



HAL
open science

Timing of Cache Creek Ocean closure: insights from new Jurassic radiolarian ages in British Columbia and Yukon and their significance for Canadian Cordillera tectonics

Fabrice Cordey

► To cite this version:

Fabrice Cordey. Timing of Cache Creek Ocean closure: insights from new Jurassic radiolarian ages in British Columbia and Yukon and their significance for Canadian Cordillera tectonics. *Canadian journal of earth sciences*, 2020, 57 (10), pp.1167-1179. 10.1139/cjes-2019-0236 . hal-03271659

HAL Id: hal-03271659

<https://hal.science/hal-03271659v1>

Submitted on 30 Jun 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

1 *Title:* Timing of Cache Creek Ocean closure: insights from new Jurassic radiolarian ages in
2 British Columbia and Yukon, and their significance for Canadian Cordillera tectonics.

3

4 *Author :* Fabrice Cordey

5 *Affiliation and address :* Université de Lyon, Université Claude Bernard Lyon 1, Laboratoire de
6 Géologie de Lyon Terre Planètes Environnement LGLTPE, CNRS-UMR 5276, Bd du 11
7 Novembre 1918, 69622 Villeurbanne, France

8 *Email:* fabrice.cordey@univ-lyon1.fr

9 *Phone:* +33 633527563

10

11 *Short title:* Jurassic radiolarian ages from the Cache Creek Terrane

12

13

14

15

16

17 *Keywords:* Cache Creek Terrane, Radiolaria, Jurassic, Canadian Cordillera, radiolarian chert,
18 Bridge River Terrane

19

20 *Title:* Timing of Cache Creek Ocean closure: insights from new Jurassic radiolarian ages in
21 British Columbia and Yukon, and their significance for Canadian Cordillera tectonics.

22

23 *Author :* Fabrice Cordey

24

25 **Abstract**

26 The closure of the Cache Creek Ocean during the Jurassic led to the structuration of the Canadian
27 Cordillera. To reassess the timing of this major tectonic event, this study proposes a
28 biochronological review of all the youngest radiolarian-bearing localities of the Cache Creek
29 Terrane in British Columbia and Yukon using updated radiolarian biozonations and taxonomy,
30 complemented by new data from the type locality. The results show that all ages are Early
31 Jurassic and fairly homogenous along the entire terrane. All the youngest siliceous rocks are
32 restricted to the Late Sinemurian–Early Toarcian interval (~195–180 Ma). The youngest well-
33 dated pelagic cherts are Early Pliensbachian, with slightly younger siliceous argillites of
34 Pliensbachian and possibly Early Toarcian age. These results suggest that Cache Creek deep
35 pelagic sedimentation ceased fairly synchronously along the entire belt, probably during the
36 Pliensbachian (~191–183 Ma), predating the final closure of the basin when Cache Creek units
37 were thrust over Stikinia and Quesnellia in the Middle and Late Jurassic. This apparent
38 synchronicity should result in re-evaluating the tectonic mechanism of the Cache Creek
39 “entrapment model” in its present form. The study also shows that pelagic sedimentation ceased
40 22 to 31 m.y. earlier in the Cache Creek Terrane than in the Bridge River Terrane, confirming the
41 stratigraphic discrepancy between the two terranes during the Jurassic.

42 **Résumé**

43 La fermeture de l'océan Cache Creek au Jurassique a conduit à la structuration de la Cordillère
44 Canadienne. Afin de réévaluer la chronologie de cet événement tectonique majeur, l'étude
45 propose une synthèse biochronologique de toutes les plus jeunes localités à radiolaires du terrane
46 de Cache Creek en Colombie-Britannique et au Yukon grâce aux nouvelles biozonations et à une
47 taxonomie actualisée, avec en complément de nouvelles données pour la localité-type. Les
48 résultats montrent que tous les âges sont du Jurassique inférieur et sont homogènes pour
49 l'ensemble du terrane. Toutes les roches siliceuses les plus jeunes sont comprises dans l'intervalle
50 Sinémurien supérieur–Toarcien inférieur (~ 195–180 Ma). Les plus jeunes cherts pélagiques sont
51 du Pliensbachien inférieur, avec des argilites siliceuses légèrement plus jeunes du Pliensbachien
52 et peut-être du Toarcien inférieur. Ces résultats suggèrent que la sédimentation pélagique
53 profonde de l'océan Cache Creek a cessé de manière relativement synchrone sur toute sa
54 longueur, probablement pendant le Pliensbachien (~191–183 Ma), avant la fermeture finale du
55 bassin lorsque les unités de Cache Creek ont été charriées sur la Stikinia et la Quesnellia au
56 Jurassique moyen et supérieur. Ce synchronisme apparent devrait conduire à réévaluer les
57 modalités du modèle tectonique en ciseau sous sa forme actuelle. L'étude montre aussi que la
58 sédimentation pélagique a cessé 22 à 31 Ma plus tôt dans le terrane de Cache Creek que dans
59 celui de Bridge River, confirmant la différence stratigraphique entre les deux unités au
60 Jurassique.

61

62 *Mots-clés* : terrane de Cache Creek, Radiolaria, Jurassique, Cordillère canadienne, radiolarite,
63 terrane de Bridge River

64

65 **Introduction**

66

67 The Canadian Cordillera (Fig. 1) is a complex collage of arc and oceanic terranes which has been
68 the subject of a vast amount of studies and literature in the past 50 years. Various models
69 describing the tectonic history of the orogen are still debated (Monger & Gibson 2019 and
70 references therein) but they all point to the importance of the Cache Creek Terrane, considered as
71 one major evidence for a large Mesozoic ocean basin in the Canadian Cordillera. One important
72 issue is the timing of the ocean closure during the Jurassic period which led to collision with
73 Stikinia and Quesnellia volcanic arcs, contributing to the structuration of the Cordillera (Nelson
74 and Mihalynuk 1993, Colpron et al. 2015, Monger & Gibson 2019).

75 To determine the age of the Cache Creek Terrane, radiolarian biostratigraphy has been applied
76 over the last 40 years to its deep ocean strata with a particular focus on the youngest localities
77 considered to predate the final stages of convergence. The youngest Jurassic unit of the Cache
78 Creek Terrane was originally found in its type locality in southern British Columbia (Cordey et
79 al. 1987). At the time, it contradicted the scenario in which amalgamation of the Cache Creek and
80 Quesnellia terranes occurred in the Late Triassic (Monger 1981, Monger et al. 1982). Further
81 investigations confirmed the occurrence of Jurassic radiolarian-bearing oceanic strata in all
82 segments of the Cache Creek Terrane in British Columbia and Yukon (Fig. 2; Cordey et al. 1991,
83 Cordey & Struik 1996, Cordey 1998, Orchard et al. 2001, Struik et al. 2001, Mihalynuk et al.
84 2004). Although most of these localities are Early Jurassic, some confusion remained due to the
85 “Early or Middle Jurassic” age of the youngest Cache Creek rocks in the type locality. This
86 question also led to conflicting interpretations in comparisons between the Cache Creek Terrane
87 and other Paleozoic-Mesozoic oceanic units of the Canadian Cordillera such as the Bridge River
88 and Hozameen terranes (Cordey et al. 1987, Cordey & Schiarizza 1993, Mihalynuk et al. 1994,
89 Cordey 1998, Monger 2014).

90 To clarify the stratigraphy of the youngest Cache Creek strata, the goal of this study is to review
91 all the youngest radiolarian localities and, when possible, improve and refine previous ages with
92 new Jurassic radiolarian biozonations and taxonomy (Baumgartner et al. 1995, Carter et al. 1988,
93 1998, 2010, Goričan et al. 2006, 2018, O'Dogherty et al. 2009). The results reveal that the
94 youngest ages are fairly homogenous along the entire Cache Creek belt, which provides some
95 clues regarding the accuracy of current tectonic models such as the Cache Creek Terrane
96 entrapment in its present form (Mihalynuk et al. 1994). Finally, the study provides some new
97 elements for stratigraphic comparison of the Cache Creek Terrane with other main oceanic units
98 of the Canadian Cordillera during the Jurassic (Cordey and Schiarizza 1993, Monger and Gibson
99 2019).

100

101

102 **Material and Methods**

103

104 The radiolarian assemblages presented in this paper are part of a large dataset of Devonian to
105 Jurassic radiolarian samples collected and studied in several terranes of the Canadian Cordillera
106 since the 1980s. Among them, the youngest Jurassic assemblages of the Cache Creek Terrane
107 were found at eight localities from southern British Columbia to southern Yukon (Fig. 2: J1,
108 Pavilion; J2, Alkali Lake; J3, Blackwater; J4, Pinchi Lake; J5, French Range; J6-J8, Teslin
109 Plateau). The geological setting and lithostratigraphy of these localities are described in detail in
110 former publications (J1: Mortimer 1987, Cordey et al. 1987, Cordey 1998; J2: Read 1993,
111 Cordey, unpub. data; J3: Cordey and Struik 1996, Orchard et al. 2001; J4: Orchard et al. 2001,
112 Struik et al. 2001; J5: Mihalynuk et al. 2004; J6-J8: Cordey et al. 1991).

113 The radiolarian faunas from the Cache Creek Terrane are usually poorly or moderately preserved
114 due to silica recrystallization as a result of diagenesis associated with P/T conditions during

115 tectonic emplacement and local magmatic intrusions. To maximize the quality of the
116 microfossils, the samples were selected with specific field detection techniques applied to pelagic
117 strata from orogenic belts, using a strong hand lens and investigating specific microfacies such as
118 argillaceous layers within chert beds (Cordey & Krauss 1990, Cordey 1998). Radiolarians were
119 then extracted by repetitive leaching of samples with low-concentration hydrofluoric acid (HF)
120 and then hand-picked and mounted on aluminum stubs for SEM observation and taxonomical
121 identifications (Tabletop SEM Phenom ProX, Laboratoire de Géologie de Lyon).

122 Although most radiolarian assemblages presented here are described in previous publications,
123 new SEM images have been obtained for a selection of samples to improve the quality of
124 previous illustrations and complement former studies with new taxa.

125 When microfossil assemblages are not well-preserved, radiolarians are usually identified at the
126 genus level only (J1, J2, J5, J7, J8; Table 1). In this case, the age is established from overlapping
127 ranges of genera (O'Dogherty et al. 2009). Other assemblages show a better state of preservation
128 with radiolarians identified at the species level (J3, J4, J6), allowing correlations to more precise
129 biozones (Carter et al. 1988, Cordey 1998, Whalen and Carter 2002, Goričan et al. 2006, Carter
130 et al. 2010). A selection of biostratigraphically-significant radiolarians is presented in Figures 5
131 and 6. Radiolarian assemblages and ages are synthesized in Table 1.

132

133

134 **Results**

135

136 **New radiolarian assemblage from the type locality**

137 In southern British Columbia, the Cache Creek Terrane is divided into three belts (Figs. 3, 4)
138 (Duffell and McTaggart 1952, Trettin 1980, Shannon 1981, Monger and McMillan 1984, Monger
139 1985, Mortimer 1987). The central belt is composed of massive limestone and marble of the

140 Marble Canyon Formation where schwagerinid fusulinids of Late Permian age (*Colania*
141 assemblage) belong to a Tethyan faunal province and are cited as evidence that carbonate units of
142 the Cache Creek Terrane are far-travelled (Monger and Ross 1971; Monger et al. 1982; Danner
143 1985; Orchard et al. 2001). To the west of Marble Canyon, the western belt contains the youngest
144 strata of the type locality as shown by Early or Middle Jurassic radiolarians found in siliceous
145 argillites above Hambrook Creek (“R2”, Cordey et al. 1987, Cordey 1998).

146 With the aim of improving this previous radiolarian dating, this locality was resampled (NEO-R2,
147 Figs. 3, 4). A new radiolarian assemblage J1 (Table 1) is composed of the following taxa:

148 *Archaeodictyomitra* sp., *Homoeoparonaella* sp. cf. *reciproqua* Carter, *Hsuum* sp.,
149 *Pseudocrucella?* sp., *Thurstonia* sp., *Trillus* sp., *Xiphostylus?* sp., *Triactoma* sp., and *Zartus* sp..

150 The previous collection was dated as Pliensbachian–Bajocian based on the age range of *Zartus*
151 sp. (Cordey et al. 1987). In the new sample NEO-R2, the co-occurrence of *Thurstonia* sp., *Trillus*
152 sp. and *Zartus* sp. provides an age restricted to the Early Pliensbachian–Early Toarcian interval
153 (O’Dogherty et al. 2009). Although the preservation of the assemblage is poor, the specimens of
154 *Thurstonia* sp. display well-developed nodes at pore frame intersections (Fig. 5, no. 1), showing
155 affinities with *Thurstonia* specimens from the northern part of the Cache Creek Terrane (J6, Fig.
156 5, no. 3) as well as *Thurstonia* sp. B documented in Early Jurassic radiolarian assemblages from
157 the Bridge River and Hozameen terranes (Cordey 1998).

