. Secondary mineral associated with pyrite or marcasite.

Amphibole. A mineral group consisting of complex silicates including tremolite, actinolite and hornblende. Common rock-forming mineral.

Andesite. A dark coloured volcanic rock composed mainly of plagioclase feldspar with amphibole or pyroxene.

Andorite. $PbAgSb_3S_6$. H=3-3½. Dark grey metallic, striated prismatic or tabular crystals; massive. Conchoidal fracture. Black streak. Soluble in HCl. Associated with sulphides and other sulphosalts.

Anglesite. $PbSO_4$. H=2½-3. Colourless to white, greyish, yellowish or bluish tabular or prismatic crystals, or granular. Adamantine or resinous lustre. Characterized by high specific gravity (6.36 to 6.38) and adamantine lustre. Effervesces in nitric acid. Secondary mineral formed generally from galena. Ore of lead.

Ankerite. $Ca(Mg, Fe) (CO_3)_2$. Variety of dolomite from which it cannot be distinguished in the hand specimen.

Anorthite. $CaAl_2Si_2O_8$. A plagioclase feldspar.

Antigorite. $Mg_3Si_2O_5(OH)_4$. H=2½. Green translucent variety of serpentine having lamellar structure.

Antimony. Sb. H=3-3½. Light grey metallic, massive, granular, lamellar, or radiating. Occurs with other antimony minerals. Used as a component of lead alloys for manufacture of storage batteries, cable coverings, solders, bearing metal; also for flame-proofing textiles, paints and ceramics.

Apatite. $Ca_5(PO_4)_3$ (F,Cl,OH). H=5. Green, blue, colourless, brown, red hexagonal crystals, or granular, sugary massive. Vitreous lustre. May be fluorescent. Distinguished from beryl and quartz by its inferior hardness; massive variety is distinguished from calcite, dolomite by its superior hardness and lack of effervescence in HCl, and from massive diopside and olivine by its inferior hardness. Used in the manufacture of fertilizers and detergents.

Aragonite. $CaCO_3$. H-3½-4. Colourless to white or grey and, less commonly, yellow, blue, green, violet, rose-red, prismatic or acicular crystals; also columnar, globular, stalactitic aggregates. Vitreous lustre. Transparent to translucent. Distinguished from calcite by its cleavage and higher specific gravity (2.93). Effervesces in dilute HCl.

Argentite. Ag_2S. H=2-2½. Dark grey cubic, octahedral crystals; arborescent, massive, metallic. Very sectile. Occurs in sulphide deposits with other silver minerals. Inverts to acanthite at temperatures below 180°C.

Argillite. A clayey sedimentary rock without a slaty cleavage or shaly fracture.

Arsenopyrite. FeAsS. H=5½-6. Light to dark grey metallic, striated prisms with characteristic wedge-shaped cross-section; also massive. Tarnishes to bronze colour. Ore of arsenic; may contain gold or silver.

Asbestos. Fibrous variety of certain silicate minerals such as serpentine (chrysotile) and amphibole (anthophyllite, tremolite, actinolite, crocidolite) characterized by flexible, heat- and electrical-resistant fibres. Chrysotile is the only variety produced in Canada; it occurs as veins with fibres parallel (slip fibre) or perpendicular (cross-fibre) to the vein walls. Used in the manufacture of asbestos cement sheeting, shingles, roofing and floor tiles, millboard, thermal insulating paper, pipecovering, clutch and brake components, reinforcing in plastics, etc.

Aurichalcite. $(Zn, Cu)_5(CO_3)_2(OH)_6$. H=1-2. Light green to blue silky to pearly acicular or lath-like crystals forming tufted, feathery, plumose, laminated or granular encrustations. Transparent. Soluble in acids and in ammonia. Secondary mineral occurring in oxidized zones of copper and zinc deposits, associated with other secondary copper and zinc minerals.

Axinite. $Ca_2 (Fe, Mn) Al_2BSi_4O_{15}(OH)$. H=7. Violet, pink, yellow to brown wedge-shaped crystals or massive, lamellar. Vitreous lustre. Fuses readily with intumescence. Occurs commonly in contact-altered calcareous rocks. Transparent varieties used as gemstones.

Azurite. $Cu_3(CO_3)_2(OH)_2$. H=3½-4. Azure-blue to inky blue tabular or prismatic crystals; also massive, earthy, stalactitic with radial or columnar structure. Vitreous, transparent. Secondary copper mineral. Effervesces in acids. Ore of copper.

Barite. $BaSO_4$. H=3-3½. White, pink, yellowish, blue tabular or platy crystals; granular massive. Vitreous lustre. Characterized by a high specific gravity (4.5) and perfect cleavage. Used in the glass, paint, rubber, and chemical industries, and in oil-drilling technology.

Basalt. Dark coloured, fine grained volcanic rock or lava composed predominantly of an amphibole or pyroxene with plagioclase. Amygdaloidal basalt is one that contains cavities which may be occupied by one or more minerals.

Batholith. A very large body of coarse-textured igneous rocks such as granite or diorite.

Beudantite. $PbFe_3 (AsO_4)(SO_4)(OH_6)$. H=3½-4½. Dark green, brown, black rhombohedral crystals; also yellow earthy or botryoidal masses. Vitreous, resinous to dull lustre. Secondary mineral occurring in iron and lead deposits. Difficult to distinguish in hand specimen from other yellowish secondary minerals.

