





viinītile (104).		•
ossii sampie	site: microfossil (surface, drill core, low accuracy location), macrofossil	● (f) (f) (F)
Geochronolo	gy sample site:	
J-Pb zircon, Bedding: top:	J-Pb detrital zircon, Ar-Ar, K-Ar, Re-Os	$\forall X \times \forall \times$
-oliation (incl	ined, vertical)*	77
ineation (inc	lined, horizontal)*	//
Jnconformity	: defined, approximate, inferred from aeromagnetic data, inferred	· · · · · · · · · · · · · · · · · · ·
-ault: defined	I, approximate, inferred from aeromagnetic survey, inferred.	<u> </u>
Normal fault: (dot on hangi	defined, approximate, inferred from aeromagnetic survey, inferred	2 - 2 - <u>2</u> - <u>7</u>
Thrust fault: (lefined, approximate, inferred from aeromagnetic survey, inferred.	h_h_h
tooth on han	ging waii)	∑a >k Ku >i
Altered or gos	sanous rocks	
lighway 37,∣	Highway 51, rough road, railroad grade	
Extent of map	pping	····
lamed peaks	* grey symbols from Read (1983,1984), Read and Psutka (1990	▲), and Gabrielse
Stratifi	ed rocks	
	Icanic rocks	
Plvb	Basalt flows; grey; augite, olivine, and plagioclase phenocrysts.	
	O PLEISTOCENE	
NPlvb	Alkali basalt ; grey to brown; columnar jointed; olivine and plagioclase phenocrysts in an groundmass; includes alkali basalt flows, minor trachyite and rhyolite of the Level Mounta	aphanitic in Group.
IEOGENE	Maitland Volcanice: Basalt flows, ware broosis and ach serve and it is in the	ioclaso
Nvb	phenocrysts; common ultramafic inclusions.	uuudse
 Dverlap a	assemblages	
OCENE	Tanzilla Canyon Formation: Conglomerate, sandstone, mudstone, marl; rare freshwa	ater
	Incestone and high-volatile B bituminous coal; conglomerate contains chert, volcanic and locally derived clasts; poorly consolidated.	
RETACEOL	IS	
KSs	Tango Creek Formation: Feldspathic sandstone, siltstone, shale, and carbonaceou with conglomerate interbeds: basal monomictic conglomerate: sandstone locally mu	s shale scovite
	bearing; conglomerate contains chert, volcanic, and granitic pebbles to cobbles.	
Stikinia JPPER JUR/	ASSIC	
Bowser Lake	Group Mudstone. siltstone. verv fine- to medium-grained sandstone: appears intercalated v	vith mafic
uJBs	coherent flows and/or subvolcanic intrusions; sandstone contains rare white to dark grey clasts; coherent rocks are augite- and plagioclase-phyric; parallel laminated and thinly be sedimentary rocks; originally mapped as Tsaybabe group, but reinterpreted here as Bows	chert dded er Lake
	Group based on ca. 160 Ma U-Pb detrital zircon maximum depositional age.	
Sowser Lake	Group	
muJBs	Siltstone, sandstone, shale ; minor tuff and lapilli-tuff; basal conglomerate and calcareou sandstone; brown; conglomerate contains mafic augite-plagioclase-phyric volcanic, plagic phyric volcanic, and hypabyssal clasts; typically laminated to thinly bedded; marine with (us oclase- late
	Toárcian-) early Bajocian ammonites; ca. 171 Ma U-Pb detrital zircon maximum depositio	nal age.
muJBBvm	Mount Blair unit: <i>Matic volcanic flows</i> , lesser tuff and lapillistone; orange-brown; flows 10% brown or red altered augite (0.1-1 mm) and 30-50% plagioclase (0.1-0.2 mm) pheno laminated, well-sorted and clast-supported tuff and lapillistone; flows commonly have breat	contain crysts; cciated
	bottoms and tops, and locally a moderately developed columnar jointed base; interpreted subaerial flows and air-fall deposits.	as
muJBBs	Mount Blair unit: Siltstone, sandstone, and conglomerate; rare lapilli-tuff; laminated li common near base; maroon, green-grey to orange-brown; conglomerate contains chert a limestane pables; to cobles; laminated to yory thick badded; internally massive to cross	mestone nd rare
1	intercalated mafic flows (unit muJBBvm) and lustrous black organic detritus suggest main marine; ca. 169 Ma U-Pb detrital zircon maximum depositional age.	ily non-
muJBBsc	Mount Blair unit: <i>Conglomerate, minor sandstone</i> ; orange-grey; contains chert pebble limestone pebbles to cobbles and rare woody fragments; medium to very thick beds of inf	es, ernally
	massive to locally normally graded conglomerate, interbedded with very thin to thin beds grained sandstone to granule conglomerate; likely non-marine.	of medium-
AIDDLE JUR	ASSIC Latite, trachyte, basalt, and epiclastic rocks; maroon to salmon pink; K-feldspar, plagic	oclase,
mJv.gal	augite, and biotite phenocrysts; common calcite-filled amygdules; nepheline normative; of mapped as Stuhini Group (Upper Triassic), but reinterpreted here as Middle Jurassic base mineralogical and lithogeochemical similarity to Hluey Lake monzonite (unit MJds).	riginally ed on
	local unconformity	
Horn Mou	Intain Formation	io broce'-
mJHvm	lapilli-tuff, lapillistone, and tuff; dark grey; coherent rocks and clasts are augite-plagioclase very rare coarse platy plagioclase-phyric volcanic rocks; ca. 173 Ma U-Pb detrital zircon r	e-phyric; naximum
	aepositional age.	oordinate
mJHvf	felsic flows; rare welded felsic lapilli-tuff; light grey, pale maroon, pale green; clasts are sp plagioclase-phyric, hornblende(?)-quartz-plagioclase-phyric to aphyric, flow banded and l spherulitic; flows are hornblende(?)-quartz-plagioclase phyric and flow banded and l	oarsely ocally well
OWED TO .	stratified; 170.99±0.13, 171.0±1.5 Ma U-Pb zircon ages.	weii
Jpper Hazelt	on Group	
Horn Mou	Sister Mary unit: Felsic tuff and lapilli-tuff; lesser felsic coherent flows and/or subvolca	inic
TVENUE	angular to very angular clasts that are aphanitic, plagioclase-phyric, and (biotite-) quartz- plagioclase-phyric; lesser flow banded and spherulitic; coherent rocks are biotite(?)-quart	
	plagloclase-phyric and commonly flow banded; massive to locally crudely stratified; 172.5 U-Pb zircon age.	94±∪.11 Ma
	Sister Mary unit: <i>Mafic to intermediate flows, volcanic breccia, tuff breccia, lapillist and lapilli-tuff</i> ; minor volcaniclastic sandstone and siltstone, felsic volcanic rocks; rare w lapilli-tuff; dark grev to maroon; mafic flows contain 30-70% equant to lath shaped places	o ne, tuff, elded clase (0 1-
lmJHv		
lmJHv	1.5 mm) and 5-30% augite (0.2-1.5 mm) phenocrysts; intermediate flows typically contain stubby plagioclase (0.5-4 mm), 0-11% augite (0.1-1 mm), and 0-7% biotite (0.4 mm) phen fragmental rocks contain variable and a study of the study of th	40-45% locrysts;
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ImJHv	 1.5 mm) and 5-30% augite (0.2-1.5 mm) phenocrysts; intermediate flows typically contain stubby plagioclase (0.5-4 mm), 0-11% augite (0.1-1 mm), and 0-7% biotite (0.4 mm) pher fragmental rocks contain varicoloured mainly subangular augite-plagioclase-phyric clasts aphyric clasts in a matrix with abundant angular to euhedral plagioclase; crudely stratified interpreted as mainly subaerial. Glacial Mountain unit: Mafic volcanic breccia, tuff breccia, lapilli-tuff, rare volcanicla sandstone and mafic tuff very rare folgio volcanic ared/or dorly area folgio volcanic. 	40-45% locrysts; and lesser l; stic
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ImJHvm ImJHvs ImJHvs ImJHv.xpl ImJHv.tm Spatsizi I	 1.5 mm) and 5-30% augite (0.2-1.5 mm) phenocrysts; intermediate flows typically contain stubby plagioclase (0.5-4 mm), 0-11% augite (0.1-1 mm), and 0-7% biotite (0.4 mm) pher fragmental rocks contain varicoloured mainly subangular augite-plagioclase-phyric clasts aphyric clasts in a matrix with abundant angular to euhedral plagioclase; crudely stratified interpreted as mainly subaerial. Glacial Mountain unit: <i>Mafic volcanic breccia, tuff breccia, lapilli-tuff</i>, rare volcanicla sandstone and mafic tuff; very rare felsic volcanic rocks; dark grey to green; monomictic, predominantly clast supported; subangular clasts (0.5-100 cm) contain 40-50% euhedral tabular plagioclase (0.2-2 mm), 15-20% euhedral equant augite (0.2-5 mm), and very rare 5% hornblende (0.5-1 mm) phenocrysts; massive to very thickly bedded; granitoid clasts common near basal unconformity; basal felsic volcanic rocks returned 175.28±-0.10 Ma t age. Glacial Mountain unit: <i>Polymictic conglomerate with mainly mafic volcanic clasts, sandstone</i>, minor siltstone; rare mafic flows; orange; clasts and flows are augite-plagioclase and very rarely hornblende-augite-plagioclase-phyric; massive, rarely bedded; ca. 172 Ma detrital zircon maximum depositional age. Glacial Mountain unit: <i>Volcaniclastic sandstone</i>, lesser siltstone; minor mafic lapilli-tuf crystal tuff; brown; sandstone contains abundant angular to subangular plagioclase grains laminated to thickly bedded. Cariboo unit: <i>Intermediate coherent flows and/or subvolcanic intrusions, intermediat volcanic breccia</i>, and volcanic breccia, and volcanic breccia apillows; dark grey; clasts and pillows contain 20-35% platy plagioclase (0.5-2 cm), 0-5% a 1 mm) phenocrysts and common vesicles; moderately to crudely stratified. Cariboo unit: <i>Intermediate lapilli-tuff, lapillistone, tuff breccia, and volcanic breccia</i> and monomictic. 	40-45% nocrysts; and lesser ; stic equant to ely up to locally J-Pb zircon ase-phyric a U-Pb ff and s; fate rric, upported ; local hugite (0.5-
ImJHv ImJHvs ImJHvs ImJHv.xpl ImJHv.tm Spatsizi	 1.5 mm) and 5-30% augite (0.2-1.5 mm) phenocrysts; intermediate flows typically confair stubby plagioclase (0.5-4 mm), 0-11% augite (0.1-1 mm), and 0-7% biotite (0.4 mm) pher fragmental rocks contain varicoloured mainly subangular augite-plagioclase-phyric clasts aphyric clasts in a matrix with abundant angular to euhedral plagioclase; crudely stratified interpreted as mainly subaerial. Glacial Mountain unit: <i>Mafic volcanic breccia, tuff breccia, lapilli-tuff</i>, rare volcanicla sandstone and mafic tuff; very rare felsic volcanic rocks; dark grey to green; monomictic, predominantly clast supported; subangular clasts (0.5-100 cm) contain 40-50% euhedral tabular plagioclase (0.2-2 mm), 15-20% euhedral equant augite (0.2-5 mm), and very rare 5% hornblende (0.5-1 mm) phenocrysts; massive to very thickly bedded; granitoid clasts common near basal unconformity; basal felsic volcanic rocks returned 175.28±-0.10 Ma Lage. Glacial Mountain unit: <i>Polymictic conglomerate with mainly mafic volcanic clasts, sandstone</i>, minor siltstone; rare mafic flows; orange; clasts and flows are augite-plagioclase due very rarely hornblende-augite-plagioclase-phyric; massive, rarely bedded; ca. 172 Mi detrital zircon maximum depositional age. Glacial Mountain unit: <i>Volcaniclastic sandstone</i>, lesser siltstone; minor mafic lapilli-tuff crystal tuff; brown; sandstone contains abundant angular to subangular plagioclase grains laminated to thickly bedded. Cariboo unit: <i>Intermediate coherent flows and/or subvolcanic intrusions, intermedi volcanic breccia</i>; medium grey; coherent rocks and clasts are plagioclase-phyric to aphy commonly flow banded and vesicular and locally spherulitic; fragmental rocks are clast su and monomictic. Cariboo unit: <i>Intermediate lapilli-tuff, lapillistone, tuff breccia, and volcanic breccia</i> and monomictic. Cariboo unit: <i>Intermediate lapilli-tuff, lapillistone, tuff breccia, and volcanic breccia</i> and monomictic. <	40-45% hocrysts; and lesser ; stic equant to ely up to locally J-Pb zircon ase-phyric a U-Pb ff and s; fate vric, upported ; local hugite (0.5- siltstone, o euhedral

ImJSv.tm Intermediate volcanic breccia; medium grey; clast supported, monomictic; clasts are medium grey coarse platy plagioclase-phyric and pale grey aphyric, commonly vesicular. Argillite, siltstone, and very fine- to medium-grained sandstone; orange-brown; laminated to medium bedded; internally massive to locally laminated sandstone beds with scoured bases generally fine upward into parallel laminated siltstone; minor medium- to coarse-grained quartzbearing felspathic arenite, volcaniclastic sandstone, conglomerate, and mafic volcanic rocks; rare pale grey tuff laminae; late Pliensbachian to middle Toarcian fossils; ca. 179, 176, and 176 Ma U-Pb detrital zircon maximum depositional ages with prominent Late Triassic detrital zircon populations.

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d Psutka (1990), and Gabrielse (1998)



British Columbia Geological Survey

Geoscience Map 2022-01 Sheet 1 of



Bedrock geology of the Dease Lake area Parts of NTS Sheets 104G, 104H, 104I, 104J

Bram I. van Straaten, James M. Logan, JoAnne L. Nelson, David P. Moynihan, Larry J. Diakow, Rohanna Gibson, Sebastian J. Bichlmaier, Curran D. Wearmouth, Richard M. Friedman, Martyn L. Golding, Emily A. Miller and Terry P. Poulton

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1:100,000 scale

Universal Transverse Mercator Projection, North American Datum 1983, Zone 9 North 100 m contour interval

Basal sandstone and conglomerate; light grey to orange-brown; quartz-rich, medium- to very coarse-grained feldspathic arenite (locally calcite-cemented); rare fossiliferous calcareous sandstone and siltstone; subfeldspathic arenite (likely grus) unconformably overlies Cake Hill pluton; conglomerate contains granitoid clasts similar to subjacent Cake Hill pluton, local augite- and/or plagioclase-phyric and aphyric volcanic clasts; thin to medium bedded; early (to middle) Toarcian fossils, Late Triassic U-Pb detrital zircon population. UPPER TRIASSIC Stuhini Group **uTrSsv Volcaniclastic sandstone**, *siltstone*, *and siliceous siltstone*; dark grey, orange grey, green grey; sandstone contains angular to subangular plagioclase and lesser equant mafic grains; laminated to medium bedded; late Carnian conodonts. _ _ _ _ _ _ _ Mafic coherent flows and/or subvolcanic intrusions, rare mafic fragmental volcanic rocks; green, grey; plagioclase-phyric; massive. Mafic tuff breccia, lapilli-tuff, lesser volcanic breccia and lapillistone; dark grey; clasts contain 44% lath to rare tabular plagioclase (0.1-1 mm) and 23% equant augite (0.2-3 mm) phenocrysts in an aphanitic groundmass; clasts set in a plagioclase and augite crystal and fine ash matrix; massive to very rarely crudely thin to very thick bedded, clast to matrix supported; includes augite-plagioclaseconerent rocks that may represent subvolcanic sions of llows, can be distinguished in mafic volcanic rocks in the Tsaybahe group (unit mTrTvm) by lower augite and higher plagioclase phenocryst content, higher magnetic susceptibility (median 34 x 10⁻³ SI units), and less primitive lithogeochemical composition; early Carnian conodonts. _ _ _ _ _ _ _ **UTrSvs Polymictic conglomerate with mainly mafic volcanic clasts, sandstone**, rare basalt flows; orange; augite- and plagioclase-phyric clasts, basal succession contains strata with limestone, chert, and siltstone clasts; augite-phyric flows; massive, rarely bedded. MIDDLE TO UPPER TRIASSIC **muTrvm** *Mafic volcanic breccia, tuff, and flows*; grey-green and green; aphyric to plagioclase- and locally augite-phyric; may be equivalent to Tsaybahe group or Stuhini Group. MIDDLE TRIASSIC Tsaybahe group **mTrTvm** *Mafic tuff breccia* and lesser lapilli-tuff; very dark grey; clasts contain 30% equant augite (1-3.5 mm), 10% tabular-equant plagioclase (0.2-1 mm) phenocrysts in an aphanitic groundmass; clasts set in an augite and plagioclase crystal and fine ash matrix; massive, clast to matrix supported; can be distinguished from mafic volcanic rocks in the Stuhini Group (unit uTrSvm) by higher augite and lower plagioclase phenocryst content, lower magnetic susceptibility (median 0.82 x 10³ SI units), and more primitive lithogeochemical composition. LOWER TO MIDDLE TRIASSIC Tsaybahe group ImTrTs Argillite, siliceous argillite, siltstone, and very fine- to fine-grained sandstone; rare chert; dark grey; sandstone contains predominantly plagioclase and lesser matic grains; well stratified; commonly cut by mafic sills and dikes (unit MTrhm); Middle (rare Early) Triassic conodonts. **DEVONIAN TO PERMIAN** Stikine assemblage **DPSsI** *Lime mudstone, fossiliferous wackestone and packstone; other undivided limestone; commonly interstratified with chert*; light grey to yellow-grey; massive to laminated to medium bedded; commonly foliated; Artinskian-Kungurian conodonts. **DPSv Tuff, crystal tuff, and lapillistone; phyllitic greenstone**; grey to green; contains grey, maroon and green aphanitic to microphenocrystic volcanic clasts, euhedral plagioclase, and minor altered mafic crystals; generally well-developed phyllitic foliation. **DPSsv** *Phyllite, phyllitic greenstone*; minor chert; rare limestone; light to dark green; rusty weathering. **DPSs Very fine- to medium-grained meta-sandstone and phyllite**; minor meta-volcaniclastic sandstone or tuff; rare limestone, argillite, siliceous argillite, siltstone, and chert; grey; well-developed phyllitic _____ foliation Whitehorse trough MIDDLE JURASSIC Bowser Lake Group Polymictic conglomerate, sandstone, siltstone, and argillite; minor intermediate volcanic rocks mJBscp (similar to unit mJBvi); orange grey, dark to light grey; conglomerate contains pebbles, cobbles, and rare boulders of limestone, (sub)volcanic and plutonic rocks, and quartz; originally mapped as Takwahoni Formation based on very poorly preserved Toarcian ammonites, but re-interpreted here as Bowser Lake Group based on ca. 164 Ma U-Pb zircon maximum depositional age. Intermediate lapillistone, lapilli-tuff, and tuff breccia interbedded with siltstone, sandstone, volcaniclastic sandstone, and rare polymictic conglomerate; orange-grey; subangular volcanic clasts, hornblende-plagioclase-phyric; originally mapped as Takwahoni Formation, but tentatively reinterpreted here as Bowser Lake Group. **Fine- to medium-grained volcaniclastic sandstone, sandstone, and siltstone**; lesser intermediate volcanic rocks (similar to unit mJBvi), rare polymictic conglomerate (similar to unit mJBscp); dark grey; moderately sorted volcaniclastic sandstone with subangular to angular plagioclase, subordinate mafic grains, rare quartz grains and locally minor microphenocrystic volcanic clasts; originally mapped as Takwahoni Formation, but tentatively re-interpreted as Bowser Lake Group; ca. 185 Ma U-Pb detrital zircon maximum depositional age. **mJBsf** Argillite, siltstone, and very fine-, fine- to rarely medium-grained sandstone; dark grey; laminated to thin bedded; originally mapped as Takwahoni Formation, but tentatively re-interpreted here as Bowser Lake Group. LOWER JURASSIC Laberge Group Inklin Formation Phyllite, phyllitic greywacke, siltstone; minor limestone and conglomerate; grey to black, grey-**IJIst** green; well cleaved, well stratified. Takwahoni Formation IJTsc Polymictic conglomerate, coarse-grained feldspathic sandstone, lesser siltstone; conglomerate contains cobbles and pebbles of granite, hornblende-quartz porphyry, aphyric volcanic rock, argillite, chert, and recrystallized limestone; ca. 175 Ma U-Pb detrital zircon maximum depositional age. **Siltstone**, lesser fine- to medium-grained feldspathic arenite and rare feldspathic wacke; brown-grey; lithic and quartz-bearing sandstone; well stratified; ca. 188 Ma U-Pb detrital zircon maximum depositional age. **IJTst** Fine- to medium-grained feldspathic arenite to feldspathic wacke, and lesser siltstone, mudstone, conglomerate; grey to orange; lithic and quartz-bearing sandstone; well stratified; mostly Pliensbachian fossils; ca. 189 Ma U-Pb detrital zircon maximum depositional age. IJTsf Argillite, siltstone, and very fine-, fine- to rarely medium-grained sandstone; dark grey; laminated to thin bedded; late Sinemurian fossils; ca. 188 Ma U-Pb zircon maximum depositional **IJTsco** *Monomictic conglomerate*; medium grey; subrounded limestone pebbles and rare cobbles. ___ __ __ __ __ __ __ __ __ unconformity ___ __ __ __ __ __ __ __ __ __ UPPER TRIASSIC Sinwa Formation **uTrSsI Limestone**; light grey; typically massive and recrystallized, where less recrystallized the protolith is a wackestone to packstone with abundant fossil fragments in a lime mud matrix; middle Norian-early Rhaetian conodonts. Cache Creek MISSISSIPPIAN TO TRIASSIC

MTrCsI *Marble*; local yellow chert and tuffaceous interbeds; white, grey, and black; medium bedded, thinly foliated

MTrCvm *Meta-basalt*; dark green; aphyric to fine pyroxene porphyry; metamorphic assemblage includes epidote, chlorite, calcite, and pyrite; pervasively fractured, penetratively foliated.