158

159 **Refined Jurassic radiolarian ages**

160 *Southern British Columbia*

161 An Early Jurassic radiolarian assemblage was found in gray-green radiolarian chert of the Riske
162 Creek Formation in the Alkali Lake map area (locality J2, Fig. 2) as a result of mapping and
163 sampling by Read (1993). Such as J1, it is located within the western belt of the terrane. This
164 assemblage is composed of *Canutus* sp., *Lantus* sp., *Orbiculiformella* sp., *Parahsuum* sp. and

165 *Praeconocaryomma* sp. (Table 1). Originally dated as Sinemurian or Pliensbachian, its age is
 166 refined to the Early Pliensbachian–Early Toarcian interval (Table 1) based on co-occurrence of
 167 the genera *Canutus* sp. and *Lantus* sp.. (O’Dogherty et al. 2009). It is noteworthy that the age
 168 ranges of J1 and J2 assemblages are identical, although based on different radiolarian taxa.

169

170 *Central British Columbia*

171 Geological mapping of the Cache Creek Terrane in central British Columbia (Struik et al. 2007
 172 and references therein) resulted in an important number of Paleozoic and Mesozoic radiolarian
 173 collections (Cordey and Struik 1996, Struik 1998, Orchard et al. 2001). The youngest radiolarian
 174 chert succession of this region is exposed along the Blackwater River in Punchaw Lake map area
 175 (J3, Fig. 2), 25 km to the south-southwest of the town of Prince George (Cordey and Struik 1996,
 176 Orchard et al. 2001, Struik et al. 2001). This succession is broadly continuous and contains
 177 Middle Triassic, Late Triassic, and Early Jurassic radiolarians. The youngest radiolarian
 178 assemblage found near the top of the section was initially dated as Pliensbachian (Cordey and
 179 Struik 1996, Orchard et al. 2001). Complementary chemical processing and new SEM images
 180 reveal an abundant and well-preserved assemblage (Table 1) composed of *Atalantria* sp.,
 181 *Beatricea? argescens* Cordey, *Bipedis japonicus* Hori, *Broctus* sp., *Canoptum rugosum* Pessagno
 182 & Poisson, *Canoptum* sp. cf. *dixonii* Pessagno & Whalen, *Charlottea* sp., *Katroma* sp. cf.
 183 *elongata* Carter, *Lantus* sp. cf. *praeobesus* Carter, *Laxtorum* sp., *Orbiculiformella? trispina* s.l.
 184 (Yeh), *Orbiculiformella* sp., *Palaeosaturnalis* sp., *Parahsuum simplum* Yao, *Parahsuum*
 185 *vizcainoense* Whalen & Carter, *Praeconocaryomma* sp. cf. *sarahae* Carter, *Thurstonia* sp. and
 186 *Spumellaria* gen. sp. indet. (Figs. 5, 6). This assemblage corresponds to the interval from the
 187 middle part of the *Canutus tipperi* – *Katroma clara* Zone to the base of the *Gigi fustis* – *Lantus*
 188 *sixi* Zone of Early Pliensbachian age (Carter et al. 2010).

189

190 In the Fort-St-James area, the Tezzeron succession (originally called the Pinchi succession by
191 Struik et al. (1996) and Cordey and Struik (1996)) is exposed to the north of Stuart and Pinchi
192 lakes and bears some similarities with clastic assemblages from the upper part of the Cache Creek
193 Terrane in southern British Columbia (Shannon 1981, Monger 1985) and in Yukon (Cordey et al.
194 1991, Gordey and Stevens 1994). It is interpreted as belonging to the Cache Creek Terrane
195 (Bellefontaine et al. 1995, Struik et al. 1996, Orchard et al. 2001, Struik et al. 2001).

196 Within the Tezzeron succession, a limy siltstone unit located near the south end of Pinchi Lake
197 contains an Early Jurassic radiolarian assemblage (J4, Fig. 2, Table 1) previously reported by
198 Orchard et al. (2001) and Struik et al. (2001). It is composed of *Emiluvia?* sp. A (Carter et al.
199 1988), *Hsuum lucidum* Yeh (formerly interpreted as *H. sp. cf. optimum* Carter), *Paronaella*
200 *grahamensis* Carter, *Praeconocaryomma decora* gr. Yeh (formerly *P. sp. A*), and
201 *Praeparvicingula tlellensis* Carter (formerly *Parvicingula sp. E*, Carter et al. 1988). This
202 assemblage was originally assigned to the biozones 2 to 5 of Carter et al. (1988). It correlates
203 with the *Elodium pessagnoii* – *Hexasaturnalis hexagonus* Zone of Carter et al. (2010) of Middle-
204 Late Toarcian age. The corresponding sample, which is a limy siltstone, cannot be considered
205 part of “deep ocean” Cache Creek strata. It shows, however, that radiolarian pelagic input lasted
206 until the Toarcian, at least locally.

207

208 *Northern British Columbia*

209 In the French Range to the west of the Dease Lake area, a unit belonging to the Cache Creek
210 Terrane is composed of cherty argillites with local tuffaceous layers that contain Middle Triassic
211 and Early Jurassic radiolarians (Mihalynuk et al. 2004). This succession is correlative to the rocks
212 on the Teslin Plateau, ~200 km to the north (Cordey et al. 1991). One Early Jurassic radiolarian
213 assemblage (J5, Fig. 2, Table 1) was extracted from a black cherty argillite exposure located 2.5
214 km to the north of Slate Creek. It is from blueschists, and therefore places a maximum age limit

215 on blueschist mineral formation ((Mihalynuk et al. 2004). The assemblage is composed of
 216 *Parahsuum izeense* (Pessagno & Whalen) (formerly *Canutus izeensis* Pessagno & Whalen),
 217 *Orbiculiformella? trispina* s.l. (Yeh) (formerly *Orbiculiforma silicatilis* Cordey),
 218 *Praeconocaryomma* sp. cf. *sarahae* Carter (formerly *P. aff. media* Pessagno & Poisson),
 219 *Praeconocaryomma* sp., and *Thurstonia* sp. (Table 1). Initially, the radiolarian assemblage was
 220 dated as Pliensbachian–Toarcian (Mihalynuk et al. 2004). The age is revised to the
 221 Pliensbachian–Early Toarcian based on the occurrence of *Parahsuum izeense* Pessagno &
 222 Whalen and the refined range of *Thurstonia* (Table 1). The presence of *Praeconocaryomma* sp.
 223 cf. *sarahae* Carter suggests that this assemblage could be restricted to the Pliensbachian (Carter et
 224 al. 2010), but this cannot be confirmed due to the incomplete nature of the specimen.

225

226 *Yukon*

227 An assemblage composed of radiolarian cherts and fine-grained clastic rocks is exposed on the
 228 Teslin Plateau, ~20 km to the north of the British Columbia-Yukon border (Gordey 1991). This
 229 succession has previously been called the Lewes River assemblage (Wheeler et al. 1991, Gordey
 230 1991) or Teenah Lake assemblage (Jackson 1992), and is equivalent in part to the Kedahda
 231 Formation of Monger (1975). Several localities with Middle Triassic, Late Triassic, and Early
 232 Jurassic radiolarian assemblages were discovered along a five-kilometre-long ridge north of
 233 Mount Bryde and Sterlin Lake (Gordey 1991, Cordey et al. 1991). The ridge consists of
 234 successive outcrops and isolated sections of stacked radiolarian chert, argillite and graywacke
 235 previously described and discussed in detail (Cordey et al. 1991).

236 The first Early Jurassic radiolarian assemblage J6 (Fig. 2, Table 1) is from siliceous argillite
 237 interbedded with graywacke that contain *Bipedis* sp., *Broctus* sp., *Canoptum anulatum* Pessagno
 238 & Poisson, *Canoptum* sp., *Hagiastrum majusculum* Whalen & Carter (formerly called *H. sp. A*,
 239 Cordey 1998), *Homoeoparonaella* sp., *Lantus sixi* Yeh, *Napora cerromesaensis* Pessagno,

240 Whalen & Yeh, *Pantanellium cumshewaense* Pessagno & Blome, *Parahsuum izeense* (Pessagno
 241 & Whalen) (formerly described as *Canutus giganteus* Pessagno & Whalen), *Praeconocaryomma?*
 242 sp. cf. *yakounensis* Carter (formerly interpreted as *Praeconocaryomma*. sp. aff. *P.* sp. B Yeh),
 243 *Thurstonia* sp., and *Wrangellium* sp.. This assemblage was originally dated as
 244 Pliensbachian–Early Toarcian (Table 1). It is now correlated with the base of the *Gigi fustis* –
 245 *Lantus sixi* Zone to the middle part of the *Eucyrtidiellum nagaiiae* – *Praeparvicingula tllellensis*
 246 Zone (Unitary associations UA 12-22) (Carter et al. 2010), establishing a late Early Pliensbachian
 247 to Late Pliensbachian age.

248 The second youngest Early Jurassic sample on the Teslin Plateau (J7, Fig. 2, Table 1) is from a
 249 radiolarian chert succession located 4 km to the south of J6 (Cordey et al. 1991). It was
 250 previously dated as Sinemurian–Toarcian (Cordey et al. 1991). It is composed of *Beatricea?*
 251 *argescens* Cordey, *Canoptum* sp. cf. *anulatum* Pessagno & Poisson (previously interpreted as
 252 *Wrangellium* sp. cf. *thurstonense* Pessagno & Whalen), *Canoptum* sp., *Praeconocaryomma* sp.
 253 cf. *immodica* Pessagno & Poisson, and *Wrangellium* sp. (Table 1). The age is here refined to the
 254 Late Sinemurian–Late Pliensbachian interval based on the co-occurrence of *Beatricea* sp. and
 255 *Wrangellium* sp..

256 The third sample (J8, Fig. 2, Table 1) is part of the same radiolarian chert succession and location
 257 as J7. The radiolarian assemblage is composed of *Beatricea? argescens* Cordey, *Bipedis* sp.,
 258 *Canoptum* sp. cf. *dixonii* Pessagno & Whalen, *Gorgansium* sp., *Pantanellium* sp., *Parahsuum* sp.,
 259 *Praeconocaryomma* sp., and *Wrangellium* sp.. It was previously dated as Sinemurian–Toarcian
 260 (Cordey et al. 1991). It is here refined to the Late Sinemurian–Late Pliensbachian interval, based
 261 on the co-occurrence and refined ranges of *Beatricea* sp., *Bipedis* sp. and *Wrangellium* sp. (Table
 262 1).

263

264

265 **Discussion**

266

267 **Homogeneity of youngest Cache Creek ages**

268 Revised Jurassic radiolarian ages reveal that the youngest Cache Creek ages are fairly
269 homogenous along the entire Canadian Cordillera (Fig. 7). These ages are comprised within the
270 Late Sinemurian–Late Toarcian interval (~195–174 Ma, Cohen et al. 2013). The siliceous rocks
271 (radiolarian chert and siliceous argillite) are restricted to the Late Sinemurian–Early Toarcian
272 interval (~195–180 Ma), including error margins. The most precise age determinations from
273 central British Columbia and Yukon (Fig. 7) indicate that the youngest true radiolarian cherts (=
274 devoid of clastic intercalations) are Pliensbachian in age (J3), and the youngest siliceous argillites
275 may also be Pliensbachian in age, possibly reaching the Early Toarcian (J1, J5, J6). The youngest
276 Jurassic age obtained on a limy siltstone in the Tezzeron succession (J4) suggests that radiolarian
277 pelagic input possibly lasted until the Middle or Late Toarcian in central British Columbia,
278 although chert sedimentation might have ceased. To date, no pelagic sedimentary strata of Middle
279 Jurassic age have been found in the Cache Creek Terrane.

280

281 **Cache Creek Terrane and overlap assemblages**

282 Some of the youngest Cache Creek strata have locally been interpreted as overlap assemblages,
283 for instance the chert-argillite-graywacke successions exposed on the Teslin Plateau (Lewes
284 River assemblage, Wheeler et al. 1991, Gordey 1991; Teenah Lake assemblage, Jackson 1992).
285 More recently, all post-Middle Triassic sequences were proposed to represent overlap
286 assemblages on top of already assembled terranes including the Paleozoic units of the Cache
287 Creek Terrane (Zagorevski et al. 2017).

