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Canada

CRY LAKE JADE BELT
NORTH-CENTRAL BRITISH COLUMBIA

by
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Since the mid-1960s the Cry Lake area in northern British Columbia has been one of the world's leading producers of nephrite jade. Production has come from boulders and talus blocks generally near their source areas or from in situ lenses enclosed in serpentinite of the Cache Creek Complex. The host rocks occur mainly in a belt of ultramafic, volcanic, sedimentary and mafic plutonic rocks more than 80 km long and ranging from 6 to 15 km wide, extending from southwest of Eagle River to east of Kutcho Creek. The belt is bounded to the north and east by the Thibert and Kutcho faults and to the south and west by the King Salmon Fault. The ultramafic rocks are readily recognized in the field by their dun brown to serpentine green weathering and general lack of vegetation. Jade lenses from 1 to 10 m wide and up to several tens of metres long are discontinuous and relatively rare. High quality material constitutes only a small part of a lens because of schistosity resulting from deformation postdating the formation of jade.

Several constraints on the environment of jade formation are provided by structural and petrological studies of the Cache Creek Complex. The distribution of the various lithologies suggests the style of a structural melange. Many of the contacts between rock units are faults and all units are discontinuous over a wide range of scales. Where faults bound ultramafic bodies they are marked by zones of listwanite or highly sheared, fish-scale serpentinite. Attitudes of slickensides, the lensoid form of jade bodies and pervasive foliation indicate the effects of rotation, boudinaging and shearing.

High pressure and possibly low temperature metamorphism within the Cache Creek Complex is shown by the local presence of riebeckite, crossite and jadeite. Stilpnomelane is widespread and, in places, muscovite is conspicuous in metasedimentary rocks. Near jade occurrences serpentinite commonly consists of hornfelsic, feathery reticulated antigorite. This texture is identical to that of the fine grained jade suggesting the possibility that the jade formed from antigorite simply by addition of calcium and perhaps silica in zones of metasomatism.

The integration of structural and petrological data point to the deformation of accretionary and oceanic lithologies in a subduction zone resulting in a structural melange and relatively high pressures and low temperatures of metamorphism. In this environment nephrite jade lodes formed from antigoritic serpentinites along zones of metasomatism. In most, if not all cases, the metasomatism has taken place where the serpentinites were in contact with sedimentary or volcanic rocks.

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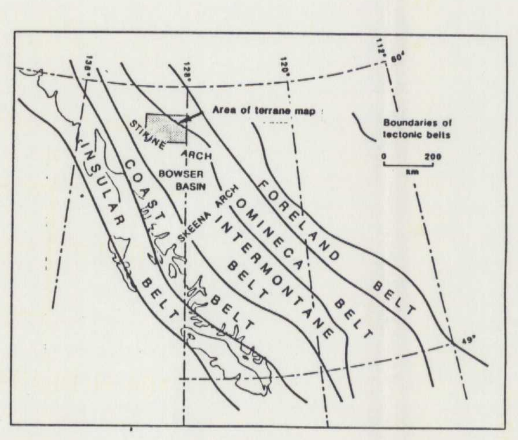

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LEGEND

STIKINIA

OVERLAP ASSEMBLAGES

JURASSSIC
MIDDLE TO LATE JURASSIC

Jsc — **SNOWDRIFT CREEK, TACHILTA LAKES AND RELATED PLUTONS:** Biotite-hornblende granodiorite

MIDDLE JURASSIC (BAJOCIAN, in part)

JBL — **BOWSER LAKE GROUP**, undivided: conglomerate, siltstone, shale, andesite flows, tuff, breccia, agglomerate; marine and nonmarine; J_{BLv}, dominantly volcanic; J_{BLs}, dominantly sedimentary

EARLY TO MIDDLE JURASSIC

mJM — **MCBRIDE RIVER PLUTON:** hornblende-biotite granodiorite ; mJ_{Md}, diorite

mJTS — **THREE SISTERS PLUTON:** J_{TSl}, leucocratic clinopyroxene-hornblende granodiorite, quartz monzodiorite; J_{TSp}, potassic marginal phase: biotite-hornblende quartz monzonite, granite, syenite; J_{TSc}, central phase: biotite-hornblende quartz monzodiorite, quartz monzonite; J_{TSm}, mafic phase: biotite-hornblende quartz diorite, diorite, gabbro; J_{TSf}, fine grained phase: clinopyroxene-biotite-hornblende quartz diorite, diorite and quartz monzodiorite