Bindheimite. $Pb_2Sb_2O_6(O,OH)$. H=4-4½. Yellow to brown, white to grey or greenish powdery to earthy encrustations; also nodular. Secondary mineral found in antimony-lead deposits. Difficult to identify except by X-ray methods.

Bismuth. Bi. H=2-2½. Light grey metallic reticulated crystal aggregates; also foliated or granular. Iridescent tarnish. Used as a component of low melting-point alloys and in medicinal and cosmetic preparations.

"Black diamond". A siliceous hematite which, when polished, takes a high, mirror-like lustre. Used as a gemstone.

Bog iron ore. Loose, porous iron ore formed by precipitation of water in bogs or swampy areas. Ore consists of limonite, goethite, and/or hematite.

Bornite. Cu_5FeS_4. H=3. Reddish brown metallic. Usually massive and tarnished to iridescent blue, purple, etc. Known as peacock ore, variegated copper ore purple copper ore or vitreous copper. Ore of copper.

Boulangerite. $Pb_5Sb_4S_{11}$. H=2½-3. Dark bluish grey metallic, striated, elongated prismatic to acicular crystals; also fibrous, plumose aggregates. Fibrous cleavage is distinguishing characteristic. Occurs in veins with lead minerals. Ore of antimony.

Bournonite. $PbCuSbS_3$. H=2½-3. Grey to blackish grey metallic. Short prismatic or tabular crystals with striated faces; massive. Occurs in veins with sulphides and sulphosalts. Not readily identified in hand specimen.

Brochantite. $Cu_4(SO_4)(OH)_6$. H=3½-4. Vitreous emerald-green acicular crystal aggregates; massive, granular. Secondary mineral formed by oxidation of copper minerals. Distinguished from malachite by lack of effervescence in HCl.

Brucite. $Mg(OH)_2$. H=2½. White, grey, light blue or green tabular, platy, foliated or fibrous aggregates, also massive. Pearly or waxy lustre. Soluble in HCl. Distinguished from gypsum and talc by its superior hardness and lack of greasy feel. Resembles asbestos but lacks silky lustre. Is more brittle than muscovite. Used for refractories and as a minor source of magnesium metal.

Cabochon. A polished gemstone having a convex surface; transluscent or opaque minerals such as opal, agate, jasper, and jade are generally cut in this style.

Calaverite. $AuTe_2$. H=2½-3. Brass-yellow to silver-white metallic, bladed, lath-like or striated short prisn.atic crystals. Fuses readily; on charcoal gives bluish green flame and gold globules. Ore of gold. Occurs in veins with pyrite, native gold.

Cassiterite. SnO_2. H=6-7. Yellow to brown prismatic crystals; twinning common. Also radially fibrous, botryoidal, or concretionary masses; granular. Adamantine, splendent lustre. White to brownish or greyish streak. Distinguished from other light coloured nonmetallic minerals by its high specific gravity (6.99); from wolframite by its superior hardness. Ore of tin. Concentrically banded variety used as a gemstone.

Cerussite. $PbCO_3$. H=3-3½. Transparent white, grey or brownish tabular crystals with adamantine lustre; also massive. High specific gravity (6.5) and lustre are distinguishing features. Secondary mineral formed by oxidation of lead minerals. Fluoresces in shades of yellow in ultraviolet light. Ore of lead.

Chabazite. $CaAl_2Si_4O_{12}\cdot 6H_2O$. H=4. Colourless, white, yellowish or pinkish square crystals. Vitreous lustre. Occurs in cavities in basalt. Distinguished from other zeolites by its almost cubic crystal form; distinguished from calcite by its superior hardness and its lack of effervescence in HCl.

Chalcedony. SiO_2. H=7. Translucent micro-crystalline variety of quartz. Colourless, grey, bluish, yellowish, reddish, brown. Formed from aqueous solutions. Attractively coloured chalcedony is used for ornamental objects and jewellery. Varieties include agate, carnelian, jasper, etc.

Chalcocite. Cu_2S. H=3½-4. Dark grey to black metallic; massive. Tarnishes to iridescent blue, purple, etc. Also referred to as vitreous copper, sulphurette of copper or copper glance. Soluble in HNO_3. Black colour and slight sectility distinguish it from other copper sulphides. Ore of copper.

Chalcopyrite. $CuFeS_2$. H=3½-4. Brass-yellow massive, or tetrahedral crystals. Iridescent tarnish. Brass colour distinguishes it from pyrrhotite. Distinguished from pyrite by its inferior hardness, from gold by its superior hardness and lower density. Also called copper pyrite and yellow copper. Ore of copper.

Chert. Massive opaque variety of chalcedony; generally drab coloured in various tints of grey or brown.

Chlorite. $(Mg, Fe, Al)_6(Al,Si)_4O_{10}(OH,O)_8$. H=2-2½. Transparent green flaky aggregates. Distinguished from mica by its colour and non-elastic flakes.

Chrysocolla. $(Cu, Al)_2H_2Si_2O_5(OH)_4{\bullet}nH_2O$. H=2-4. Blue to blue-green earthy, botryoidal, or fine-grained massive. Conchoidal fracture. Secondary mineral found in oxidized zones of copper-bearing veins. Often intimately mixed with quartz or chalcedony, producing attractive patterns; because of it being mixed with quartz, the resultant superior hardness renders it suitable for use in jewellery and ornamental objects. Minor ore of copper.

Chrysotile. Fibrous variety of serpentine (asbestos).