288 The notion of an “overlap assemblage” implies that marine sedimentation ceased prior to the
289 deposition of clastic sediments on top of exhumed oceanic units. Regarding the Cache Creek

290 Terrane, this view is not consistent with the occurrence of radiolarian chert sedimentation as
291 young as Pliensbachian or of Middle Jurassic blueschists with in part Early Jurassic sedimentary
292 protoliths (Mihalynuk et al. 2004), which demonstrate that deep ocean sedimentation persisted
293 between Stikinia and Quesnellia until the end of the Early Jurassic. In central British Columbia
294 (Blackwater; Figs. 7, 8), a Triassic–Early Jurassic chert succession also suggests that Cache
295 Creek marine sedimentation was continuous prior to the closure of the basin. However, pelagic
296 and clastic regimes are interrelated: in the northern part of the Cache Creek Terrane, the argillites
297 and graywackes are locally intercalated with Late Triassic radiolarian cherts (Cordey et al. 1991).
298 More recently, a Hettangian age (199.5 ± 2.0 Ma) was obtained on detrital zircons from a Cache
299 Creek graywacke east of Carcross (Colpron et al. 2015) and interpreted as a probable distal
300 equivalent of the Richtofen Formation (Laberge Group), showing a probable link between the
301 Cache Creek Terrane and the Whitehorse trough as early as the end of the Triassic or the
302 beginning of the Jurassic. The input of clastic sediments within Cache Creek pelagic strata may
303 be a result of the geometry of the terrane at this time, flanking the Yukon-Tanana Terrane to the
304 north during the counterclockwise rotation of Stikinia (“isolation stage” of Mihalynuk et al. 1994;
305 Colpron et al. 2015). These transitional regimes evolved towards a narrowing Cache Creek basin
306 incorporating thicker and coarser siliciclastic sediments associated with tectonic convergence in
307 the form of synorogenic piggyback basins (Colpron et al. 2015, Bickerton et al. 2020).
308 Numerous examples of pelagic to clastic successions are found in other segments of the circum-
309 Pacific ranges such as in Japan and Siberia where the Permian-Jurassic oceanic terranes display
310 Jurassic intercalations of radiolarian chert, siliceous argillite and sandstone interpreted as ocean
311 environments within the depositional influence of one continental margin or flanking sources
312 (Isozaki et al. 1990, Matsuoka et al. 1996). In general, the intercalations and lateral facies
313 changes between pelagic and clastic rocks make it difficult to delineate a clear boundary where
314 oceanic terrane sedimentation ends and where clastic assemblages begin. This is true for the

315 Cache Creek Terrane in the Yukon, but also in southern British Columbia (Mortimer 1987,
316 Cordey et al. 1987). The composite nature of Cordilleran oceanic terranes, i.e. the likelihood for
317 these terranes to be the end-result of juxtaposed basinal entities, has previously been suggested
318 for the Bridge River Terrane (Cordey and Schiarizza 1993, Cordey 1998) and the Cache Creek
319 Terrane (Golding 2018) but these hypotheses do not challenge the interpretation that these
320 terranes were dominantly oceanic until the final stages of convergence.

321

322 **Cache Creek closure: fast entrapment?**

323 Several models have been proposed for the tectonic mechanism of Cache Creek Ocean closure
324 (see Golding 2018 for a recent review). The consensus model of Cache Creek “entrapment” from
325 Nelson and Mihalynuk (1993) and Mihalynuk et al. (1994) proposes that the terrane became
326 enclosed between the Stikinia and Quesnellia terranes leading to Cache Creek oceanic crust being
327 subducted during an oroclinal bending event, with a progressive “scissor-like” closure from north
328 to south, and the Yukon-Tanana Terrane acting as the hinge. In this scenario, the Whitehorse
329 trough is considered a northern precursor to the Bowser Basin (Ricketts et al. 1992, Evenchick et
330 al. 2010) accompanying the final stages of convergence and closure (Colpron et al. 2015).

331 The entrapment model implies a diachronous closure of the Cache Creek Ocean, with the
332 youngest oceanic sedimentary rocks progressively younging to the south (basin isolation
333 followed by closure, Mihalynuk et al. 1994). The updated radiolarian ages suggest instead a
334 relative synchronicity in the cessation of pelagic sedimentation along the entire Cache Creek
335 Terrane. While Yukon hemipelagic rocks (J6) are Pliensbachian in age, a similar age
336 (Pliensbachian–Early Toarcian) is obtained on siliceous argillites 1200 km to the south in the
337 type locality (J1). Additionally, radiolarian cherts from central British Columbia (J3) and Yukon
338 (J8) could have a common Pliensbachian age, even though they are ~1000 km apart.

339 One could argue that the speed and geometry of the counterclockwise oroclinal bending of

340 Stikinia towards Quesnellia are not precisely known. One way to reconcile the entrapment model
341 with the relative synchronicity of the youngest Cache Creek oceanic strata is through very rapid
342 tectonic rotation. In northern British Columbia, Mihalynuk et al. (1994, 2004) assessed that the
343 final closure of the Cache Creek Terrane in the north occurred before 171 Ma (late Aalenian or
344 early Bajocian, Cohen et al. 2013), the age of the post-kinematic Fourth of July batholith that
345 intrudes deformed Cache Creek units in the Atlin Lake area (Mihalynuk et al. 1992). The
346 minimum age of Cache Creek extrusion in the French Range was constrained to ~174.5–172 Ma
347 (latest Toarcian or Aalenian, Cohen et al. 2013), using the interval between the youngest
348 blueschists and the oldest intrusions (Mihalynuk et al. 2004). In the south, the Cache Creek
349 Terrane was thrust eastward over Quesnellia in the Late Jurassic (≤ 160 Ma) (Travers 1978).
350 The most precise ages of the youngest Cache Creek Terrane strata are Pliensbachian and found in
351 central British Columbia (J3) and Yukon (J6). The Early Pliensbachian chert J3 (Figs. 7, 8) found
352 at the top of a Triassic-Early Jurassic succession along the Blackwater River in central British
353 Columbia is a good time proxy for the age of the youngest and still truly oceanic Cache Creek
354 sedimentation at the center of the Cache Creek belt, suggesting that the youngest sustained
355 hemipelagic sedimentation in southern British Columbia could be slightly younger, possibly Late
356 Pliensbachian or Early Toarcian, predating the final closure of the Cache Creek Ocean. In this
357 case, the final phase of the counterclockwise rotation of Stikinia must have occurred within 8
358 m.y. (the interval between late Early Pliensbachian and Early Toarcian, ~188–180 Ma, Cohen et
359 al. 2013).

360

361 **Comparison between youngest Cache Creek and Bridge River ages**

362 Since the 1980s, geological and paleontological studies have established that the oceanic strata of
363 the Cache Creek and the Bridge River terranes (Fig. 1) share fairly similar Carboniferous-Jurassic
364 stratigraphic ages (Cordey et al. 1987, Mihalynuk et al. 1994, Monger 2014). The Hozameen

365 Terrane exposed in southern British Columbia and northern Washington (Fig. 1) is considered as
366 a southern continuation of the Bridge River Terrane (Monger 1985).

367 Early Jurassic radiolarian assemblages found in the Cache Creek Terrane are also present in the
368 Bridge River and Hozameen terranes which contain Pliensbachian and Toarcian radiolarian
369 cherts (Cordey and Schiarizza 1993, Cordey 1998). However, the cherts of the Bridge River
370 Terrane document a pelagic sedimentation that lasted significantly longer: the youngest
371 radiolarian assemblages are from the Noaxe Creek area (Cordey and Schiarizza 1993, Cordey
372 1998) where six localities are Middle Jurassic (Aalenian–Bajocian, Early–Middle Bathonian,
373 Late Bathonian–Middle Callovian, Late Bathonian–Late Callovian), and one locality is Middle
374 or Late Jurassic (Late Callovian–?Middle Oxfordian) based on biozonations for the Middle-Late
375 Jurassic (Baumgartner et al. 1995, Matsuoka 1995, Goričan et al. 2018). This Bridge River
376 radiolarian chert succession probably grades into Late Jurassic and earliest Cretaceous clastic
377 rocks of the Tyaughton-Methow basin (Mahoney and Journeay 1993, Cordey 1996, Monger
378 2014, Monger and Gibson 2019).

379 It is hypothesized here that the youngest radiolarian chert of the Cache Creek Terrane is Early
380 Pliensbachian in age (~191–187 Ma, Cohen et al. 2013) based on the well-constrained
381 assemblage at the Blackwater section in central British Columbia (J3, Figs. 7-8). In the Bridge
382 River Terrane, the youngest age for a radiolarian chert is within the “Late Callovian – Middle
383 Oxfordian” interval (~165–160 Ma, Cohen et al. 2013). These ages imply that the Cache Creek
384 Terrane oceanic sedimentation had ceased since 22 to 31 m.y. (minimum and maximum possible
385 durations due to the error margins of biostratigraphic data, corresponding to “Late
386 Pliensbachian–Late Callovian” and “Early Pliensbachian–Middle Oxfordian” intervals,
387 respectively) while the Bridge River Ocean was still recording pelagic sedimentation in the
388 Middle Jurassic and possibly the early Late Jurassic.

389

390 Cache Creek and Bridge River terranes: one or two sutures?

391 The question whether the Cache Creek and Bridge River terranes mark two distinct sutures or are
392 the remnants of a single oceanic domain has long been debated (Monger et al. 1972, Coney et al.
393 1980, Monger et al. 1982, Monger 1985, Cordey 1986, Cordey et al. 1987, Monger et al. 1994,
394 Nokleberg et al. 2000, Dickinson 2004, Johnston and Borel 2006, Gehrels et al. 2009). This issue
395 has been revived by Sigloch and Mihalynuk (2013, 2017) who combined high-resolution
396 tomography, plate reconstructions and the concept of vertical slab walls. Their analysis of the
397 North American Cordillera implies that a cryptic suture zone existed between the Insular and
398 Intermontane superterranes. In this model, the Bridge River Terrane corresponds to the land
399 remnant of an intraoceanic domain identified in the subducted Mezcalera slab wall (named from
400 the Mezcalera oceanic plate hypothesized in Mexico by Dickinson and Lawton 2001).

401 However, some authors question the accuracy of this “two-sutures” model which also implies a
402 west-dipping subduction zone inboard of Wrangellia (see the recent discussion by Pavlis et al.
403 2019). Monger (2014) and Monger and Brown (2016) have proposed instead that the Bridge
404 River and Hozameen terranes are the southern continuation of the Cache Creek Terrane, prior to
405 dextral displacements of ~115 km on the latest Cretaceous–Paleocene Yalakom Fault (Umhoefer
406 and Schiarizza 1996) and ~140 km of Eocene movement on the Fraser-Straight Fault (Monger
407 and Brown 2016). The age discrepancy between the two terranes is interpreted by implying that
408 the Bridge River Terrane faced open ocean to the west until it was trapped in the Early
409 Cretaceous (≤ 130 Ma) behind the arc rocks in the southwestern Coast Mountains, whereas in
410 northern British Columbia, the Cache Creek Terrane was thrust southwestward over Stikinia in
411 the earliest Middle Jurassic (~174 Ma) (Mihalynuk et al. 2004), and in southern British Columbia
412 was thrust eastward over Quesnellia probably in the Late Jurassic (≤ 160 Ma) (Travers 1978).

413 The likelihood of differentiating the two terranes based on provincial radiolarian signatures has
414 been discussed by Cordey (1998) and Orchard et al. (2001) and present some limitations. Some

415 elements of correlation with Tethyan assemblages may be found in older Paleozoic and Triassic
416 assemblages of the Cache Creek Terrane (Cordey 1998, Orchard et al. 2001), but also in the
417 Bridge River Terrane (Cordey and Schiarizza 1993, Cordey 1996, Cordey 1998). During the
418 Jurassic, one can only demonstrate that the Bridge River Terrane has a longer record of chert
419 sedimentation than the Cache Creek Terrane.

420

421

422 **Conclusions**

423

424 So far as known, all the youngest radiolarian assemblages of the Cache Creek Terrane are Early
425 Jurassic in age, including in the type locality in southern British Columbia. All refined ages of the
426 youngest radiolarian cherts and siliceous argillites are within the Late Sinemurian–Early Toarcian
427 interval (~195–180 Ma) with a possible Pliensbachian common age (~191–183 Ma). Well-dated
428 Early Pliensbachian radiolarian cherts are exposed in the central part of the terrane and may
429 correspond to the youngest pelagic strata. These results suggest that Cache Creek deep pelagic
430 “true chert” sedimentation ceased fairly synchronously along the entire belt, probably during the
431 Pliensbachian, followed by hemipelagic sedimentation in the Pliensbachian and/or the Toarcian,
432 predating the final closure of the basin that occurred by tectonic thrusting of Cache Creek units
433 over Stikinia and Quesnellia in the Middle and Late Jurassic.