JP — **PALLEN CREEK PLUTON** and related plutons: biotite-hornblende quartz monzodiorite and quartz monzonite, minor granodiorite

JT — **TANZILLA PLUTON:** biotite-hornblende granodiorite

LOWER JURASSIC

lJTs — **TAKWAHONI FORMATION** (lJ_{Ts}, lJ_{Tg}, lJ_{Tcg}): Shale, siltstone, sandy limestone, arkosic, calcareous sandstone; lJ_{Tsm}, calc silicate hornfels; Toarcian

lJTg — Greywacke, shale, minor conglomerate; Pliensbachian; lT_{Tgm}, hornfelsed equivalents of lJ_{Tg} including abundant sills and dykes of quartz-feldspar porphyry

lJTcg — Coarse, polymicitic conglomerate; Sinemurian

EARLY JURASSIC

eJu — **TAHLTAN PLUTON:** zoned ultramafic body; pyroxenite, pyroxene syenite, syenite; rich in apatite and magnetite

TRIASSIC AND JURASSIC

TJv — Grey and maroon plagioclase porphyry, andesite, volcanic conglomerate, tuffaceous mudstone, breccia, rhyolite

TRIASSIC
UPPER TRIASSIC

uTs — **STUHINI GROUP:** massive and pillowed porphyritic augite basal and coarse-bladed feldspar porphyry, aphanitic basalt; local basal granitic-cobble conglomerate

LATE TRIASSIC

lTB — **BEGGERLAY CREEK PLUTON:** biotite-hornblende diorite, gabbro, monzodiorite, pyroxenite

lTGL — **GNAT LAKES ULTRAMAFITE:** hornblende clinopyroxenite, hornblendite

lTCH — **CAKE HILL PLUTON** : hornblende quartz monzodiorite, granodiorite, monzodiorite (and metamorphosed equivalents); rare hornblende diorite

lTLC — **LATHAM CREEK PLUTON:** hornblende quartz diorite, monzodiorite

lTCM — **CARIBOO MEADOWS PLUTON:** augite metagabbro, hornblendite

lTK — **KAKETSA PLUTON** and related intrusions: biotite-hornblende diorite, hornblende diorite; minor biiotite-clinopyroxene diorite

lTMC — **MANSFIELD CREEK PLUTON:** diorite and gabbro, strongly kaolinized

lTgd — Undivided biotite-hornblende quartz diorite, granodiorite, quartz monzonite, diorite