Cinnabar. HgS. H=2-2½. Red to brownish red rhombohedral, tabular or short prismatic crystals; also granular or earthy. Adamantine to metallic or dull lustre. Bright red streak. Sectile. Perfect cleavage. Volatile before blow-pipe. Alters to native mercury and mercury minerals. Occurs in veins, or fractures in sandstone or quartizite. Ore of mercury.

Cirque. Semicircular basin along mountain slopes formed by glaciers.

Clinozoisite. $Ca_2Al_3(SiO_4)_3(OH)$. H=7. Pale green to greenish grey prismatic crystals; also granular or fibrous masses. Vitreous lustre. Perfect cleavage. Member of epidote group. Occurs in metamorphic rocks.

Columbite-Tantalite. $(Fe, Mn)Nb_2O_6$-$(Fe, Mn)Ta_2O_6$. H=5-7. Brownish black to black prismatic or tabular crystals forming parallel groups; also massive. Submetallic lustre. Occurs in pegmatites. Ore of niobium which is used in high-temperature steel alloys, and of tantalum which is used in electronics.

Concretion. Rounded mass formed in sedimentary rocks by accretion of some constituent (iron oxides, silica, etc.) around a nucleus (mineral impurity, fossil fragment, etc.).

Conglomerate. A sedimentary rock formed of rounded pebbles or gravel.

Copper. Cu. H=2½-3. Massive, filiform or arborescent; cubic or dodecahedral crystals. Hackly fracture. Ductile and malleable. Occurs in lava.

Covellite. CuS. H=1½-2. Inky blue iridescent in shades of brass yellow, purple, coppery red. Massive; crystals (hexagonal plates) rare. Metallic lustre. Distinguished from chalcocite and bornite by its perfect cleavage and colour.

Cubanite. $CuFe_2S_3$. H=3½. Brass- to bronze-yellow tabular crystals or massive. Distinguished from chalcopyrite by its strong magnetism. Associated with other copper-iron sulphides. Rare mineral.

Cuprite. Cu_2O. H=3½-4. Red to almost black crystals (octahedral, dodecahedral or cubic), massive, earthy. Adamantine, submetallic or earthy lustre. Brownish red streak. Distinguished from hematite by its inferior hardness, from cinnabar and proustite by its superior hardness. On charcoal it is reduced to a metallic globule of copper. Soluble in concentrated HCl. Associated with native copper and other copper minerals. Ore of copper.

Diabase. Dark coloured igneous rock composed mostly of lath-shaped crystals of plagioclase and of pyroxene. Used as building, ornamental and monument stone.

Diopside. $CaMgSi_2O_6$. H=6. Colourless, white to green monoclinic variety of pyroxene.

Diorite. A dark coloured igneous rock composed mainly of plagioclase and amphibole or pyroxene.

Dolomite. $CaMg(CO_3)_2$. H=3½-4. Colourless, white, pink, yellow or grey rhombohedral or saddle-shaped crystals; also massive. Vitreous to pearly lustre. Slightly soluble in cold HCl. Ore of magnesium which is used in the manufacture of lightweight alloys.

Dundasite. $PbAl_2(CO_3)_2(OH)_4 \bullet H_2O$. H=2. White, silky to vitreous radiating crystals, spherical aggregates, matted encrustations. Effervesces in acids. Secondary mineral associated with lead minerals.

Dyke. A long narrow body of igneous rocks that cuts other rocks.

Epidote. $Ca_2(Al,Fe)_3(SiO_4)_3(OH)$. H=6-7. Yellowish green to deep green prismatic crystals, also fibrous or granular masses. Vitreous lustre. Yellow-green colour is distinguishing feature. Occurs in metamorphic and granitic rocks, and in basalt.

Esker. A long stream-deposited ridge or mound formed by the accumulation of sand, gravel, and boulders left by retreating glaciers.

Fault. Structural feature produced by the movement of one rock mass relative to another; shear zone, brecciated zone, fault zone refer to the region affected by the movement.

Feldspar. A mineral group consisting of alumino-silicates of potassium and barium (monoclinic or triclinic), and of sodium and calcium (triclinic). Orthoclase and microcline belong to the first group, plagioclase to the second. Used in the manufacture of ceramics, porcelain-enamel, porcelain, scouring powders, and artificial teeth.

Fluorescence. Property of certain substances to glow when exposed to light from an ultraviolet lamp. It is caused by impurities in the substance or by defects in its crystal structure. Two wavelengths are commonly used to produce fluorescence: long wave (320 to 400 n), short wave (254 n).

Fluorite. CaF_2. H=4. Transparent, colourless, blue, green, purple or yellow, cubic or, less commonly, octahedral crystals; also granular massive. Vitreous lustre. Good cleavage. Often fluorescent; this property derives its name from the mineral. Used in optics, steel-making, ceramics.

Freibergite. $(Ag,Cu,Fe)_{12}(Sb,As)_4S_{13}$. A silver-rich variety of the tetrahedrite-tennantite mineral series.

Freieslebenite. $AgPbSbS_3$. H=2-2½. Grey metallic striated prismatic crystals. Grey streak. Associated with silver and lead ores.

Fuchsite. An emerald-green chromium-rich muscovite.

Gabbro. A dark, coarse-grained igneous rock composed mainly of calcic plagioclase and pyroxene. Used as a building and monument stone.

Gahnite. $ZnAl_2O_4$. H=7½-8. Dark blue-green, yellow or brown octahedra, rounded grains, massive. Vitreous lustre. Occurs in granite pegmatite and in marble.

Galena. PbS. H=2½. Dark grey metallic cubic crystals or crystal aggregates; also massive. Perfect cleavage. Distinguished by its high (7.58) specific gravity and perfect cleavage. Ore of lead.