434 These results should lead to re-evaluating the tectonic mechanism of the Cache Creek entrapment
435 model in its present form, either in speed or geometry. In addition, the study shows that pelagic
436 sedimentation ceased ~22 to 31 m.y. earlier in the Cache Creek Terrane than in the Bridge River
437 Terrane, confirming the stratigraphic discrepancy between the two terranes during the Jurassic.

438 These refined chronological data now need to be more precisely taken into account by the current
439 tectonic models which integrate the two terranes and the suture(s) they represent at the core of the

440 discussion.

441

442

443 **Acknowledgements**

444

445 This study results from a long collaboration with regional geologists and paleontologists who
446 investigated the Cache Creek Terrane: J. Monger, M. Orchard, P. Read, N. Mortimer, H.
447 Gabrielse, S. Gordey, B. Struik, M. Mihalynuk, J. English, C. Floriet, H. Sano, J. Jackson, S.
448 Johnston, P. Schiarizza, and A. Zagorevski. Former fieldwork was supported by the Geological
449 Survey of Canada (Vancouver) and the British Columbia Geological Survey Branch (Victoria).
450 Laboratory facilities were provided by the Laboratoire de Géologie de Lyon (Centre National de
451 la Recherche Scientifique CNRS - Unité Mixte de Recherche UMR5276). Reviewers S. Goričan
452 and J. Nelson as well as Editor A. Polat and Associate Editor B. Pratt provided insightful
453 comments which significantly improved the first version of the manuscript.

454

455

456 **References**

457

458 Baumgartner, P.O., Bartolini, A., Carter, E.S., Conti, M., Cortese, G., Danelian, T., De Wever, P.,
459 Dumitrica, P., Dumitrica-Jud, R., Goričan, Š., Guex, J., Hull, D.M., Kito, N., Marcucci, M.,
460 Matsuoka, A., Murchey, B., O'Dogherty, L., Savary, J., Vishnevskaya, V., Widz, D., and Yao, A.
461 1995. Middle Jurassic to Early Cretaceous radiolarian biochronology of Tethys based on Unitary
462 Associations. *In* Middle Jurassic to Lower Cretaceous Radiolaria of Tethys: Occurrences,
463 Systematics, Biochronology. *Edited by* P.O. Baumgartner, L. O'Dogherty, Š. Goričan, E.
464 Urquhart, A. Pillevuit and P. De Wever. Mémoires de Géologie (Lausanne), Vol. 23, pp. 1013–

465 1038.

466

467 Bellefontaine, K.A., Legun, A., Massey, N., and Desjardins, P. 1995. Digital Geological
468 Compilation of Northeast B.C. Southern Half (NTS 83D, E, 93F, G, H, I, J, K, N, O, P). British
469 Columbia Ministry of Energy Mines and Petroleum Resources, Open File 1995–24.

470

471 Beyers, J.M., and Orchard, M.J. 1989. Permian-Triassic boundary beds in the Cache Creek
472 Group, Marble Range, near Jesmond, British Columbia. *In* Current Research, Geological Survey
473 of Canada, Paper 89-1E, pp. 127–132. doi.org/10.4095/127466

474

475 Beyers, J.M., and Orchard, M.J. 1991. Upper Permian and Triassic conodont faunas from the
476 type area of the Cache Creek Complex, south-central British Columbia, Canada. *In* Ordovician to
477 Triassic conodont paleontology of the Canadian Cordillera. *Edited by* M.J. Orchard and A.D.
478 McCracken. Geological Survey of Canada, Bulletin 417, pp. 269–279. doi.org/10.4095/132441

479

480 Bickerton, L., Colpron, M., Gibson, H. D., Thorkelson, D., and Crowley, J. L. 2020. The northern
481 termination of the Cache Creek terrane in Yukon: Middle Triassic arc activity and Jurassic–
482 Cretaceous structural imbrication. *Canadian Journal of Earth Sciences*, **57**: 227–248.

483 doi.org/10.1139/cjes-2018-0262

484

485 Carter, E.S., Cameron, B.E.B., and Smith, P.L. 1988. Lower and Middle Jurassic radiolarian
486 biostratigraphy and systematic paleontology, Queen Charlotte Islands, British Columbia.
487 Geological Survey of Canada, Bulletin 386. doi.org/10.4095/126315

488

489 Carter, E.S., Whalen, P.A., and Guex, J. 1998. Biochronology and paleontology of Lower

- 490 Jurassic (Hettangian and Sinemurian) radiolarians, Queen Charlotte Islands, British Columbia.
491 Geological Survey of Canada, Bulletin 496. doi.org/10.4095/209778
492
- 493 Carter, E.S., Goričan, Š., Guex, J., O'Dogherty, L., De Wever, P., Dumitrica, P., Hori, R.S.,
494 Matsuoka, A., and Whalen, P. 2010. Global radiolarian zonation for the Pliensbachian, Toarcian
495 and Aalenian. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **297**: 401–419.
496 doi.org/10.3986/9789612545192
497
- 498 Cohen, K.M., Finney, S.C., Gibbard, P.L., and Fan, J.-X. 2013 (updated 2020). The ICS
499 International Chronostratigraphic Chart. *Episodes*, **36**: 199–204. Available from
500 <http://www.stratigraphy.org/index.php/ics-chart-timescale>
501
- 502 Colpron, M., Crowley, J.L., Gehrels, G.E., Long, D.G.F., Murphy, D.C., Beranek, L.P., and
503 Bickerton, L. 2015. Birth of the northern Cordilleran orogen, as recorded by detrital zircons in
504 Jurassic synorogenic strata and regional exhumation in Yukon. *Lithosphere*, **7**: 541–562.
505 doi:10.1130/L451.1.
506
- 507 Coney, P.J., Jones, D.L., and Monger, J.W.H. 1980. Cordilleran suspect terranes. *Nature*, **288**:
508 329–333. doi.org/10.1038/288329a0
509
- 510 Cordey, F. 1986. Radiolarian ages from the Cache Creek and Bridge River complexes and from
511 chert pebbles in Cretaceous conglomerates, British Columbia. Geological Survey of Canada
512 Paper 86-1A, pp. 595–602. doi.org/10.4095/120430
513
- 514 Cordey, F. 1996. Radiolarian chert terranes of the Canadian Cordillera: the Bridge River terrane

515 and faunal comparison with East Asia. *In* Mesozoic radiolarians and radiolarian-bearing
516 sequences in the Circum-Pacific regions: A report of the symposium 'Radiolarians and Orogenic
517 Belts'. *Edited by* A. Matsuoka, Y. Aita, Munasri, K. Wakita, G. Shen, H. Ujiie, K. Sashida, V.S.
518 Vishnevskaya, N.Y. Bragin and F. Cordey. *Island Arc*, **5**: 209–210. doi.org/10.1111/j.1440-
519 1738.1996.tb00026.x

520

521 Cordey, F. 1998. Radiolaires des complexes d'accrétion cordillérais. Geological Survey of
522 Canada, Bulletin 509. doi.org/10.4095/209945

523

524 Cordey, F., and Krauss, P. 1990. A field technique for identifying and dating Radiolaria applied
525 to British Columbia and Yukon. *In* Current Research, part E. Geological Survey of Canada, Paper
526 90-1E, pp. 127–129. doi.org/10.4095/131378

527

528 Cordey, F., and Schiarizza, P. 1993. Long-lived Panthalassic remnant: the Bridge River
529 accretionary complex, Canadian Cordillera. *Geology*, **21**: 263–266. doi.org/10.1130/0091-
530 7613(1993)021<0263:LLPRTB>2.3.CO;2.

531

532 Cordey, F., and Struik, L.C. 1996. Radiolarian biostratigraphy and implications: Cache Creek
533 Group of Fort Fraser and Prince George map areas, central British Columbia. *In* Current
534 Research 1996-E. Geological Survey of Canada, pp. 7–18. doi.org/10.4095/207868

535

536 Cordey, F., Mortimer, N., De Wever, P., and Monger, J.W.H. 1987. Significance of Jurassic
537 radiolarians from the Cache Creek Terrane, southern British Columbia. *Geology*, **15**: 1151–1154.
538 doi.org/10.1130/0091-7613(1987)15%3C1151:sojrf%3E2.0.co;2

539

- 540 Cordey, F., Gordey, S.P., and Orchard, M.J. 1991. New biostratigraphic data for the northern
541 Cache Creek Terrane, Teslin map area, southern Yukon. *In* Current Research, Part E. Geological
542 Survey of Canada, Paper 91-1E, pp. 67–76. doi.org/10.4095/132629
- 543
- 544 Danner, W.R. 1985. Tethyan exotic terrane, southwestern British Columbia. *In* Field Trip No. 13,
545 Meetings of the Geological Society of America, Cordilleran Section, Vancouver, B.C.
- 546
- 547 Dickinson, W.R. 2004. Evolution of the North American Cordillera: Annual Review of Earth and
548 Planetary Sciences, **32**: 13–45. doi:10.1146/annurev.earth.32.101802.120257.
- 549
- 550 Dickinson, W.R., and Lawton, T.F. 2001. Carboniferous to Cretaceous assembly and
551 fragmentation of Mexico. Geological Society of America Bulletin, **113**: 1142–1160.
552 doi.org/10.1130/0016-7606(2001)113%3C1142:ctcaaf%3E2.0.co;2
- 553
- 554 Duffell, S., and McTaggart, K.C. 1952. Ashcroft map-area, British Columbia. Geological Survey
555 of Canada, Memoir 262. doi.org/10.4095/101598
- 556
- 557 Evenchick, C.A., Poulton, T.P., and McNicoll, V.J. 2010. Nature and significance of the
558 diachronous contact between the Hazelton and Bowser Lake groups (Jurassic), north-central
559 British Columbia. Bulletin of Canadian Petroleum Geology, **58**: 235–267.
560 doi:10.2113/gscpgbull.58.3.235.
- 561
- 562 Gehrels, G., Rusmore, M., Woodsworth, G., Crawford, M., Andronicos, A., Hollister, L.,
563 Patchett, P., Ducca, M., Butler, R., Klepeis, K., Davidson, C., Friedman, R., Haggart, J.,
564 Mahoney, B., Crawford, W., Pearson, D., and Girardi, J. 2009. U-Th-Pb geochronology of the

- 565 Coast Mountains batholith in north-coastal British Columbia: constraints of age and tectonic
566 evolution. *Geological Society of America Bulletin*, **1201**: 1340–1361. doi.org/10.1130/B26404.1.
567
- 568 Golding, M. 2018. Heterogeneity of conodont faunas in the Cache Creek Terrane, Canada;
569 significance for tectonic reconstructions of the North American Cordillera. *Palaeogeography,*
570 *Palaeoclimatology, Palaeoecology*, **506**: 208–216. doi.org/10.1016/j.palaeo.2018.06.038
571
- 572 Gordey, S.P. 1991. Teslin map area, a new geological mapping project in southern Yukon. *In*
573 *Current research, Part A. Geological Survey of Canada, Paper 91-1A*, pp. 171–178.
574 doi.org/10.4095/132511
575
- 576 Gordey, S.P., and Stevens, R.A. 1994. Tectonic framework of the Teslin region, southern Yukon
577 Territory. *In Current research, part A. Geological Survey of Canada, Paper 94-A*, pp. 11–18.
578 doi.org/10.4095/193617
579
- 580 Goričan, Š., Carter, E.S., Dumitrica, P., Whalen, P.A., Hori, R.S., De Wever, P., O’Dogherty, L.,
581 Matsuoka, A., and Guex, J. 2006. Catalogue and systematics of Pliensbachian, Toarcian and
582 Aalenian radiolarian genera and species. Založba ZRC, Ljubljana.
583 doi.org/10.3986/9789612545192
584
- 585 Goričan, Š., O’Dogherty, L., Baumgartner, P.O., Carter E.S., and Matsuoka, A. 2018. Mesozoic
586 radiolarian biochronology – current status and future directions. *Revue de micropaléontologie*,
587 **61**: 165–189. doi.org/10.1016/j.revmic.2018.08.001
588
- 589 Isozaki, Y., Maruyama, S., and Furuoka, F. 1990. Accreted oceanic materials in Japan.

590 Tectonophysics, **181**: 179–205. doi.org/10.1016/0040-1951(90)90016-2

591

592 Jackson, J.L. 1992. Tectonic analysis of the Nisling, northern Stikine and northern Cache Creek
593 terranes, Yukon and British Columbia. Ph.D. thesis, University of Arizona, Tucson.

