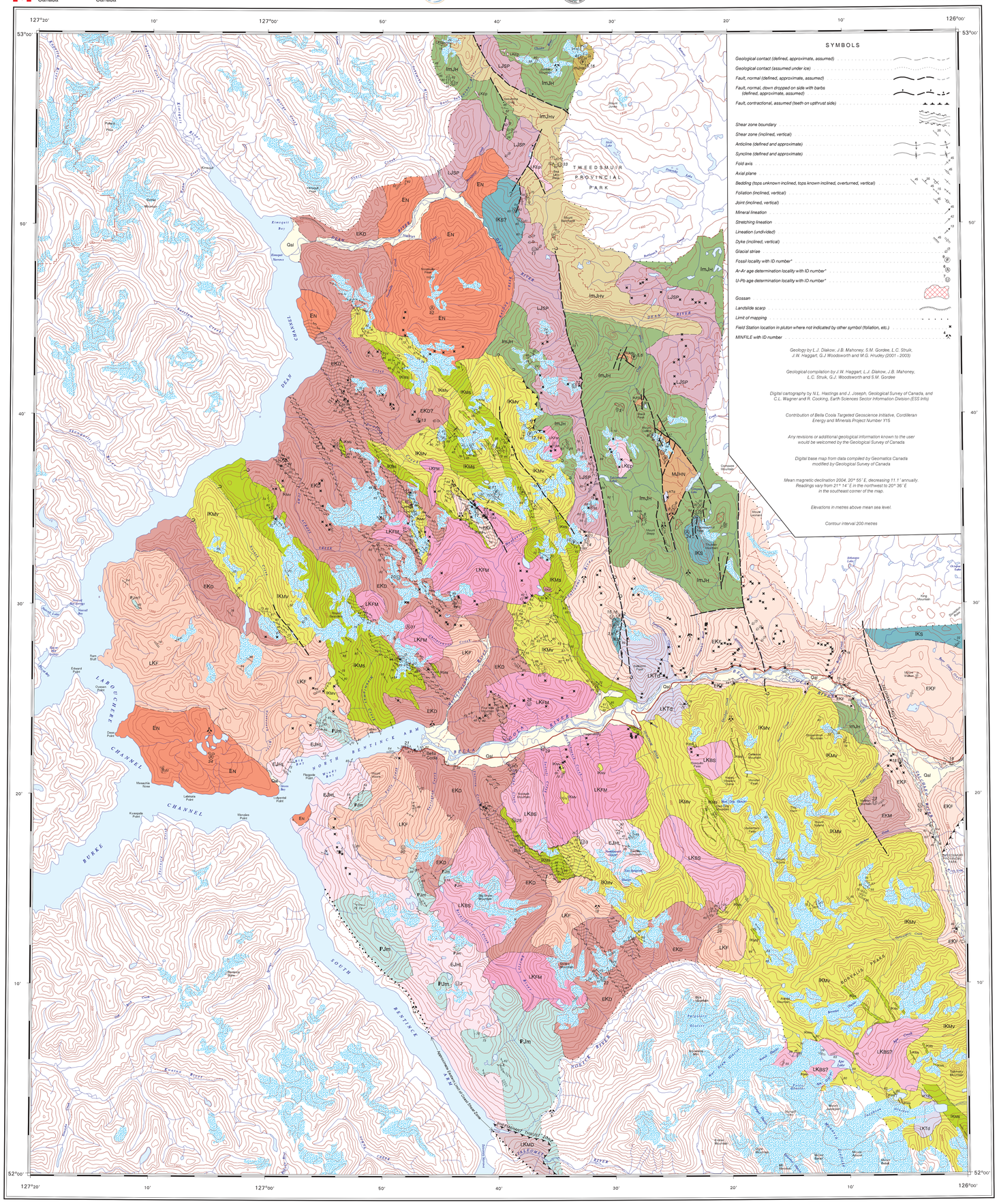
Natural Resources Canada / Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA / COMMISSION GÉOLOGIQUE DU CANADA