Cache Creek complex

Pegd	Snow Peak pluton: Quartz monzodiorite to granodiorite: nink: equigranular to K-feldenar
	porphyritic; biotite-hornblende; 63.5±0.4 Ma U-Pb zircon age.
RASSIC 1	
JEgg	
TE JURA	SSIC Intermediate to felsic dikes and sills; light grey to white; (quartz-)hornblende-plagioclase
	porphyritic; common acicular hornblende; crosscuts Tanzilla alteration system, deformed Takwahon Formation, the King Salmon fault, and rocks of the Cache Creek terrane; 152.2±1.1 Ma U-Pb zircor age.
MLJhd	<i>Microdiorite</i> ; medium grey; fine grained, equigranular; (biotite-)hornblende-bearing clinopyroxene.
MLJSgd	McBride River, Snowdrift Creek, Tanzilla plutons and related stocks: <i>Granodiorite</i> , minor quartz monzodiorite, rare tonalite; medium to dark grey; medium grained, equigranular; biotite-hornblende; dioritic xenoliths locally common; 163.60±0.09, 160.43±0.16, 158.17±0.31 U-Pb zircon ages.
tikinia	
IDDLE JUF	ASSIC Hluev Lakes pluton: <i>Monzonite to svenite</i> : pink: porphyritic to equigranular: biotite-bearing
MJds	clinopyroxene; local miarolitic cavities; typically nepheline normative; 166.5±0.7 Ma U-Pb zircon age
	RASSIC(?) Syenite, quartz syenite to syenogranite; medium grained, equigranular to K-feldspar porphyritic;
wJdqs	biotite-hornblende; high magnetic response on airborne magnetic survey; Middle Jurassic or possibly younger.
DDLE JUF	RASSIC s plutonic suite
Three Si	sters pluton Potassic phase: Granite: pink to pink grey: medium grained, equigrapular to K-feldspar and/or
MJTgg Three Si	plagioclase porphyritic; typically contains 3-10% mafic minerals, with biotite and varying proportions of hornblende; 170±1, 169.1±0.8, 168.57±0.54 Ma U-Pb zircon ages. sters and Pallen Creek plutons
MJTdqm	Felsic phase: <i>Quartz monzonite, quartz monzodiorite</i> , rare monzogranite; medium grey to pink; medium grained, equigranular to K-feldspar porphyritic; hornblende-biotite, biotite or biotite-
T L •	nombiende; locally with subordinate clinopyroxene; local dioritic xenoliths; 172.75±0.87, 172.2±1.0, 169.0±1.3 Ma U-Pb zircon ages.
I hree Si	sters pluton
IJTh.xhb	porphyritic; hornblende-biotite; unfoliated; 173.2±1.4 Ma Ar-Ar hornblende cooling age.
/JTh.xcp	Intermediate phase: Intermediate dikes and stocks; porphyritic; 25-40% tabular to equant plagioclase (1-4 mm), 3-10% equant clinopyroxene (<2 mm) and minor magnetite; 173.25±0.18 Ma U-Pb zircon age.
Three Si	sters and Pallen Creek plutons Mafic phase: <i>Quartz diorite</i> ; rare quartz monzodiorite. diorite: green-grev. pink to grange gream:
MJTdq	medium grained, equigranular to (biotite-) hornblende porphyritic, locally coarse platy plagioclase porphyritic diorite (unit MJTdq.tm); biotite-clinopyroxene-hornblende; unfoliated to rarely foliated; locally contains microdiorite xenoliths; 172.0±1.6, 171.9±1.7 Ma Ar-Ar hornblende cooling ages.
ARLY TO M	IIDDLE JURASSIC ton Group
Horn Mo	untain Formation
EMJhf	Horn Mountain intrusions: <i>Felsic hypabyssal intrusions</i> ; rare intrusive breccia; yellow; contain 8-27% euhedral tabular to equant plagioclase (0.3-2 mm), 0-12% anhedral quartz (0.2-0.7 mm), and 0-7% altered euhedral hornblende(?) (0.2-0.5 mm) phenocrysts; generally flow banded, locally spherulitic; interpreted as subvolcanic feeders to the Horn Mountain Formation.
	Horn Mountain intrusions: Intermediate dikes, sills, and other intrusions; dark grey; contain 35-45% platy plagioclase (0.5-3 cm) 4-19% augite phonocruite (0.5-5 mm) and rate around the intermediate dikes.
EMJh.tm	an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation.
EMJh.tm EMJhm	 Horn Mountain intrusions: <i>Mafic dikes, sills, and other intrusions</i>; dark green-grey; contain 35-65% tabular to equant plagioclase phenocrysts (0.1-1 mm), 8-16% equant augite phenocrysts (0.2-mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Science (0.2-5 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders (0.2-5 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders (0.2-5 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation.
EMJh.tm EMJhm ATE TRIAS	 Horn Mountain intrusions: <i>Mafic dikes, sills, and other intrusions</i>; dark green-grey; contain 35 65% tabular to equant plagioclase phenocrysts (0.1-1 mm), 8-16% equant augite phenocrysts (0.2-mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Sill (0.2-mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Sill (0.2-5 mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation. SIC TO JURASSIC
EMJh.tm EMJhm ATE TRIAS LTrJds	 Horn Mountain intrusions: Mafic dikes, sills, and other intrusions; dark green-grey; contain 35 65% tabular to equant plagioclase phenocrysts (0.1-1 mm), 8-16% equant augite phenocrysts (0.2-mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation. SIC TO JURASSIC Meta-syenite; biotite.
EMJh.tm EMJhm ATE TRIAS LTrJds ATE TRIAS ikine pluto	 Horn Mountain intrusions: Mafic dikes, sills, and other intrusions; dark green-grey; contain 35 65% tabular to equant plagioclase phenocrysts (0.1-1 mm), 8-16% equant augite phenocrysts (0.2-mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Sill TO JURASSIC Meta-syenite; biotite.
EMJh.tm EMJhm ATE TRIAS LTrJds ATE TRIAS tikine pluto LTrSh	 Horn Mountain intrusions: <i>Mafic dikes, sills, and other intrusions</i>; dark green-grey; contain 35 65% tabular to equant plagioclase phenocrysts (0.1-1 mm), 8-16% equant augite phenocrysts (0.2-mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation. SIC TO JURASSIC Meta-syenite; biotite. SIC onic suite Gnat Pass porphyry: <i>Hypabyssal intrusions</i>; plagioclase, rare quartz and hornblende porphyritic 216.5±1.4 Ma U-Pb zircon age; hosts porphyry-style alteration and copper mineralization at Gnat Pass developed prospect and Moss showing (MINFILES 1041 001, 029).
EMJh.tm EMJhm ATE TRIAS LTrJds ATE TRIAS tikine pluto LTrSh	 Horn Mountain intrusions: Mafic dikes, sills, and other intrusions; dark green-grey; contain 35 65% tabular to equant plagioclase phenocrysts (0.1-1 mm), 8-16% equant augite phenocrysts (0.2-mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation. SIC TO JURASSIC Meta-syenite; biotite. SIC onic suite Gnat Pass porphyry: Hypabyssal intrusions; plagioclase, rare quartz and hornblende porphyritic 216.5±1.4 Ma U-Pb zircon age; hosts porphyry-style alteration and copper mineralization at Gnat Pass developed prospect and Moss showing (MINFILES 1041 001, 029). Cake Hill pluton: Monzogranite to granodiorite; grey-white; medium grained, equigranular to quartz porphyritic; hornblende; unfoliated; contains tabular hornblende and minor ubiquitous quartz eyes; lacks xenoliths; 217.91±0.24, 216.2±1.2 Ma U-Pb zircon ages.
EMJh.tm EMJhm ATE TRIAS LTrJds ATE TRIAS tikine pluto LTrSh LTrSgg	 Horn Mountain intrusions: Mafic dikes, sills, and other intrusions; dark green-grey; contain 35 65% tabular to equant plagioclase phenocrysts (0.1-1 mm), 8-16% equant augite phenocrysts (0.2-mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation. SIC TO JURASSIC Meta-syenite; biotite. SIC onic suite Gnat Pass porphyry: Hypabyssal intrusions; plagioclase, rare quartz and hornblende porphyritic 216.5±1.4 Ma U-Pb zircon age; hosts porphyry-style alteration and copper mineralization at Gnat Pass developed prospect and Moss showing (MINFILES 1041 001, 029). Cake Hill pluton: Monzogranite to granodiorite; grey-white; medium grained, equigranular to quartz porphyritic; hornblende; unfoliated; contains tabular hornblende and minor ubiquitous quartz eyes; lacks xenoliths; 217.91±0.24, 216.2±1.2 Ma U-Pb zircon ages. Cake Hill pluton: Quartz monzodiorite, quartz monzonite; pale grey; medium grained, equigranular to quartz porphyritic; hornblende; unfoliated; contains tabular hornblende; locally leucocratic (unit LTrSdqm.xle); unfoliated to moderately foliated; contains tabular hornblende; locally leucocratic (unit LTrSdqm.xle); unfoliated to moderately foliated; contains tabular hornblende; locally leucocratic (unit LTrSdqm.xle); unfoliated to moderately foliated; contains tabular hornblende; locally leucocratic (unit LTrSdqm.xle); unfoliated to moderately foliated; contains tabular hornblende; locally leucocratic (unit LTrSdqm.xle); unfoliated to moderately foliated; contains tabular hornblende; locally leucocratic (unit LTrSdqm.xle); unfoliated to moderately foliated; contains tabular hornblende; locally leucocratic (unit LTrSdqm.xle); unfoliated to moderately foliated; contains tabular hornblende; locally leucocratic (unit LTrSdqm.xle); unfoliated to moderately foliated; contains tabular hornblende; locally leucocratic (unit LTrSdqm.xle);
EMJh.tm EMJhm ATE TRIAS LTrJds LTrJds LTrSh LTrSgg LTrSdqm	 Horn Mountain intrusions: <i>Mafic dikes, sills, and other intrusions</i>; dark green-grey; contain 35 65% tabular to equant plagioclase phenocrysts (0.1-1 mm), 8-16% equant augite phenocrysts (0.2-mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation. SIC TO JURASSIC Meta-syenite; biotite. SIC Onic suite Gnat Pass porphyry: Hypabyssal intrusions; plagioclase, rare quartz and hornblende porphyritic 216.5±1.4 Ma U-Pb zircon age; hosts porphyry-style alteration and copper mineralization at Gnat Pass developed prospect and Moss showing (MINFILES 1041 001, 029). Cake Hill pluton: Monzogranite to granodiorite; grey-white; medium grained, equigranular to quartz porphyritic; hornblende; unfoliated; contains tabular hornblende and minor ubiquitous quartz eyes; lacks xenoliths; 217.91±0.24, 216.2±1.2 Ma U-Pb zircon ages. Cake Hill pluton: Quartz monzodiorite, quartz monzonite; pale grey; medium grained, equigranular to quigranular; hornblende to lesser biotite-hornblende; locally leucocratic (unit LTrSdqm.xle); unfoliated to moderately foliated; contains tabular hornblende; trace titanite usually ubiquitous; lack microdioritic xenoliths; 221±3, 218.2±1.3 Ma U-Pb zircon ages. Latham Creek pluton: Quartz diorite; black and white; medium grained, equigranular; biotite-bearing clinopyroxene-hornblende; commonly foliated; 228.36±0.16 Ma U-Pb zircon age.
EMJh.tm EMJhm ATE TRIAS LTrJds LTrJds LTrSh LTrSgg LTrSdqm LTrSdq LTrSdq	 Horn Mountain intrusions: Mafic dikes, sills, and other intrusions; dark green-grey; contain 35 65% tabular to equant plagioclase phenocrysts (0.1-1 mm), 8-16% equant augite phenocrysts (0.2-mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation. SIC TO JURASSIC Meta-syenite; biotite. SIC onic suite Gnat Pass porphyry: Hypabyssal intrusions; plagioclase, rare quartz and hornblende porphyritic 216.5±1.4 Ma U-Pb zircon age; hosts porphyry-style alteration and copper mineralization at Gnat Pass developed prospect and Moss showing (MINFILES 1041 001, 029). Cake Hill pluton: Monzogranite to granodiorite; grey-white; medium grained, equigranular to quartz porphyrit; infoliated; contains tabular hornblende and minor ubiquitous quartz eyes; lacks xenoliths; 217.91±0.24, 216.2±1.2 Ma U-Pb zircon ages. Cake Hill pluton: Quartz monzodiorite, quartz monzonite; pale grey; medium grained, equigranular; hornblende to lesser biolite-hornblende; locally leucocratic (unit LTrSdqm,xle); unfoliated to moderately foliated; contains tabular hornblende, equigranular; biotitebarring clinopyroxene-hornblende; commonly 228.36±0.16 Ma U-Pb zircon age. Beggerlay Creek pluton: Gabbro, rare clinopyroxenite; medium grained, equigranular; hornblende; commonly foliated; 228.36±0.16 Ma U-Pb zircon age.
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EMJh.tm EMJhm EMJhm ATE TRIAS LTrJds LTrSh LTrSgg LTrSgg LTrSdqm LTrSdq LTrSdq LTrSdq LTrSdq	 But programs interpreted as subvolcanic feeders to the Horn Mountain Formation. Horn Mountain intrusions: Mafic dikes, sills, and other intrusions; dark green-grey; contain 35 65% tabular to equant plagioclase phenocrysts (0.1-1 mm), 8-16% equant augite phenocrysts (0.2-mm, locally up to 10 mm) and rare amygdules in an aphanitic groundmass; interpreted as subvolcanic feeders to the Horn Mountain Formation. SIC TO JURASSIC Meta-syenite; biotite. SIC SIC Control JURASSIC Meta-syenite; biotite. SIC Case porphyry: Hypabyssal intrusions; plagioclase, rare quartz and hornblende porphyritic 216.5±1.4 Ma U-Pb zircon age; hosts porphyry-style alteration and copper mineralization at Gnat Pass developed prospect and Moss showing (MINFILES 1041 001, 029). Cake Hill pluton: Monzogranite to granodiorite; grey-white; medium grained, equigranular to quartz porphyritic; hornblende; unfoliated; contains tabular hornblende and minor ubiquitous quartz eyes; lacks xenoliths; 217.91±0.24, 216.2±1.2 Ma U-Pb zircon ages. Cake Hill pluton: Quartz monzodiorite, quartz monzonite; pale grey; medium grained, equigranular, hornblende to moderately foliated; contains tabular hornblende; uncul (unit LTrSdqm.xle); unfoliated to moderately foliated; contains tabular hornblende; usually ubiquitous; lack microdioritic xenoliths; 221±3, 218.2±1.3 Ma U-Pb zircon ages. Latham Creek pluton: Gabbro, rare clinopyroxenite; medium grained, equigranular; biotite-bearing clinopyroxene-hornblende; commonly foliated; 228.36±0.16 Ma U-Pb zircon age. Beggerlay Creek pluton: Websterite; medium to coarse grained, equigranular; biotite-bearing clinopyroxene-rich, locally biotite-bearing; unfoliated to foliated; 210.9±1.6 Ma Ar Ar hornblende cooling age. Beggerlay Creek pluton: Websterite; medium to coarse grained, equigranular; cumulus framework of touching clinopyroxene and completel
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MTrCu **Peridotite**; dun; chrome spinel-bearing; variably serpentinized; locally listwanite altered (unit MTrCu.xlw); a probable serpentinized dunite(?) at the southern margin is thoroughly serpentinized and highly magnetic.



British Columbia Geological Survey



Bedrock geology of the Dease Lake area Parts of NTS Sheets 104G, 104H, 104I, 104,

> Bram I. van Straaten, James M. Logan, JoAnne L. Nelson, David P. Moynihan, Larry J. Diakow, Rohanna Gibson, Sebastian J. Bichlmaier, Curran D. Wearmouth, Richard M. Friedman, Martyn L. Golding, Emily A. Miller and Terry P. Poulton

SUPPLEMENT

Recommended citation van Straaten, B.I., Logan, J.M., Nelson, J.L., Moynihan, D.P., Diakow, L.J., Gibson, R., Bichlmaier, S.J., Wearmouth, C.D., Friedman, R.M., Golding, M.L., Miller, E.A. and Poulton, T.P., 2022. Bedrock geology of the Dease Lake area, British Columbia Ministry of Energy, Mines and Low Carbon Innovation, British Columbia Geological Survey, Geoscience Map 2022-01, 1:100,000 scale.

Supporting digital data, including structural, magnetic susceptibility and GIS data, will be available in a forthcoming publication. This release is part of a broader compilation for an approximately 8,500 km² area that, once incorporated into the British Columbia digital geology, will be available from <<u>https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-</u>

mining/british-columbia-geological-survey/geology/bcdigitalgeology>.