Garnet. $(Ca, Fe, Mg, Mn)_3$ $(Al, Cr, Fe, Mn)_2$. H=6½-7½. Transparent red dodecahedral crystals, or massive granular; also yellow, brown, green. Distinguished by its crystal form. Used as an abrasive. Transparent garnet is used as a gemstone. Mineral group consisting of several species including almandine, pyrope, grossular.

Garnierite. A general term for green hydrous nickel silicates.

Geode. A hollow nodule whose shell is composed of chalcedony from which crystals, commonly of quartz, project into the interior.

Gneiss. A coarse grained foliated metamorphic rock composed mainly of feldspar, quartz and mica. Used as a building and monument stone.

Goethite. FeO(OH). H=5-5½. Dark brown, reddish or yellowish brown, earthy, botryoidal, fibrous, bladed or loosely granular masses; also prismatic, acicular, tabular crystals or scaly. Has characteristic yellowish brown streak. Weathering product of iron-rich minerals. Ore of iron.

Gold. Au. H=2½-3. Yellow metallic, irregular masses, plates, scales, nuggets. Rarely as crystals. Distinguished from other yellow metallic minerals by its hardness, malleability, high specific gravity (19.3). Precious metal.

Gossan. A decomposed or weathered rusty covering on masses of pyrite or in upper zone of veins; consists of hydrated iron oxides.

Granite. Grey to reddish coloured relatively coarse-grained igneous rock composed mainly of feldspar and quartz. Used as a building and monument stone.

Granodiorite. An igneous rock intermediate in composition between granite and diorite.

Graphite. C. H=1-2. Dark grey to black metallic, flaky or foliated masses. Flakes are flexible. Greasy to touch. Black streak and colour distinguish it from molybdenite. Usually occurs in metamorphic rocks. Used as a lubricant, in "lead" pencils, and refractories.

Greenstone. A metamorphosed volcanic rock composed mainly of chlorite.

Greywacke. Sedimentary rock containing large amounts of amphibole or pyroxene and feldspar.

Gunningite. $ZnSO_4 \cdot H_2O$. H=2½. White powder occuring as an efflorescence on sphalerite from which it has oxidized. First described from the Keno Hill deposits, it was named in 1962 for Dr. H.C. Gunning, a former geologist with the Geological Survey of Canada, and later, Head of the Geology Department, University of British Columbia.

Gypsum. $CaSO_4 \cdot 2H_2O$. H=2. White, grey, light brown, granular massive; also fibrous (satin spar), or colourless, transparent (selenite). Distinguished from anhydrite by its inferior hardness. Occurs in sedimentary rocks. Used in the construciton industry for plaster, wallboard, cement, tiles, paint, and as a soil conditioner and fertilizer. Satin spar and alabaster (fine grained translucent variety) are used for carving into ornamental objects.

Hawleyite. CdS. Bright yellow powdery coating; earthy. Associated with sphalerite and siderite. First described from the lead-silver-zinc deposit at the Hector-Calumet Mine in Elsa, Yukon. Named for Professor J.E. Hawley of Queen's University, Kingston.

Hematite. Fe_2O_3. H=5½-6½. Reddish brown to black massive, botryoidal, or earthy, with greasy to dull lustre; also foliated or micaceous with high metallic lustre (specularite). Characteristic red streak. Ore of iron.

Hexahydrite. $MgSO_4 \cdot 6H_2O$. Colourless or white, finely fibrous, columnar; also globular encrustations. Pearly to vitreous lustre. Bitter, saline taste. Occurs sparingly as an alteration product of epsomite. Originally found at a Bonaparte River locality in British Columbia. Associated with other sulphates from which it is not readily distinguished.

Hoodoos. Pillars or tower-like forms resulting from erosion of horizontal strata.

Hornblende. $Ca_2(Mg, Fe)_4Al(Si_7Al)O_{22}(OH,F)_2$. H=6. Member of amphibole group. Dark green, brown, black prismatic crystals or massive. Vitreous lustre. Common rock-forming mineral.

Hydromagnesite. $Mg_5(CO_3)_4(OH)_2 \cdot 4H_2O$. H=3½. Colourless or white, transparent, flaky, acicular or bladed crystal aggregates forming tufts, rosettes or encrustations; also massive. Vitreous, silky or pearly lustre. Associated with serpentine, brucite, magnesite. Effervesces in acids. Distinguished from calcite by its habit.

Igneous. Rocks that have crystallized from magma or from the melting of other rocks; usually composed of feldspar and quartz, with hornblende, pyroxene or biotite.

Ilesite. $(Mn, Zn, Fe)SO_4 \cdot 4H_2O$. Green to white loose prismatic crystal aggregates. A secondary mineral formed by oxidation in sulphide veins.

Iridosmine. (Os, Ir). H=6-7. Light grey metallic, tabular or, rarely, short primatic crystals; flakes, flattened grains. Perfect cleavage. Associated with gold and platinum placer deposits.

Jade. See Nephrite.

Jamesonite. $Pb_4FeSb_6S_{14}$. H=2½. Dark grey metallic, acicular, fibrous, columnar or plumose aggregates commonly striated. Iridescent tarnish. Decomposes in HNO_3. Occurs in veins with other lead sulphosalts and sulphides.

Jarosite. $KFe_3(SO_4)_2(OH)_6$. H=2½-3½. Yellow to brown pulverulent coating associated with iron-bearing rocks and with coal. Distinguished from iron oxides by giving off SO_2 when heated.

