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Abstract

Herein, we report an euselachian assemblage from the late Campanian Bearpaw Formation recovered from southern Alberta, Canada. This small yet uniquely diverse fauna includes the northern-most occurrences of *Paraorthacodus andersoni*, *Squalus worlandensis*, *Odontaspis aculeatus*, and *Archaeotriakis ornatus* within the Western Interior Seaway. It also constitutes the first record of *P. andersoni*, *S. worlandensis*, and *A. ornatus* from Canadian deposits. Moreover, we report the stratigraphically youngest record of *Cretoxyrhina mantelli*. This assemblage is unique in that all the identifiable euselachian species are either pelagic or benthopelagic but not benthic. This is in stark contrast to the batoid-rich euselachian assemblage of the Lethbridge Coal Zone that immediately underlies the Bearpaw Formation in southern Alberta. We attribute this difference to dysoxic bottom waters during the deposition of the formation, rather than to sampling bias.

Introduction

Late Cretaceous (100–66 Ma) North America was divided in two land masses by the Western Interior Seaway (WIS), a large intercontinental sea that extended from the Arctic Ocean to the Gulf of Mexico (e.g., Kauffman 1984). The Bearpaw Formation was deposited in the late Campanian to early Maastrichtian during the last major transgression event of this seaway (Caldwell 1968; Kauffman 1984; Caldwell et al. 1993). This formation outcrops in the Canadian provinces of Alberta and Saskatchewan and has produced well-preserved marine reptile remains including elasmosaurid and polycotylid plesiosaurs (e.g., Sato 2003, 2005; Kubo et al. 2012) and three subfamilies of mosasaurs (e.g., Tokaryk 1993; Holmes 1996; Holmes et al. 1999; Bullard 2006; Konishi 2012; Konishi et al. 2011, 2014). However, very little is known about euselachian diversity from the Bearpaw Formation in this relatively high-palaeolatitudinal region of the WIS (Beavan and Russell 1999). Previously, Mahaney et al. (2013) reported probable shark coprolites from the Bearpaw Formation of Saskatchewan and Konishi et al. (2014), in their description of the marine reptile *Mosasaurus missouriensis* from the same formation of Alberta, noted the likely scavenging of the carcass by lamniform selachians.

Recently, an upper Campanian euselachian assemblage was collected from five microsites from the Bearpaw Formation exposed in the vicinity of Dorothy, southern Alberta, Canada. The fossil remains, consisting largely of isolated teeth, represent one of the most northern euselachian faunas within the Campanian Western Interior Basin. The purpose of this research is to identify the euselachian taxa and assist in habitat reconstruction of this portion of the seaway. Additionally, a faunal comparison with contemporaneous euselachian assemblages from well-documented sites in lower

palaeolatitudinal regions within the seaway provides insights into palaeobiogeographical patterns of the identified taxa.

Geology

During the deposition of the Bearpaw Formation, southern Alberta would have been situated within an embayment along the western margin of the WIS and west of a submarine topographic high known as the Sweetgrass Arch (Tsujita and Westermann 1998). The formation overlies the non-marine to marginal-marine Dinosaur Park Formation and underlies the marginal-marine Blood Reserve, Horseshoe Canyon and Eastend formations (Tsujita and Westermann 1998, and references therein) and consists of marine sands and silty clays intercalated with bentonite layers (Mahaney et al. 2013, and references therein; pers. observ.) (Fig. 1).

Materials and methods

All the fossil material was recovered within the 1.25 km linear distance along the south side of the Red Deer River in Dorothy, Alberta, Canada (51°16' 29"N, 112°19'43"W to 51°15' 57"N, 112°19'5"W). Most of the specimens were collected in situ from five microvertebrate sites concentrated within a 150 m diameter (DSnail, MSnail-1–3, and Tsnail; specific UTM coordinates available in the Royal Tyrrell Museum of Palaeontology collections database). Fossils from those microsites were first collected through dry, bulk sampling of the matrix on site, approximately 100kg in total mass, which was then screen washed with micro-sieving (No. 20/0.841 mm mesh) at the museum. TMP 2011.048.274 and TMP 2011.048.291 were surface collected

approximately 560m and 1240m SE from MSnail-1 respectively, MSnail-1 constituting the northernmost collection site. All the specimens including the surface-collected material were recovered from just below the top of the Dorothy Bentonite dated at 73.2 Ma, and are middle late Campanian in age (Konishi 2012, and references therein). All the specimens are curated at the Royal Tyrrell Museum of Palaeontology, Drumheller, Alberta. An S-570 Hitachi Scanning Electron Microscope was used to image the specimens. Dental terminology and euselachian taxonomy largely follows that of Cappetta (2012).