1. Introduction

Digital files

Geoscience Map 2022-01 portrays the bedrock geology of a 5,000 km² area in northwestern British Columbia between the community of Dease Lake and the Stikine River (parts of NTS sheets 104G, 104H, 104I and 104J). This geology is based on mapping by the British Columbia Geological Survey carried out between 2011 and 2018. Rocks in the study area are mainly in the Stikine terrane (Stikinia), a Paleozoic to Mesozoic island arc that was deformed in the latest Triassic to Early Jurassic before accreting to ancestral North America in the Middle Jurassic. Latest Triassic to Early Jurassic folds are coeval with a magmatic and depositional hiatus that spans at least 30 m.y. (Fig. 1). This deformation, recorded throughout northwestern British Columbia, has been attributed to collision between the Yukon-Tanana and Stikine terranes (Nelson et al., 2022). Subsequent terrane accretion to ancestral North America is recorded by a Middle Jurassic fold-and-thrust belt in the northern part of the map area that includes two regional north-dipping thrusts, the King Salmon and Kehlechoa faults. In the hanging wall of the King Salmon fault are rocks of the Cache Creek terrane, which represents a composite of suprasubduction zone ophiolites, mafic and bimodal primitive intra-oceanic arc successions, oceanic island-type basalts, and limestone (Schiarizza, 2012; McGoldrick et al., 2017), and unconformably overlying units of the Whitehorse trough, which represent a latest Triassic to Early Jurassic syn-collisional overlap assemblage. Slightly farther south, Whitehorse though units in the hanging wall of the Kehlechoa fault are structurally juxtaposed against Stikinia.

2. Pre-collisional (Paleozoic to Late Triassic)

2.1. Stikinia 2.1.1. Stikine assemblage

suite (McBride River pluton).

The oldest units in the map area are deformed meta-sedimentary and meta-volcanic rocks of the Stikine assemblage (Devonian to Permian; units **DPSs, DPSsv, DPSv, DPSsl**). These rocks are exposed in the western and southern parts of the map area. Limestone in the western exposures yielded Early Permian conodonts (Table 1). 2.1.2. Deformation (D1)

Kilometre-scale tight folds are outlined by Stikine assemblage rocks in the western part of the map area (see cross-section B-B").

Rocks generally display a penetrative steeply northwest-dipping phyllitic foliation and the southeasterly vergent folds display subhorizontal to gently northeast and southwest plunging axes. In the southern part of the map area, mapping by Read (1984) and Read and Psutka (1990) shows roughly parallel bedding and foliation in Stikine assemblage rocks; south of the Stikine River they typically display moderate southeasterly dips. The absence of penetrative deformation in overlying Triassic units suggests that deformation was Middle Permian to Early Triassic (Tahltanian orogeny of Wheeler, 1967; Logan and Koyanagi, 1994). 2.1.3. Tsaybahe group and Stuhini Group

The Stikine assemblage is overlain (likely unconformably) by a volcano-sedimentary sequence informally referred to as the Tsaybahe group (Lower-Middle Triassic; Read, 1983; 1984; Read and Psutka, 1990). These rocks are exposed in the western, central, and southern parts of the map area. We subdivide the Tsaybahe group into a sedimentary unit of fine-grained siliciclastic rocks and minor chert (unit **ImTrTs**), and a volcanic unit of monomictic tuff breccia with plagioclase-augite-phyric mafic volcanic clasts (unit **mTrTvm**). The sedimentary unit contains rare Early Triassic fossils; both units contain Middle Triassic fossils (Table 1). The overlying Stuhini Group (Upper Triassic) includes monomictic tuff breccia, lapilli-tuff, conglomerate, and subordinate volcaniclastic sandstone and siltstone (**uTrS** units). Volcanic and coarse clastic rocks contain augite-plagioclase-phyric mafic volcanic clasts. Rare fossils and cross-cutting relationships with Stikine plutonic suite intrusions (Late Triassic, see below) suggest that the Stuhini Group is Carnian (Fig. 1). Tsaybahe volcanic rocks may appear texturally similar to the Stuhini Group, but are separated based on their stratigraphic position atop the Stikine assemblage, rare Middle Triassic biostratigraphic ages, higher augite and lower plagioclase phenocryst content, more primitive lithogeochemical composition, low magnetic susceptibility, and low response on regional aeromagnetic surveys. Compared to widespread exposures of mafic volcanic rocks of the Stuhini Group in northern Stikinia, occurrences of the Tsaybahe group and its correlatives are rare. However, owing to a lack of ages for such mafic volcanic rocks, we consider that some Tsaybahe group exposures may have been included in the Stuhini Group and suggest that the unit is more extensive than currently recognized. The Tsaybahe group may represent the remnants of an Early-Middle Triassic marine basin that evolved into nascent Middle Triassic arc volcanism before widespread Upper Triassic Stuhini arc activity

(van Straaten and Wearmouth, 2019a). 2.1.4. Triassic intrusions In the southwestern and southern parts of the map area, several small gabbro bodies (unit **MTrdg**) with low magnetic susceptibility and primitive lithogeochemical composition cut successions no younger than the Tsaybahe group and are interpreted as Middle Triassic feeders to the Tsaybahe volcanic succession. A lithogeochemical sample (van Straaten et al., 2022) shows the lowest MgO (on a volatile-free basis) and lowest LREE of all non-cumulate textured Triassic intrusions. Gabbroic and ultramafic intrusions of the Gnat Lakes plutonic suite (LTrG units, renamed from Polaris plutonic suite of Woodsworth et al.,

1991) form several small bodies throughout the western half of the map area. They have high magnetic susceptibility, Late Triassic cooling ages, cut successions no younger than the Stuhini Group, and are likely comagmatic with Stuhini Group volcanic rocks (Anderson, 1983; Nixon et al., 1997; this study). This suite includes the Gnat Lakes ultramafic body (unit LTrGu), for which whole rock and mineral chemistry suggests an Alaskan-type affinity (Nixon et al., 1997). Hanson and McNaughton (1936) named a contiguous composite granitoid body that occupies >2000 km² in the central part of the map area the Hotailuh batholith. Subsequent studies retained this name but demonstrated that this body includes rocks of widely different age and lithology (Anderson, 1983; Gabrielse, 1998; van Straaten et al., 2012; see below), including Late Triassic intrusions of the Stikine plutonic suite (Beggerlay Creek, Latham Creek and Cake Hill plutons), a Middle Jurassic intrusion of the

Three Sisters plutonic suite (Three Sisters pluton) and a late Middle to Late Jurassic intrusion of the Snowdrift Creek plutonic

2.2. Cache Creek terrane In the northwest corner of the map area, north of the King Salmon fault, is a fault panel of penetratively foliated meta-basalt and marble (units MTrCvm, MTrCsl) of the Cache Creek complex (Mississippian to Triassic). Variably serpentine- and listwanitealtered ultramafic bodies (unit **MTrCu**) are also exposed along the trace and north of the King Salmon fault.

3. Syn-collisional (latest Triassic to Early Jurassic) 3.1. Stikinia 3.1.1. Deformation (D2) Yukon-Tanana and Stikine terranes (Nelson et al., 2022). deformation. **3.1.2.** Depositional and magmatic hiatus Late Triassic volcanic and plutonic rocks are unconformably overlain by late Early to Middle Jurassic volcano-sedimentary strata

and undergoing uplift and erosion at this time. 3.2. Whitehorse trough 3.2.1. Sinwa Formation and Laberge Group the hanging wall of the Kehlechoa fault. Northeast of the map area, Sinwa limestone overlies Permo-Triassic bimodal primitive Takwahoni Formation (e.g., Logan et al., 2012b).

2015; Nelson et al., 2022).



dashed black lines = possible age. Symbols coloured by rock unit; grey colour = uncertain unit assignment. Geological time scale after Cohen et al. (2013); with modifications for Triassic (sub)stage boundary numerical ages for early-late Induan by Burgess et al. (2014) early-late Olenekian by Ogg et al. (2014), early-middle Anisian and middle-late Anisian by Li et al. (2018), early-late Ladinian by

Wotzlaw et al. (2014).

Gabbro and subordinate ultramafic intrusions of the Beggerlay Creek pluton (units **LTrSdg, LTrSu**; 210.9 ±1.6 Ma Ar-Ar hornblende cooling age, Table 2) and quartz diorite of the Latham Creek pluton (unit LTrSdq; 228.36 ±0.16 Ma CA-TIMS U-Pb zircon crystallization age, Table 2) form two separate ca. 70 km² bodies near and north of the Stikine River. The two plutons show significant lithological, petrological and lithogeochemical similarities, and we suggest the younger cooling age for the Beggerlay Creek pluton may indicate a protracted cooling history or resetting by a later thermal event. These mafic plutons represent the oldest intrusions of the Stikine plutonic suite (Fig. 1), coeval with diorite, quartz diorite, and syenite intrusions dated at ca. 229-225 Ma approximately 100 km to the west (Takaichi and Johnson, 2012; Takaichi, 2013a; Mihalynuk et al., 2016). Beggerlay Creek and Latham Creek lithogeochemical samples (n=5) show a higher SiO, content (on a volatile-free basis) and steeper LREE slopes than non-cumulate textured gabbroic Gnat Lakes plutonic suite samples (n=3; van Straaten et al., 2022), supporting the current two-fold subdivision. The lack of crystallization age determinations, unequivocal crosscutting relationships, and mineral chemistry for Late Triassic ultramafic to mafic intrusions makes it difficult to determine their genetic and temporal relationships. The Cake Hill pluton occupies 460 km² in the centre of the map area. It probably occupied a much larger area before emplacement of the younger Three Sisters pluton (van Straaten et al., 2012). The main phase, which has the largest areal extent, is a medium-grained equigranular hornblende quartz monzodiorite to quartz monzonite (unit **LTrSdqm**). It cuts and contact metamorphoses Stuhini Group and older strata. Two smaller bodies (4-6 km²) ca. 3 and 17 km south-southeast of Glacial Mountain are composed of medium-grained equigranular to quartz porphyritic hornblende monzogranite to granodiorite (unit **LTrSgg**). Lithogeochemistry shows higher SiO₂ (on a volatile-free basis), lower LREE concentrations, and overlapping to steeper LREE slopes for unit LTrSgg than unit LTrSdqm. Plagioclase porphyritic hypabyssal intrusions (unit LTrSh) cut Stuhini Group strata near Lower Gnat Lake; the intrusions host, and are interpreted to be responsible for, porphyry copper mineralization at the Gnat Pass advanced prospect and Moss showing (MINFILES 104I 001, 029; van Straaten and Gibson, 2017; Lang et al., 2020). Drilling at Gnat Pass in the 1960s defined a non NI 43-101-compliant resource of 30 million tonnes grading 0.389% copper. U-Pb zircon ages range from ca. 221-218 Ma for unit LTrSdgm, ca. 218-216 Ma for unit LTrSgg and ca. 216 Ma for unit LTrSh (Table 2). The geochronological data indicate that these are the youngest dated intrusions of the Stikine plutonic suite (Fig. 1).

Triassic map units generally lack penetrative tectonic fabrics, but map patterns and stereonet analysis of bedding variations in the southwestern part of the map area suggest the stratified units are deformed into map-scale open folds with north-south axial traces (see cross-sections B-B", C-C'). The absence of north-trending folds in unconformably overlying late Early to Middle Jurassic strata suggests latest Triassic to Early Jurassic deformation, similar to that in the adjacent 104G map sheet to the southwest (Brown et al., 1996). This deformation, recorded throughout northwestern British Columbia and considered latest Triassic (Henderson et al., 1992; Rhys, 1993; Rees et al., 2015; Nelson et al., 2018), has been attributed to collision between the In the southernmost part of the map area, bedding and foliation in Stikine assemblage rocks appear folded into an open, northwest-trending, antiform (Read, 1984; Read and Psutka, 1990); this fold likely formed as a result of Triassic (D2) or younger

of the upper Hazelton Group. The best exposures of the unconformity are approximately 4 km south-southeast of Horn Mountain (UTM 470,496 E – 6,453,091 N and 469,880 E – 6,453,251 N). The unconformity spans at least 30 m.y. (Fig. 1) and represents one of the few well-documented examples of unroofed Stuhini arc in northern Stikinia. The depositional hiatus is coincident with a magmatic gap (Fig. 1). A similar depositional and magmatic hiatus is found along the entire Stikine arch (Souther, 1971; Anderson, 1984; Brown et al., 1996) and suggests the northern to northeastern part of Stikinia was amagmatic Limestone of the Sinwa Formation (unit **uTrSsI**; Upper Triassic) is commonly in the hanging wall of King Salmon fault and locally in

arc rocks of the Cache Creek terrane (Kutcho assemblage; Schiarizza, 2012). Sedimentary rocks of the Laberge Group (Lower Jurassic) constitute the main fill of the Whitehorse trough and include the Takwahoni Formation and the Inklin Formation. The Takwahoni Formation is in two separate fault panels (Fig. 1). The northern fault panel, between the King Salmon and Kehlechoa faults, extends across the entire map area and contains predominantly greywacke (unit IJTst; Pliensbachian), lesser siltstone (unit IJTs; Pliensbachian), and conglomerate (unit IJTsc; Toarcian). The southern fault panel, between the McBride and Kehlechoa faults in the eastern part of the map area, contains fine-grained siliciclastic rocks (unit **IJTsf**; Sinemurian to Pliensbachian). Exposed in the hanging wall of the King Salmon fault, the predominantly fine-grained siliciclastic Inklin Formation (unit **IJIst**) is interpreted as the distal equivalent to the coarser grained Whitehorse trough strata in the map area are juxtaposed with Middle Jurassic and older units of Stikinia across the Kehlechoa thrust fault. Farther northwest, Whitehorse trough strata lie unconformably atop Stikinia (Souther, 1971; Mihalynuk et al., 1995; Shirmohammad et al., 2011; Colpron et al., 2015), representing an overlap assemblage between the Cache Creek and Stikine terranes. Regionally, rocks of the Laberge Group record unroofing of the Yukon-Tanana – Stikinia collision zone (Colpron et al.,

Kozur and Bachmann (2008), early-middle Norian by Diakow et al. (2011), early-late Carnian, Carnian-Norian, middle-late Norian using long-Rhaetian option of Ogg et al. (2014), and Norian-Rhaetian by

4. Syn-accretionary (late Early to early Late Jurassic)

4.1.1. Upper Hazelton Group

4.1. Stikinia

The Triassic-Jurassic unconformity is overlain by sedimentary rocks of the Spatsizi Formation (**ImJS** units, up to 1 km thick, Toarcian) that grade laterally and vertically to volcanic rocks of the Horn Mountain Formation (ImJH units, up to 4.5 km thick, Toarcian-Bajocian; van Straaten and Nelson, 2016); both are part of the upper Hazelton Group as defined by Gagnon et al. (2012). The volcano-sedimentary rocks form a homoclinal, moderately north- to northeast-dipping, sequence that is exposed across the entire northern part of map area (see cross-sections A-A', D-E'', F-F''); bedding attitudes flatten towards the southeast (see cross-section H-H'''). Previously, the volcanic rocks were largely assigned to the Stuhini Group (Anderson, 1983; Gabrielse, 1998; Logan et al., 2012b), which is not surprizing given the similarity of the augite-phyric mafic volcanic rocks that are predominant in both successions. The basal Hazelton Group, with granitoid clasts and feldspathic to subfeldspathic arenites, returned Late Triassic detrital zircon peaks, confirming derivation from the Cake Hill pluton and related intrusions. Herein we informally subdivide the Horn Mountain Formation into the: 1) Cariboo unit (**ImJHv.tm, ImJHv.xpl**), comprising intermediate (coarse platy) plagioclase-phyric volcanic rocks, contained within or at the base of the Glacial Mountain unit; 2) Glacial Mountain unit, (ImJHvm, ImJHvs, ImJHsv) comprising partly or wholly subaqueous, massive green mafic volcanic breccia and conglomerate with predominantly mafic volcanic (augite-plagioclase-phyric) clasts; 3) Sister Mary unit (**ImJHv, ImJHvf**), a subaerial volcanic succession consisting of interlayered mafic to intermediate maroon (biotite-)augite-plagioclase-phyric flows, volcanic breccias and tuff that gradationally overlies the Glacial Mountain unit; and 4) Zuback unit, comprising felsic volcanic rocks (unit **mJHvf**) atop the Sister Mary unit, locally overlain by a mafic volcanic succession (unit mJHvm). The Cariboo, Glacial Mountain, and Sister Mary units are cut by numerous, roughly coeval subvolcanic feeder dikes, sills, and intrusions (EMJh units). New high-precision CA-TIMS U-Pb zircon geochronological data constrains Horn Mountain volcanism to 175.3-171.0 Ma (Fig. 1, Table 2). Linked synto post-depositional north-northeasterly normal faults and west-northwesterly dextral faults suggest formation due to a west-

northwest dextral shear couple (van Straaten and Nelson, 2016; van Straaten and Gibson, 2017). Timing of Horn Mountain volcanism is unusual because it postdates typical Late Triassic to Early Jurassic arc development in Stikinia and was deposited during accretion of the Quesnel, Cache Creek and Stikine terranes to ancestral North America (van Straaten and Nelson, 2016). The Horn Mountain Formation hosts the Tanzilla prospect (MINFILE 104I 178), where an advanced argillic lithocap overlies porphyry-style alteration at depth. Quartz-sericite-pyrite to potassic alteration with anomalous copper and molybdenum is hosted by a synmineral ca. 173 Ma plagioclase porphyry (unit MJTh.xcp) that was emplaced during a local hiatus in volcanism (van Straaten and Gibson, 2017). The advanced argillic alteration extends eastward for at least 27 km (e.g., MINFILES 104I 172, 173, 177) and is interpreted as a lithocap formed by acidic hydrothermal fluid flow along an unconformity or fault in the upper part of the Horn Mountain Formation. At the eastern end of the alteration zone, the McBride showing (MINFILE 104I 171) displays widespread quartz-sericite-pyrite and local potassic alteration with elevated copper and gold. 4.1.2. Three Sisters plutonic suite The Three Sisters plutonic suite (**MJT** units) includes the Three Sisters (440 km²) and Pallen Creek (40 km²) plutons. The Three Sisters pluton occupies a large area between Beggerlay Creek and the McBride River. From here, a 1 to 6 km-wide offshoot

extends west- to northwestward to Highway 37 and to a newly defined – but poorly exposed – intrusive body at Sitsa Lake. The pluton includes mafic, intermediate, felsic and potassic phases. A mafic subphase with platy plagioclase (unit **MJTdq.tm**) may suggest a common magma source with Horn Mountain (sub)volcanic rocks. The Pallen Creek pluton includes a marginal mafic phase and a central felsic phase. Geochronological data for the suite indicate emplacement in a relatively brief time interval (ca. 173-169 Ma, Table 2), during or after the latest phases of Horn Mountain volcanism. Three Sisters plutonic suite intrusions and their immediate wall-rocks host zones of alteration and mineralization containing locally elevated molybdenum, copper, silver, and/or gold in fractures, veins, skarns, and gossans (e.g., MINFILES 104I 162, 170; 104J 019, 034, 046). 4.1.3. Hluey Lakes volcano-plutonic complex A distinctive package of maroon to salmon pink weathering trachyandesite (latite), trachyte, basalt and epiclastic rocks (unit

mJv.gal) is exposed north of Hluey Lakes. The adjacent Hluey Lakes monzonite to syenite pluton (4 km²; unit MJds) returned a 166.5±0.7 Ma U-Pb zircon age and an incongruous older 212.2±1.8 Ma Ar-Ar biotite cooling age. Both units contain feldspar, clinopyroxene, and biotite phenocrysts. Lithogeochemical samples from both units show a similar alkalic signature, high REE concentrations, and a very steep LREE slope (van Straaten et al., 2022); all but one volcanic sample, and all intrusive samples are nepheline normative. The alkalic volcanic unit was originally mapped as Stuhini Group (Logan et al., 2012b), but reinterpreted here as Middle Jurassic based on mineralogical and lithogeochemical similarity to the Hluey Lake pluton. The volcano-plutonic complex hosts the Hu porphyry Cu-Au prospect (MINFILE 104J 013). The magmatic system at Hluey Lakes has a similar alkalic affinity as the ca. 180-175 Ma Duckling Creek plutonic suite in neighbouring Quesnel terrane, and highlights its prospectivity for alkalic porphyry Cu-Au deposits such as Lorraine (Devine et al., 2014; Jones et al., 2021). 4.1.4. Bowser Lake Group