Jasper. An opaque deep red to brown, yellow, green or mauve variety of quartz. Used as an ornamental stone and as a gemstone.

Kaolinite. $Al_2Si_2O_5(OH)_4$. H=2. Chalk-white, greyish, yellowish or brownish earthy masses. Dull lustre. Clay mineral formed chiefly by decomposition of feldspars. Becomes plastic when wet. Used as a filler in paper, and in the manufacture of ceramics.

Lamprophyre. Fine-grained dark-coloured dyke rock composed of plagioclase feldspar, amphibole and/or pyroxene.

Lapieite. CuNiSbS3. Grey metallic microscopic grains associated with pyrite, polydymite, gersdorffite and millerite in a matrix consisting of quartz with altered spinel, magnesite and bright green mica. The mineral was named in 1984 for the Lapie River, which was named for an Indian guide to explorer Robert Campbell.

Laumontite. $CaAl_2Si_4O_{12} \bullet 4H_2O$. H=4. White to pink or reddish white, vitreous to pearly, prismatic crystal aggregates; also friable, chalky due to dehydration. Characteristic alteration distinguishes it from other zeolites.

Lazulite. $MgAl_2(PO_4)_2(OH)_2$. H=5½-6. Blue pyramidal or tabular crystals; massive. Vitreous lustre. soluble in hot acids. Transparent variety used as a gemstone.

Limestone. Soft, white, grey or buff sedimentary rock formed by the deposition of calcium carbonate. Dolomitic limestone contains variable proportions of dolomite and is distinguished from calcium limestone by its weaker (or lack of) effervescence in HCl. Used as a building stone and as road metal. Shell limestone (coquina) is a porous rock composed mainly of shell fragments. Crystalline limestone (marble) is a limestone that has been metamorphosed and is used as a building, monument and ornamental stone.

Limonite. Field term referring to natural hydrous iron oxides composed mainly of goethite. Yellow-brown to dark brown earthy, porous, ochreous masses; also stalactitic or botryoidal. Secondary product of iron minerals.

Magnesite. $MgCO_3$. H=4. Colourless, white, greyish, yellowish to brown, lamellar, fibrous, granular or earthy masses; crystals rare. Vitreous, transparent to translucent. Distinguished from calcite by lack of effervescence in cold HCl. Used in the manufacture of refractory bricks, cements, flooring, and for making magnesium metal.

Malachite. $Cu_2CO_3(OH)_2$. H=3½-4. Bright green granular, botryoidal, earthy masses; usually forms coating with other secondary copper minerals on copper-bearing rocks. Distinguished from other green copper minerls by effervescence in HC1. Ore of copper.

Marble. See limestone.

Marcasite. FeS_2. H=6-6½. Pale bronze to grey metallic radiating, stalactitic, globular or fibrous forms; twinning produces cockscomb and spear shapes. Yellowish to dark brown tarnish. Massive variety is difficult to distinguish from pyrite in the hand specimen.

Melaconite. CuO. Dull powdery coatings or masses; lustrous, resembling coal; reniform or colloform masses. Soluble in HCl or HNO_3. Known as copper pitch ore. Name has been changed to tenorite.

Meneghinite. $Pb_{13}Sb_7S_{24}$. H=2½. Blackish grey metallic. Slender, striated prismatic crystals, fibrous, massive. Oxidized by HNO_3. Associated with sulphides and sulphosalts.

Microcline. $KAlSi_3O_8$. H=6. White, pink to red, or green (amazonite) crystals or cleavable masses. Member of feldspar group. Distinguished from other feldspars by X-ray or optical methods.

Minium. Pb_3O_4. H=2½. Bright red to brownish red, earthy, pulverulent masses with greasy to dull lustre. Orange-yellow streak. Affected by HCl and HNO_3. Secondary mineral formed by the alteration of galena or cerussite.

Molybdenite. MoS_2. H=1-1½. Dark bluish grey metallic tabular, foliated, scaly aggretates or hexagonal crystals; also massive. Sectile with greasy feel. Distinguished from graphite by its bluish lead-grey colour and by its streak (greenish on porcelain, bluish grey on paper). Ore of molybdenum.

Monticellite. $CaMgSiO_4$. H=5. Colourless, grey, small prismatic crystals or grains. Vitreous lustre. Occurs in calcite and crystalline limestone. Related to olivine group. Not readily identifiable in hand specimen.

Moraine. An accumulation of sand, gravel, boulders carried and deposited by glaciers.

Nephrite. $Ca_2(Fe, Mg)_5Si_8O_{22}(OH)_2$. H=6. Dense, compact fibrous variety of tremolite-actinolite group. Green to black, grey, white. Occurs in metamorphic rocks, in periodotite or serpentinite. Very tough. Nephrite is one type of jade used as a gemstone and ornamental stone.

Olivine. $(Mg, Fe)_2SiO_4$. H=6½. Olive-green, vitreous, granular masses or rounded grains; also yellowish to brownish black. Distinguished from quartz by its cleavage; from other silicates by its olive-green colour. Soluble in hot dilute HCl. Used in manufacture of refractory bricks. Transparent variety (peridot) is used as a gemstone.

Opal. $SiO_2 \bullet nH_2O$. H=5½-6½. Colourless, green, grey to black with waxy lustre, and iridescence in gem varieties. Common, or non-gem variety, lacks the iridescence, is translucent to opaque, colourless to white, red, brown, grey, green, yellow, etc. Massive, botryoidal, mammillary or pisolitic forms. Distinguished from chalcedony by its inferior hardness, lower specific gravity. Formed at low temperatures by silica-bearing waters seeping into fissures and cavities in sedimentary and volcanic rocks.