BRITISH COLUMBIA
Ministry of Energy and Mines
Mining and Minerals Division
Geological Survey and Development Branch



LEGEND

STRATIFIED ROCKS

QUATERNARY

Qal — *Recent alluvium, till*

PALEOGENE
Eocene

Er — *Eocene volcanic strata*
Rhyolitic block-lapilli tuff

EARLY CRETACEOUS
Albian
Salloomt assemblage

lKS — *Amygdaloidal basalt ± hornblende-augite-plagioclase andesite porphyry; local reworked volcanic breccias; rare columnar jointing; lesser andesitic to rhyolitic lapilli tuff, maroon to green to white; fine- to medium-grained feldspathic sandstone, locally cross-stratified and calcareous, with shale rip-up clasts; siltstone; black mudstone to argillite; rounded granitoid cobble to boulder conglomerate locally at base*

Valanginian
Monarch assemblage
Volcanic facies

lKMv — *>50% volcanic rocks; amorphous olive green amygdaloidal basalt and basaltic andesite and associated breccia, tuff, and tuff breccia; locally intercalated with thinly bedded siltstone, black argillite to slate; complexly interfingered with lKMs*

Sedimentary facies

lKMs — *>50% sedimentary rocks; feldspathic sandstone and siltstone; black argillite, locally with thin cross-stratified calcareous sandstone to sandy limestone containing shallow water fauna; pebble to cobble conglomerate; lapilli tuff and welded ash-flow tuff; lesser basaltic andesite and basalt flows and breccias; rare interformational conglomerate within sedimentary sequences; rare pillow basalt; complexly interfingered with lKMv*

EARLY AND MIDDLE JURASSIC
HAZELTON GROUP
Hazelton Group undifferentiated (U/Pb ca. *191, 176, 171 Ma*)

ImJH — *Aphanitic basalt, diabase, diorite and quartz diorite, dark green; volcanic breccia, lapilli tuff, lesser welded ash-flow tuff; rhyolitic lava flows and breccia; porphyritic green andesite flows; volcanic arkose, siltstone, black-white tuffaceous mudstone; granule-pebble conglomerate*

Bajocian to ?Callovian
Nooguchih assemblage (U/Pb ca. 165-163 Ma)

mJHN — *Well stratified volcaniclastic sedimentary rocks with lesser volcanic interbeds; contains volcanic feldspathic arenite, siltstone, black-white thickly-laminated tuffaceous mudstone; granule to pebble conglomerate; monomict breccia, lapilli tuff; lesser welded ash-flows and welded ash-flow tuff, rusty rhyolite, off-white aphanitic lava flows and flow domes(); porphyritic green andesite flows; sub-volcanic localized quartz-phyric rhyolite dykes; interbeds of felsic ash and welded ignimbrites up to 25 m thick*

Aalenian to Bajocian
Smithers Formation

mJHs — *Sandstone, siltstone and shale, locally with pebble to cobble conglomerate; interstratified with welded rhyolitic tuff to lapilli tuff; sandstone locally contains bioclastic tag deposits*

"Microdiorite" unit

ImJHv — *Aphanitic basalt, diabase and fine- to medium-grained diorite and lesser quartz diorite, dark green with ubiquitous epidote-chlorite alteration; recrystallized? mafic flows or microdiorite predominate; small pyroxene diorite plug-like intrusions; cut by northwest-trending pink plagioclase porphyry and granodiorite dykes*

?PALEOZOIC TO ?EARLY JURASSIC

PJm — *Undifferentiated basaltic and andesitic metavolcanic and volcaniclastic rocks; rare calc-silicate rock and marble*

INTRUSIVE ROCKS

PALEOGENE
Eocene
Nooskulla plutonic suite (U/Pb ca. 52 Ma; Ar/Ar 53.0 Ma)

EN — *Hornblende-biotite tonalite to granodiorite; fine- to coarse-grained, equigranular to potassium feldspar-megacrystic; unfoliated except possibly at margins; exfoliation joints prominent*