The Bowser Lake Group (Bajocian and younger) records initiation of deposition of erosional products from the Stikinia-Cache Creek tectonic welt. In the southeast part of the map area, the contact between the Horn Mountain Formation and overlying Bowser Lake Group is conformable. Here, chert and limestone clast-bearing pebble to cobble conglomerate (unit **muJBBsc**; >330 m thick) is interpreted to have formed close to range front faults along the building orogen. Farther south, the coarse clastic facies transitions to interbedded subaerial siltstone, sandstone, chert clast-bearing conglomerate, and mafic flows (units muJBBs, muJBBvm; >430 m thick; van Straaten and Bichlmaier, 2018a). All three units are assigned here to the informal Mount Blair unit, a non-marine succession that is lithologically distinct from mainly marine units in the Bowser Lake Group to the south (Evenchick and Thorkelson, 2005). A representative stratigraphic section is exposed 2 km north-northeast of MINFILE 104I 016 (contact with underlying Horn Mountain Formation at UTM 499,528 E – 6,433,031 N, top of section at UTM 499,646 E – 6,432,733 N). A highprecision CA-TIMS U-Pb zircon crystallization age on immediately underlying Horn Mountain Formation felsic volcanic rocks constrains the onset of Bowser Lake Group sedimentation to 170.99±0.13 Ma (Fig. 1, Table 2). In the center of the map, marine

sedimentary rocks of the Bowser Lake Group (unit **muJBs**) unconformably overlie the Horn Mountain Formation. Radiometric and biostratigraphic ages show that these units are the oldest known Bowser Lake Group strata in Stikinia. 4.2. Cache Creek terrane and Whitehorse trough 4.2.1. Bowser Lake Group In the northeast, between the McBride and Kehlechoa faults, is a succession of polymictic conglomerate, intermediate volcanic rocks, volcaniclastic sedimentary rocks, and fine-grained siliciclastic rocks (units **mJBscp, mJBvi, mJBsv** and **mJBsf**). The units were originally mapped as Takwahoni Formation (Gabrielse, 1998; van Straaten and Bichlmaier, 2018a), but are re-interpreted

here as Bowser Lake Group based on a ca. 164 Ma U-Pb detrital zircon maximum depositional age (Table 2). 4.2.2. Deformation (D3) A Middle to early Late Jurassic fold-and-thrust belt is restricted to the Cache Creek terrane and Whitehorse trough (Logan et al., 2012a; van Straaten and Gibson, 2017). Rocks in the hanging wall of the King Salmon thrust fault typically display a penetrative tectonic fabric, with a north- to northeast-dipping cleavage axial planar to open to tight folds. Rocks between the King Salmon and Kehlechoa thrust faults are generally unfoliated, but a mostly north- to northeast-dipping cleavage is locally developed in west- to northwest-trending open folds. The west- to northwest-trending folds and regional south- to southwest-vergent thrust faults are interpreted to have formed during accretion of the Quesnel, Cache Creek, and Stikine terranes to ancestral North America (e.g., Mihalynuk et al., 2004). The absence of internal imbrication and folding in the homoclinal footwall sequence suggests the Kehlechoa fault is the foreland thrust of the orogenic welt. The Snowdrift Creek pluton (MLJSgd) stiches the Kehlechoa fault and constrains foreland fault movement to between ca. 164 and 160 Ma. Dome-and-basin fold interference in Triassic rocks in the southwest, and a very open fold defined by Horn Mountain Formation strata in the southeast (cross-section

H-H''') may be related to D3 or D4 (see below). Polymetallic veins near the Kehlechoa and King Salmon thrust faults locally contain elevated gold and silver (MINFILES 104I 093, 100, 101) and may be similar in age to lode Au occurrences in the Atlin camp (Ash, 2001; Mihalynuk et al., 2017).

5. Post-accretionary (late Middle Jurassic and younger) 5.1. Snowdrift Creek plutonic suite and other Late Jurassic intrusions

Tanzilla pluton (14 km²), and several smaller satellite stocks. The intrusions typically comprise medium-grained equigranular biotite-hornblende granodiorite. New high-precision CA-TIMS U-Pb zircon crystallization ages ranging from 163.6 to 158.2 Ma (Table 2) indicate these intrusions belong to a previously unrecognized late Middle to Late Jurassic plutonic suite. The Snowdrift Creek pluton hosts a porphyry Mo prospect along its southern margin (Mo, MINFILE 104I 146). Porphyry dikes and sills with plagioclase, hornblende and/or quartz phenocrysts (unit LJh) cross-cut folded and foliated sedimentary rocks of the Takwahoni Formation, homoclinal strata of the Horn Mountain Formation, hydrothermally altered rocks at Tanzilla, and the King Salmon fault (Logan et al., 2012a; van Straaten and Nelson, 2016). A sample returned a 152.2±1.1 Ma U-Pb zircon crystallization age (Fig. 1, Table 2). 5.2. Sustut Group

Sandstone, siltstone, shale and conglomerate of the Sustut Group (unit **KSs**) unconformably overlie deformed Triassic rocks in the southwestern part of the map area. The succession has been assigned to the Tango Creek Formation (Read, 1983; Gabrielse, 1998). It returned mid-Cretaceous (middle Albian to Cenomanian, Table 1) palynomorphs, within the range of Barremian or early Albian to late Campanian ages for better-studied Tango Creek Formation sections farther to the south (Evenchick and Thorkelson, 2005). The strata are interpreted to have formed in the foreland basin to the Skeena fold-and-thrust-belt.

5.3. Deformation (D4) Cretaceous Skeena fold-and-thrust belt deformation is well-documented south of the Pitman fault in Sustut Group, Bowser Lake Group, and older strata (Evenchick, 1991; Evenchick and Thorkelson, 2005). North of the Pitman fault, the northeastern limit of Skeena fold-and-thrust belt deformation has been interpreted to extend as far north as Sustut Group strata near Mount Meehaus, approximately 15 km southwest of the map area (Read, 1983; Evenchick, 1991). The Pitman fault is considered a sinistral tear fault that accommodated thick-skinned northeast-directed shortening in the Skeena fold-and-thrust belt to the south (Evenchick and Thorkelson, 2005). Sinistral motion along the Pitman fault may have been responsible for counter-clockwise rotation in the Tsaybahe Mountain area, which includes the southern exposures of the Stikine assemblage, the Dease Lake fault, and related structures. Within the map area, no unequivocal D4 folds have been documented. However, several folds in the southwest, south, and southeast parts of the map area may be related to D2, D3, and/or D4 (see Sections 3.1.1., 4.2.2.).

5.4. Snow Peak pluton In the northwest part of the map area, the Snow Peak pluton (unit **Pegd**, 14 km²; Paleocene) cuts porphyry dikes (unit **LJh**) and is surrounded by a several km-wide contact metamorphic aureole containing fine grained biotite (Moynihan and Logan, 2012). A sample returned a 63.5±0.4 Ma U-Pb zircon crystallization age (Table 2). Local Mo±Au and/or W mineralization is developed along west-northwest trending fracture planes in the central part of the pluton (Mack, MINFILE 104J 014); a Re-Os molybdenite sample from this location returned a 64.5±0.3 Ma age (Table 2). 5.5. Tanzilla Canyon Formation

Poorly consolidated sedimentary rocks of the Tanzilla Canyon Formation (unit **ETsc**, Eocene) are exposed along the Tanzilla and Tuya rivers in the western part of the map area (Ryan, 1991; Gabrielse, 1998; Logan et al., 2012a). 5.6. Deformation (D5)

Tanzilla Canyon Formation strata immediately west of the limit of mapping are affected by north-northeasterly trending open folds (Ryan, 1991). South of the Snow Peak pluton, outcrop-scale folds in Takwahoni Formation strata trend approximately north; they overprint east-west trending folds (D3, Middle Jurassic), and may be coeval with post-Eocene folds affecting the Tanzilla Canyon Formation (Moynihan and Logan, 2012). 5.7. Young volcanic rocks

Neogene basalt flows (unit **Nvb**) exposed as km-scale outliers in the southern part of the map area returned K-Ar whole rock cooling ages between 5.7 and 4.8 Ma. We correlate these with the Maitland Volcanics of Evenchick and Thorkelson (2005), which extend from the west-centre of NTS sheet 104H into the southern portion of the map area and returned ca. 5.2-4.6 Ma K-Ar dates. The volcanic rocks are coeval with the Nido phase of the Mount Edziza volcanic complex (Souther, 1992). Undivided Neogene to Pleistocene basalts (unit NPIvb) form local outliers across the map area. They may correlate with the Maitland Volcanics (Pliocene), Mount Edziza volcanic complex (Miocene to recent; Souther, 1992) or Level Mountain volcanic complex (Milocene and younger; Gabrielse, 1998).

Isolated exposures of Pleistocene basalt flows (unit **Plvb**) were mapped by Read (1984) along the Stikine River and immediately south of the map area along the Pitman fault; they returned 0.5 Ma and 0.19 Ma K-Ar dates (Table 2). A distinct aeromagnetic high connects the volcanic exposures along the Pitman fault, via Morchuea Lake to outcrop along the Stikine River, and is interpreted here as a ca. 14 km-long flow. It suggests that the Stikine River canyon is Pleistocene or older. The unit is coeval with the Klastline phase of the Mount Edziza volcanic complex (Souther, 1992).