Orthoclase. $KAlSi_3O_8$. H=6. Red, pink or white feldspar. Short prismatic crystals. Vitreous lustre. Perfect cleavage. Distinguished from plagioclase feldspar by absence of twinning striations.

Pegmatite. A very coarse grained dyke rock.

Pentlandite. $(Fe, Ni)_9S_8$. H=3½-4. Light bronze-yellow massive, granular aggregates. Octahedral parting and nonmagnetic property distinguish it from pyrrhotite with which it is commonly associated. Ore of nickel.

Peridotite. An igneous rock consisting almost entirely of olivine and pyroxene with little or no plagioclase feldspar.

Permafrost. Permanently frozen ground. The zone may be a few inches to several hundred m thick and may be thousands of years in this state.

Perovskite. $CaTiO_3$. H=5½. Reddish brown to black cubic or octahedral crystals; also granular massive. Adamantine to metallic lustre. Uneven fracture. White to grey streak. Distinguished from titanite by its crystal form, from pyrochlore by its lustre and streak.

Phyllite. A lustrous metamorphic rock with a texture between that of a schist and a slate.

Picrolite. A non-flexible fibrous variety of antigorite (serpentine).

Placer. Sand or gravel deposit containing gold and/or other mineral particles; generally refers to deposits in paying quantities.

Plagioclase. $(Ca, Na)Al(Al, Si)Si_2O_8$. H=6. White or grey tabular crystals or cleavable masses having twinning striations on cleavage surfaces. Vitreous to pearly lustre. Distinguished from other feldspars by its twinning striations.

Platinum. Pt. H=4-4½. Grey metallic, grains, scales, nuggets, cubic crystals (rare). Hackly fracture. Malleable and ductile. Occurs in basic and ultrabasic igneous rocks, and in placers.

Plumbojarosite. $PbFe_6(SO_4)_4(OH)_{12}$. Yellowish brown to dark brown, dull to silky, powdery, earthy, or compact encrustations; microscopic hexagonal plates. Soft and feels like talc. Dissolves slowly in acids. Oxidation product of lead ores. Not readily identified in hand specimen.

Polybasite. $(Ag, Cu)_{16}Sb_2S_{11}$. H=2-3. Black metallic tabular crystals or massive. Thin splinters are deep red in colour. Decomposed by HNO_3. Occurs with silver-bearing minerals in veins.

Porphyry. A dyke rock consisting of distinct crystals (phenocrysts) in a fine-grained matrix.

Posnjakite. $Cu_4(SO_4)(OH)_6{\bullet}H_2O$. Minute, blue flaky and radiating sheaf-like aggregates. Associated with other secondary copper minerals; not readily distinguished from them in the hand specimen.

Prehnite. $Ca_2Al_2Si_3O_{10}(OH)_2$. H=6½. Light green globular, stalactitic, masses with fibrous or columnar structure. Vitreous lustre. Colour and habit are distinguishing features.

Psilomelane. $(Ba,H_2)Mn_5O_{10}$. H=5-6. Black massive botryoidal, stalactitic, or earthy. Dull to submetallic lustre. Black streak, and amorphous appearance. Ore of manganese. Name has been changed to romanechite.

Pyrargyrite. Ag_3SbS_3. H=2½. Deep red prismatic crystals, massive. Adamantine lustre. Deep red streak. Occurs in veins carrying other silver minerals. Known as ruby silver. Ore of silver. Colour is identifying characteristic.

Pyrite. FeS_2. H=6-6½. Pale brass-yellow metallic crystals (cube, pyritohedrons, octahedrons), or massive granular. Iridescent when tarnished. Distinguished from other sulphides by its colour, crystal form, and superior hardness. Source of slulphur.

Pyroaurite. $Mg_6Fe_2(CO_3)(OH)_{16}{\bullet}4H_2O$. H=2½. Colourless, yellowish, blue, green, or white flaky, nodular or fibrous. Pearly or waxy lustre. Crushes to talc-like powder. Effervesces in HCl. Becomes golden yellow and magnetic when heated.

Pyroxene. A mineral group consisting of Mg, Fe, Ca and Na silicates related structurally. Diopside, enstatite, aegirine, jadeite, etc. are members of the group. Common rock-forming mineral.

Pyroxenite. An igneous rock composed mainly of pyroxene with little or no feldspar.

Pyrrhotite. $Fe_{1-x}S$. H=4. Brownish bronze massive granular. Black streak. Magnetic; this property distinguishes it from other bronze sulphides.

Quartz. SiO_2. H=7. Colourless, yellow, violet, pink, brown, black, six-sided prisms with transverse striations or massive. Transparent to translucent with vitreous lustre. Rock forming mineral. Occurs in veins in ore deposits. Used in glass and electronic industries. Transparent varieties used as gemstones.

Quartzite. A quartz-rich rock formed by the metamorphism of a sandstone. Used as a building and monument stone, and, if colour is attractive, as an ornamental stone; high purity quartzite is used in the glass industry.

Rhodonite. $MnSiO_3$. H=6. Pink to rose-red massive, commonly veined with black manganese minerals. Conchoidal fracture, very tough. Resembles rhodochrosite from which it is distinguished by a superior hardness and lack of effervescence in HCl. Associated with manganese ores. Used as a gemstone and an ornamental stone.