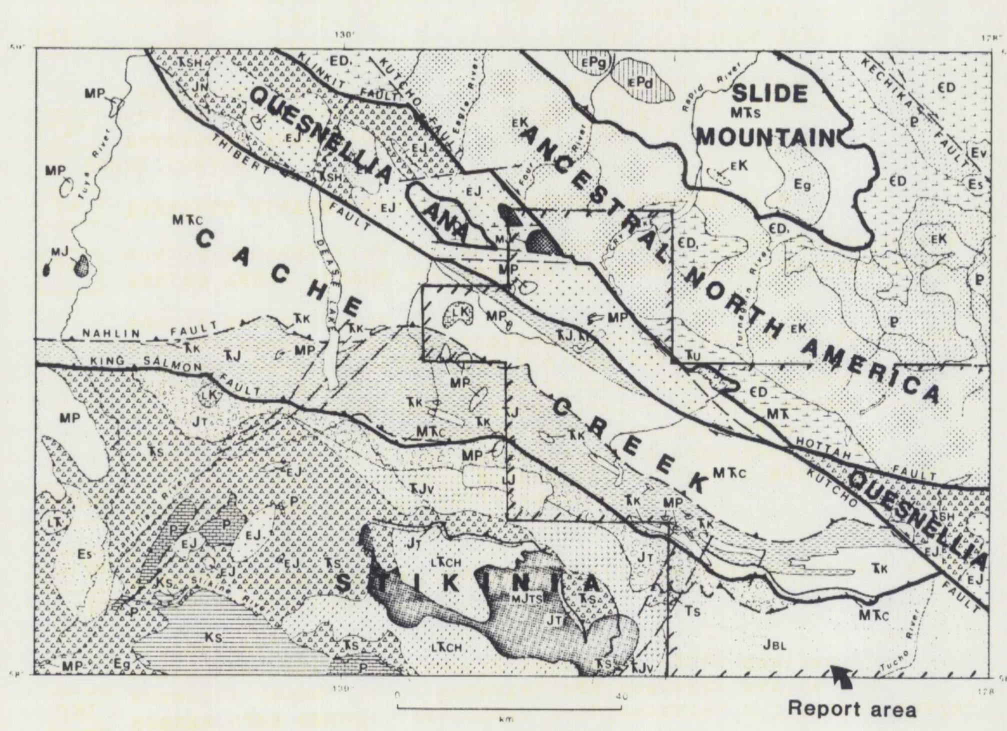
LOWER AND MIDDLE TRIASSIC

lmTs — Argillite, siliceous argillite, greyacke, phyllite; minor chert and limestone

PERMIAN

Pc — Massive limestone; Ps, phyllite, ribbon chert; Pv, phyllitic greenstone

TERRANES



CACHE CREEK TERRANE

JURASSIC
LOWER JURASSIC

JI — **INKLIN FORMATION:** penetratively cleaved phyllitic slate, greywacke, pebble and cobble conglomerate; J_{Id}, diamictite, possibly part of Kutcho Formation

TRIASSIC
UPPER TRIASSIC

Ts — **SINWA FORMATION:** limestone, commonly argillaceous and fetid

TK — **KUTCHO FORMATION:** basaltic to rhyolitic schist (flows, breccia, crystal tuff); fine grained volcanic sediments, basic schist, conglomerate (may be basal Inklin Formation, in part)

MISSISSIPPIAN TO TRIASSIC
CACHE CREEK COMPLEX (MT_K, P_T, P_{FR}, MP_H, MPc, MPv, MPg, MPu)

MTK — **KEDAHDA FORMATION:** chert, cherty argillite; minor argillite, siltstone and volcanic sandstone; minor volcanic rocks and metamorphosed equivalents; MT_{Ksv}, sediments and volcanics, undivided; MT_{Kg}, greywacke, slate, chert; may be entirely of Late Triassic age ?

PERMIAN

PT — **TESLIN FORMATION:** massive limestone, minor mafic volcanics

PFR — **FRENCH RANGE FORMATION:** basalt, tuff, agglomerate

UPPER MISSISSIPPIAN TO PERMIAN

MPH — **HORSEFEED FORMATION:** limestone, dolomitic limestone

MPc — Limestone, age unknown

MPv — Mafic volcanics, greenstone, age unknown

MPg — Coarse grained to pegmatitic gabbro, diorite; MPgv, fine grained, foliated gabbro, greenstone; may include small serpentinite bodies

MPu — Peridotite, dunite, pyroxenite, generally serpentinized; locally includes pods of nephrite jade and small bodies of listwanite, rodingite and talc

QUESNELLIA

JURASSIC
MIDDLE JURASSIC (?)

mJgd — Pink weathering biotite-hornblende quartz monzonite, granodiorite, granite; age uncertain

LOWER JURASSIC

lJN — **NAZCHA FORMATION:** greywacke, conglomerate, shale, slate, siltstone; Sinemurian and (?) younger

EARLY JURASSIC

eJgd — Biotite-hornblende quartz monzonite, granodiorite, quartz diorite

TRIASSIC
LATE TRIASSIC

lTgd — Hornblende granodiorite, hornblende diorite; commonly foliated; may be in part of Early Jurassic age

lTu — Peridotite, dunite, serpentinite (Alaskan-type ultramfic body)

uTc — Limestone

UPPER TRIASSIC

uTSH — **SHONEKTAW FORMATION:** augite porphyry, feldspar porphyry, tuff, agglomerate, pyroxenite; may include some lTg

UPPER PALEOZOIC (?) and/or TRIASSIC (?)