	FO	GSC no. C-098054	Easting 398888	Northing 6457649	Location accuracy moderate	Unit ETsc	Age probably Eocene or younger	Fossil description Pollen (<i>Alnus verus</i> (R. Potonie) Martin and Rouse 1966, <i>Carya</i> sp., (?) <i>Diervilla</i> sp., <i>Engelhardia</i> sp. in Piel 1971, <i>Juglans</i> sp., <i>Pterocarya stellatus</i> (R. Potonie) Martin and Rouse 1966, <i>Tilia crassipites</i> Wodehouse 1933 (common), <i>Ulmus</i> sp., common bisaccate and rare tricolpate and triporate pollen), fungal spores	Identified by A.R. Sweet	Source Gabrielse (1998), Read (1983)	Location source 4b
	n/a F15h', F70';	C-007872 C-099642,	432122	6436307 6441756	moderate	KSs KSs	Cenomanian late Albian to/or possibly	(common) Pollen (<i>Pseudocycas unjiga</i> (Dawson) Bell, <i>Araliaephyllum parvidens?</i> Hollick, <i>Dicotylophyllum</i> spp.) n/a	W.A. Bell A.R. Sweet	Gabrielse (1998) Read (1983, 1984)	3a 4b
	F15i', F71'; F15j',F72' F15n', F76;	С-099643, С-099644 ^{DH} С-099624,	425411	6441667	moderate	KSs	early Cenomanian	n/a	A.R. Sweet	Read (1983, 1984)	4b
molades	F15m', F75' F15t', F82'	C-099626 ⁵¹ C-099625 ^{DH}	425272	6441508	moderate	KSs	early Cenomanian late Albian to/or possibly early Cenomanian	n/a	A.R. Sweet	Read (1983, 1984)	4b
- - 	F14d', F61	C-099627 ^{DH}	425165	6442088	moderate	KSs	late Albian to/or possibly early Cenomanian	n/a	A.R. Sweet	Read (1983, 1984)	4b
	F15b', F64'	C-099628 ^{DH}	425108	6441942	moderate	KSs	late Albian to/or possibly early Cenomanian	n/a	A.R. Sweet	Read (1983, 1984)	4b
	F15r', F80'	C-099629 ^{dh}	425306	6441633	moderate	KSs	late Albian to/or possibly early Cenomanian	n/a	A.R. Sweet	Read (1983, 1984)	4b
	F15I', F74'	C-099630 ^{DH}	425388	6441670	moderate	KSs	late Albian to/or possibly early Cenomanian	n/a	A.R. Sweet	Read (1983, 1984)	4b
	F15c', F65'; F15d', F66'; F15e', F67'	С-099639, С-099640, С-099641 ^{DH}	424841	6441830	moderate	KSs	late Albian to/or possibly early Cenomanian	n/a	A.R. Sweet	Read (1983, 1984)	4b
	n/a	C-095020, C-095023, C-095024	498898	6441810	moderate	muJBs	early Bajocian	Ammonites (C-095020: Sonninia? spp. indet., C-095023: Sonninia? sp. indet., C-095024: Several genera of sonniniids), bivalves (C-095024: <i>Myophorella</i> sp., Trigoniids, other indeterminate forms), corals	H. Frebold, H.W. Tipper	Gabrielse (1998)	3a
	n/a n/a	C-095018 C-095019	499575 499102	6441370 6441574	moderate moderate	muJBs muJBs	early Bajocian early Bajocian	Ammonites (indet. fragment, possibly inner whorl of a sonniniid) Ammonites (poorly preserved inner whorls of ammonite, indet., possibly a sonniniid)	H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper	Gabrielse (1998) Gabrielse (1998)	3a 3a
	n/a n/a	C-095016 C-095241	502494 493049	6439876 6444025	moderate low	muJBBsc? muJBBsc,	early Bajocian probably Toarcian-early	Ammonites (fragments and distorted specimens of <i>Chondroceras</i> spp. indet., fragments and poor impressions of <i>Stephanoceras</i> s.l.), brachiopods, bivalves (pelecypods), gastropods Belemnites (indet. true belemnites (Order Belemnitida Zittel 1895 emend. Jeletzky 1966))	H. Frebold J.A. Jeletzky	Gabrielse (1998) Gabrielse (1998)	3a 3b
	14MT-03-01	V-003336	461222	6464921	high	lmJHv or IJTsf? muJBs	Aptian late Toarcian-early	Ammonite (partial impression of a large probable hammatoceratid, resembling late Toarcian Hammatoceras)	T.P. Poulton	Poulton (pers. comm.,	., 1
	n/a	C-095240	493691	6444586	moderate	muJBBsc, ImJHv or IJTsf?	late Pliensbachian-early Toarcian	Belemnites (<i>Nannobelus</i> -like representatives of Belmnitidae d'Orbigny s. restr. (Order Belemnitida Zittel 1895 emend. Jeletzky 1966)), bivalve (indeterminate pelecypods), brachiopods (indeterminate)	J.A. Jeletzky	Gabrielse (1998)	3a
	n/a n/a	C-095251 C-095025,	482599 481316	6441035 6439760	moderate moderate	lmJHvm ImJSs	possibly Toarcian- Bajocian early Toarcian	Belemnite (<i>Belemnopsis</i> sp. indet.) Ammonites (C-095025: gen. et sp. indet., C-095026: probably Hildaites sp. ind.)	J.A. Jeletzky H. Frebold,	Gabrielse (1998) Gabrielse (1998)	3a 3a
	n/a	C-095026 C-095093	481287	6441617	moderate	ImJSs	middle Toarcian	Ammonites (<i>Peronoceras verticosum</i> ?, <i>Zugodactylites</i> ? sp. ind., <i>Harpoceras</i> ?, sp. ind., <i>Phymatoceras</i> ? so. ind.)	H.W. Tipper, G. Jakobs H. Frebold, G. Jakobs	Gabrielse (1998)	3a
	707 F 325F	C-081903 C-095327, C-095328, C-095242	469607 455117	6453466 6456363	low high	lmJSscb lmJSscb	early-middle Toarcian early Toarcian	Ammonites (<i>Hildaites levisoni, Dactylioceras</i> sp. ind., <i>Pseudomercaticeras</i> ? sp. indet.; numerous poorly preserved fragments, probably several species are present) Ammonites (a few poorly preserved fragments, including <i>Harpoceras</i> which may belong to <i>Harpoceras exaratum</i> Young and Bird or to a related species), foraminifera (<i>Linguilina</i> sp., <i>Ammodiscus</i> sp., <i>Reinholdella</i> sp., <i>Astacolus</i> sp., <i>Citharina</i> sp., and unidentified polymorphinids), ostracods (juvenile <i>bairdiid</i>), bivalves (five pelecypod genera including <i>Weyla</i>), cyclostome bryozoa (<i>Heteropora tipperi</i> n. sp.), endolithic blue-green algae, radiolarians, sponge spicules, holothuroid sclerites, coral fragments (scleractinid), tubes, fish debris, gastropod debris	H. Frebold, G. Jakobs C.M. Henderson, D.G. Perry (H.W. Tipper, H. Frebold, B.E.B. Cameron)	Gabrielse (1998), Anderson (1983) Henderson and Perry (1981), Gabrielse (1998), Anderson (1983)	5* 1
	16BvS-12-83-1	V-003813	469008	6453576	high	ImJSs	probably late Pliensbachian (probably Kunae zone)	Ammonites (fragmentary impressions of ammonites including Protogrammoceras, Fuciniceras and Leptaleoceras), bivalves (Bositra buchi)	T.P. Poulton, A.H. Caruthers	Poulton, Caruthers (pers. comm., 2020)	1
	705 F 276 F	n/a C-095106	469215 469906	6453833 6453248	low low	lmJHvm ImJSscb	possibly Triassic Indet.	Ammonites (rare, poorly preserved ammonites and ammonite fragments) Ammonites (crushed impressions, indet.)	H.W. Tipper E.T. Tozer	Anderson (1983) Gabrielse (1998), Anderson (1983)	5* 3b
	18BvS-6-46 11JLO-20-198	V-012819 V-002637	441906 454897	6450931 6457021	high high	lmJSsv ImJSs	Barren Barren	Conodonts (barren) Conodonts (barren)	M.L. Golding M.J. Orchard	Golding (2019) Orchard (2012)	1
	11JLO-28-279	V-002638	428715	6468985	high	uTrSvm	late Carnian	Conodonts (CAI 4-4.5, Quadralella noah (Hayashi 1968); Parapetella lanei Orchard 2014; Primatella primitia (Mosher 1970)), ichthyoliths	M.L. Golding	Golding et al. (2017), Orchard (2012)	1
	81-MJO-H-42F, F7 83-MJO-P-41F	C-087659 C-102920	438893	6445635	low	uTrSvm uTrSsv?	early Carnian	Condonts (CAI 2.5-3.5, Paragondolella inclinata (Kovacs 1983), Quadralella lobata (Orchard 2007), Neogondolella inclinata (Kovacs 1983)), ichthyoliths Conodonts (CAI 4-4.5, Neogondolella cf. liardensis Orchard 2007, Quadralella lobata (Orchard 2007)),	M.L. Golding	Golding et al. (2017), Gabrielse (1998), Read (1984) Golding et al. (2017),	4a 3b*
	11DMO-29-239	C-549354	419369	6464978	high	uTrSsv	possibly Middle to	radiolarians (indet.) Bivalves (<i>Posidoniid</i> bivalves, probably <i>Halobia</i> ; not sufficiently well preserved to confidently differentiate	T.P. Poulton	Gabrielse (1998)	1
	11JLO-25-256	C-549352	422534	6463502	high	uTrSvs	probably Late Triassic Silurian to Middle Jurassic	them from <i>Daonella</i>) Spiriferinid brachiopod (?), undeterminable sand-size calcite particles, probably shell fragments, not common	T.P. Poulton	Poulton (2011)	1
	18BvS-16-139	n/a	427378	6468001	high	uTrSsv	Indet.	Radiolaria (sphaeromorphs, ? <i>Paronaella</i> -like triradiate morphotype, ? <i>Triassocampe</i> sp.)	F. Cordey	Cordey (2018)	1
	. IU	J-U0/509	+∠∠243	0 4 43799	moderate	uutris	איז איזאס אוואנאר-Ladinian(?)	ramiform elements), radiolarians (?Archeothamnulus verticillatus Dumitrica, Enactinosphaera? romuli Lahm, Tandarnia? sp., Xiphosphaera spp., Xiphostylus spp.), sponge spicules	olding, E.S. Carter	comm., 2019), comm., 2019), Gabrielse (1998), Read (1983)	4 0
	82-MJO-P-30F, F12b'; 82-MJO- P-31F, F12c'	C-102764, C-102765 ^{DH}	424997	6442784	moderate	ImTrTs	late Anisian-early Ladinian	Conodonts (C-102764: CAI 5, Paragondolella ex gr. excelsa Mosher 1968, Paragondolella ex gr. liebermani Kovacs 1994, C-102765: CAI 5, Paragondolella ex gr. liebermani Kovacs 1994), ichthyoliths	M.L. Golding	Golding et al. (2017), Gabrielse (1998), Read (1983)	4b
	81-MJO-H-1F, F22	C-087706	441267	6449243	moderate	ImTrTs	late Anisian-early Ladinian	Conodonts (CAI 5-7, Neogondolella ex gr. transita (Kozur & Mostler 1971), Neogondolella sp.)	M.L. Golding	Golding et al. (2017), Gabrielse (1998), Read (1984)	4a
	o∠-mJO-P-35F, F40", F12d	u-102768	424624	0442762	moderate	#1111 * ÎS	เลเซ Anisian-early Ladinian	оопоцопы (окто, огаюдпатловия sp., Neogondolella constricta morphotype B Golding 2014, Neogondolella sp., Paragondolella ex gr. liebermani Kovacs 1994), radiolarians	w.∟. Golding	Golaing et al. (2017), Gabrielse (1998), Read (1983, 1984)	4D
	F124	C-087708	450773	6426369	moderate	lmTrTs	late Anisian	Conodonts (Neogondolella ex gr. constricta, Paragondolella ex gr. liebermani)	M.L. Golding	Golding (pers. comm., 2019), Read (1984)	4b
	83-MJO-P-39F	C-102918	418368	6446768	low	ImTrTs	middle-late Anisian	Conodonts (CAI 3.5-4.5, Neogondolella ex gr. constricta (Mosher & Clark 1965), Magnigondolella sp., Magnigondolella julii Golding and Orchard 2018, Nicoraella? sp.)	M.L. Golding	Golding (pers. comm., 2021), Golding et al. (2017), Gabrielse (1998)	3b*
	82-MJO-P-64F, F12g	C-102770	424101	6442644	moderate	ImTrTs	latest Olenekian (late Spathian)-early Anisian	Conodonts (CAI 4.5-5.5, <i>Chiosella timorensis</i> (Nogami 1968), <i>Magnigondolella</i> sp., <i>Triassospathodus</i> ex gr. <i>homeri</i> (Bender 1970))	M.L. Golding	Golding (pers. comm., 2021)	4b
							/ العاقالية، ويتبعد ,			Golding et al. (2017), Gabrielse (1998), Orchard and Bucher (1992), Read (1983)	
	82-MJO-P-25F,	C-102761,	425675	6442149	moderate	ImTrTs	early Olenekian	Conodonts (C-102761: CAI 4.5-5, Cornudina sp., C-102762: CAI 5, Neospathodus cf. triangularis (Bender 1970). Neostrachanognathus sp. A (Agendeu et al. 2009). Sections	M.L. Golding	Golding et al. (2017),	4b
	F14b, F59; 82-MJO-P-26F, F14c, F60	C-102762					(Smithian)-Anisian, late Olenekian (Spathian)	1970), Neostrachanognathus sp. A (Agematsu et al. 2008), Spathicuspus spathi (Sweet 1970), Triassospathodus ex gr. homeri (Bender 1970))		Gabrielse (1998), Orchard and Bucher (1992), Read (1983, 1984)	
	F8	C-087501	418543	6446749	moderate	lmTrTs	Early to Middle Triassic	Conodonts (CAI 4.5-5, Cornudina sp.)	M.L. Golding	Golding (pers. comm., 2019), Gabrielse (1998),	4b
	82-MJO-P-32F, F81	C-102766	426141	6441569	moderate	ImTrTs	Triassic	Conodonts (CAI 5, <i>Ellisonia</i> sp., <i>Neogondolella</i> sp.)	M.L. Golding	Read (1983) Golding et al. (2017), Gabrielse (1998),	4b
	83-MJO-P-45F	C-102924	423390	6449831	low	lmTrTs	Triassic	Conodonts (CAI 5-6, Neogondolella sp.)	M.L. Golding	Read (1984) Golding et al. (2017), Gabrielse (1998)	3b
	82-MJO-P-34F, F12f, F43"	C-102767	424747	6442663	moderate	lmTrTs	Triassic	Conodonts (CAI 5, Neogondolella sp.)	M.L. Golding	Golding et al. (2017), Gabrielse (1998), Read (1983, 1984)	4b
	82-MJO-P-63F, F12i	C-102769	424274	6442529	moderate	ImTrTs	Triassic	Conodonts (CAI 5-5.5, Neogondolella sp.)	M.L. Golding	Golding et al. (2017), Gabrielse (1998),	4b
	83-MJO-R-25F, F8	C-102901	428193	6453099	moderate	ImTrTs	Triassic	Conodonts (CAI 6, Neogondolella sp.), other microfossils (sphaeromorph)	M.L. Golding	Read (1983) Golding et al. (2017), Gabrielse (1998), Road (1984)	4b
	82-MJO-R-12F, F15p', F78'	C-102771 ^{DH}	425784	6441642	moderate	lmTrTs	Triassic	Conodonts (CAI 4, Neogondolella sp.)	M.L. Golding	Golding et al. (2017), Gabrielse (1998), Read (1983, 1984)	4b
	F12o', F51'	C-102772 ^{DH}	425842	6442366	moderate	lmTrTs	probably Triassic	Conodonts (CAI 5, ramiform elements), sponge spicules	M.L. Golding	Golding (pers. comm., 2019),	4b
	82-MJO-P-27F,	C-102763	425726	6442051	moderate	lmTrTs	Changhsingian-early	Conodonts (CAI 5, <i>Clarkina</i> cf. <i>carinata</i> (Clark 1959))	M.L. Golding	Gabrielse (1998), Read (1983, 1984) Golding et al. (2017),	4b
	F15a, F63	C 102772	424109	6442400	modorato	ImTrTo	Olenekian (Smithian)		M L Orobord	Gabrielse (1998), Read (1983, 1984)	46
	F17	C-102774 C-087660	441033	6450299	moderate	mTrTvm	Late Ordovician to Cenozoic	n/a	M.J. Orchard	Read (1984)	4b 4b
	11LDI-18-145A, 11LDI-18-145C	V-002634, V-002635	442227	6447684	high	ImTrTs	Barren	Conodonts (barren)	M.J. Orchard	Orchard (2012)	1
	18CWE-26-184	V-002838	421233	6454347	high	DPSsl?	Wuchiapingian (Lopingian)-early Induan (Griesbachian)	Conodonts (CAI 6, <i>Hindeodus typicalis</i> (Sweet 1970))	M.L. Golding	Golding (2019)	1
	80-MJO-H-8F, F3	C-087099	416615	6456674	moderate	DPSsl	Kungurian	Conodonts (CAI 5.5-6.5, <i>Mesogondolella</i> sp., <i>Neostreptognathodus pequopensis</i> Behnken 1975, <i>Neostreptognathodus</i> cf. <i>sulcoplicatus</i> (Youngquist, Hawley & Miller 1951)), ichthyoliths	M.L. Golding	Golding et al. (2017), Gabrielse (1998), Read (1983)	3a
	11DMO-28- 231A, 11DMO- 28-231B	V-002640, C-549355	419116	6458041	high	DPSsl	Artinskian-Kungurian	Conodonts (V-002640: CAI 5.5-6, Mesogondolella sp., Neostreptognathodus sp.), foraminifera (C-549355: abundant schwagerinid fusulinaceans)	M.L. Golding, E.W. Bamber	Golding et al. (2017), Orchard (2012), Bamber (2011)	1
	11DMO-28-235	V-002641	420445	6457381	high	DPSsl	Artinskian-Kungurian	Conodonts (CAI 5-6, Neostreptognathodus sp.)	M.L. Golding	Golding et al. (2017), Orchard (2012)	1
	80-MJO-H-10F, F2	C-087100	420184	6456827	moderate	DPSsl	Asselian-Capitanian	Conodonts (CAI 5, Sweetognathus sp.), ichthyoliths	M.L. Golding	Golding et al. (2017), Gabrielse (1998), Read (1983)	3a
	F122 F116	C-081532 C-087707	451593 447493	6427499 6428469	moderate moderate	DPSsl DPSsl	Carboniferous or Permian probably late Paleozoic or	n/a n/a	E.W. Bamber M.J. Orchard	Read (1984) Read (1984)	4b 4b
	18BvS-27-251 18BvS-27-255	V-012823 V-012824	423337 422812	6458284 6457681	high high	DPSs DPSs	early Mesozoic Barren Barren	Conodonts (barren) Conodonts (barren)	M.L. Golding M.L. Golding	Golding (2019) Golding (2019)	1 1
	18BvS-28-259 18BvS-24-224	V-012825 V-012820	419680 418605	6455889 6452981	high high	DPSs DPSsl	Barren Barren	Conodonts (barren) Conodonts (barren)	M.L. Golding M.L. Golding	Golding (2019) Golding (2019)	1 1
	18BvS-25-230 18BvS-25-232	V-012821 V-012822	416575 416214	6455726 6455974	high high	DPSsl DPSsl	Barren Barren	Conodonts (barren) Conodonts (barren)	M.L. Golding M.L. Golding	Golding (2019) Golding (2019)	1
	18BvS-28-262 18BvS-34-350	V-012826 V-012827	420216 452641	6456841 6431196	high high	DPSsl DPSsl	Barren Barren	Conodonts (barren) Conodonts (barren) Conodonts (barren)	M.L. Golding	Golding (2019) Golding (2019)	1 1
	11LDI-16-127	V-012829	+∠1122 421992	0454391 6457865	high	DPSsl	Indet.	Conodonts (barren)	M.J. Orchard	Orchard (2012)	1
	ıı/a	C-095261, C-095263, C-095264	498088	0447366	moderate	mJBscp	eany-middle Toarcian	Automates, very poorty preserved (C-095261: very poorly preserved impressions and fragments of Dactylioceratidae gen. et sp. indet. (ribs apparently undivided), C-095263: Dactylioceras commune ?, Harpoceras sp. ind., Hildaites sp. ind., Harpoceras chrysanthemum ?, C-095264: very poorly preserved impressions and fragments of Dactylioceratidae (ribs apparently undivided), C-095265: fragment, indet., C-095264: very poorly preserved impressions and fragments of Dactylioceratidae (ribs apparently undivided), C-095265: fragment, indet., C-095264: very poorly preserved impressions and fragments of Dactylioceratidae (ribs apparently undivided), C-095265: fragment, indet., C-095264: very poorly preserved impressions and fragments of Dactylioceratidae (ribs apparently undivided), C-095265: fragment, indet., C-095264: very poorly preserved impressions and fragments of Dactylioceratidae (ribs apparently undivided), C-095265: fragment, indet., C-095265	⊓. ⊢rebold, H.W. Tipper, G. Jakobs	Gaprielse (1998)	Ja
		C-095265,						apparently undivided)			
	n/a	C-095265, C-095266	499994	6445184	moderate	mJBsv	probably early Toarcian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et	H. Frebold,	Gabrielse (1998)	3a
	n/a 17SBI-23-125 17SBI-22-123	C-095265, C-095266 C-095266 C-095101 V-003862 V-003861	499994 499851 501320	6445184 6447971 6447523	moderate high high	mJBsv mJBsv* mJBsv*	probably early Toarcian Phanerozoic Barren	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren), ichthyoliths Conodonts (barren)	H. Frebold, G. Jakobs M.L. Golding M.L. Golding	Gabrielse (1998) Golding (2019) Golding (2019)	3a 1 1
	n/a 17SBI-23-125 17SBI-22-123 n/a n/a	C-095265, C-095266 C-095266 C-095101 V-003862 V-003861 C-095017 C-028861	499994 499851 501320 493138 454706	6445184 6447971 6447523 6448200 6467825	moderate high high low moderate	mJBsv mJBsv* mJBsv* mJBvi* IJTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?)	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren), ichthyoliths Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.)	H. Frebold, G. Jakobs M.L. Golding M.L. Golding E.T. Tozer H. Frebold	Gabrielse (1998) Golding (2019) Golding (2019) Gabrielse (1998) Gabrielse (1998)	3a 1 1 3b 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a n/a n/a	C-095265, C-095266 C-095266 C-095101 V-003862 V-003861 C-095017 C-028861 C-090991, C-094986, C-094994	499994 499851 501320 493138 454706 501835	6445184 6447971 6447523 6448200 6467825 6447339	moderate high high low moderate moderate	mJBsv mJBsv* mJBsv* mJBvi* IJTst IJTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) Iate Pliensbachian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren), ichthyoliths Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: <i>Arieticeras</i> cf. <i>algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Sowerby), <i>Aveyroniceras</i> cf. <i>inaequiornatum</i> (Bettoni), <i>Aveyroniceras</i> sp.?, <i>Leptaleoceras</i> aff. <i>accuratum</i> (Fucini), small lytoceratid?, C-094986: <i>Amaltheus margaritatus</i> de Montfort, <i>Protogrammoceras</i> cf. <i>P. normanianum</i> (d'Orbigny), fragments of <i>Protogrammoceras</i> sp. indet. <i>Fucinicerae</i> ?, C.004004:	H. Frebold, G. Jakobs M.L. Golding M.L. Golding E.T. Tozer H. Frebold H. Frebold, H.W. Tipper	Gabrielse (1998) Golding (2019) Golding (2019) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998)	3a 1 1 3b 3a 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a n/a n/a	C-095265, C-095266 C-095266 C-095101 V-003862 V-003861 C-095017 C-028861 C-090991, C-094986, C-094994	499994 499851 501320 493138 454706 501835	6445184 6447971 6447523 6448200 6467825 6447339	moderate high high low moderate moderate	mJBsv* mJBsv* mJBsv* mJBvi* IJTst IJTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) Iate Pliensbachian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren), ichthyoliths Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: <i>Arieticeras</i> cf. <i>algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Sowerby), <i>Aveyroniceras</i> cf. <i>inaequiornatum</i> (Bettoni), <i>Aveyroniceras</i> sp.?, <i>Leptaleoceras</i> aff. <i>accuratum</i> (Fucini), small lytoceratid?, C-094986: <i>Amaltheus margaritatus</i> de Montfort, <i>Protogrammoceras</i> cf. <i>P.