594

595 Johnston, S.T., and Borel, G.D. 2006. The odyssey of the Cache Creek terrane, Canadian
596 Cordillera: Implications for accretionary orogens, tectonic setting of Panthalassa, the Pacific
597 superwell, and break-up of Pangea. Earth and Planetary Science Letters, **253**: 415–28.

598 doi:10.1016/j.epsl.2006.11.002

599

600 Matsuoka, A. 1995. Jurassic and Lower Cretaceous radiolarian zonation in Japan and in the
601 western Pacific. The Island Arc, **4**: 140–153. doi.org/10.1111/j.1440-1738.1995.tb00138.x

602

603 Matsuoka, A., Aita, Y., Munasri, Wakita, K., Shen, G., Ujiii, H., Sashida, K., Vishnevskaiia, V.,
604 Bragin, N., and Cordey, F. 1996. Mesozoic radiolarians and radiolarian-bearing sequences in the
605 circum-Pacific regions: A report of the symposium-'Radiolarians and Orogenic Belts'. The Island
606 Arc, **5**: 203–213. doi.org/10.1111/j.1440-1738.1996.tb00026.x

607

608 Mihalynuk, M.G., Smith, M.T. Gabites, J.E., Runkle, D., and Lefebure, D. 1992. Age of
609 emplacement and basement character of the Cache Creek terrane constrained by new
610 geochemical data. Canadian Journal of Earth Sciences, **29**: 2463–2477. doi.org/10.1139/e92-193

611

- 612 Mihalyuk, M.G., Nelson, J.A., and Diakow, L.J. 1994. Cache Creek terrane entrapment:
613 oroclinal paradox within the Canadian Cordillera. *Tectonics*, **13**: 575–595.
614 doi.org/10.1029/93tc03492
615
- 616 Mihalyuk, M.G., Erdmer, P., Ghent, E.D., Cordey, F., Archibald, D.A., Friedman, R.M., and
617 Johannson, G.G. 2004. Coherent French Range blueschist: Subduction to exhumation in < 2.5
618 m.y.? *Geological Society of America Bulletin*, **116**: 910–922. doi.org/10.1130/b25393.1
619
- 620 Monger, J.W.H. 1975. Upper Paleozoic rocks of the Atlin Terrane, northwestern B.C. and south-
621 central Yukon. *Geological Survey of Canada, Paper 74-47*, pp 1–63. doi.org/10.4095/102554
622
- 623 Monger, J.W.H. 1981. Geology of parts of western Ashcroft map area, southwestern British
624 Columbia. *In Current Research, Part A. Geological Survey of Canada, Paper 81-1A*, pp. 185–
625 189. doi.org/10.4095/109627
626
- 627 Monger, J.W.H. 1985. Structural evolution of the southwestern Intermontane belt, Ashcroft and
628 Hope map areas, British Columbia. *In Current Research, Part A. Geological Survey of Canada,*
629 *Paper 85-1A*, pp. 349–358. doi.org/10.4095/120183
630
- 631 Monger, J.W.H. 2014. Logan Medallist 1. Seeking the Suture: The Coast-Cascade Conundrum.
632 *Geoscience Canada*, **41**: 379–398. doi.org/10.12789/geocanj.2014.41.058
633
- 634 Monger, J.W.H., and Brown, E.H. 2016. Tectonic evolution of the southern Coast-Cascade
635 Orogen, northwestern Washington and southwestern British Columbia. *In Chapter 10, The*
636 *Geology of Washington and Beyond: From Laurentia to Cascadia. Edited by E.S. Cheney,*

637 University of Washington Press, pp. 101–130.

638

639 Monger, J.W.H., and Gibson, H.D. 2019. Mesozoic-Cenozoic deformation in the Canadian

640 Cordillera: The record of a “Continental Bulldozer”? *Tectonophysics*, **757**: 153–169.

641 doi.org/10.1016/j.tecto.2018.12.023

642

643 Monger, J.W.H., and McMillan, W.J. 1984. Bedrock geology of Ashcroft (92 I) map area.

644 Geological Survey of Canada, Open-File Report 980. doi.org/10.4095/129860

645

646 Monger, J.W.H., and Ross, C.A. 1971. Distribution of fusulinaceans in the western Canadian

647 Cordillera. *Canadian Journal of Earth Sciences*, **8**: 259–278. doi.org/10.1139/e71-026

648

649 Monger, J.W.H., Souther, J.G., and Gabrielse, H. 1972. Evolution of the Canadian Cordillera; a

650 plate tectonic model. *American Journal of Science*, **272**: 577–602. doi.org/10.2475/ajs.272.7.577

651

652 Monger, J.W.H., Price, R.A., and Tempelman-Kluit, D.J. 1982. Tectonic accretion and the origin

653 of the two major metamorphic and plutonic belts in the Canadian Cordillera. *Geology*, **10**: 70–

654 75. [doi.org/10.1130/0091-7613\(1982\)10<70:TAATOO>2.0.CO;2](https://doi.org/10.1130/0091-7613(1982)10<70:TAATOO>2.0.CO;2).

655

656 Monger, J.W.H., Van der Heyden, P., Journeay, J.M., Evenchick, C.A., and Mahoney, J.B. 1994.

657 Jurassic–Cretaceous basins along the Canadian Coast belt: Their bearing on pre–mid-Cretaceous

658 sinistral displacements. *Geology*, **22**: 175–178. [doi.org/10.1130/0091-](https://doi.org/10.1130/0091-7613(1994)022<0175:JCBATC>2.3.CO;2)

659 [7613\(1994\)022<0175:JCBATC>2.3.CO;2](https://doi.org/10.1130/0091-7613(1994)022<0175:JCBATC>2.3.CO;2).

660

661 Mortimer, N. 1987. The Nicola Group: Late Triassic and Early Jurassic subduction-related

- 662 volcanism in British Columbia. *Canadian Journal of Earth Sciences*, **24**: 2521–2536.
663 doi.org/10.1139/e87-236
664
- 665 Nelson, J.L., and Mihalynuk, M.G. 1993. Cache Creek Ocean: closure or enclosure? *Geology*,
666 **21**: 173–176. doi.org/10.1130/0091-7613(1993)021%3C0173:ccocoe%3E2.3.co;2
667
- 668 Nokleberg, W.J., Parfenov, L.M., Monger, J.W.H., Norton, I.O., Khanchuk, A.I., Stone, D.B.,
669 Scotese, C.R., Scholl, D.W., and Fujita, K. 2000. Phanerozoic tectonic evolution of the circum-
670 North Pacific. U. S. Geological Survey Professional Paper 1626, 1–133. doi.org/10.3133/pp1626
671
- 672 O’Dogherty, L., Carter, E.S., Dumitrica, P., Goričan, S., De Wever, P., Bandini, N.,
673 Baumgartner, P.O., and Matsuoka, A. 2009. Catalogue of Mesozoic radiolarian genera: Part 2.
674 Jurassic–Cretaceous. *Geodiversitas*, **31**: 271–356. doi.org/10.5252/g2009n2a4
675
- 676 Orchard, M.J. 1981. Triassic conodonts from the Cache Creek Group, Marble Canyon, southern
677 British Columbia. *In* Current Research, Part A. Geological Survey of Canada, Paper 81-1A, pp.
678 357–359. doi.org/10.4095/109559
679
- 680 Orchard, M.J. 1984. Pennsylvanian, Permian, and Triassic conodonts from the Cache Creek
681 Group, southern British Columbia. *In* Current Research, Part B. Geological Survey of Canada,
682 Paper 84-1B, pp. 197–206. doi.org/10.4095/119575
683
- 684 Orchard, M.J., Cordey, F., Rui, L., Bamber, W., Struik, L.C., and Sano, H. 2001. Paleontological
685 constraints on the paleogeography of the Carboniferous to Jurassic Cache Creek Terrane in

686 central British Columbia; *Canadian Journal of Earth Sciences*, **38**: 551–578. doi.org/10.1139/e00-
687 120
688

689 Pavlis, T. L., Amato, J. M., Trop, J. M., Ridgway, K. D., Roeske, S. M., and Gehrels, G. E. 2019.
690 Subduction polarity in ancient arcs: A call to integrate geology and geophysics to decipher the
691 Mesozoic tectonic history of the Northern Cordillera of North America. *GSA Today*: **29**: 4–10.
692 doi.org/10.1130/gsatg402a.1
693

694 Piercey, S.J., and Colpron, M. 2009. Composition and provenance of the Snowcap assemblage,
695 basement to the Yukon-Tanana Terrane, northern Cordillera; implications for Cordilleran crustal
696 growth. *Geosphere*, **5**: 439–464. doi.org/10.1130/ges00505.s3
697

698 Read, P.B. 1993. Geology of northeast Taseko Lakes map area, southwestern British Columbia.
699 *In* Current Research, Part A. Geological Survey of Canada, Paper 93-1A, pp. 159–166.
700 doi.org/10.4095/134202
701

702 Ricketts, B.D., Evenchick, C.A., Anderson, R.G., and Murphy, D.C. 1992. Bowser basin,
703 northern British Columbia: Constraints on the timing of initial subsidence and Stikinia-North
704 America terrane interactions. *Geology*, **20**: 1119–1122. doi.org/10.1130/0091-
705 7613(1992)020%3C1119:bbnbcc%3E2.3.co;2
706

707 Shannon, K.R. 1981. The Cache Creek Group and contiguous rocks near Cache Creek, British
708 Columbia. *In* Current research, Part A. Geological Survey of Canada, Paper 81–1A, pp. 217–221.
709 doi.org/10.4095/109616
710

- 711 Sigloch, K., and Mihalynuk, M.G. 2013. Intra-oceanic subduction shaped the assembly of
712 Cordilleran North America. *Nature*, **496**: 50–56. doi.org/10.1038/nature12019
713
- 714 Sigloch, K., and Mihalynuk, M.G. 2017. Mantle and geological evidence for a Late Jurassic-
715 Cretaceous suture spanning North America. *Geological Society of America Bulletin*, **129**: 1489–
716 1520. doi.org/10.1130/abs/2017am-306159
717
- 718 Struik, L. C. 1998. Bedrock geology, Tezzeron, British Columbia; Geological Survey of Canada,
719 Open File 3624, 1 sheet. doi.org/10.4095/209920
720
- 721 Struik, L.C., Floriet, C., and Cordey, F. 1996. Geology near Fort St. James, central British
722 Columbia. *In* Current research, Part A. Geological Survey of Canada, Paper 96-A, pp. 71–76.
723 doi.org/10.4095/207411
724
- 725 Struik, L.C., Schiarizza, P., Orchard, M.J., Cordey, F., Sano, H., MacIntyre, D.G., Lapierre, H.,
726 and Tardy, M. 2001. Imbricate architecture of upper Paleozoic to Jurassic oceanic Cache Creek
727 Terrane, central British Columbia. *Canadian Journal of Earth Sciences*, **38**: 495–514.
728 doi.org/10.1139/e00-117
729
- 730 Struik, L.C., MacIntyre, D.G., and Williams, S.P. 2007. Nechako NATMAP Project: A digital
731 suite of geoscience information for central British Columbia Geological Survey of Canada, Open
732 File 5623. doi.org/10.4095/224578
733
- 734 Travers, W.B. 1978. Overturned Ashcroft and Nicola strata and their relation to the Cache Creek
735 Group, southwestern Intermontane Belt, British Columbia. *Canadian Journal of Earth Sciences*,

736 **15**: 99–116. doi.org/10.1139/e78-009

737

738 Trettin, H.P. 1980. Permian rocks of the Cache Creek Group in the Marble Range, Clinton area,

739 British Columbia. Geological Survey of Canada, Paper 79-17, pp 1–17. doi.org/10.4095/106637

740

741 Umhoefer, P.J., and Schiarizza, P. 1996. Latest Cretaceous to early Tertiary dextral strike-slip

742 faulting on the southeastern Yalakom fault system, southeastern Coast Belt, British Columbia.