Rhyolite. A fine-grained volcanic rock with composition similar to granite.

Roscoelite. A vanadium-bearing muscovite. Reddish brown to greenish brown.

Rozenite. $FeSO_4 \cdot 4H_2O$. White or greenish white, finely granular, botryoidal or globular encrustations. Metallic astringent taste. Difficult to distinguish in hand specimen from other iron sulphates with which it is associated.

Sandstone. Sedimentary rock composed of sand-sized particles (mostly quartz).

Scapolite. $Na_4Al_3Si_9O_{24}Cl$-$Ca_4Al_6Si_6O_{24}(CO_3,SO_4)$. H=6. White, grey, or less commonly, pink, yellow, blue, green prismatic and pyramidal crystals; also massive granular with splintery, woody appearance. Vitreous, pearly to resinous lustre. Distinguished from feldspar by its square prismatic form, prismatic cleavage, and splintery appearance on cleavage surfaces. May fluoresce under ultraviolet rays. Transparent varieties may exhibit chatoyancy (cat's - eye effect) when cut into cabochon stones.

Scheelite. $CaWO_4$. H=4½-5. White, yellow, brownish; transparent to translucent massive. Also dipyramidal crystals. High specific gravity (about 6). Generally fluoresces bright bluish white under "short" ultraviolet rays; this property is utilized in prospecting for scheelite, an ore of tungsten.

Schist. Metamorphic rock composed mainly of flaky minerals such as mica and chlorite.

Scorodite. $FeAsO_4 \cdot 2H_2O$. H=3½-4. Green, greyish green to brown crusts composed of tabular or prismatic crystals; also massive, earthy, porous or sinter-like. Vitreous to subresinous or subadamantine lustre. Soluble in acids. Secondary mineral formed by oxidation of arsenopyrite.

Senarmontite. Sb_2O_3. H=2-2½. Colourless to greyish white, transparent; octahedral crystals or granular, massive. Forms crusts. Resinous to subadamantine lustre. Soluble in HC1. Secondary mineral formed by the oxidation of antimony minerals. Minor ore of antimony.

Serpentine. $Mg_3Si_2O_5(OH)_4$. H=2-5. White, yellow, green, blue, red, brown, black massive; may be mottled, banded or veined. Waxy lustre. Translucent to opaque. Asbestos (chrysotile) is the fibrous variety. Formed by the alteration of olivine, pyroxene, amphibole, or other magnesium silicates. Found in metamorphic and igneous rocks. Used as an ornamental building stone (verde antique) and for cutting and/or carving into ornamental objects.

Serpentinite. A metamorphic rock consisting almost entirely of serpentine.

Shale. Fine-grained sedimentary rock composed of clay minerals.

Shear zone. See fault.

Siderite. $FeCO_3$. H=3½-4. Brown rhombohedral crystals, cleavable masses, earthy, botryoidal. Distinguished from calcite and dolomite by its colour and higher specific gravity, from sphalerite by its cleavage. Ore of iron.

Siltstone. A very fine grained sedimentary rock composed predominantly of quartz grains.

Silver. Ag. H=2½-3. Grey metallic arborescent, wiry, leafy, platy or scaly forms; crystals (cubic, octahedral, dodecahedral) are rare. Tarnishes to dark grey or black. Hackly fracture. Ductile, malleable. Colour, form and sectility are identifying characteristics.

Skarn. An altered rock zone in limestone and dolomite in which calcium silicates (garnet, pyroxene, epidote, etc.) have formed.

Slate. A fine-grained metamorphic rock characterized by a susceptibility to split into thin sheets.

Specularite. Black variety of hematite having a high lustre.

Sphalerite. ZnS. H-3½-4. Yellow, brown or black, granular to cleavable massive; also botryoidal. Resinous to submetallic. Honey-brown streak. Soluble in HCl, and gives off H_2S. Ore of zinc.

Stephanite. Ag_3SbS_4. H=2-2½. Black metallic, striated prismatic or tabular crystals, or massive. Decomposed by HNO_3. Occurs in veins in silver deposits.

Stibnite. Sb_2S_3. H=2. Dark grey metallic (bluish iridescent tarnish), striated prismatic crystals; also acicular crystal aggregates, radiating columnar or bladed masses; granular massive. Soluble in HCl. Most important ore of antimony.

Stilbite. $NaCa_2Al_5Si_{13}O_{36} \cdot 14H_2O$. H=4. Colourless, pink, white, platy crystal aggregates commonly forming sheaf-like aggregates. Vitreous, pearly lustre. Transparent. Sheaf-like form distinguishes it from other zeolites with which it is associated.

Syenite. An igneous rock composed mainly of feldspar with little or no quartz. Used as a building and monument stone.

Szmikite. $MnSO_4 \cdot H_2O$. H=1½. White to pink, reddish, stalactitic, botryoidal masses. Earthy. Secondary mineral found with manganese minerals.

Szomolnokite. $FeSO_4 \cdot H_2O$. H=2½. White to pinkish white fine hair-like aggregates or finely granular encrustations; also botryoidal, globular crusts. Vitreous lustre. Metallic taste. Associated with pyrite and other iron sulphates from which it is not readily distinguishable in the hand specimen.

Talc. $Mg_3Si_4O_{10}(OH)_2$. H=1. Grey, white, green finely granular or foliated. Translucent; feels greasy. Massive varieties are known as steatite and soapstone, and because of their suitability for carving, are used for ornamental purposes. Formed by alteration of magnesium silicates (olivine, pyroxene, amphibole, etc.) in igneous and metamorphic rocks. Used in cosmetics, ceramics, paint, rubber, insecticide, roofing and paper industries.