</i> <i>normanianum</i> (d'Orbigny), fragments of <i>Protogrammoceras</i> sp. indet., <i>Fuciniceras</i> ?, C-094994: <i>Protogrammoceras</i> aff. <i>P. exiguum</i> (Monestier, non Fucini), <i>Protogrammoceras</i> sp. indet.), bivalves (trigonids, <i>Weyla</i> ?, various others), corals, gastropods	H. Frebold, G. Jakobs M.L. Golding M.L. Golding E.T. Tozer H. Frebold H. Frebold, H.W. Tipper	Gabrielse (1998) Golding (2019) Golding (2019) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998)	3a 1 1 3b 3a 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a n/a n/a n/a n/a	C-095265, C-095266 C-095266 C-095266 C-095101 V-003862 V-003861 C-095017 C-028861 C-090991, C-094986, C-094994 C-094994 C-095021 C-095021 C-095098 C-095257, C-095258, C-095262	499994 499851 501320 493138 454706 501835 501627 499964 494226	6445184 6447971 6447523 6448200 6467825 6447339 6447339 6448949 6448949 6448438	moderate high low moderate moderate moderate moderate	mJBsv mJBsv* mJBsv* MJBvi* IJTst IJTst IJTst IJTst IJTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) Iate Pliensbachian Iate Pliensbachian Iate Pliensbachian Iate Pliensbachian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren), ichthyoliths Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: <i>Arieticeras</i> cf. <i>algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Sowerby), <i>Aveyroniceras</i> cf. <i>inaequiornatum</i> (Bettoni), <i>Aveyroniceras</i> sp., <i>Leptaleoceras</i> aff. <i>accuratum</i> (Fucini), small lytoceratid?, C-094986: <i>Amaltheus margaritatus</i> de Montfort, <i>Protogrammoceras</i> cf. <i>P.</i> <i>normanianum</i> (d'Orbigny), fragments of <i>Protogrammoceras</i> sp. indet., <i>Fuciniceras</i> ?, C-094994: <i>Protogrammoceras</i> aff. <i>P. exiguum</i> (Monestier, non Fucini), <i>Protogrammoceras</i> sp. indet.), bivalves (trigonids, <i>Weyla</i> , trigoniids, others), corals Ammonites (fragment of <i>Amaltheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> sp. indet.), bivalves (<i>Weyla</i> , trigoniids, others), corals Ammonites (C-095257: <i>Amaltheus</i> ? sp. indet, very poor impressions of fragments of <i>Prodactylioceras</i> spp. indet., C-095258: <i>Protogrammoceras</i> ? or <i>Fuciniceras</i> ? sp. indet., poor impressions of whorl fragments, <i>Prodactylioceras</i> aff. <i>P. talicum</i> (Meneghini), <i>Prodactylioceras</i> aff. <i>P. meneghinii</i> (Fucini), <i>Prodactylioceras</i> and <i>P. deliver</i> (Fucini), <i>Prodactylioceras</i> aff. <i>P. meneghinii</i> , <i>Prodactylioceras</i> aff.	H. Frebold, G. Jakobs M.L. Golding E.T. Tozer H. Frebold H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper H. Frebold H. Frebold, H.W. Tipper	Gabrielse (1998) Golding (2019) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998)	3a 1 3b 3a 3a 3a 3a 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a n/a n/a n/a n/a n/a	C-095265, C-095266 C-095266 C-095266 C-095101 V-003862 V-003861 C-095017 C-028861 C-090991, C-094986, C-094994 C-095021 C-095021 C-095098 C-095257, C-095258, C-095262 C-095262	499994 499851 501320 493138 454706 501835 501835 501627 499964 494226	6445184 6447971 6447523 6448200 6467825 6447339 6447339 6448949 6448949 6448438	moderate high low moderate moderate moderate moderate	mJBsv* mJBsv* mJBsv* MJBvi* IJTst IJTst IJTst IJTst IJTst IJTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren), ichthyoliths Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: <i>Arieticeras cf. algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Sowerby), <i>Aveyroniceras</i> cf. <i>inaequiornatum</i> (Bettoni), <i>Aveyroniceras</i> sp.?, <i>Leptaleoceras</i> aff. <i>accuratum</i> (Fucini), small lytoceratid?, C-094986: <i>Amaltheus margaritatus</i> de Montfort, <i>Protogrammoceras</i> cf. <i>P.</i> <i>normanianum</i> (d'Orbigny), fragments of <i>Protogrammoceras</i> sp. indet., <i>Protogrammoceras</i> , C-094994: <i>Protogrammoceras</i> aff. <i>P. exiguum</i> (Monestier, non Fucini), <i>Protogrammoceras</i> sp. indet.), bivalves (trigonids, <i>Weyla</i> , various others), corals, gastropods Ammonites (fragment of <i>Amaltheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> spp. indet.), bivalves (<i>Weyla</i> , trigonids, others), corals Ammonite (<i>Arieticeras</i> cf. <i>A. domarense</i> (Meneghini)) Ammonites (C-095257: <i>Amaltheus</i> ? sp. indet., very poor impressions of fragments of <i>Protogrammoceras</i> spp. indet., C-095258: <i>Protogrammoceras</i> ? or <i>Fuciniceras</i> ? sp. indet., poor impressions of whorl fragments, <i>Prodactylioceras</i> aff. <i>P. italicum</i> (Meneghini), <i>Prodactylioceras</i> aff. <i>P. meneghinii</i> (Fucini), <i>Prodactylioceras</i> spp. indet., C-095262: impressions of small fragments of <i>Protogrammoceras</i> ? sp. indet., other gen. et sp. indet.)	H. Frebold, G. Jakobs M.L. Golding E.T. Tozer H. Frebold H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper	Gabrielse (1998) Golding (2019) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998)	3a 1 3b 3a 3a 3a 3a 3a 3a 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a n/a n/a n/a n/a n/a n/a n/a	C-095265, C-095266 C-095266 C-095101 V-003862 V-003861 C-095017 C-028861 C-090991, C-094986, C-094994 C-095021 C-095028 C-095257, C-095258, C-095262 C-094995 C-095269 C-094987	499994 499851 501320 493138 454706 501835 501627 499964 494226 494226	6445184 6447971 6447523 6448200 6467825 6447339 6448949 6448949 6448438 6448902 6448902 6449095	moderate high low moderate moderate moderate moderate moderate moderate	mJBsv mJBsv* mJBvi* IJTst IJTst IJTst IJTst IJTst IJTst IJTst IJTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian early Pliensbachian (Imlayi zone), probably late Pliensbachian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: <i>Arieticeras cf. algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Sowerby), <i>Aveyroniceras cf. inaequiornatum</i> (Bettoni), <i>Aveyroniceras</i> sp., <i>Amaltheus stokesi</i> (J. Sowerby), <i>Aveyroniceras cf. inaequiornatum</i> (Bettoni), <i>Aveyroniceras</i> sp., <i>Leptaleoceras</i> aff. <i>accuratum</i> (Fucini), small lytoceratid?, C-094986: <i>Amaltheus margaritatus</i> de Montfort, <i>Protogrammoceras cf. P. ormanianum</i> (d'Orbigny), fragments of <i>Protogrammoceras</i> sp. indet., <i>Luciniceras?</i> , C-094994: <i>Protogrammoceras</i> aff. <i>P. exiguum</i> (Monestier, non Fucini), <i>Protogrammoceras</i> sp. indet.), bivalves (trigonids, <i>Weyla</i> ?, various others), corals, gastropods Ammonites (fragment of <i>Amaltheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> spp. indet.), bivalves (<i>Weyla</i> , trigonids, others), corals Ammonite (<i>Arieticeras cf. A. domarense</i> (Meneghini)) Ammonites (C-095258: <i>Protogrammoceras</i> ? or <i>Fuciniceras</i> ? sp. indet., poor impressions of whorl fragments, <i>Prodactylioceras</i> aff. <i>P. italicum</i> (Meneghini), <i>Prodactylioceras</i> aff. <i>P. meneghinii</i> (Fucini), <i>Prodactylioceras</i> spp. indet., c-095262: impressions of small fragments of <i>Protogrammoceras</i> sp., indet, other gen. et sp. indet.) Ammonites (impressions of small specimens of <i>Arieticeras</i> spp. indet., <i>Protogrammoceras</i> sp., impression of inner whorl of dactylioceras? sp., <i>Phylloceras</i> sp., derolytoceratid?, <i>Gemmellaroceras</i> sp., polymorphitid spp., inner whorls of <i>Tropidoceras</i> ? sp., derolytocerati?, <i>Gemmellaroceras</i> sp., polymorphitid spp., inner whorls of Tropidoceras cf. <i>erythraeum</i> ?, <i>Miltoceras</i> ? sp., other indeterminate forms, C-095269: very poorly preserved small specimens: <i>Protogrammoceras</i> sp. indet., <i>Arieticeras</i> ? sp. indet. (impression of a distorted fragment, showing keel with shallow sulci))	H. Frebold, G. Jakobs M.L. Golding E.T. Tozer H. Frebold H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper	Gabrielse (1998) Golding (2019) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998)	3a 1 3b 3a 3a 3a 3a 3a 3a 3a 3a 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a	C-095265, C-095266 C-095266 C-095101 V-003862 V-003861 C-095017 C-028861 C-090991, C-094986, C-094994 C-095098 C-095257, C-095258, C-095262 C-094995 C-095269 C-094987 C-094987 C-094989	499994 499851 501320 493138 454706 501835 501627 499964 494226 494226 494227 498614 481325 481029	6445184 6447971 6447523 6448200 6467825 6447339 6448949 6448949 6448438 6448902 6448902 6448902 6448902 6442797 6462840	moderate high low moderate moderate moderate moderate moderate moderate moderate	mJBsv mJBsv* mJBvi* IJTst IJTst IJTst IJTst IJTst IJTst IJTst IJTst IJTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) Iate Pliensbachian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. Indet.) Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: <i>Arieticeras cf. algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Sowerby), <i>Aveyroniceras cf. inaequiomatum</i> (Bettoni), <i>Aveyroniceras</i> sp., <i>Leptaleoceras</i> aff. <i>accuratum</i> (Fucini), small lytoceratid?, C-094986: <i>Amaltheus margaritatus</i> de Montfort, <i>Protogrammoceras</i> aff. <i>Accuratum</i> (Fucini), small lytoceratid?, C-094986: <i>Amaltheus margaritatus</i> de Montfort, <i>Protogrammoceras</i> aff. <i>Accuratum</i> (Fucini), small lytoceratid?, C-094986: Amaltheus margaritatus de Montfort, <i>Protogrammoceras</i> aff. <i>Protogrammoceras</i> aff. <i>Protogrammoceras</i> aff. <i>Protogrammoceras</i> aff. <i>Protogrammoceras</i> aff. <i>Protogrammoceras</i> sp. indet.), bivalves (trigonids, <i>Weyla</i> ?, various others), corals, gastropods Ammonites (fragment of <i>Amaltheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> spp. indet.), bivalves (<i>Weyla</i> , trigonids, others), corals Ammonites (<i>C</i> -095258: <i>Protogrammoceras</i> ? or <i>Fuciniceras</i> ? sp. indet., poor impressions of whorl fragments, <i>Prodactylioceras</i> aff. <i>P. italicum</i> (Meneghini), <i>Prodactylioceras</i> aff. <i>P. menghinii</i> (Fucini), <i>Prodactylioceras</i> spp. indet., <i>C</i> -095262: impressions of small fragments of <i>Protogrammoceras</i> ? sp. indet., other gen. et sp. indet.) Ammonites (impressions of small specimens of <i>Arieticeras</i> spp. indet., <i>Protogrammoceras</i> spp., impression of inner whorl of dactylioceratid, <i>Amaltheus</i> sp.) Ammonites (impression of small specimens of <i>Arieticeras</i> spp., derolytoceratid?, <i>Gemmelaroceras</i> sp., polymorphitid spp., inner whorls of <i>Tropidoceras</i> cf. <i>erytiraeum</i> ?, <i>Miltoceras</i> ? sp., other indeterminate forms, <i>C</i> -095269: very poorly preserved small specimens: <i>Protogrammoceras</i> sp., inder, <i>Arieticeras</i> ? sp. indet. (impression of a distorted fragment, indet.) Ammonites (impression of small s	H. Frebold, G. Jakobs M.L. Golding E.T. Tozer H. Frebold H. Frebold, H. Frebold, H. W. Tipper H. Frebold, H. W. Tipper H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper	Gabrielse (1998) Golding (2019) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998)	3a 1 3b 3a 3a 3a 3a 3a 3a 3a 3a 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a	C-095265, C-095266 C-095266 C-095266 C-095266 C-095266 C-095267 C-095017 C-028861 C-090991, C-094986, C-094994 C-095257, C-095258, C-095258, C-095258 C-095262 C-095269 C-095269 C-094995 C-094987 C-094988 C-094988 C-094982	499994 499851 501320 493138 454706 501835 501627 499964 494226 494226 494227 498614 494207 498614 481325 481029 465166 455689	6445184 6447971 6447523 6448200 6467825 6447339 6448949 6448949 6448438 6448902 6448902 6448902 6448902 6448902 6448902 6449095	moderate high low moderate moderate moderate moderate moderate moderate moderate moderate	mJBsv mJBsv* mJBvi* MJBvi* IJTst IJTst IJTst IJTst IJTst IJTst IJTst IJTst IJTst IJTst IJTst IJTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian early Pliensbachian probably Pliensbachian early Pliensbachian early Pliensbachian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: <i>Arieticeras cf. algovianum</i> (Oppel), <i>Protogrammoceras sp.</i> , <i>Amaltheus stokesi</i> (J. Sowerby), <i>Aveyroniceras cf. inaequiomatum</i> (Bettoni), <i>Aveyroniceras sp.</i> , <i>C</i> -094996: <i>Arieticeras cf. Inaequiomatum</i> (Bettoni), <i>Aveyroniceras sp.</i> , <i>C</i> -094996: <i>Arnetheus margaritatus</i> de Montfort, <i>Protogrammoceras sf.</i> , <i>C</i> -094994: <i>Protogrammoceras sf.</i> , <i>C</i> -094994: <i>Protogrammoceras</i> sf., <i>C</i> -094994: <i>Protogrammoceras</i> sf., <i>C</i> -094994: <i>Protogrammoceras</i> sp. indet., <i>J.</i> coinceras?, <i>C</i> -094994: <i>Protogrammoceras</i> sf., <i>C</i> -094994: <i>Protogrammoceras</i> sf., <i>C</i> -094994: <i>Protogrammoceras</i> sf., <i>A.</i> eviguum (Monestier, non Fucini), <i>Protogrammoceras</i> sp. indet.), bivalves (trigonids, <i>Weyla</i> ?, various others), corals, gastropods Ammonites (fragment of <i>Amaltheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> spp. indet., <i>C</i> -095257: <i>Amaltheus</i> ? sp. indet., very poor impressions of fragments of <i>Prodactylioceras</i> spp. indet., <i>C</i> -095268: <i>Protogrammoceras</i> ? or <i>Fuciniceras</i> ? sp. indet., <i>Devinipressions</i> of <i>Vnodactylioceras</i> spp. indet., <i>C</i> -095263: impressions of small fragments of <i>Protogrammoceras</i> ? sp. indet., orein, <i>Prodactylioceras</i> sf., <i>P.</i> indicum (Menephini), <i>Prodactylioceras</i> ? sp. indet., <i>Protogrammoceras</i> sp., impression of inner whorl of dactylicoceras if <i>Arieticeras</i> ? sp., <i>Phylloceras</i> ? sp. indet., <i>Protogrammoceras</i> sp., impression of inner whorl of <i>Trojdoceras</i> sf., <i>P.</i> , <i>Miltoceras</i> ? sp., indet., <i>Arieticeras</i> ? sp., indet., <i>Miltoceras</i> ?	H. Frebold, G. Jakobs M.L. Golding E.T. Tozer H. Frebold H. Frebold, H. Frebold, H. W. Tipper H. Frebold, H. W. Tipper H. Frebold, H.W. Tipper	Gabrielse (1998) Golding (2019) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998) Gabrielse (1998)	3a 1 3b 3a 3a 3a 3a 3a 3a 3a 3a 3a 3a 3a 3a 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a	C-095265, C-095266 C-095266 C-095266 C-095266 C-095101 V-003862 V-003861 C-095017 C-028861 C-090991, C-094986, C-094986, C-094994 C-095257, C-095258, C-095258, C-095269 C-095269 C-094995 C-095269 C-094987 C-094988 C-094988 C-094988 C-094988 C-094982 C-094987 V-003872	499994 499851 501320 493138 454706 501835 501627 499964 494226 494226 494226 494227 498614 494207 498614 498614 481325 481029 465166 455689 455056	6445184 6447971 6447523 6447523 6447339 6448200 6447339 6448949 6448949 6448902 6448900 6448902 6448900 6448000 6448000 6448000 6448000 6448000 6448000 6448000 6448000 6448000 6448000 6448000 6448000 64480000 64480000 64480000000000	moderate high low moderate moderate moderate moderate moderate moderate moderate moderate moderate moderate	mJBsv * mJBsv* mJBsv* mJBsv* mJBsv* mJBvi* JJTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian early Pliensbachian probably Pliensbachian early Pliensbachian early Pliensbachian early Pliensbachian early Pliensbachian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren), ichthyoliths Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: <i>Arieticeras cf. algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Sowerby), <i>Aveyroniceras cf. inaequiornatum</i> (Bettoni), <i>Aveyroniceras</i> sp., <i>Leptaleoceras aft. accuratum</i> (Fucini), small hytoceratid; C-094986: Amaltheus margaritatus & Montfort, <i>Protogrammoceras</i> f. <i>P.</i> <i>normanianum</i> (d'Orbigny), fragments of <i>Protogrammoceras</i> sp., <i>Leptaleoceras</i> aft. <i>accuratum</i> (forbigny), fragments of <i>Protogrammoceras</i> sp. indet., <i>Fuciniceras</i> ?, C-094994: <i>Protogrammoceras</i> aft. <i>P. exiguum</i> (Monestier, non Fucini), <i>Protogrammoceras</i> sp. indet.), bivalves (trigonids, <i>Weyla</i> ?, various others), corals Ammonites (fragment of <i>Amaltheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> sp. indet.), bivalves (<i>Weyla</i> , trigonids, others), corals Ammonites (<i>C-095257: Amaltheus</i> sp. indet., very poor impressions of fragments of <i>Prodactylioceras</i> sp. <i>indet</i> ., <i>C-095258: Protogrammoceras</i> ? sp. indet., poor impressions of whord fragments, <i>Prodactylioceras</i> aft. <i>P. tialicum</i> (Meneghini)) Ammonites (<i>C-095252</i> : impressions of small fragments of <i>Protogrammoceras</i> ? sp. indet., other gen. et sp. indet.) Ammonites (impressions of small specimens of <i>Arieticeras</i> sp. indet., <i>Protogrammoceras</i> sp., impression of inner whort of dactylioceraid, <i>Amaltheus</i> sp.). Ammonites (G-090992: <i>Coeloceras</i> ? sp., <i>Phylloceras</i> sp., derolytoceratid?, <i>Gemmellaroceras</i> sp., polymorphitid spp., inner whorts of <i>Tropidoceras</i> cf. <i>erythraeum</i> ?, <i>Miltoceras</i> ? sp., other indeterminate forms, C-095269: very poorly preserved small specimens: <i>Protogrammoceras</i> ? sp., other indeterminate forms, C-095269: very porty preserved small specimens: <i>Protogrammoceras</i> ? sp., other indeterminate forms, C-095269: very porty preserved small specimens: <i>Protogrammo</i>	H. Frebold, G. Jakobs M.L. Golding E.T. Tozer H. Frebold H. Frebold, H. Frebold, H. W. Tipper H. Frebold, H. W. Tipper H. Frebold, H.W. Tipper	Gabrielse (1998) Golding (2019) Gabrielse (1998) Gabrielse (1998)	3a 1 3b 3a 3a 3a 3a 3a 3a 3a 3a 3a 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a	C-095265, C-095266 C-095266 C-095101 V-003862 V-003861 C-095017 C-028861 C-090991, C-094986, C-094994 C-095021 C-095028 C-095257, C-095258, C-095262 C-095262 C-094995 C-095269 C-094987 C-094987 C-094988 C-094988 C-094988 C-094987 C-094988 C-094988 C-094987 C-094988 C-094987 C-094988 C-094987 C-094988 C-094987 C-095022 C-09502 C-09502 C-09502 C-09502 C-	499994 499851 501320 493138 454706 501835 501627 499964 494226 494226 494226 494227 498614 494227 498614 498614 498614 498614 45166 455689 465166 455689 455056 500357 493568	6445184 6447971 6447523 6447523 6447339 6467825 6447339 6448949 6448949 6448902 6448902 6448902 6448902 6448902 6448902 6448903 6462797 6462840 6469938 6470494 6470047 6448252 6448281 64470047	moderate high high low moderate moderate moderate moderate moderate moderate moderate moderate moderate moderate	mJBsv * mJBsv* mJBsv* mJBsv* mJBsv* mJBsv* mJBvi* JJTst JJTs	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian early Pliensbachian probably Pliensbachian probably Pliensbachian early Pliensbachian early Pliensbachian early Pliensbachian early Pliensbachian early Pliensbachian early Pliensbachian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren), ichthyoliths Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: Arieticeras cf. algovianum (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Sowerby), <i>Aveyroniceras cf. algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Sowerby), <i>Aveyroniceras cf. algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Leptaleoceras</i> aff. <i>accuratum</i> (Fucini), small lytoceratid?, C-094986: Amaltheus margaritatus de Monttort, <i>Protogrammoceras</i> aff. <i>2 exiguum</i> (Monestier, nor Fucini), <i>Protogrammoceras</i> sp. indet., <i>Fuciniceras</i> ?, C-094994; <i>Protogrammoceras</i> aff. <i>P. exiguum</i> (Monestier, nor Fucini), <i>Protogrammoceras</i> sp. indet.), bivalves (trigonids, <i>Weyla</i> ?, various others), corals Ammonites (fragment of <i>Amaltheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> sp. indet.), bivalves (<i>Weyla</i> , trigonids, others), corals Ammonites (<i>C</i> -095262: <i>mprosenmoceras</i> 92 p. indet, very poor impressions of fragments of <i>Prodactylioceras</i> spp. <i>indet</i> ., C-055263: <i>Protogrammoceras</i> 92 p. indet, poor impressions of whort fragments, <i>Prodactylioceras</i> aff. <i>P. talicium</i> (Meneghini), <i>Prodactylioceras</i> spp. indet., other gen. et sp. indet., C-05262: impressions of small fragments of <i>Protogrammoceras</i> ? sp. indet., other gen. et sp. indet., Ammonites (impressions of small specimens of <i>Arieticeras</i> spp. indet., <i>Protogrammoceras</i> spp., indet., <i>Orologeis</i> very poorly preserved mail specimens: <i>Protogrammoceras</i> ? sp. indet., <i>Arieticeras</i> ? sp. indet. (impression of small specimen, indet.) Ammonites (impression of small specimens, indet.) Ammonites (impression of small specimens (small fragments) of <i>Dubariceras</i> sp. indet., <i>Arieticeras</i> ? sp. indet. (impressions of small specimens? sp. indet.) Ammonites (impressions of small specimens (small fragments) of <i>Dubariceras</i> sp. indet.	