?LATE CRETACEOUS TO ?EOCENE

lKEp — *Undifferentiated granitic plutons: hornblende-biotite granodiorite to granite; fine- to medium-grained, equigranular*

LATE CRETACEOUS TO PALEOCENE
Four Mile plutonic suite (U/Pb ca. 73 to 62 Ma)

lKFM — *Muscovite-biotite granite; coarse-grained, equigranular; muscovite 0-8%; locally contains garnet, pink orthoclase megacrysts; aplite dykes with pegmatitic segregations bearing garnet and muscovite; unfoliated except possibly at margins; forms prominent cliffs characterized by 'onion-skin' exfoliation joints*

LATE CRETACEOUS TO TERTIARY

lKTd — *Undifferentiated dioritic plutons: hornblende diorite to biotite-hornblende tonalite; lesser quartz monzodiorite; pyroxene present locally; fine- to coarse-grained, generally equigranular; unfoliated to weakly foliated*

LATE CRETACEOUS
Fougner plutonic suite (U/Pb ca. 68 Ma)

lKF — *±Pyroxene-hornblende-biotite quartz diorite to granodiorite; medium- to coarse-grained, equigranular to locally inequigranular with potassium feldspar megacrysts, homogeneous; distinct salt-and-pepper fresh appearance with conspicuous sphene*

Big Snow plutonic suite (U/Pb ca. 86 Ma)

lKBS — *Homogeneous, coarse-grained, equigranular, ± hornblende-biotite tonalite to granodiorite; inclusions rare*

Mount Daunt pluton (U/Pb 91 ± 3 Ma)

lKMD — *Biotite-hornblende tonalite with mylonitic to protomylonitic fabric*

EARLY CRETACEOUS
Meilikan pluton (U/Pb ca. 110 Ma)

EKM — *Biotite-hornblende tonalite and lesser quartz diorite, unfoliated; everywhere with weak to strong epidote and chlorite alteration and everywhere cut by 20-70% altered basalt dykes; lithologically similar to EKF*

Desire plutonic suite (U/Pb ca. 118-122 Ma)

EKD — *Fine- to medium-grained hornblende diorite to quartz diorite and medium- to coarse-grained biotite-hornblende tonalite; equigranular; abundant screens and venoliths of metavolcanic rock and amphibolite; displays magmatic and tectonic foliation; similar in field aspects to EJH*

Firvale plutonic suite (U/Pb ca. 132-141 Ma)

EKF — *Hornblende-biotite quartz diorite and granodiorite to granite; medium- to coarse-grained, equigranular; light pink to light green colour from incipient chlorite alteration; cross-cut by texturally variable diabase dykes*

LATE JURASSIC
Stck Pass plutonic suite (U/Pb ca. 148-156 Ma)

LJSP — *Hornblende-biotite quartz monzodiorite to granite; medium- to coarse-grained, equigranular to inequigranular; distinctive mottled dark pink and light green appearance; abundant quartz, epidote veining; field characteristics very similar to EKF*

EARLY JURASSIC
Howe Lake Plutonic Suite (U/Pb ca. 181-189 Ma)

EJHL — *Fine- to coarse-grained pyroxene-hornblende diorite to quartz diorite and medium- to coarse-grained biotite-hornblende tonalite; abundant metavolcanic screens and mafic venoliths, commonly amphibolitic; common magmatic and tectonic foliation; may be subvolcanic to Hazelton Group strata*

BELLA COOLA GEOCHRONOLOGY[1]