743 Geological Society of America Bulletin, **108**: 768–785. doi.org/10.1130/0016-

744 7606(1996)108%3C0768:lctetd%3E2.3.co;2

745

746 Whalen, P. A., and Carter, E. S. 2002. Pliensbachian (Lower Jurassic) Radiolaria from Baja

747 California Sur, Mexico. Micropaleontology, **48**: 97–151. doi.org/10.1661/0026-

748 2803(2002)048[0097:pljrfb]2.0.co;2

749

750 Wheeler, J.O., Brookfield, A.J., Gabrielse, H., Monger, J.W.H., Tipper, H.W., and Woodsworth,

751 G.J. 1991. Terrane map of the Canadian Cordillera. Geological Survey of Canada, Map 1713A,

752 1:2,000,000. doi.org/10.4095/133550

753

754 Zagorevski, A., Bedard, J.H., Bogatu, A., Coleman, M., Golding, M., and Joyce, N. 2017.

755 Stikinia bedrock report of activities, British Columbia and Yukon: GEM 2 Cordillera. Geological

756 Survey of Canada, Open File 8329, pp. 1–15. doi.org/10.4095/306144

757 Table 1. Jurassic radiolarian taxa and ages from the Cache Creek Terrane

| Locality, Region | Subterranean or unit, map area & UTM coordinates | Lithology, Sample, GSC locality number when available | Radiolarian assemblage | Original age, Reference(s) | New or revised age | Generic assemblage or correlation to biozones (when applicable) |
|---------------------------------------|---|--|---|---|--|--|
| J1 southern British Columbia | western belt Pavilion NTS 092113 UTM zone 10 581045E 5646753N | siliceous argillite NEO-R2 GSC C-300438 (previously R2, Cordey et al. 1987, Cordey 1998) | <i>Archaeodictyomitra</i> sp., <i>Homoeoparonaella</i> sp. cf. <i>reciproqua</i> , <i>Hsuum</i> sp., <i>Pseudocrucella</i> ? sp., <i>Thurstonia</i> sp., <i>Trillus</i> sp., <i>Xiphostylus</i> ? sp., <i>Zartus</i> sp. | Early Jurassic (Pliensbachian- Bajocian) (Cordey et al. 1987, Cordey 1998) | Early Jurassic (Early Pliensbachian - Early Toarcian) | Co-occurrence of <i>Thurstonia</i> , <i>Trillus</i> and <i>Zartus</i> (O'Dogherty et al. 2009) |
| J2 southern British Columbia | western belt Alkali Lake NTS 092016 UTM zone 10 548240E 5749410N | gray-green radiolarian chert 92-PBR-C92-78F GSC C-210033 | <i>Canutus</i> sp., <i>Lantus</i> sp., <i>Orbiculiformella</i> sp., <i>Parahsuum</i> sp., <i>Praeconocaryomma</i> sp. | Early Jurassic (Sinemurian- Pliensbachian) (Cordey, unp. data; Read 1993) | Early Jurassic (Early Pliensbachian - Early Toarcian) | Co-occurrence of <i>Canutus</i> and <i>Lantus</i> (O'Dogherty et al. 2009) |
| J3 central British Columbia | Blackwater River Punchaw Lake NTS 093G6 UTM zone 10 490750E 5904150N | gray radiolarian chert 95FC-21-4 GSC C-303032 | <i>Atalantria</i> sp., <i>Beatricea</i> ? <i>argescens</i> , <i>Bipedis japonicus</i> , <i>Broctus</i> sp., <i>Broctus</i> ? sp., <i>Canoptum rugosum</i> , <i>Canoptum</i> sp. cf. <i>dixonii</i> , <i>Charlottea</i> sp., <i>Katroma</i> sp. cf. <i>elongata</i> , <i>Lantus</i> sp. cf. <i>praeobesus</i> , <i>Laxtorum</i> sp., <i>Orbiculiformella</i> ? <i>trispina</i> s.l. (Yeh), <i>Orbiculiformella</i> sp., <i>Palaeosaturmalis</i> sp., <i>Parahsuum</i> <i>simplum</i> , <i>Parahsuum vizcainoense</i> , <i>Praeconocaryomma</i> sp. cf. <i>sarahae</i> , <i>Thurstonia</i> sp., <i>Spumellaria</i> gen. sp. indet. | Early Jurassic (Pliensbachian) (Cordey and Struik 1996, Orchard et al. 2001) | Early Jurassic (Early Pliensbachian) | Interval from the middle part of the <i>Canutus tipperi</i> – <i>Katroma clara</i> Zone to the base of the <i>Gigi fustis</i> – <i>Lantus sixi</i> Zone (Unitary associations UA 04-12) (Carter et al. 2010). |
| J4 central British Columbia | Tezzeron succession Pinchi Lake NTS 093K9 UTM zone 10, 418200E 6049406N | limy siltstone 97-SCB-3602 GSC C-209935 | <i>Emiluvia</i> ? sp. A, <i>Hsuum lucidum</i> , <i>Paronaella grahamensis</i> , <i>Praeconocaryomma decora</i> gr., <i>Praeparvicungula tiellensis</i> | Early Jurassic (Toarcian) (Struik et al. 2001, Orchard et al. 2001) | Early Jurassic (Middle - Late Toarcian) | Interval represented by the <i>Elodium pessagnoii</i> – <i>Hexasaturmalis</i> <i>hexagonus</i> Zone (Carter et al. 2010) |
| J5 northern British Columbia | French Range Little Dease Lake NTS 104J09 UTM zone 10, 419000E 6508000N | siliceous argillite MMI99-34-12 | <i>Parahsuum izeense</i> , <i>Orbiculiformella</i> ? <i>trispina</i> s.l., <i>Praeconocaryomma</i> sp. cf. <i>sarahae</i> , <i>Praeconocaryomma</i> sp., <i>Thurstonia</i> sp. | Early Jurassic (Pliensbachian- Toarcian) (Mihalynuk et al. 2004) | Early Jurassic (Pliensbachian - Early Toarcian) | Co-occurrence of <i>Parahsuum izeense</i> and <i>Thurstonia</i> (Carter et al. 2010, O'Dogherty et al. 2009). |
| J6 Yukon | Teslin Plateau Mount Bryde NTS 105C03 UTM zone 10, 599028E 6676847N | siliceous argillite interbedded with sandstone 90FC-56-6 GSC C-177569 | <i>Bipedis</i> sp., <i>Broctus</i> sp., <i>Canoptum</i> <i>anulatum</i> , <i>Canoptum</i> sp., <i>Hagiastrum majusculum</i> , <i>Homoeoparonaella</i> sp., <i>Lantus sixi</i> , <i>Napora cerromesaensis</i> , <i>Pantanellium cumshewaense</i> , <i>Parahsuum izeense</i> , <i>Praeconocaryomma</i> ? sp. cf. <i>yakounensis</i> , <i>Thurstonia</i> sp., <i>Wrangellium</i> sp. | Early Jurassic (Pliensbachian- Early Toarcian) (Cordey et al. 1991) | Early Jurassic (late Early Pliensbachian - Late Pliensbachian) | Interval from the base of the <i>Gigi fustis</i> – <i>Lantus</i> <i>sixi</i> Zone to the middle part of the <i>Eucyrtidiellum</i> <i>nagaiae</i> – <i>Praeparvicungula tiellensis</i> Zone (Unitary associations UA 12-22; Carter et al. 2010) |
| J7 Yukon | Teslin Plateau Mount Bryde NTS 105C03 UTM zone 10, 600094E 6673025N | black radiolarian chert 90FC-63-2 GSC C-177580 | <i>Beatricea</i> ? <i>argescens</i> , <i>Canoptum</i> sp. cf. <i>anulatum</i> , <i>Canoptum</i> sp., <i>Praeconocaryomma</i> sp. cf. <i>immodica</i> , <i>Wrangellium</i> sp. | Early Jurassic (Sinemurian- Toarcian) (Cordey et al. 1991) | Early Jurassic (Late Sinemurian - Late Pliensbachian) | Co-occurrence of <i>Beatricea</i> and <i>Wrangellium</i> (O'Dogherty et al. 2009) |
| J8 Yukon | Teslin Plateau Mount Bryde NTS 105C03 UTM zone 10, 600094E 6673025N | dark gray radiolarian chert 90FC-63-9 GSC C-177587 | <i>Beatricea</i> ? <i>argescens</i> , <i>Bipedis</i> sp., <i>Canoptum</i> sp. cf. <i>dixonii</i> , <i>Gorgansium</i> sp., <i>Pantanellium</i> sp., <i>Parahsuum</i> sp., <i>Praeconocaryomma</i> sp., <i>Wrangellium</i> sp. | Early Jurassic (Sinemurian- Toarcian) (Cordey et al. 1991) | Early Jurassic (Late Sinemurian - Late Pliensbachian) | Co-occurrence of <i>Beatricea</i> , <i>Bipedis</i> , and <i>Wrangellium</i> (O'Dogherty et al. 2009) |

759 **Figure captions**

760 Figure 1 (colour online and printed). Paleozoic to early Mesozoic terranes of the Canadian
761 Cordillera and location of the Cache Creek Terrane. Modified from Piercey and Colpron (2009).

762
763 Figure 2. Geographic location of Jurassic radiolarian assemblages from the Cache Creek Terrane
764 (J1 to J8, Table 1). Black frame: Fig. 3a (type locality of the terrane).

765
766 Figure 3. a: Distribution of Paleozoic and Mesozoic rock units in the type locality of the Cache
767 Creek Terrane and position of the study area for locality J1 (Fig. 2). Geology from Monger
768 (1985). b: Geological map of the Pavilion area and location of the Early Jurassic radiolarian
769 sample NEO-R2. Geology from Monger and McMillan (1984), Mortimer (1987), and Cordey et
770 al. (1987).

771
772 Figure 4. Synthetic lithostratigraphic successions of the Cache Creek Terrane in its type locality
773 (southern British Columbia). The locality numbers (C-) refer to the Geological Survey of Canada
774 database and the radiolarian localities from Cordey (1998). Black lines (eastern belt): age of
775 blocks (Cache Creek mélange). Conodont data from Orchard (1981, 1984), Beyers and Orchard
776 (1989, 1991); fusulinid data from Monger and Ross (1971). Geological time scale from Cohen et
777 al. (2013). G: Guadalupian; L: Lopingian. LO: Lower.

778
779 Figure 5. Early Jurassic radiolarians from the Cache Creek Terrane. For each picture: taxon,
780 sample, locality (Table 1), length of scale bar. 1. *Thurstonia* sp., NEO-R2, J1, 150 µm. White
781 arrows point to fifth and sixth spines. 2. *Thurstonia?* sp., NEO-R2, J1, 170 µm. 3-7: *Thurstonia*
782 sp.; 3-5: 90FC-56-6, J6, 160 µm; 6: MMI99-34-12, J5, 110 µm; 7: 90FC-56-6, J6, 180 µm. White

783 arrows point to sixth spine. 8-9. *Spumellaria* gen. sp. indet., 95FC-21-4, J3, 165 and 140 μm . 10.
 784 *Pantanellium cumshewaense* Pessagno & Blome, 90FC-56-6, J6, 110 μm . 11-12. *Trillus* spp.,
 785 NEO-R2, J1, 120 μm . 13. *Zartus* sp., NEO-R2, J1, 115 μm . 14. *Charlottea* sp., 95FC-21-4, J3,
 786 115 μm . 15. *Palaeosaturnalis* sp., 95FC-21-4, J3, 160 μm . 16. *Hagiastrum majusculum* Whalen
 787 & Carter, 90FC-56-6, J6, 170 μm . 17. *Homoeoparonaella* sp. cf. *reciproqua* Carter, NEO-R2, J1,
 788 220 μm . 18. *Homoeoparonaella* sp., 90FC-56-6, J6, 140 μm . 19. *Orbiculiformella* sp., 95FC-21-
 789 4, J3, 170 μm . 20. *Orbiculiformella?* *trispina* s.l. (Yeh), 95FC-21-4, J3, 150 μm . 21. *Beatricea?*
 790 *argescens* Cordey, 90FC-63-2, J7, 160 μm . 22. *Praeconocaryomma?* sp. cf. *yakounensis* Carter,
 791 90FC-56-6, J6, 150 μm . 23-24. *Praeconocaryomma* sp. cf. *sarahae* Carter; 23: 95FC-21-4, J3,
 792 130 μm ; 24: MMI99-34-12, J5, 160 μm .