Systematic Palaeontology

Class Chondrichthyes Huxley, 1880

Subclass Elasmobranchii Bonaparte, 1838

Cohort Euselachii Hay, 1902

Order Hybodontiformes Maisey, 1975

Family Hybodontidae Owen, 1846

Genus *Meristodonoides* Underwood and Cumbaa, 2010

Meristodonoides montanensis (Case, 1978)

Fig. 2A and B

Referred material: TMP 2011.048.0232, incomplete tooth (MSnail-1 microsite); TMP 2011.048.0325, incomplete tooth (MSnail-1 microsite).

Description: Teeth with an erect median cusp with very strong convex labial and lingual crown faces. Distinct striations are restricted to the lower one-third on both faces. TMP 2011.048.0232A preserves a single incomplete lateral cusplet. A well-developed cutting

edge runs continuous from the apex to the base of the crown. The root is highly fractured in both specimens.

Remarks: Case (1978) originally described *Hybodus montanensis* from the late Campanian Judith River Formation of Montana and was subsequently reported from the late Campanian Teapot Member of the Mesaverde Formation of Wyoming (Case 1987) and the Lethbridge Coal Zone of the Dinosaur Park Formation of Alberta (Beavan and Russell 1999). Differences in overall tooth morphology with *Hybodus* s.s. Agassiz, 1837 led Underwood and Cumbaa (2010) to reassign several species previously reported as *Hybodus*, including *H. montanensis*, to *Meristodonoides*. To date, this species has only been reported from the WIS.

Order Hexanchiformes Buen, 1926

Family Paraorthacodontidae Glikman, 1958

Genus *Paraorthacodus* Glikman, 1957

Paraorthacodus andersoni (Case, 1978)

Fig. 2C

Referred material: TMP 2011.048.0097 (DSnail microsite), incomplete lateral tooth.

Description: Tooth with a median cusp that is slightly distally inclined. The labial crown face is very slightly convex, whereas the lingual face is strongly convex. Both faces bear well-developed striations that are restricted to the lower half of the cusp. Only a single distal lateral cusplet is preserved and also bears distinct striations. The cutting edge runs continuously the median cusp and lateral cusplet. The labial root face is more or less flat and is not overhung by the labial crown face. Multiple nutrient grooves are present along

the basal edge and are restricted to the labial region of the basal face. The lingual root face is expanded labiolingually and bears two distinct grooves containing two large foramina just below the crown-root boundary. In addition, smaller foramina are scattered throughout this root face.

Remarks: This is only the second report of *Paraorthocodus andersoni* from the WIS and the first documented occurrence from Canada. Case (1978) originally described this species from the Judith River Formation of Montana. Teeth from a second *Paraorthocodus* species described as *P. striatus* by Case (1978) from the same formation were revealed to be posterior teeth of *P. andersoni* by Siverson (1992a). As such, only a single *Paraorthocodus* species is currently known to have inhabited the waters of the WIS.

Order Squaliformes Goodrich, 1909

Family Squalidae Bonaparte, 1834

Genus *Squalus* Linnaeus, 1758

Squalus worlandensis (Case, 1987)

Fig. 2D–G

Referred material: TMP 2011.048.0196, nearly complete lateral tooth (TSnail microsite); TMP 2011.048.0323, complete lateral tooth (TSnail microsite); TMP 2011.048.0269, incomplete lateral tooth (MSnail-1); TMP 2011.048.0324, incomplete lateral tooth (MSnail-1).

Description: Lateral teeth are labiolingually compressed and possess a broad median cusp that is strongly distally inclined. Both labial and lingual crown faces are smooth. The

mesial cutting edge is convex or sigmoid in contour, whereas the distal edge is strictly convex. A well-developed convex distal heel is separated from the median cusp by a notch. The elongated labial apron extends below the lobate basal edge of the root. The lingual crown face bears a distinct uvula that is continuous with the lingual bulge of the root. A large central foramen and multiple labial and lingual marginal foramina are present.