uPT — Mafic to felsic volcanics, tuff, chert, phyllite, argillite, quartz-sericite schist, crystalline limestone

SYMBOLS

Geological boundary (defined, approximate, assumed)...
Boundary of surficial deposits........................
Facies boundary.......................................
Bedding, tops known (inclined, vertical, overturned)..
Bedding, tops unknown (inclined, vertical)............
Foliation (inclined, vertical)........................
Fault, unknown sense of displacement..................
Fault, extension (solid circle on downthrow side; defined, approximate)..............................
Fault, extension (assumed projection under younger deposits)...
Fault, contraction (teeth on upthrust side; defined, approximate, assumed)..............................
Fault, contraction (assumed projection under younger deposits)..
Fault, strike-slip (arrows indicate direction of relative movement; defined, approximate)....................
Fault, strike-slip (assumed projection under younger deposits)..
Anticline (arrow indicates plunge; defined, approximate, overturned)..............................
Syncline (arrow indicates plunge; defined, approximate, overturned)...
Anticline and syncline (long arrow points in direction of dip of axial surface)................
Lineation (horizontal, plunging)......................
Paleocurrent direction................................
Radiometric date...................................... ∘Kb 160
Location: o. Mineral: biotite, b ;muscovite, m; hornblende, h; zircon, z; whole rock, w. Method: potassium argon, K; rubidium strontium, R; uranium-lead, U. Age: in millions of years,114
Radiocarbon date (age in years before present)........ °C 8780
Fossil locality....................................... Ⓕ
Mineral occurrence : copper, Cu; lead, Pb; zinc, Zn; gold (lode), Au; gold (placer), Au_p; molybdenum, Mo; nickel, Ni; tungsten, W; asbestos, Asb; jade (lode), J; jade (boulder), J_b..............................x

Geological compilation by H.Gabrielse based on studies by H.Gabrielse in 1956,1957, 1960, 1961, 1967, 1977, 1978, 1979, 1981, 1983, 1984, 1985, 1988, 1989; J.G. Souther 1956, 1961; H.H. Bostock, B.S. Norford and other Officers of the Geological Survey of Canada, Operation Stikine, 1956; B.S. Norford, 1957, 1958; E.F. Roots, 1958; S.L. Blusson and G. Goruk, 1961; J.W.H. Monger, 1966; S.L. Blusson, C.J. Dodds and J. Crawford, 1967; R.G. Anderson, W.H. Fritz, S.F. Leaming, J.L. Mansy, J.W.H. Monger, L.E. Thorstad and H.W. Tipper, 1977, 1979; R.G. Anderson, S.L. Leaming and L.E. Thorstad, 1978; N.Irvine and B.S. Norford, 1979; R.T. Bell and CJ.Dodds, 1981; H. Geldsetzer, 1983; T.A. Harms, 1983, 1984, 1985. Incorporates data from Kutcho Creek area by A. Panteleyev and D.E. Pearson, B.C. Ministry of Mines and Petroleum Resources, 1975 and from Level Mountain area by T. Hamilton, 1981. Geology of Classy Creek (104J/2E) and Stikine Canyon (104J/1W) modified from compilation by P.B. Read, Geotex Consultants Limited, 1983. Geology of Cake Hill (104I/4W) and Stikine Canyon (104J/1E) modified from P.B. Read, Geotex Consultants Limited, 1984.

OVERLAP ASSEMBLAGES

PLEISTOCENE AND RECENT

Qs — Glacial and glacio-fluvial deposits, stream deposits, felsenmeer, talus, soil

MIOCENE TO PLEISTOCENE

MPv — **TUYA FORMATION:** alkali olivine basalt, tuff, agglomerate, minor trachyte and rhyolite; PPv, may include areas of underlying Mesozoic and Paleozoic rocks

EOCENE

Es — Conglomerate, sandstone, shale, coal

Ev — Rhyolite, chalcedonic rhyolite breccia, tuff

EARLY EOCENE

Eg — **MAJOR HART PLUTON:** granite, miarolitic in part; Ep, kaolinized feldspar-quartz porphyry; Egd, biotite-augite granodiorite