793

794 Figure 6. Early Jurassic radiolarians from the Cache Creek Terrane. For each picture: taxon,
 795 sample, locality (Table 1), length of scale bar. 1. *Lantus sixi* Yeh, 90FC-56-6, J6, 110 μm . 2.
 796 *Lantus* sp. cf. *praeobesus* Carter, 95FC-21-4, J3, 110 μm . 3. *Broctus* sp., 95FC-21-4, J3, 100 μm .
 797 4. *Broctus* sp., 90FC-56-6, J6, 130 μm . 5. *Xiphostylus?* sp., NEO-R2, J1, 140 μm . 6. *Katroma* sp.
 798 cf. *elongata* Carter, 95FC-21-4, J3, 150 μm . 7. *Parahsuum vizcainoense* Whalen & Carter, 95FC-
 799 21-4, J3, 90 μm . 8. *Parahsuum izeense* (Pessagno & Whalen), 90FC-56-6, J6, 140 μm . 9.
 800 *Canoptum* sp., 95FC-21-4, J3, 100 μm . 10. *Canoptum rugosum* Pessagno & Poisson, 95FC-21-4,
 801 J3, 90 μm . 11-12. *Canoptum* spp., 90FC-56-6, J6, 120 μm . 13. *Broctus?* sp., 95FC-21-4, J3, 110
 802 μm . 14. *Canoptum* sp. cf. *anulatum* Pessagno & Poisson, 90FC-63-2, J7, 120 μm . 15. *Canoptum*
 803 sp. cf. *dixonii* Pessagno & Whalen, 95FC-21-4, J3, 120 μm . 16. *Atalantria* sp., 95FC-21-4, J3, 120
 804 μm . 17. *Laxtorum* sp., 95FC-21-4, J3, 130 μm . 18. *Wrangellium* sp., 90FC-56-6, J6, 120 μm . 19.
 805 *Hsuum* sp., NEO-R2, J1, 110 μm . 20. *Archaeodictyomitra* sp., NEO-R2, J1, 130 μm . 21. *Bipedis*
 806 sp., 90FC-56-6, J6, 110 μm . 22. *Bipedis japonicus* Hori, 95FC-21-4, J3, 130 μm . 23. *Napora*
 807 *cerromesaensis* Pessagno, Whalen & Yeh, 90FC-56-6, J6, 105 μm .

808

809 Figure 7. Synthesis of the youngest Jurassic radiolarian ages of the Cache Creek Terrane.
810 Previous age determinations: J1: Cordey et al. (1987), Cordey (1998); J2: Read (1993), Cordey
811 (unpub. data); J3: Cordey and Struik (1996), Orchard et al. (2001); J4: Struik et al. (2001),
812 Orchard et al. (2001) ; J5 : Mihalynuk et al. (2004) ; J6-J8 : Cordey et al. (1991).

813

814 Figure 8. Radiolarian age ranges and correlations of youngest Cache Creek strata in British
815 Columbia and Yukon. The hatched band materializes the youngest common age range of
816 siliceous rocks (radiolarian cherts and siliceous argillites); limy siltstones at J4 are not included in
817 the correlation. The gray band shows the hypothetical age range of the youngest siliceous
818 argillites overlying the youngest well-dated radiolarian cherts (J3, Early Pliensbachian). The
819 oblique line represents the maximum age difference of the youngest well-dated hemipelagic
820 rocks (siliceous argillites) between southern British Columbia (J1) and Yukon (J6); this interval
821 (late Early Pliensbachian to Early Toarcian) is ~8 m.y. (~188–180 Ma, Cohen et al. 2013).