H. Frebold, G. Jakobs M.L. Golding E.T. Tozer H. Frebold H. Frebold, H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper	Gabrielse (1998) Golding (2019) Golding (2019) Gabrielse (1998) Gabrielse (1998) Poulton (2017)	3a 1 3b 3a 3a 3a 3a 3a 3a 3a 3a 3a 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a	C-095265, C-095266 C-095266 C-095266 C-095266 C-095017 C-028861 C-09091, C-094986, C-094994 C-095021 C-095021 C-095028 C-095257, C-095258, C-095262 C-094995 C-095269 C-094995 C-095269 C-094987 C-094987 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094992 C-095022 V-003872 C-094991 V-003871 C-086313	499994 499851 501320 493138 454706 501835 501627 499964 494226 494226 494226 494227 498614 494207 498614 498614 498614 498614 455689 465166 455689 455056 500357 493568 500244 415537	6445184 6447971 6447523 6447523 6447339 6467825 6447339 6448949 6448949 64489049 6448438 6448902 6448902 6448902 6448902 6448903 6448903 6469938 6470047 6462840 6469938 6470047 6448252 6448281 6447909 6476008	moderate high low moderate moderate moderate moderate moderate moderate moderate moderate moderate moderate high moderate	mJBsv * mJBsv* mJBsv* mJBsv* mJBsv* mJBsv* mJBvi* JJTst JJTs	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian early Pliensbachian probably Pliensbachian probably Pliensbachian early Pliensbachian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren), ichthyoliths Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: <i>Arteticeras cf. algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Ammonites (C-090991: <i>Arteticeras cf. algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Soverby), <i>Aveyroniceras cf. inequiomatum</i> (Betton), <i>Aveyroniceras</i> sp.?, <i>Leptaleoceras</i> aff. <i>accuratum</i> (Fucini), small tytoceratid?, C-094986: <i>Amaltheus margaritatus</i> de Montfort, <i>Protogrammoceras</i> cf. <i>P. normanianum</i> (Orbigny), fragments of <i>Protogrammoceras</i> sp. indet., <i>Picuniceras</i> , C-094994: <i>Protogrammoceras</i> aff. <i>P. exiguum</i> (Monestier, non Fucini), <i>Protogrammoceras</i> sp. indet.), bivalves (trigonids, <i>Weyla</i> ?, various others), corals, gastropods Ammonites (fragment of <i>Amaltheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> sp. indet.), bivalves (<i>Weyla</i> , trigonids, others), corals Ammonites (<i>C-095257: Amaltheus?</i> sp. indet., very poor impressions of fragments of <i>Protogrammoceras</i> sp. indet., <i>C-095262: impressions of small fragments of Protogrammoceras</i> sp., indet., <i>Netacclylicoceras</i> sp. indet, <i>C-095262: impressions of small fragments of Protogrammoceras</i> sp., indet., <i>Netacclylicoceras</i> sp. indet, <i>C-095262: impressions of small fragments of Protogrammoceras</i> sp., inpression of inner whorl of dactylicoceraid, <i>Amaltheus</i> sp.) Ammonites (impressions of small specimens of <i>Arieticeras</i> sp., derolytoceraid?, <i>Germellaroceras</i> sp., ingelymorphild sp., inner whorls of <i>Tropidoceras</i> sp., indet/sh of <i>Tropidoceras</i> df. <i>P. Indiceras</i> Sp., indet., <i>Arieticeras</i> ? sp., intel forms, <i>C-095269: very poorly</i> preserved small specimens: <i>Protogrammoceras</i> Sp., indet., <i>Arieticeras</i> ? sp., indet. (Impression of a distorted fragment, indet.) Ammonites (poorly preserved Dubariceras sp., indet.) Ammonites (impressions of small specime	H. Frebold, G. Jakobs M.L. Golding E.T. Tozer H. Frebold H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper	Gabrielse (1998) Golding (2019) Golding (2019) Gabrielse (1998) Gabrielse (1998) Poulton (2017) Gabrielse (1998) Poulton (2017)	3a 1 3b 3a 3a 3a 3a 3a 3a 3a 3a 3a 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a	C-095265, C-095266 C-095266 C-095266 C-095266 C-095261 C-095017 C-028861 C-090991, C-094986, C-094994 C-095021 C-095021 C-095262 C-095262 C-095262 C-095269 C-095269 C-094995 C-094987 C-094987 C-094988 C-094988 C-094988 C-094988 C-094988 C-094987 C-094988 C-094987 C-095022 V-003872 C-095022 V-003871 C-086313 C-086314	499994 499851 501320 493138 454706 501835 501627 499964 494226 494226 494226 494227 498614 494207 498614 494207 498614 494207 493568 455056 500357 493568 500244 415537	6445184 6447971 6447523 6447525 6447339 6448949 6448949 64489049 6448438 6449049 6448902 6448902 6448902 6448902 6448903 6448903 6448903 6470047 646252 6448252 6448252 6448252 6448252 6447909 6476003	moderate high low moderate moderate moderate moderate moderate moderate moderate moderate moderate moderate high moderate high iow	mJBsv mJBsv* mJBsv* mJBsv* mJBsv* mJBsv* mJBvi* JTst JTst JTst JTst JTst JTst JTst JTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian early Pliensbachian probably Pliensbachian probably Pliensbachian early Pliensbachian	Ammonites (very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren), ichthyoliths Conodonts (barren) Bivalves (indet.) Ammonites (imprints of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: <i>Arieticeras cf. algovianum</i> (Oppel), <i>Protogrammoceras</i> sp., <i>Amaltheus stokesi</i> (J. Sowerby), <i>Averyoniceras cf. naequicinatum</i> (Bettoni), <i>Aveyoniceras</i> sp.?, <i>Leptaleoceras</i> aff. <i>accuratum</i> (Fucini), small tytoceratid?, C-094986: <i>Amaltheus marganitatus</i> de Montfort, <i>Protogrammoceras</i> cf. <i>P.</i> <i>normanianum</i> (Grobigny), fragments of <i>Protogrammoceras</i> sp. Indet., <i>Picticineras</i> ?, C-094994: <i>Protogrammoceras</i> aff. <i>P. exiguum</i> (Monestier, non Fucini), <i>Protogrammoceras</i> sp. indet., <i>Dol</i> 49949; <i>Protogrammoceras</i> aff. <i>P. exiguum</i> (Monestier, non Fucini), <i>Protogrammoceras</i> sp. indet.), bivalves (<i>Weyla?</i> , various others), corals Ammonites (fragment of <i>Amaltheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> spp. indet.), <i>bivalves</i> (<i>Weyla?</i> , triponids, others), corals Ammonites (<i>C-095267: Amaltheus</i> ?, sp. indet., very poor impressions of fragments of <i>Prodactylioceras</i> spp. <i>indet</i> ., <i>C-095268: Protogrammoceras</i> ? sp. <i>Lenivierars</i> ? Sp. indet., pori impressions of dwolf fragments, <i>Prodactylioceras</i> aff. <i>P. talicum</i> (Meneghini), <i>Prodacylioceras</i> spp. indet., other gen. et sp. indet.). Ammonites (C-090592: <i>Coeloceras</i> ? sp., <i>Phylloceras</i> spp., indet., <i>Protogrammoceras</i> ? sp. indet., of inner whort of dactyliocerait d., <i>Amaltheus</i> spp., <i>Phylloceras</i> spp., derolytoceraitd?, <i>Gemmellaroceras</i> sp., indet.] Ammonites (impressions of small specimens, <i>Protogrammoceras</i> ? sp., other indeterminate forms, C-095282: impressions of small specimens, <i>Protogrammoceras</i> ? sp., other indeterminate forms, C-095289: very poorly preserved mall specimens; <i>Protogrammoceras</i> ? sp., other <i>indet</i> .) Ammonites (poorly preserved Molf fragment, indet.) Ammonites (poorly preserved small specimens (small fragments) of <i>Duba</i>	H. Frebold, G. Jakobs M.L. Golding E.T. Tozer H. Frebold H. Frebold, H. Frebold, H. Frebold, H. Frebold, H. Frebold, H. Frebold, H. Frebold, H. Frebold, H. W. Tipper H. Frebold, H.W. Tipper T.P. Poulton M.J. Orchard M.J. Orchard	Gabrielse (1998) Golding (2019) Gabrielse (1998) Gabrielse (1998) Poulton (2017) Gabrielse (1998) Poulton (2017) Golding (pers. comm., 2021), Gabrielse (1998) Golding (pers. comm., 2021),	3a 1 3b 3a 3a 3a 3a 3a 3a 3a 3a 3a 3a
	n/a 17SBI-23-125 17SBI-22-123 n/a	C-095265, C-095266 C-095266 C-095266 C-095266 C-095001 C-095017 C-028861 C-090991, C-094986, C-094994 C-095021 C-095028 C-095257, C-095258, C-095262 C-094995 C-095269 C-094987 C-094987 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094987 C-094988 C-094987 C-094987 C-094987 C-094987 C-094987 C-094988 C-094988 C-094987 C-094981 C-094981 C-094981 C-094981 C-094981 C-094981 C-094982 C-095022 C-095022 C-095022 C-095022 C-095022 C-094991 C-094981 C-094983 C-094983 C-094992 C-09502 C-095022 C-09502 C-09502 C-09502 C-09502 C-09502 C-09502 C-09502 C-09502 C-09502 C-09502 C-09502 C-09502 C-09502 C-09502 C-09502 C-09502 C-0950	499994 499851 501320 493138 501835 501835 501627 499964 494207 499964 494226 494207 498614 494207 498614 494207 498614 493568 40357 493568 500244 415537 415537 415780	6445184 6447971 6447523 6447525 6447339 6448949 6448949 64489049 6448438 6448902 6448902 6448902 6448902 6448902 6448903 6448903 6470047 6462840 6469938 6470047 6462840 6470047 6448252 6448281 6470043 6476003 6476003	moderate high high low moderate moderate moderate moderate moderate moderate moderate moderate moderate high moderate high iow	mJBsv mJBsv* mJTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian late Pliensbachian early Pliensbachian probably Pliensbachian early Pliensbachian	Ammonites, very poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indet.) Conodonts (barren) Bivalves (indet.) Ammonites (inprits of small <i>Hildocerataceae</i> , gen. et sp. indet.) Ammonites (C-090991: <i>Arieticeras of. algovianum</i> (Oppel), <i>Protogrammoceras sp., Amatheus stokesi</i> (J. Sowerby), <i>Aveyroniceras of. inaequiomatum</i> (Bettoni), <i>Aveyroniceras sp. 7, Loptalooceras aft. accuratum</i> (Fuchi), small lytoceratid?, <i>C-094966: Amatheus margaritatus</i> de Montforl, <i>Frotogrammoceras of</i> . <i>P.</i> <i>normanianum</i> (d'Orbigny), fragments of <i>Protogrammoceras</i> sp. indet., <i>Fuciniceras?</i> , C-094994: <i>Protogrammoceras aft. P. exigum</i> (Monester, on Fucini), <i>Protogrammoceras</i> sp. indet.), bivalves (trigonids, <i>Weyla</i> ?, various others), corals Ammonites (fragment of <i>Amaltheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> spp. indet., <i>Divalves</i> (<i>Weyla</i> , trigonitds, others), corals Ammonites (<i>C-395257: Amaltheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> spp. indet., <i>Divalves</i> (<i>Weyla</i> , trigonitds, others), corals Ammonites (<i>C-395257: Amaltheus</i> sp. indet, very poor impressions of fragments of <i>Protogrammoceras</i> spp. indet.) <i>Divalves</i> (<i>Weyla</i> , trigonitds, others), corals Ammonites (<i>C-395262: Impressions</i> of small fragments of <i>Protogrammoceras</i> , sp. indet., <i>Divalves</i> (<i>Weyla</i> , trigonitds, <i>athers</i>), sp. indet, neore impressions of whorf fragments, <i>Prodactylicceras</i> aff. <i>P. Italicam</i> (Meneghini)). Ammonites (impression of small specimens of <i>Arieticeras</i> sp. Indet., <i>Divalves</i> (<i>Deb202: Impressions</i> of <i>Small</i> fragments of <i>Protogrammoceras</i> sp., indet.) Ammonites (<i>C-0959262: Coeloceras</i> ? sp., <i>Phylloceras</i> sp., derolytoceratid?, <i>Germellaroceras</i> sp., indet., <i>Divalves</i> (<i>Divalves Coeloceras</i> ? sp., <i>Phylloceras</i> sp., derolytoceratid?, <i>Germellaroceras</i> sp., indet. (Impression of small specimens, indet.) Ammonites (<i>Cop99922: Coeloceras</i> ? sp., <i>Phylloceras</i> sp., derolytoceratid?, <i>Germellaroceras</i> sp., indet. (Impression of	H. Frebold, G. Jakobs M.L. Golding E.T. Tozer H. Frebold H. Frebold, H. W. Tipper H. Frebold, H.W. Tipper H. Frebold, H. Frebold, H. Frebold, H. Frebold, H. Frebold, H. Frebold, H. Frebo	Gabrielse (1998) Golding (2019) Golding (2019) Gabrielse (1998) Gabrielse (1998) Poulton (2017) Gabrielse (1998) Poulton (2017) Golding (pers. comm., 2021), Gabrielse (1998) Golding (pers. comm., 2021), Gabrielse (1998) Bamber (2011)	3a 1 3b 3a 3a 3a 3a 3a 3a 3a 3a 3a 3a
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	n/a 17SBI-23-125 17SBI-22-123 n/a n/a n/a n/a n/a n/a n/a n/a	C-095265, C-095266 C-095266 C-095266 C-0950101 V-003862 V-003861 C-095017 C-028861 C-090991, C-094986, C-094994 C-095093 C-095262 C-095262 C-095262 C-095262 C-095269 C-094987 C-094987 C-094987 C-094987 C-094988 C-094988 C-094987 C-094988 C-094987 C-094987 C-094988 C-094987 C-094987 C-094987 C-094987 C-094987 C-094987 C-094988 C-094981 C-094981 C-094983 C-094992 C-095022 V-003872 C-094993 C-095015 C-095015 C-095015	499994 499851 501320 493138 454706 501835 501835 459964 494226 499964 494226 494207 498614 494226 493614 493614 493614 455056 455056 455056 455056 455056 455056 455056 455056 455056 410510 410537 415537 415537 500244 415537	6445184 6447971 6447523 6447525 6447339 6467825 6447339 6448949 6448949 6448438 6449049 6448902 6448902 6448902 6448902 6448903 6470494 6470047 6448252 6448281 6470494 6470047 6447325	moderate high low moderate moderate moderate moderate moderate moderate moderate moderate diff moderate moderate moderate diff moderate moderate moderate moderate moderate moderate moderate moderate	mJBsv i mJBsv* mJBsv* mJBvi* iJTst	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) Iate Pliensbachian Iate Pliensbachian Iate Pliensbachian Iate Pliensbachian early Pliensbachian	Ammonites, vary poorly preserved (C-095096: faint impressions of harpoceratid, aptychi, C-095101: gen. et sp. indel.) Concodonts (barren) Elvalves (indet) Ammonites (imprints of small <i>Hildocorataceae</i> , gen. et sp. indel.) Ammonites (C-090991: <i>Arieticoras cl. algovienum</i> (Dope), <i>Protogrammoceras sp., Amatheus stokes</i> (J. Ammonites (C-000991: <i>Arieticoras cl. algovienum</i> (Dope), <i>Protogrammoceras sp., Classicoras afl, accuratum</i> (Fucin), small tytocoratid7, C-09486: <i>Amatheus margaritatus</i> de Monford, <i>Protogrammoceras afl, accuratum</i> (Fucin), small tytocoratid7, C-09486: Amatheus margaritatus de Monford, <i>Protogrammoceras afl, accuratum</i> (Fucin), small tytocoratid7, C-09486: Amatheus margaritatus de Monford, <i>Protogrammoceras afl, accuratum</i> (Fucin), small tytocoratid7, C-09486: Amatheus <i>Protogrammoceras sp.</i> , indel.), bivalves (trigonids, Weyla?, various others), corals, gastropods Ammonites (fragment of <i>Amatheus</i> sp. Margaritatus Group, fragments of <i>Protogrammoceras</i> sp. indel.), bivalves (Weyla, Tvanitheus? sp., indel, very poor impressions of fragments of <i>Protogrammoceras</i> sp. indel., C-095257: <i>Amatheus</i> ? sp. indel, very poor impressions of tragments of <i>Protogrammoceras</i> sp. <i>Protogrammoceras</i> ? of <i>Fucineeras</i> ? sp. indel, poor impressions of wholf fragments, <i>Protogrammoceras</i> ? a sp., indel, poor impressions of wholf fragments, <i>Protogrammoceras</i> ? sp., indel, poor impressions of marger and the sp. <i>Protogrammoceras</i> ?, indel sp. Ammonites (impressions of small speciments of <i>Protogrammoceras</i> ? sp. indel, not fragments of <i>Protogrammoceras</i> ?, indel sp. Ammonites (impression of small speciment, sp.), <i>Bryliocras</i> sp., indel, <i>Protogrammoceras</i> ?, inforest indel. (impression of small specimens, indel.) Ammonites (poorly preserved Mord fragment, indel.) Ammonites (poorly preserved hubariceras sp., indel.) Ammonites (poorly preserved hubariceras sp., indel.) Ammonites (roprisessions of small specimens (small fragments) of <i>Dubariceras</i> ?, impressions of inner whoris of <i>Protogrammo</i>	H. Frebold, G. Jakobs M.L. Golding E.T. Tozer H. Frebold H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper T.P. Poulton H.J. Orchard E.W. Bamber M.J. Orchard T.P. Poulton H.J. Orchard H.W. Tipper H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper	Gabrielse (1998) Golding (2019) Gabrielse (1998) Gabrielse (1998) Poulton (2017) Gabrielse (1998) Poulton (2017) Golding (pers. comm., 2021), Gabrielse (1998) Foulton (2017) Golding (pers. comm., 2021), Gabrielse (1998) Bamber (2011) Orchard (2012) Poulton (2011) Gabrielse (1998) Gabrielse (1998)	3a 1 3b 3a 3a 3a 3a 3a 3a 3a 3a 3a 3a
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Indet, very poor impressions of fragments of <i>Prodactyloceras</i> spp. <i>indet</i> , <i>Collegal</i> , <i>Protogrammoceras</i> sp. indet, <i>Developmenticeras</i> sp. indet, <i>Collegal</i> , <i>Collegal</i> , <i>et al.</i> , <i>Protogrammoceras</i> sp. indet, <i>Collegal</i> , <i>Collegal</i> , <i>et al.</i> , <i>Protogrammoceras</i> sp. indet, <i>Collegal</i> , <i>Collegal</i> , <i>et al.</i> , <i>Protogrammoceras</i> sp. indet, <i>Collegal</i> , <i>Collegal</i> , <i>et al.</i> , <i>Protogrammoceras</i> sp. indet, <i>Collegal</i> , <i>Collegal</i> , <i>et al.</i> , <i>Protogrammoceras</i> sp. indet, <i>Collegal</i> , <i>Collegal</i> , <i>et al.</i> , <i>Protogrammoceras</i> sp. indet, <i>Collegal</i> , <i>Neutoceras</i> sp., <i>Impression</i> of anall specimens of <i>Arabiberas</i> sp., <i>derolytoceratid</i> , <i>Collegal</i> , <i>Collegal</i> , <i>Sp.</i> , <i>Phyloceras</i> sp., <i>derolytoceratid</i> , <i>Collegal</i> , <i>Collegal</i> , <i>Sp.</i> , <i>Phyloceras</i> sp., <i>derolytoceratid</i> , <i>Collegal</i> , <i>Collegal</i> , <i>Sp.</i> , <i>Phyloceras</i> sp., <i>derolytoceratid</i> , <i>Phyloceras</i> sp., <i>indet</i> , <i>Collegal</i> , <i>Phyloceras</i> sp., <i>indet</i> , <i>Collegal</i> , <i>Collegal</i> , <i>Sp.</i> , <i>Phyloceras</i> sp., <i>indet</i> , <i>Collegal</i> , <i>Collegal</i> , <i>Sp.</i> , <i>Phyloceras</i> sp., <i>indet</i> , <i>Nanoteras</i> sp., <i>indet</i> , <i>Collegal</i> , <i>Collegal</i>	H. Frebold, M.L. Golding E.T. Tozer H. Frebold H. Frebold, H.W. Tipper H. Frebold, H. Frebold, H. Frebold, H. Frebold, H. Frebold, H. Frebold, H. Frebold, H.W. Tipper H. Frebold, H.W. Tipper H.W. Tipper	Gabrielse (1998) Golding (2019) Gabrielse (1998) Gabrielse (1998)	3a 1 3b 3a 3a
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Whitehorse trough	n/a 17SBI-23-125 17SBI-22-123 n/a n/a n/a n/a n/a n/a n/a n/a	C-095265, C-095266 C-095266 C-095266 C-095011 V-003862 V-003861 C-095017 C-028861 C-094991, C-094993 C-095098 C-095262 C-095098 C-095262 C-095262 C-094995 C-095269 C-094987 C-094987 C-094987 C-094987 C-094987 C-094988 C-094987 C-094988 C-094987 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-094988 C-0948 C-09488	499994 499851 501320 493138 454706 501835 501627 499964 494226 494226 494226 494227 498614 494227 498614 494227 493616 455689 455056 455056 40357 493568 500244 415537 493568 500244 415537 493568 500244 415537 493568 500244 415537 493568 500244 401010 415326 500244 401010 415326 500244 40357 403568 500244 40357 403568 500244 40357 403568 500244 40357 403568 500535 500535 500535	6445184 6447971 6447923 6447525 6447329 6447339 6448949 6448949 64489049 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6448902 6449095 6449095 6447049 6447049 64470047 64479233 6479233 6479233 64471251 6447325 6447325 6443504 6443503 6443503 6443503 6443504 6443505 6443505 6443505 6443601 6443602	moderate moderate moderate moderate moderate moderate moderate moderate moderate moderate moderate moderate moderate moderate moderate moderate high noderate high noderate high high	mJBsv i mJBsv* mJBsv* iJTst iJ	probably early Toarcian Phanerozoic Barren Indet. Toarcian(?) Iate Pliensbachian Iate Pliensbachian Iate Pliensbachian early P	aparamonites, way provide yresenved (C-095096: faint impressions of harpocentid, aptychi, C-095101: gen. et sp. indel., Canodonis (barren), ichthyolithis Conodonis (barren), ichthyolithis Conodonis (barren), ichthyolithis Conodonis (marren) Environmentes (C-095091: <i>Arieleoars et algovianum</i> (Oppel), <i>Protogrammocenas</i> sp. , <i>Amatheura stokes</i> (J. Sowerby), <i>Aveyroniseras et, langovianum</i> (Oppel), <i>Protogrammocenas</i> sp. , <i>Amatheura stokes</i> (J. Sowerby), <i>Aveyroniseras et, langovianum</i> (Oppel), <i>Protogrammocenas</i> sp. , <i>Indel</i> ,), <i>bivalves</i> ((rigonids, Weyla?, various others), conals. (pastrono, Sp.), <i>Conformation</i> , 1999, 19	H. Frebold, M.L. Golding E.T. Tozer H. Frebold H. Frebold, H. Tipper H. Frebold,	Gabrielse (1998) Golding (2019) Gabrielse (1998) Gabrielse (1998) Gabriels	3a 1 3b 3a 3a 3a 3a 3a 3a 3a 3a 3a 3a