CRETACEOUS (?) AND TERTIARY
UPPER CRETACEOUS (?) TO EOCENE

KEs — **SIFTON FORMATION:** conglomerate, sandstone, shale

KTv — **SLOKO GROUP:** rhyolite, dacite and trachyte flows, dykes, breccia

CRETACEOUS
LOWER AND (?) UPPER CRETACEOUS

KTc — **TANGO CREEK FORMATION OF SUSTUT GROUP:** conglomerate ,sandstone, siltstone, shale

LATE CRETACEOUS

lKg — Biotite-hornblende granite, miarolitic in part

EARLY CRETACEOUS

eKg — **CASSIAR SUITE:** biotite-hornblende and biotite-muscovite granite, quartz monzonite, granodiorite; stippled areas indicate abundant lit-par-lit gneiss and screens and pendants of metamorphic rocks

ANCESTRAL NORTH AMERICA

DEVONIAN AND MISSISSIPPIAN
UPPER DEVONIAN TO MISSISSIPPIAN (FRASNIAN TO VISEAN)

DME — **EARN GROUP:** Shale, black, grey and blue grey, locally pyritic; argillite; light green, tuffaceous (?) shale; porcellanite

MIDDLE TO UPPER DEVONIAN (GIVETIAN TO FRASNIAN)

DM — **MCDAME FORMATION:** upper member, limestone, platy, light grey; local karst breccia; lower member, dolostone, dark grey, fetid; limestone; carbonate breccia

LOWER DEVONIAN (?)

DR — **RAMHORN FORMATION:** upper member, laminated dolostone; lower member, dolomitic sandstone, sandy dolostone, dolostone and sandstone, commonly cross-bedded

SILURIAN AND DEVONIAN

SD — Undivided carbonate and sandstone of **SANDPILE, RAMHORN AND MCDAME** formations

SILURIAN
LOWER SILURIAN

Ss — **SANDPILE FORMATION:** dolostone, cherty dolostone, dolostone breccia

ORDOVICIAN AND SILURIAN
LOWER ORDOVICIAN TO LOWER SILURIAN (ARENIG TO WENLOCK)

OSR — **ROAD RIVER FORMATION:** upper unit, graptolitic, platy siltstone, Silurian; lower unit, black, pyritic, graptolitic shale, Ordovician; ODM, undivided black, calcareous shale, slate, phyllitic slate, minor limestone, siltstone and pebble conglomerate; Ordovician to Devono-Mississippian and (?) younger

CAMBRIAN AND ORDOVICIAN
UPPER CAMBRIAN TO LOWER ORDOVICIAN

€OK — **KECHIKA GROUP:** argillaceous limestone, calcareous shale, limestone, shale; $€O_{KC}$, wavy banded, silty limestone

CAMBRIAN
LOWER CAMBRIAN
ATAN GROUP

€AR — **ROSELLA FORMATION:** limestone, dolostone, calcareous shale, brown, grey and green-grey shale

€AB — **BOYA FORMATION:** quartzitic sandstone, siltstone, slate, phyllite; $€_{Am}$, micaceous quartzite, mica schist, minor crystalline limestone; may include some Stelkuz Formation; €Mm, undivided pyritic, hornfelsic slate, argillite, siltstone, quartzite, micaceous quartzite, schist, limestone; variably metamorphosed; mainly Cambrian to Mississippian (?)

UPPER PROTEROZOIC

INGENIKA GROUP

HS — **STELKUZ FORMATION:** interbedded chloritic sandstone, shale, limestone, phyllite; includes distinctive green and maroon weathering members; $€H_{SB}$, undivided **STELKUZ AND BOYA** formations

HIE — **ESPEE FORMATION:** crystalline limestone, sandy limestone, dolostone

HIST — **SWANNELL AND TSAYDIZ FORMATIONS**, undivided: upper part, mainly sericite and chlorite phyllite, schist, calcareous phyllite and phyllitic limestone, siltstone; lower part, mainly micaceous quartz

HIm — Lit-par-lit gneiss; garnet, staurolite, sillimanite and andalusite schist; abundant granitic sills; amphibolite; probably mainly metamorphosed Swannell Formation

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