822

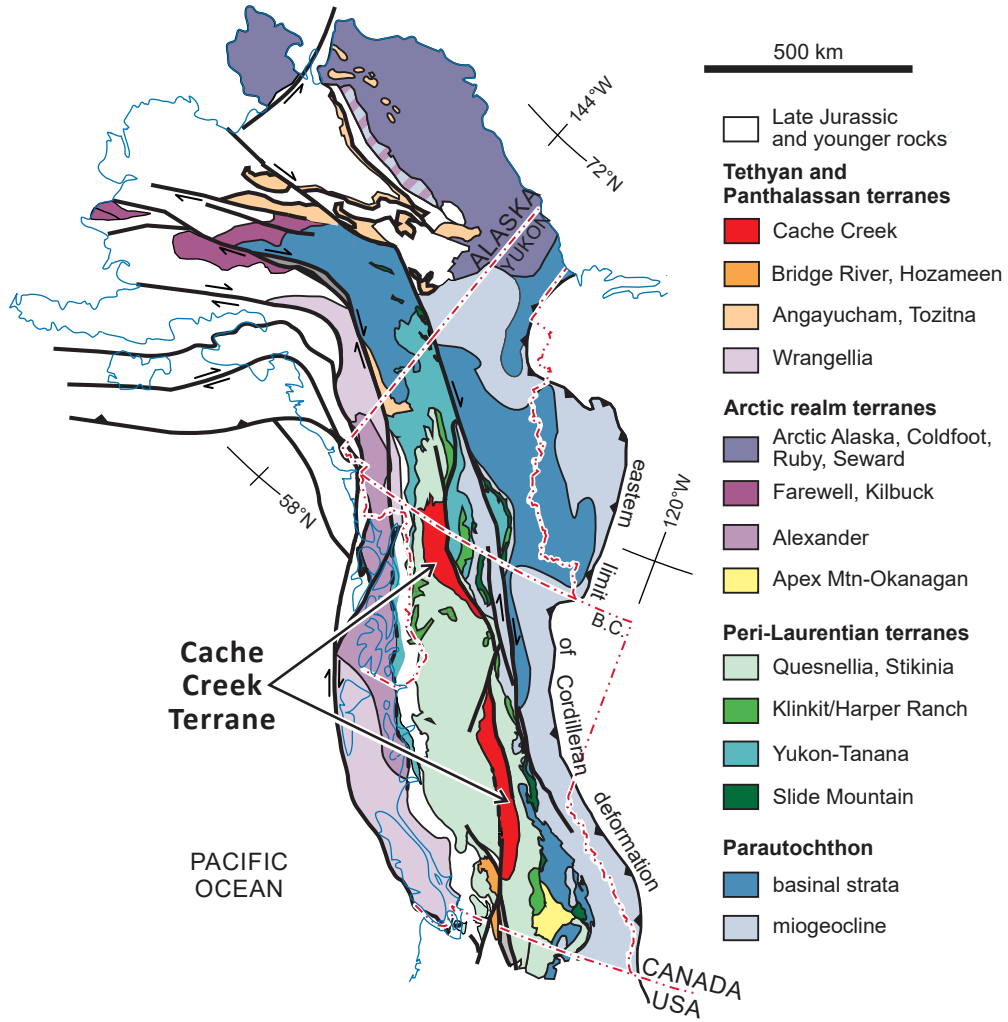


Figure 1

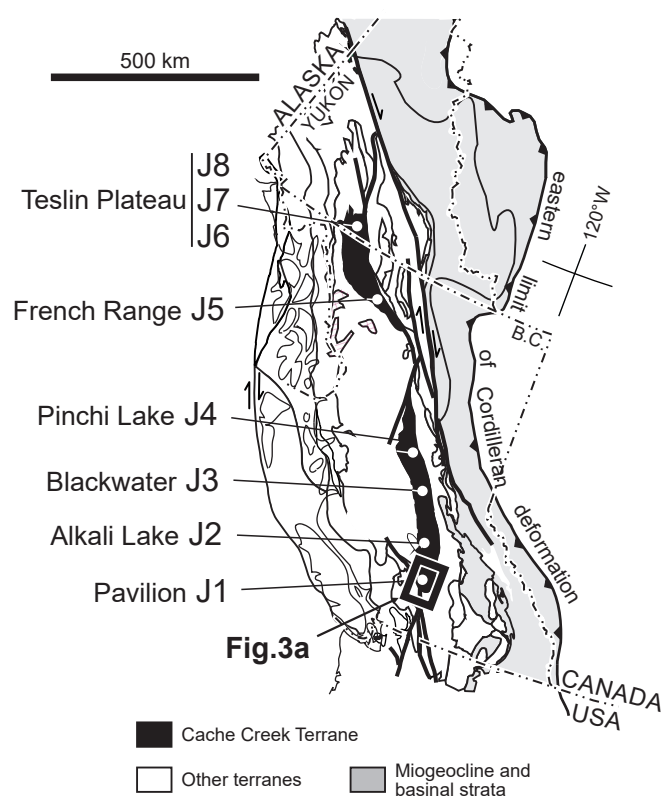


Figure 2

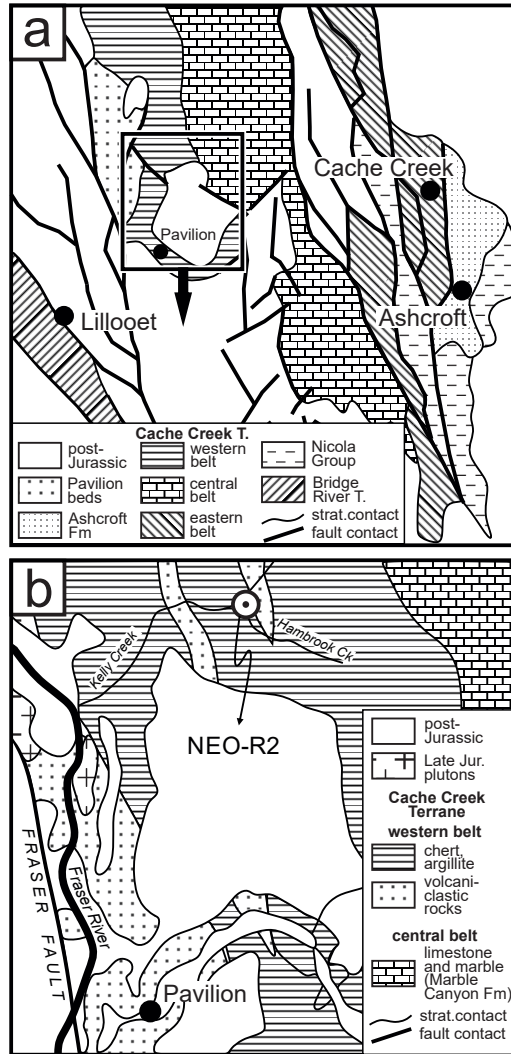


Figure 3

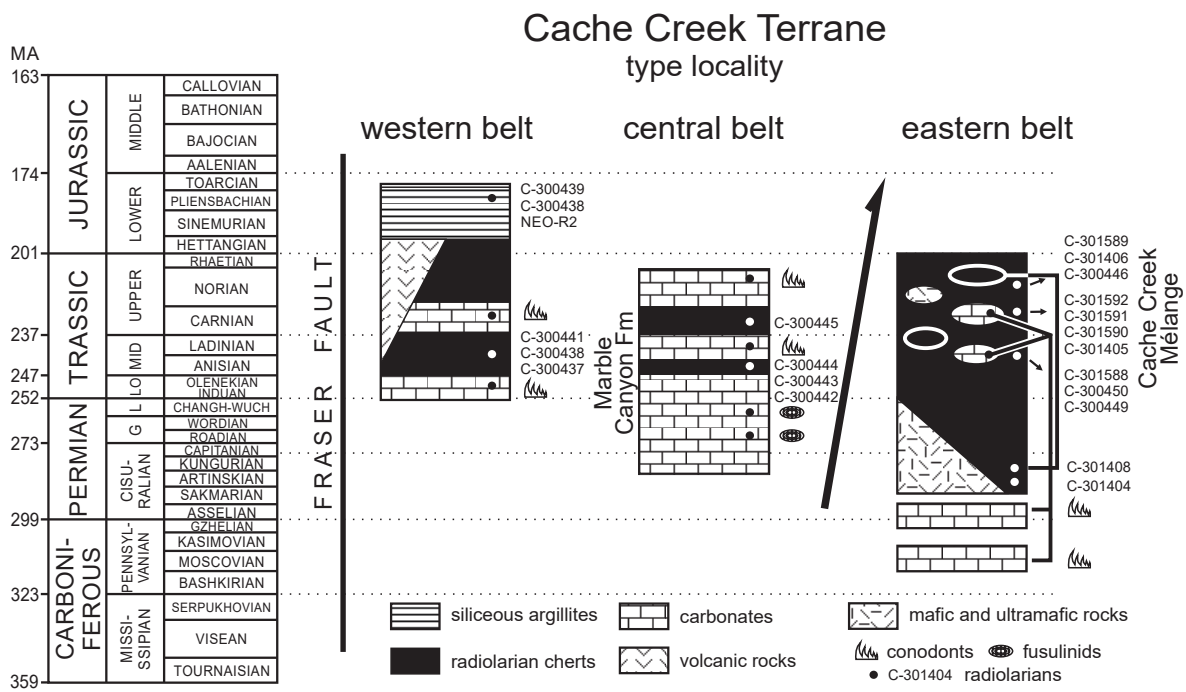


Figure 4

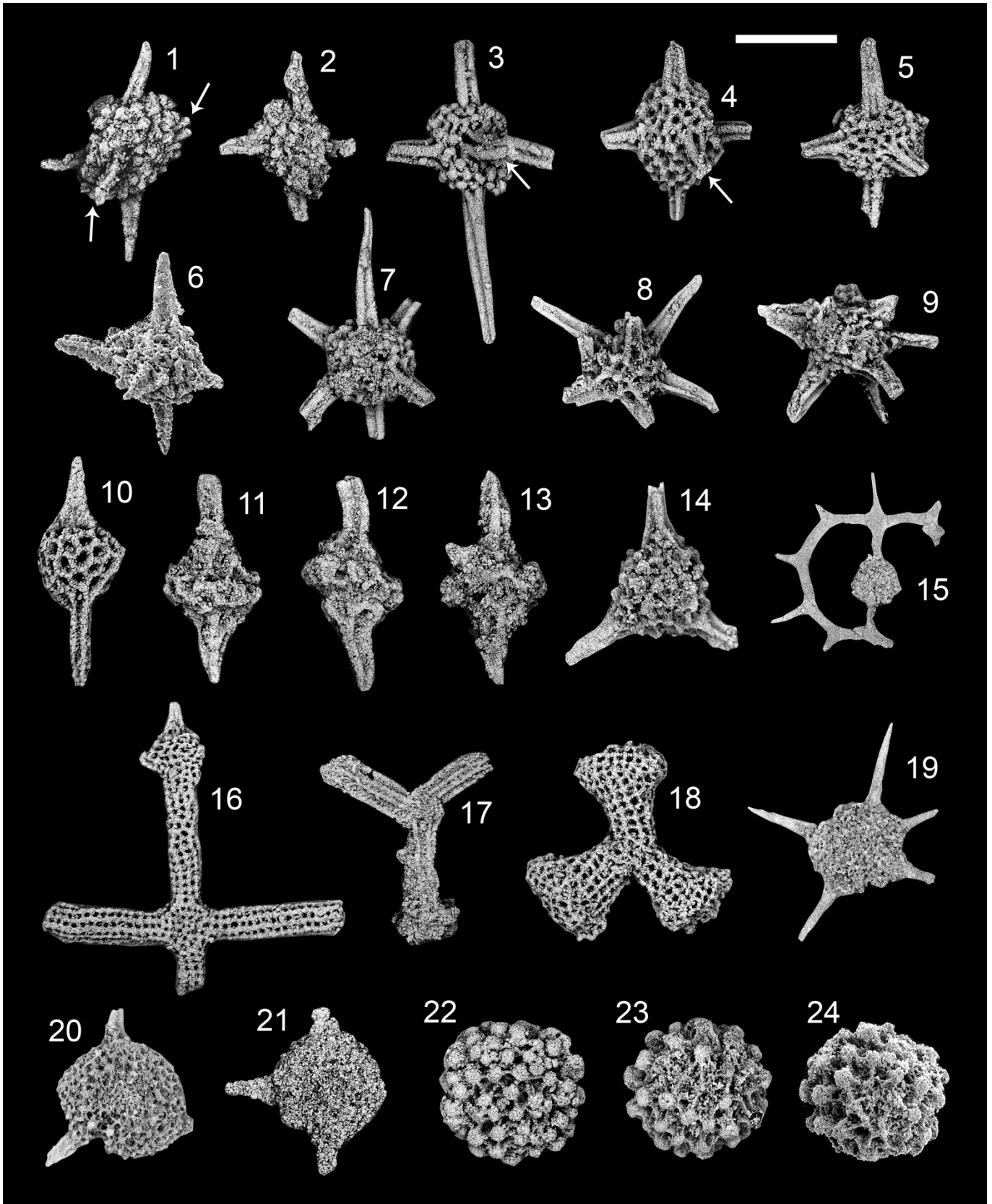


Figure 5

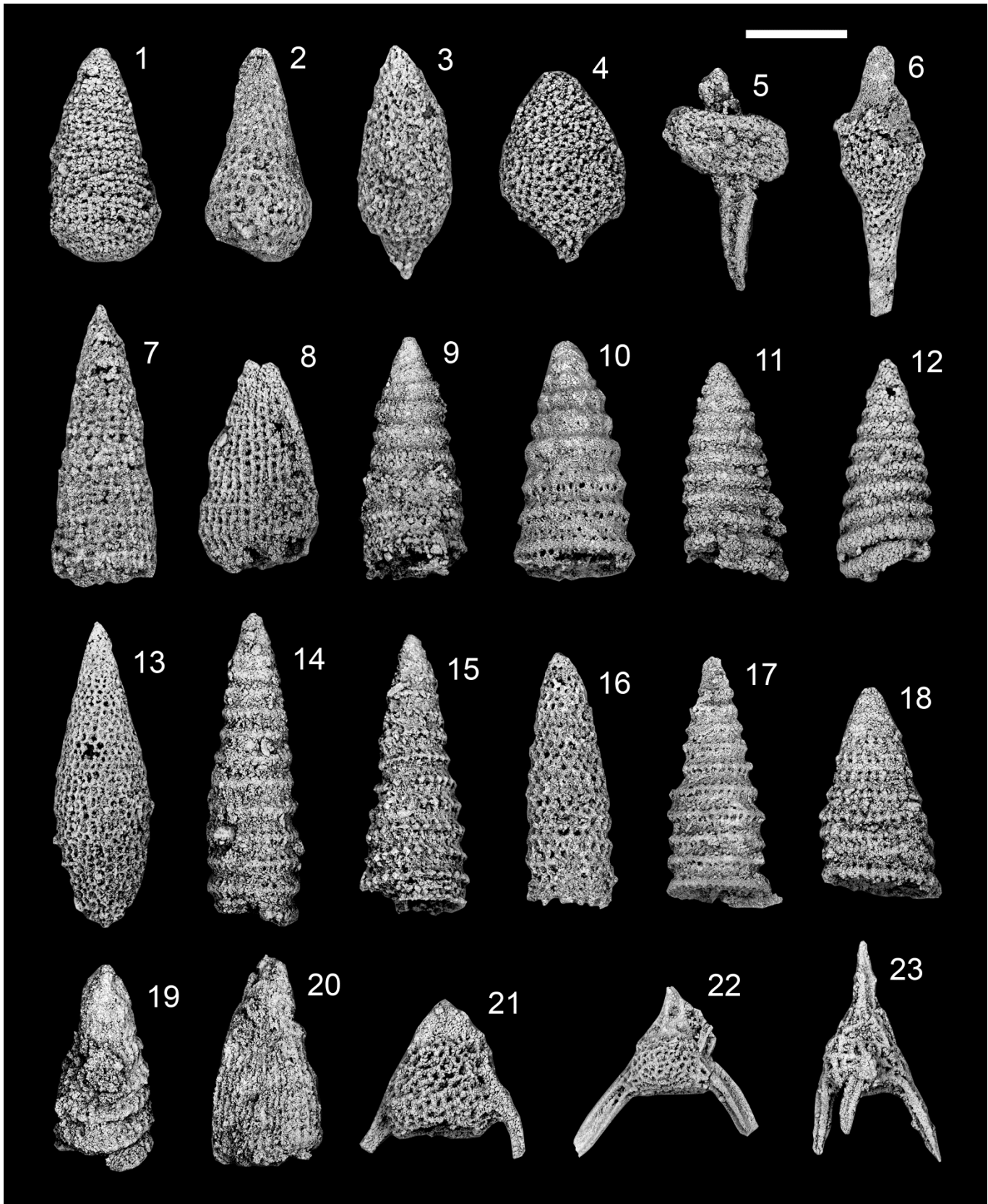


Figure 6

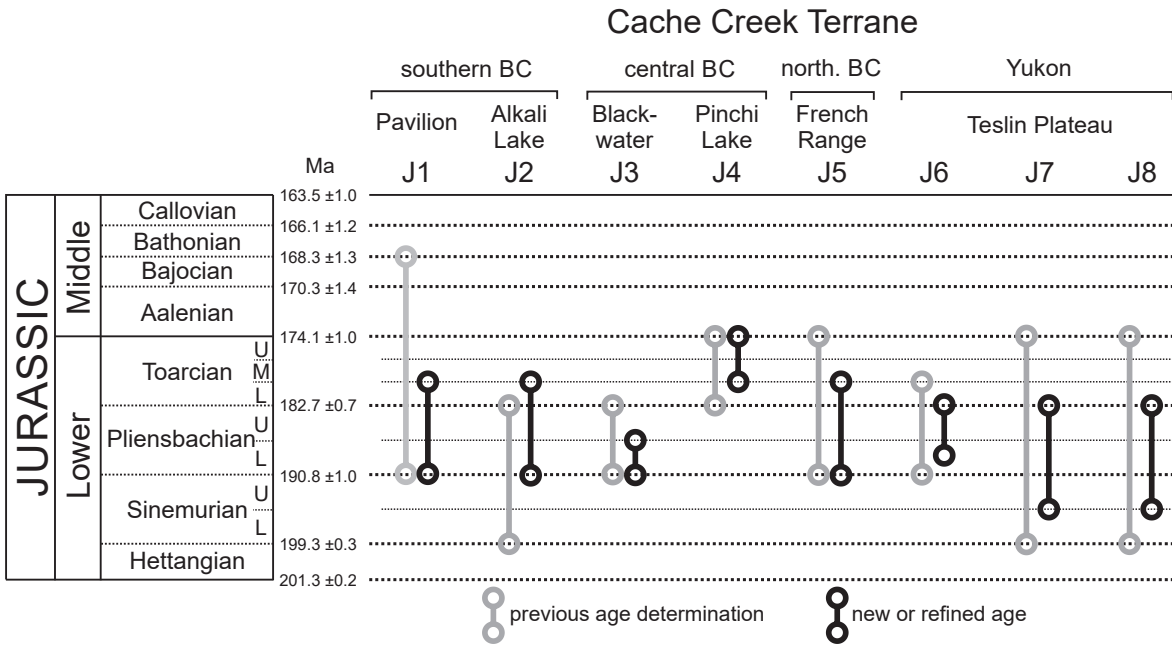


Figure 7

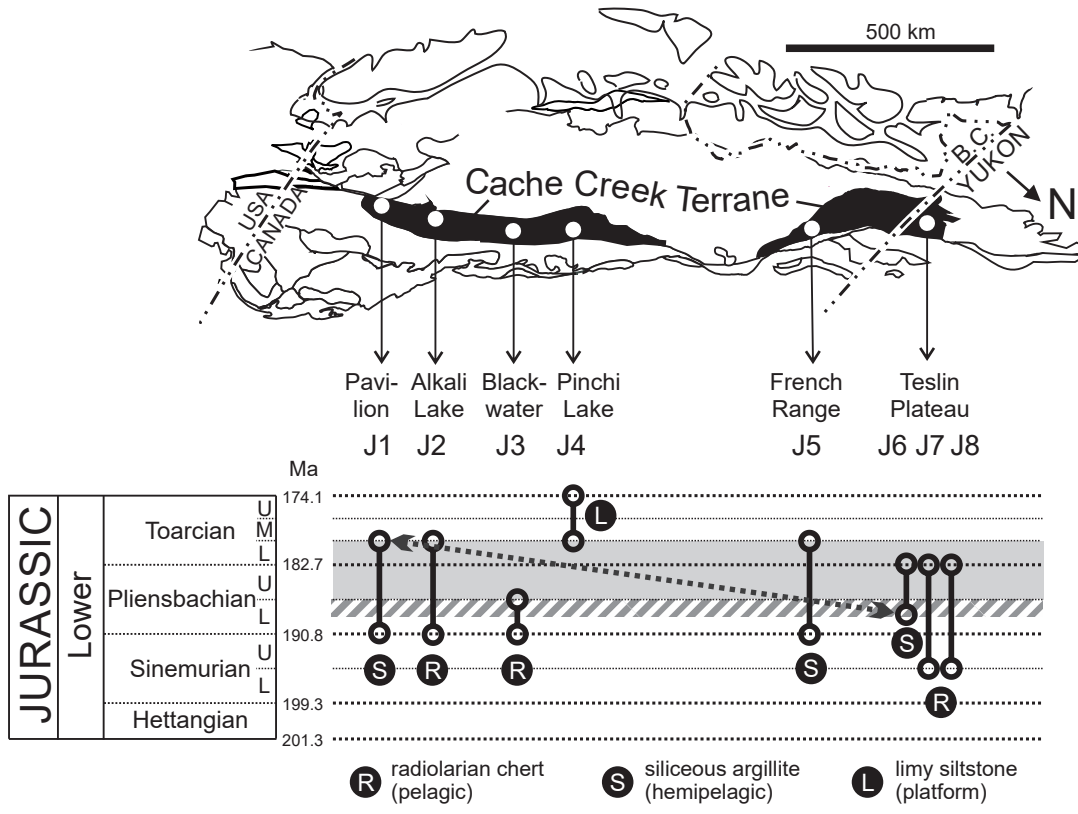


Figure 8