Remarks: Case (1987) originally described *Centrophoroides worlandensis* from the late Campanian Teapot Member of the Mesaverde Formation of Wyoming. This species was subsequently reassigned to *Squalus* by Case and Cappetta (1997). The teeth reported herein are the only second documented occurrence in WIS, as well as the first record of this genus from Cretaceous deposits of Canada, and greatly extends the palaeobiogeographical range of this species.

The presence of *Squalus* is relatively rare within the WIS. The species *S. huntensis*, reported from the Maastrichtian Kemp Formation of Texas (Case and Cappetta 1997), can be distinguished from *S. wolandensis* by the considerably smaller median cusp. The Palaeocene species *S. minor*, from the Cannonball Formation of North Dakota (Cvancara and Hoganson 1993), has a less distinct notch between the median cusp and the distal heel. This latter species has a relatively large palaeobiogeographical range also being reported along the East Coast of North America (Ward and Weist 1990; Case 1996) and Europe and northern Africa (Daimeries 1888; Gurr 1962; Casier 1967; Herman 1973).

Order Lamniformes Berg, 1958

Family Odontaspididae Müller and Henle, 1839

Genus *Carcharias* Rafinesque, 1810

Carcharias cf. *C. samhammeri* (Cappetta and Case, 1975)

Fig. 3A–D

Referred material: TMP 2011.048.0291, incomplete lower anterior tooth (surface collected); TMP 2011.048.0156, incomplete upper anterior tooth (MSnail-3 microsite); TMP 2011.048.0187, incomplete upper lateral tooth (TSnail microsite); TMP 2011.048.0228, incomplete posterior tooth (MSnail-1 microsite).

Description: Anterior teeth have a median cusp that is very slightly distally inclined. The labial crown face is slightly convex and overhangs the labial root face. The lingual crown face is strongly convex. Both crown faces are smooth. TMP 2011.048.0291 has a distinct cutting edge that runs continuously from the apex to a pair of small lateral cusplets. The lateral cusplets of TMP 2011.048.0156 have been fractured and are missing. The lingual neck is present. The lingual protuberance is well-developed and has a prominent nutrient groove that houses a single central foramen. The distal root lobe is elongated and somewhat labiolingually compressed, whereas the mesial root lobe is missing. The basal concavity is deep.

Lateral tooth exhibits a large distally inclined median cusp. The smooth labial crown face is slightly convex, whereas the smooth lingual face is strongly convex. A marked notch separates the median cusp from the single preserved distal lateral cusplet. A distinct cutting edge runs continuously across the crown. The lingual neck is well-developed. The lingual protuberance has a prominent nutrient groove. The distal root lobe

is slightly labiolingually compressed and has a rounded edge. The mesial root lobe is missing. The basal concavity is shallower than that of the anterior tooth.

A tooth that would have been situated in the posterior region of the jaw has a median cusp that is considerably reduced in size and a labial root face that is greater in height than that of the labial crown face.

Remarks: Compagno and Follet (1986, p. 89, 90) noted that the anterior teeth of extant *Carcharias* have “stout and broad-tipped” median cusps that are flanked by “short and strongly hooked” lateral cusplets, whereas the lateral teeth are “compressed and blade-like” and the teeth situated near the jaw commissure are “strongly differentiated as carinate, molariform crushers”. The *Carcharias* dentition described herein largely follows this general morphology.

Cappetta and Case (1975) originally described *Carcharias samhammeri* (as *Odontaspis samhammeri*) from the early Maastrichtian Mount Laurel Formation of New Jersey. Kent (1994) and Hartstein et al. (1999) also reported *C. samhammeri* from the late Maastrichtian Severn Formation of the Chesapeake Bay region. Potential reports of this species from the WIS include the late Maastrichtian Fox Hills Formation of South Dakota (Becker et al. 2004, as *Carcharias* cf. *C. samhammeri*) and Kemp Formation of Texas (Case and Cappetta 1997, as *Carcharis* cf. *samhammeri*).