MAP #	FIELD #	AGE (Ma)	LITHOLOGY	NOTES
1	HFBL02-2003	191 +/- 12 (U/Pb)	Quartz-dacite lapilli tuff	Stratigraphically low in the east-dipping homoclinal succession near Jumble Mountain.
2	HFBM02-3020	189 +/- 0,8 Ma (U/Pb)	Tonalite	Cogenetic with Hazelton Group?
3	HFBL02-1604-1	181,9 +/- 0,8 (U/Pb)	Foliated biotite tonalite	
4	HFBM02-1405-1	176,6 +/- 0,7 (U/Pb)	Crystal-lithic lapilli tuff	Associated ammonoids indicate a Late Toarcian to Early Aalenian age. Time-stratigraphic with the Smithers Fm.
5	SCBD01-0605	171,6 +/- 2,3 (U/Pb)	Aphanitic dacite flow dome	A featureless dacitic dome on the lower slope of Tzeetsaytsul Peak which is unconformably mantled by volcanic conglomerate and mafic flows of the Salloomt Assemblage(?).
6	HFBL02-1404-1	170,2 +/- 1,4 (U/Pb)	Quartz-rhyolite flow	Conglomerates in this section are correlated with lithologically identical deposits associated with the massive pile of mafic rocks that unconformably overlie a ca. 172 Ma dacite and fossil-bearing Bathonian strata at Tzeetsaytsul Mtn and Mount Collins, respectively.
7	SCBD01-2502	164,7 +/- 2,2 (U/Pb)	Rhyolite ash-flow tuff	Welded rhyolite tuffs occur sporadically throughout a succession of volcaniclastic-epiclastic turbidite deposits.
8	GR96-124	164,2 +/- 4,4 (U/Pb)	Quartz phyric rhyolite dyke	This felsic dyke is one of a number of similar dykes trending northeast. They crosscut andesitic country rocks that form much of the hanging wall sequence at Nifty.
9	SCBD00-0707-1	163,7 +/- 0,4 (U/Pb)	Dacitic breccia	Felsic country rocks that host VMS mineralization at Nifty.
10	V89-56-4	159,6 +- 0,5 (U/Pb)	Mylonitic granodiorite	van der Heyden (2004).
11	HFBL02-0601-1	149 +/- 1 (U/Pb)	Hornblende-biotite granodiorite	Hbl-biot granodiorite dykes cut an extensive basalt-microdiorite complex. Granodiorite contains screens of microdiorite and also occurs as dykes cutting microdiorite. It in turn is cut by microdiorite-basalt dykes.
12	HFBL02-3004-2	148,6 +/- 0,6 (U/Pb)	K-mega granodiorite	Phase cuts older hornblende diorite and is cut in turn by N-S mafic dyke swarm.
13	SCBM01-1405-1	141 +/- 1 (Ar/Ar [hbl])	Quartz-phyric granodiorite	
14	SCB01-1704-1	139,9 +/- 1,2 (U/Pb)	Chlorite-altered biotite granodiorite	Biotite granodiorite dykes cross-cut hornblende diorite.Constrains maximum age of the sheeted andesite dykes which cut the granodiorite and are thought to feed the Monarch
15	SCB01-4106-2	134,3 +/- 0,2 (U/Pb)	Chlorite-altered hornblende granodiorite	Granodiorite is nonconformably overlain by stratified rocks of the Salloomt Assemblage.
16	V89-49-1	133,9 +/- 0,2 (U/Pb)	Chlorite-altered biotite-hornblende granodiorite	van der Heyden (2004). Sample is immediately beneath nonconformable contact with Early K (probably Albian) sedimentary and volcanic rocks.
17	SCB01-1301-3	133,4 +/- 0,2 (U/Pb)	Foliated quartz diorite	Pluton appears to intrude Lower Cretaceous volcaniclastic rocks, yet is cut by shear fabric and an undeformed two mica granite that gives a U/Pb age of 72,9Ma (SCB01 1209-1).