ocation accuracy: high - GPS measurements (this study); moderate - digitization of fossil locations from 1:50,000 scale map (Read, 1983; 1984; Read and Psutka, 1990) or 1:100,000 scale map (Gabrielse, 1998, Figure 14), or converted from tabulated coordinates in UTM

Fossil age labels on map: Stage names on map are abbreviated using e = early, m = middle, I = late, followed by the first three letters of the stage name (e.g. early Bajocian = eBaj). System or series names on map are abbreviated using Early = Early, M = Middle, L = Late,

Location source: 1. This study; 3. Gabrielse (1998) - a) digitized from 1:100,000 scale map, b) coordinates from appendix; 4. Read (1983; 1984), Read and Psutka (1990) - a) digitized from 1:50,000 scale map, b) coordinates from table; 5. Anderson (1983); * Modified to

NAD27 on map (Read, 1983; 1984; Read and Psutka, 1990); low - converted from latitude-longitude (Anderson, 1983; Gabrielse, 1998, Appendix 2)

followed by the first (and, rarely, second) letter of system or series (e.g., Eocene = E, Middle Jurassic = MJ). ? = possibly, (?) = probably.

* after unit code indicates sample taken from clast.

match location descriptio

 Table 1: Fossil data

The Snowdrift Creek plutonic suite (unit **MLJSgd**) includes the McBride River pluton (165 km²), Snowdrift Creek pluton (97 km²),

Table 2: Geochronology data	
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Sample	Easting	Northing	Unit	Age (Ma)	Type	Quality	Sample description	Source	Location source
H80-107	438043	6421549	Plvb	0.186±0.06	K-Ar WR	Moderate	Medium grey, aphanitic, vesicular basalt	Breitsprecher and Mortensen (2004)	4a
H80-87F	437000	6432480	Plvb	0.507±0.07	K-Ar WR	Moderate	OI-PI-phyric basalt lava flow	Breitsprecher and Mortensen (2004)	4a
H81-1KAR	441200	6438460	Nvb	4.8±0.2	K-Ar WR	Moderate	Ol-Opx-phyric basaltic andesite	Breitsprecher and Mortensen (2004)	4a
H81-6KAR	442370	6426116	Nvb	4.9±0.2	K-Ar WR	Moderate	Ol-phyric basalt	Breitsprecher and Mortensen (2004)	4a
H81-8KAR	445548	6427636	Nvb	4.9±0.2	K-Ar WR	Moderate	OI-PI-phyric basalt	Breitsprecher and Mortensen (2004)	4a
AN-77-195-3	462690	6436370	Nvb	5.07±0.39	K-Ar WR	Moderate	OI basalt	Hunt and Roddick (1992)	3a
H81-5KAR	454205	6430959	Nvb	5.3±0.2	K-Ar WR	Moderate	OI-Aug-phyric basalt	Breitsprecher and Mortensen (2004)	4a
H81-2KAR	447316	6437189	Nvb	5.4±0.2	K-Ar WR	Moderate	OI-PI-phyric basalt	Breitsprecher and Mortensen (2004)	4a
H81-4KAR	439381	6425813	Nvb	5.7±0.2	K-Ar WR	Moderate	Ol-phyric basalt	Breitsprecher and Mortensen (2004)	4a
11DMO-13-94	417549	6480099	Pegd	63.5±0.4	U-Pb Zrn	Good	Bt-Hbl granite	Logan et al. (2012)	1
11DMO-13-95	417144	6480205	Pegd	64.5±0.3	Re-Os Mo	Good	Mo in fractures cutting porphyritic Bt-Hbl granite to Qtz monzonite	Logan et al. (2012)	1
11JLO-29-296-2	431062	6479699	LJh	152.2±1.1	U-Pb Zrn	Good	PI-Hbl-phyric dike	Logan et al. (2012)	1
18CWE-23-168	416221	6455048	MLJSgd	158.17±0.31	U-Pb Zrn	Good	Hbl-Bt Qtz monzodiorite (Tanzilla pluton)	B.I. van Straaten, unpublished	1
15BvS-14-5	464005	6463656	MLJSgd	160.43±0.16	U-Pb Zrn	Good	Hbl-Bt tonalite; equigranular (Snowdrift Creek pluton)	B.I. van Straaten, unpublished	1
17BvS-6-36	491425	6432627	MLJSgd	163.60±0.09	U-Pb Zrn	Good	Hbl-Bt granodiorite (McBride River pluton)	B.I. van Straaten, unpublished	1
AN-78-467	493616	6434342	MLJSgd	184±8	U-Pb Zrn	Moderate	Hbl-Bt-bearing granodiorite; massive, equigranular, medium-grained	Anderson and Bevier (1992)	3a
400-0 07 040	404400	6450000				Quad	(McBride River pluton)		
18BvS-27-246	424108	6458996	UJBS	159.5±1.9	U-Pb Zrn (D)	Good	interstratified mudstone, siltstone, siliceous argillite, very fine- to medium-grained sandstone	B.I. van Straaten, unpublished	1
17BvS-25-238	498661	6447266	mJBscp	164.3±1.7	U-Pb Zrn (D)	Good	Polymictic conglomerate with limestone and volcanic clasts	B.I. van Straaten, unpublished	1
17SBI-10-60	495568	6426021	muJBBs	168.6±3.3	U-Pb Zrn (D)	Good	Medium-grained sandstone	B.I. van Straaten, unpublished	1
15BvS-20-8	461225	6464919	muJBs	171.0+4.0/-3.0	U-Pb Zrn (D)	Good	Polymictic conglomerate and sandstone	B.I. van Straaten, unpublished	1
17BvS-25-242	500472	6447222	mJBsv	185.1+1.3/-1.1	U-Pb Zrn (D)	Good	Feldspathic arenite to volcaniclastic sandstone	B.I. van Straaten, unpublished	1
11DMO-1-4	427492	6466972	MJds	166.5±0.7	U-Pb Zrn	Good	Syenite; Kfs porphyritic	Logan et al. (2012)	1
11DMO-1-4	427492	6466972	MJds	212.2±1.8	Ar-Ar Bt	Good	Syenite; Kfs porphyritic	Logan et al. (2012)	1
15BvS-20-7	461054	6464384	MLJSgd?	157.5±1.1	Ar-Ar Mu	Good	Intensely Qtz-Ser altered rock with coarse white mica	B.I. van Straaten, unpublished	1
MLT-0133	477941	6441818	MJTdqm?	167.00±0.58	U-Pb Zrn	Good	Monzonite (Three Sisters pluton)	Takaichi (2013a, b)	1
CNJ054	479532	6450300	MJTgg	168.57±0.54	U-Pb Zrn	Good	Bt-bearing Hbl Qtz monzonite; PI-porphyritic (Three Sisters pluton)	Takaichi (2013a, b)	1
11B\/A-35-276	480640	6439273	MJTdam	169 0+1 1	Ar-Ar Bt	Good	Hbl-bearing Bt Otz monzonite to monzogranite. (Three Sisters	van Straaten et al. (2012)	1
11207 00 210	400040	0400210	Moraqiii	100.011.1		0000	pluton)		1
11BVA-35-276	480640	6439273	MJTdqm	169.0±1.3	U-Pb Zrn	Good	Hbl-bearing Bt Qtz monzonite to monzogranite (Three Sisters pluton)	van Straaten et al. (2012)	1
11BVA-31-232	478755	6434626	MJTgg	169.1±0.8	U-Pb Zrn	Good	Hbl-bearing Bt monzogranite (Three Sisters pluton)	van Straaten et al. (2012)	1
AN-77-356	445724	6450450	MJTgg	170±1	U-Pb Zrn	Moderate	Bt-bearing Hbl Qtz monzonite; massive, equigranular and medium-	Anderson et al. (1982)	4a
11B\/A-42-329	466997	6448398	MJTda	171 9+1 7	Ar-Ar Hbl	Good	grained	van Straaten et al. (2012)	1
1101/-3-41	400007	6454429	MITda	172.0+1.6	Ar-Ar Hbl	Good	Bt-Hbl monzonite dike (Pallen Creek pluton)		1
11 11 0-30-308	428617	6460487	MITdam	172.0±1.0	LI-Ph 7m	Good	Hbl-Bt Otz monzodiorite: equiaranular to locally Kfs menacrystic	Logan et al. (2012)	1
11320-30-300	420017	0400407	Maraqin	172.211.0	0-10211	0000	(Pallen Creek pluton)		I
CNJ059	472897	6449924	MJTdqm	172.75±0.87	U-Pb Zrn	Good	Hbl Qtz monzodiorite; equigranular (Three Sisters pluton)	Takaichi (2013a, b)	1
11BVA-42-332	479794	6436014	MJTh.xhb	173.2±1.4	Ar-Ar Hbl	Good	Hbl-Bt Qtz diorite; fine-grained (Three Sisters pluton)	van Straaten et al. (2012)	1
TZ15-01 352.26- 373.43m (15BvS-22-9)	461335	6464490	MJTh.xcp	173.25±0.18	U-Pb Zrn	Good	Syn-hydrothermal Aug-bearing PI porphyry intrusion	B.I. van Straaten, unpublished	1
(472206	6451205	MITdam2	177 12+0 50	LI Dh Zm	Cood	Suppite (Three Sisters pluter)	Takajahi (2012a, h)	1
17581 37 301	473300	6/3116/	m Huf	170.00±0.13		Good		R L van Straaton, unnublished	1
17581-37-301	490013	6/35581	m Hvf	171.0+1.5	U-FD ZIII	Good		B.I. van Straaten, unpublished	1
19000 15 100	490103	6470040		171.011.5		Good			1
10BVS-15-120	429507	0473310	ImjHvs	172.1+1.0/-1.0	U-PD Zm (D)	Good		B.I. van Straaten, unpublished	1
18BVS-4-31	444229	6450735		172.54±0.11	U-PD Zm	Good		B.I. van Straaten, unpublished	1
14M1-3-4	461900	6464420	mJHVm	172.90±0.12		Good		B.I. van Straaten, unpublished	1
17BvS-19-159	481756	6441786	ImJHvm	175.28±0.10	U-Pb Zrn	Good	Felsic lapillistone to lapilli tuff	B.I. van Straaten, unpublished	1
11JLO-5-42	435063	6474098	ImJHvs	179.5±1.8	Ar-Ar Hbl	Good	Aug-Hbl-phyric basaltic andesite	Logan et al. (2012)	1
15BvS-5-8	460352	6458011	ImJHvm	187.7±0.9 (xenocrystic)	U-Pb Zrn	Good	Felsic clasts in matic volcanic breccia	B.I. van Straaten, unpublished	1
16BvS-15-111a	468730	6454417	lmJHvm	215.5±1.4	U-Pb Zrn (D)	Good	Felsic lapilli tuff with abundant aphyric to PI-phyric clasts	B.I. van Straaten, unpublished	1
110IV-4-52	454921	6457038	ImJSs	175.5±0.8	U-Pb Zrn (D)	Good	Siliceous tuff	lverson et al. (2012)	1
110IV-4-53	454891	6457027	ImJSs	175.8±2.3	U-Pb Zrn (D)	Good	Medium- to coarse-grained volcanic lithic arenite	lverson et al. (2012)	1
110IV-4-48	455087	6456668	ImJSs	178.9±2.6	U-Pb Zrn (D)	Good	Medium-grained lithic feldspathic arenite	lverson et al. (2012)	1
15BvS-3-14	461607	6455278	ImJSscb	215.3±1.5	U-Pb Zrn (D)	Good	Polymictic conglomerate with plutonic and pale aphyric clasts	B.I. van Straaten, unpublished	1
18BvS-17-142	421159	6472328	IJTsc	174.7+0.7/-1.2	U-Pb Zrn (D)	Good	Coarse feldspathic arenite	D.A. Kellett, unpublished	1
17BvS-22-193	499337	6444093	IJTsf	187.7±0.8	U-Pb Zrn (D)	Good	Medium-grained sandstone	B.I. van Straaten, unpublished	1
16BvS-35-256	480542	6463784	IJTs	188.0+1.8/-0.8	U-Pb Zrn (D)	Good	Felspathic arenite	B.I. van Straaten, unpublished	1
16RGI-45-307	464390	6469842	IJTst	188.8+1.5/-1.6	U-Pb Zrn (D)	Good	Felspathic arenite	B.I. van Straaten, unpublished	1
11BVA-27-199	462983	6427463	LTrSdg	210.9±1.6	Ar-Ar Hbl	Good	Cpx-bearing Hbl-rich gabbro	van Straaten et al. (2012)	1
11BVA-38-304	481362	6439991	LTrSgg	216.2±1.2	U-Pb Zrn	Good	Hbl-bearing granodiorite to monzogranite	van Straaten et al. (2012)	1
11JLO-32-319	451832	6457090	LTrSh	216.5±1.4	U-Pb Zrn	Good	- PI-porphyritic hypabyssal intrusion	van Straaten et al. (2012)	1
(DDH G-89-8 55.47-60.05 m)							· · · ·	· · ·	
, 16BvS-20-149	473674	6453418	LTrSaa	217.91±0 24	U-Pb Zrn	Good	Hbl monzogranite: equigranular	B.I. van Straaten, unpublished	1
11R\/A_42_323	463602	6431161	oyy	218 2+1 3	U-Ph 7m	Good	Hbl Otz monzonite	van Straaten et al. (2012)	1
11R\/A_42-333	463602	6431161	TrSdam	220 5+2 2	Ar-Ar Hbl	Good	Hbl Qtz monzonite	van Straaten et al. (2012)	1
AN-78-560 3	400082	6452252	L TrSdam	220.012.2]-Ph 7m	Moderato		Anderson and Revier (1002)	2
18CWE_20 140	446000	6430366	L TrQda	228 36+0 16	U-D ZIII	Good	Hhl-rich diorite to Otz diorite: foliated equipropular	B I van Straaten unnublished	-
11.11 0-23-232	416617	6463076	TrGda	218 1+3 6	Ar-Ar Hbl	Good	Hbl gabbro to diorite: equiaranular medium- to coarse grained	JM Logan unpublished	
7F00-0570	450017	6440776		273 3+2 0		Good	Homblendite to pyrovenite: layered to discordant	A Zagoravski uppublishod	1
(Z10117)	+50041	0118440	LIIGU	223.JE2.U		0000		במצטיפיזאו, מווףמטוואופט	
18CWE-18-137	444668	6444671	ImTrTs	ca. 243	U-Pb Zrn (D)	Moderate	Very fine-grained sandstone to siltstone	B.I. van Straaten, unpublished	1
UTM NAD83 Zone	e 9N								

Type: U-Pb Zrn (D) - U-Pb detrital zircon maximum depositional age, calculated using the Youngest Statistical Population method of Coutts et al. (2019) or TuffZirc routine in Isoplot (Ludwig, 2012). Location source: 1. This study; 2. Breitsprecher and Mortensen (2004); 3. Gabrielse (1998) - a) location digitized from 1:100,000 scale map; 4. Read (1983, 1984), Read and Psutka (1990) - a) location digitized from 1:50,000 scale

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