Previous reports of *Carcharias* from the Campanian of Alberta include *C. steineri* (Case, 1987) from the underlying Lethbridge Coal Zone of the Dinosaur Park Formation (Beavan and Russell, 1999). This species, originally described by Case (1987) as *Odontaspis steineri* from the late Campanian Mesaverde Formation of Wyoming, has well-developed enameloid folding along the basal region of the labial crown face. The

relatively smooth crowns of the teeth figured by Beavan and Russell (1999, fig 3.9–3.12) from the Dinosaur Park Formation appears to be more akin to that of *C. samhammeri* than to that of *C. steineri*.

Genus *Odontaspis* Agassiz, 1838

Odontaspis aculeatus (Cappetta and Case, 1975)

Fig. 3E–H

Referred material: TMP 2011.048.0215, incomplete anterior tooth (MSnail-1 microsite); TMP 2011.048.0221, incomplete lower lateral tooth (MSnail-1 microsite); TMP 2011.048.0217, incomplete upper lateral tooth (MSnail-1 microsite); TMP 2011.048.0222, incomplete upper lateral tooth (MSnail-1 microsite).

Description: Anterior tooth has a slender and erect median cusp. The slightly convex labial face has a basal edge that overhangs the labial root face. The lingual face is strongly convex. Both crown faces are smooth. The cutting edge does not reach the base of the median cusp. Flanking the median cusp are two pairs of lateral cusplets; however only the mesial cusplets are preserved. The apex of proximal cusplet is missing. The distal cusplet is considerably smaller and is curved towards the median cusp. A distinct lingual neck is present. The lingual protuberance has a well-developed nutrient groove. A series of relatively large foramina are located below the labial basal edge of the crown, whereas numerous smaller foramina are found throughout the lingual root face. The majority of the root lobes are missing.

Lateral teeth have a median cusp that becomes increasingly more distally inclined moving towards the jaw commissure and is considerably reduced in the posterior-most

files. The labial crown is slightly convex, whereas the lingual face is strongly convex. The median cusp may be flanked by up to three pairs of lateral cusplets. The most proximal pair of cusplets is relatively robust and extends one-third the height of the median cusp. The basal region of the labial crown face bears short enameloid folding. The cutting edge is interrupted between the median cusp and lateral cusplets. A distinct lingual neck is present. The lingual protuberance has a well-developed nutrient groove. The labial root face bears a series of large foramina below the labial basal edge, whereas the lingual face has numerous smaller foramina. The basal concavity separates the root lobes.

Remarks: Compagno and Follet (1986, p. 90) noted that the anterior teeth of extant *Odontaspis* have “slender and narrow-tipped” median cusps and lateral cusplets that are “long and straight or weakly curved”, whereas the lateral dentition are not compressed and the teeth situated near the jaw commissure are “not differentiated as molariform crushers”. This describes the overall morphology of the *Odontaspis* dentition reported herein.

Odontaspis aculeatus was originally described by Cappetta and Case (1975, as *Hypotodus aculeatus*) from late Campanian Mount Laurel Formation of New Jersey. Within WIS deposits, this species has been reported from the Maastrichtian Kemp Formation of Texas (Case and Cappetta 1997), Arkadelphia Formation of Arkansas (Becker et al. 2006), and Fox Hills Formation of South Dakota (Becker et al. 2004). Case (1978, p. 190) erected *Odontaspis grandis* (as *Hypotodus grandis*) from the late Campanian Judith River Formation of Montana and distinguished this species from *O. aculeatus* based on a larger size and differences in “lateral cusp shape” of the former. In

their report of latter species from the Dinosaur Park Formation, Beavan and Russell (1999, p. 499) noted that their examination of the *O. grandis* topotype material did not warrant new species designation; however, they went on to compare the species *Carcharias sanguieni* and *O. grandis* and noted that differences in tooth morphology “clearly separates them as two distinct taxa”. We have not examined the *O. grandis* type material, thus we conservatively assign these teeth to *O. aculeatus* at this time.

Family Cretoxyrhinidae Glikman, 1958

Genus *Cretoxyrhina* Glikman, 1958

Cretoxyrhina mantelli (Agassiz, 1843)

Fig. 3I

Referred material: TMP 2011.048.0274, nearly complete lateral tooth (surface collected).