18	V89-57	133,1 +/- 4,3 (U/Pb)	Chlorite-altered biotite-hornblende granodiorite	van der Heyden (2004).
19	BBC-9	132,0 +/- 0,6 (U/Pb)	Altered granodiorite	van der Heyden (2004). Precise age can not be assigned, but minimum age and a 136 Ma upper intercept age suggest rocks are similar to 133-134 Ma samples of Firvale suite.
20	SCB01-2306-1	122,6 +/- 1,4 (U/Pb)	Biotite-quartz diorite/tonalite	The tonalite is foliated only within the shear zones and therefore records deformation associated with the shear zones flanking the east side of the Coast Mega Shear.
21	91GC1001	119,0 +/- 2 (U/Pb)	Biotite-quartz diorite	Gehrels and Boghossian (2000).
22	HFBWV02-0905	118,8 +/- 0,4 (U/Pb)	Tonalite	
23	HFBWV02-0803-2	110,3 +/- 0,5 (U/Pb)	Granite	Local contact with Monarch Assemblage(?) volcanics is a fault on west, but appears intrusive on north side of Meilikan Mtn.
24	SCBD01-0406	Prelim: 104.6 +/- 2.5 Ma (Ar/Ar [hbl])	Augite-hornblende phyric andesite	The 1300m-thick mafic succession at Tzeesaytsul Peak contains a rare, thin rhyolitic tuff interval about 1100m above the base which gave an inconclusive 113 Ma (minimum) U/Pb date. An interval of monomict volcanic boulder conglomerate separates this succession from underlying volcano-sedimentary strata that yield several U/Pb dates ranging from circa 165 to 172 Ma.
25	HFB02-0101-2	86,9 +/- 0,9 (U/Pb)	Biotite granodiorite	Plutons cut *en echelon* zones of intensively strained metavolcanic and metaplutonic rocks north and south of the Bella Coola River valley. Date constrains the youngest episode of ductile deformation.
26	SCB00-0505-1	79 +4/-6 (U/Pb)	Granodiorite to quartz diorite	Note: age is based on lower intercept; Jurassic inheritance.
27	SCB01-1209-1	72,9 +/- 0,5 (U/Pb)	Garnet-muscovite-biotite granite	This pluton crosscuts shear fabric in diorite that gives a U/Pb age of 133,4 Ma (SCB01 1301-3).
28	SCB00-0710-1	72,1 +0,2/-1,0 (U/Pb)	Garnet-muscovite granite	
29	01JBM03	72,0 +/- 0,3 (U/Pb)		Good date on 4 Mile suite.
30	HFBL02-2201-1	68,2 +/- 1,0 (U/Pb)	Biotite tonalite	Pluton cuts granitoids containing metavolcanic screens at Mt Moore and in N Bentinck Arm and is weakly deformed within a NW-trending shear zone. In Labouchere Channel area (93D/6), muscovite-garnet pegmatite and aplite dykes, believed to represent a phase of the Four Mile suite, crosscut a tonalite body that is assigned to the Fougner suite.
31	HFBG02-1003-1	67,2 +/- 0,3 (Ar/Ar [biot])	Muscovite-biotite granite, trace muscovite	The pluton clearly cuts mylonitized rocks of the Pootlass shear zone.
32	HFBWV02-1203-1	53,0 +/- 0,2 (Ar/Ar [biot])	Biotite tonalite	Quartz-plag-biotite-sphene.
33	HFBL02-0903	53 +/- 0,1 (U/Pb)	Biotite-quartz rhyolite flow dome	The Eocene age of this rhyolite flow and related lapilli-block tuff suggest correlation with the Ootsa Lake Group.
34	HFBWV02-0201-2	51,9 +/- 0,2 (Ar/Ar [musc]); 52,7 +/- 0,4 (Ar/Ar [biot])	Muscovite-biotite granite	Provides cooling constraints on this post-kinematic pluton.