Tetrahedrite – Tennantite. $Cu_{12}Sb_4S_{13}$ - $Cu_{12}As_4S_{13}$. H=3½-4. Dark-grey to iron-black, metallic, tetrahedral crystals; also massive granular to compact. Brown, black, or deep red streak. Ore of copper; may contain silver, antimony values.

Titanite. $CaTiSiO_5$. H=6. Brown, wedge-shaped crystals; also massive granular. May form cruciform twins. Adamantine lustre. White streak. Distinguished from other dark silicates by its crystal form, lustre and colour. Also known as sphene.

Topaz. $Al_2SiO_4(OH, F)_2$. H=8. Colourless, white, pale blue, yellow, brown, grey, green, prismatic crystals with perfect basal cleavage; also massive granular. Vitreous, transparent. Distinguished by its crystal habit, cleavage, hardness. Used as a gemstone.

Tourmaline. $Na(Mg, Fe)_3Al_6(BO_3)_3Si_6O_{18}(OH)_4$. H=7½. Black, green, blue, pink, brown, yellow prismatic crystals; also columnar, massive granular. Prism faces are striated vertically. Vitreous lustre. Conchoidal fracture. Distinguished by triangular cross-section, striations, fracture. Used in the manufacture of pressure gauges; transparent variety used as a gemstone.

Tremolite. $Ca_2Mg_5Si_8O_{22}(OH)_2$. H=5-6. White, grey, striated prismatic crystals, bladed crystal aggregates, fibrous. Perfect cleavage. Vitreous lustre. Generally occurs in metamorphic rocks. Fibrous variety is used for asbestos; transparent crystals are sometimes used as a gem curiousity.

Tuff. A rock formed from volcanic ash.

Valleriite. $4(Fe, Cu)S \bullet 3(Mg,Al)(OH)_2$. Massive, platy, bronze-black. Perfect cleavage. Occurs in copper deposits.

Vesuvianite. $Ca_{10}MgAl_4(SiO_4)_5(Si_2O_7)_2(OH)_4$. H=7. Yellow, brown, green, violet, transparent prismatic or pyramidal crystals with vitreous lustre; also massive, granular, compact od pulverulent. Distinguished from other silicates by its tetragonal crystal form; massive variety distinguished by its ready fusibility and intumescence in blowpipe flame. Also known as idocrase. Transparent varieties may be used as a gemstone.

Wad. A field term used for substances consisting mainly of manganese oxides.

Wittichenite. Cu_3BiS_3. H=2-3. Grey metallic tabular crystals or columnar, acicular aggregates; massive. Fuses easily. Soluble in HCl and gives off H_2S; decomposed by HNO_3. Alters readily to yellowish brown, red, blue colours, and eventually forms covellite.

Wolframite. $(Fe, Mn)WO_4$. H=4-4½. Dark brown to black, short prismatic striated crystals, lamellar or granular. Submetallic to adamantine lustre. Perfect cleavage in one direction. Distinguishing features are colour, cleavage, and high specific gravity (7.1-7.5). Ore of tungsten.

Wollastonite. $CaSiO_3$. H=5. White to greyish white, compact, cleavable, or fibrous masses with splintery or woody structure. Vitreous to silky lustre. May fluoresce under ultraviolet rays. Distinguished from tremolite (H=6) and sillimanite (H=7) by its inferior hardness and by its solubility in HCl. Used in ceramics and paints.

"Yukon diamond". A term used in the North for concentrically banded black, dark brown, tan-coloured cassiterite pebbles found in placers of the Yukon. Also known as wood tin. Used as a gemstone.

Yukonite. $Ca_3Fe_3(AsO_4)_4OH \bullet 12H_2O$. H=2-3. Black to dark brown irregular concretions. Decrepitates at low heat and when immersed in water. Easily fusible. Found originally at Tagish Lake, Yukon.

Zinc. Zn. H=2. White to light grey metallic crystals, scales. Brittle.

Zoisite. $Ca_2Al_3(SiO_4)_3(OH)$. H=6½. Grey, brownish grey, yellowish brown, mauvish pink, green aggregates of long prismatic crystals (striated); also compact fibrous to columnar masses. Vitreous to pearly lustre. Transparent to translucent. Massive variety distinguished from amphibole by its perfect cleavage. Transparent varieties used as gemstones; pink variety known as thulite, deep blue variety as tanzanite.

CHEMICAL SYMBOLS FOR CERTAIN ELEMENTS

Ag - silver
Al - aluminum
As - arsenic
Au - gold
B - boron
Ba - barium
Be - beryllium
Bi - bismuth
C - carbon
Ca - calcium
Cb - columbium (niobium)
Ce - cerium
Cl - chlorine
Co - cobalt
Cr - chromium
Cu - copper
Er - erbium
F - fluorine
Fe - iron
H - hydrogen
K - potassium
La - lanthanum
Li - lithium
Mg - magnesium
Mn - manganese
Mo - molybdenum
Na - sodium
Nb - niobium
Ni - nickel
O - oxygen
P - phosphorus
Pb - lead
Pt - platinum
R - rare-earth elements
S - sulphur
Sb - antimony
Se - selenium
Si - silicon
Sn - tin
Sr - strontium
Ta - tantalum
Te - tellurium
Th - thorium
Ti - titanium
U - uranium
W - tungsten
Y - yttrium
Yb - ytterbium
Zn - zinc
Zr - zirconium

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