[1]Age determinations by R.M. Friedman, M. Villeneuve and T.D. Ullrich

REFERENCES

Gehrels, G.E. and Boghossian, N.D. 2000. Reconnaissance geology and U-Pb geochronology of the west flank of the Coast Mountains between Bella Coola and Prince Rupert, coastal British Columbia; in Stowell, H.H. and McClelland, W.C., eds., Tectonics of the Coast Mountains, Southern Alaska and British Columbia; Geological Society of America, Special Paper 343, pp. 61-75.

Struik, L.C., Hrudey, M.G., Mahoney, J.B., Diakow, L.J., Sparks, H.A., Kaiser, E.A., Gleeson, T.P. and Woodsworth, G.J. 2003. Geology, Necleetsconnay River area, British Columbia (93D/10 and part of 93D/07); Geological Survey of Canada, Open File 1463, geologic map, scale 1:50 000, 16 text-pp.

van der Heyden, P. 2004. Uranium-lead and potassium-argon ages from eastern Bella Coola and adjacent parts of Anahim Lake and Mount Waddington map areas, west-central British Columbia; Geological Survey of Canada, Current Research 2004-A2, 14 pp.

BELLA COOLA MINFILE

MAP #	MINFILE #	NAME	COMMODITY	STATUS	DEPOSIT PROFILE CODE[1]
1	093D 001	RUSS	MO, CU	Showing	
2	093D 003	MALACHITE CLIFF	CU, AG, MO	Showing	
3	093D 005	CC	CU	Showing	D03
4	093D 006	NIFTY	AG, CU, AU, ZN, BA, PB	Prospect	G06
5	093D 007	KEEN	CU, ZN, PB, AG	Prospect	G06
6	093D 009	BELLA COOLA CHIEF (L.176)	CU, AG, AU	Showing	
7	093D 010	SURE COPPER	CU	Showing	
8	093D 011	BELLA COOLA	CU, AU	Showing	
9	093D 013	SMTLEY RIVER	AG, AU, CU, PB, ZN	Showing	
10	093D 014	NJMAS	CU, MO	Showing	
11	093D 016	BELLA COOLA VALLEY	AB	Showing	M06
12	093D 022	SMTLEY-OLY	AU, AG, CU, MO	Showing	I06
13	093D 023	JAMTART	PB, ZN	Showing	
14	093D 027	BENTINCK ARM	GT	Showing	
15	093D 030	BURNT BRIDGE	MO, PB, CU	Showing	
16	093D 035	SWALLOP CREEK	KY	Showing	P02

Commodity abbreviations: AB = Asbestos, AG = Silver, AU = Gold, BA = Barium, CU = Copper, GT = Graphite, KY = Kyanite, MO = Molybdenum, PB = Lead, ZN = Zinc

BELLA COOLA PALEONTOLOGY

MAP #	GSC #	DATE	FOSSILS	AGE	IDENTIFIER	REPORT #*
1	65044	1964	cf. *Lima* (*Limea*) ex gr. *blakei* Cox *Ostrea*? sp. indet. *Rhynchonella* (s. str.) ex aff. *alemanica* Rollier	Early to Middle Jurassic?	J.A. Jeletzky	Km-7-1965-JAJ
2	C-211801	21/08/01	Possible harpoceratid ammonites? (float)	Early Jurassic?	J.W. Haggart	JWH-2001-07
3	C-306441	01/09/02	macrofossil	Early C. ataceous?	J.W. Haggart	Pers. Comm., 2003
4	C-306442	01/09/02	macrofossil	Early Cretaceous?	J.W. Haggart	Pers. Comm., 2003
5	65045	1964	*Ostrea* (?) sp. indet. *Pinna* (?) sp. *Camptonectes* (?) sp. *Lopha marshii* (Sowerby) *Lopha* (?) sp., large, with well-developed ligament attachment cf. *Lima* (*Limea*) ex gr. *blakei* Cox *Camptonectes* (*Camptochlamys*) ? sp. Other bivalves, indet. *Rhynchonellid* brachiopods, indet. Terebratulid brachiopods, indet.	Early to Middle Jurassic Jurassic (?) Jurassic (?)	J.A. Jeletzky T.P. Poulton T.P. Poulton	Km-7-1965-JAJ J16-1989-TPP J4-2001-TPP
6	65046	1964	*Camptonectes* sp. *Lima* (*Limea*) ex gr. *blakei* Cox *Lima* spp. *Meleagrinella* (?) sp. or *Entolium* (?) sp. Ostreid(?) bivalves, indet. *Rhynchonella* (s. str.) ex aff. *bakaianensis Mojsisovics* *Rhynchonellid* brachiopods, indet. Terebratulid brachiopods, indet. Bivalves, indet.	Early to Middle Jurassic Jurassic (?) Jurassic (?)	J.A. Jeletzky T.P. Poulton T.P. Poulton	Km-7-1965-JAJ J16-1989-TPP J4-2001-TPP
7	C-082681	1980	*Cylindroteuthis* (*Arctoteuthis*) ex gr. *septentrionalis* Bodylevsky	Callovian to early Oxfordian	J.A. Jeletzky	Km-7-1981-JAJ
8	C-306159	2001	*Belemnite*, gen. and sp. indet. Probable cadoceratid ammonite Radiolarians	Probably Bathonian or Callovian	T.P. Poulton	Pers. Comm., 2002
9	C-306160	17/07/01	*Dichotomites* cf. *quatsinoensis* (Whiteaves) *Dichotomites* sp. *Buchia*? sp. *Inoceramus* sp. cf. *neocomiensis* (d'Orbigny)? Bivalve, gen. and sp. indet. Conifer frond	Late Valanginian	J.W. Haggart	JWH-2001-07
10	C-306162	27/07/01	Ammonite with compressed whorl, gen. and sp. indet. Ammonite fragment, indet. *Pleuromya* ? sp. Bivalve, pectinid? Bivalve, buchiid? Bivalves, fam. indet.	Late Mesozoic	J.W. Haggart	JWH-2001-07
11	C-306165	13/08/01	*Polypty chites* (*sensu stricto*)? sp. *Dichotomites* sp. *Buchia* sp. Bivalve, gen. and sp. indet. Conifer frond	Late Valanginian	J.W. Haggart	JWH-2001-07
12	C-306166	13/08/01	*Dichotomites* cf. *quatsinoensis* (Whiteaves) *Dichotomites* cf. *giganteus* (Imlay) *Tollia* ? sp.	Late Valanginian	J.W. Haggart	JWH-2001-07
13	C-306168	08/08/01	Polyptychitid? ammonite fragments	Probably Jurassic to Early Cretaceous	J.W. Haggart	JWH-2001-07
14	C-306169	17/07/01	*Dichotomites* cf. *quatsinoensis* (Whiteaves) *dichotomites* cf. *giganteus* (Imlay)	Late Valanginian	J.W. Haggart	JWH-2001-07
15	C-404725	18/08/02	*Tro itsaia westermanni* Pouton & Tipper Bivalves, indet.	Earliest Aalenian	T.P. Poulton	Pers. Comm., 2003
16	C-404726	19/08/02	*Tro itsaia westermanni* Pouton & Tipper Bivalves, indet.	Earliest Aalenian	T.P. Poulton	Pers. Comm., 2003

* unpublished G.S.C Fossil Report numbers

Canada

GSC OPEN FILE 4639

BC GSDB OPEN FILE 2004-13

GEOLOGY

BELLA COOLA AREA
(PARTS OF 93D/01, D/02, D/06, D/07, D/08, D/09, D/10, D/11, D/15 AND D/16)

BRITISH COLUMBIA

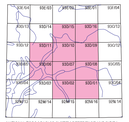
Scale 1:150 000/Échelle 1/150 000

kilometres 2 0 2 4 6 8 10 12 kilomètres

Universal Transverse Mercator Projection
North American Datum 1983

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1983

© Her Majesty the Queen in Right of Canada 2004
© Sa Majesté la Reine du chef du Canada 2004



Recommended citation:
Haggart, J.W., Diakow, L.J., Mahoney, J.B., Struik, L.C., Woodsworth, G.J., and Gordee, S.M.
2004. Geology, Bella Coola area (parts of 93D/01, D/02, D/06, D/07, D/08, D/09, D/10, D/11, D/15 and D/16), British Columbia; Geological Survey of Canada, Open File 4639; British Columbia Geological Survey and Development Branch, Open File 2004-13, scale 1:150 000.