Description: Lateral tooth with a single large labiolingually compressed median cusp that is distally inclined. The apex of the cusp is missing. The labial crown face is more or less flat, whereas the lingual face is convex. Both crown faces are smooth. A mesial cutting edge is weakly sigmoid, whereas the distal edge is concave. There is a very weak distal notch between the cusp and a low and oblique distal heel. A lingual neck is present. The lingual protuberance lacks a nutrient groove. The mesial root lobe is slightly elongated and separated from its distal lobe by a shallow basal concavity.

Remarks: Comparing the overall size of TMP 2011.048.0274 with that of multiple *Cretoxyrhina mantelli* teeth described and figured by Siverson and Lindgren (2005, fig.2), it is apparent that the Bearpaw specimen represents a lateral tooth of a juvenile. Siverson and Lindgren (2005) also noted the latest occurrence of species from the WIS

was early Campanian; whereas the last report of this species from northern Europe was slightly younger. Siverson (1992b) described a single tooth from the lower-most upper Campanian of Sweden but cautiously stated the possibility of reworking due to its poor preservation. Although the root of TMP 2011.048.0274 does indicate some erosion, the crown shows very little signs of wear. Consequently, the Bearpaw specimen may represent the youngest documented occurrence of *C. mantelli*. However, since only a single tooth was recovered, we cautiously suggest a stratigraphic extension for this species.

Order Carcharhiniformes Compagno, 1973

Family Triakidae Gray, 1851

Genus *Archaeotriakis* Case, 1978

Archaeotriakis ornatus (Case, 1987)

Fig. 3J

Referred material: TMP 2011.048.0237, incomplete tooth (MSnail-1 microsite).

Description: Small tooth with a broad triangular median cusp that is flanked by well-developed and divergent lateral cusplets. One lateral cusplet bears an incipient cusplet at the base. The labial crown face slightly overhangs the labial root face near the crown-root boundary. The labial face of the median cusp bears three distinct enameloid folds found on the central region of the cusp. The lingual face of the median cusp has numerous folds that are restricted to the base. The holaulacorhizous root has an expanded base face and has a central and margino-lingual foramen.

Remarks: This is second documented report of *Archaeotriakis ornatus* to date and extends its palaeobiogeographical range to the north. Case (1987) originally described this species from the Teapot Member of the Mesaverde Formation of Wyoming. Along with this species, Case (1987) also reported the congeneric *A. rochelleae* which was first reported from the Judith River Formation of Montana (Case 1978) and can be largely differentiated from *A. ornatus* by its smooth lingual crown face and labial crown face that does not overhang the root.

Discussion

This relatively small pelagic or benthopelagic Bearpaw assemblage includes seven species from five orders, six families, and seven genera and represents a slight temporal extension for *Cretoxyrhina mantelli* and a northerly palaeobiogeographical extension for *Meristodonoides montanensis*, *Paraorthacodus andersoni*, *Squalus worlandensis*, and *Archaeotriakis ornatus*. This range extension follows a similar northern expansion of subtropical invertebrate biotas, “reaching central Canada” during the transgressive Bearpaw Cyclothem (Kauffman 1984, p. 297).

The euselachian assemblage reported by Beavan and Russell (1999) from the Lethbridge Coal Zone of the Dinosaur Park Formation underlies the Bearpaw Formation. As such, a faunal comparison between the two assemblages provides insight into changes in regional euselachian composition over a relatively short geological span of time. Of the ten species reported from the Dinosaur Park Formation, only three species (*Meristodonoides montanensis*, *Odontaspis aculeatus*, and *Carcharias samhammeri*) are present in the assemblage described herein.

Noticeably absent from the Bearpaw assemblage are benthic euselachians. If we follow Musick et al. (2004, p. 38) and assume that “fossil forms had ecological attributes similar to closely related modern taxa”, the recovered species from the assemblage were likely either pelagic or benthopelagic. Conversely, Beavan and Russell (1999) reported numerous benthic species from the Dinosaur Park Formation, including the orectolid *Cretorectolobus olsoni* and the batoids *Ischyrrhiza mira*, *Ptychotrygon blainense*, *Protoplatyrhina renae*, and *Myledaphus bipartitus*. Teeth of the latter two species were by far the most frequently recovered fossil elements in the Lethbridge Coal Zone, thus the conspicuous lack of batoid specimens in the Bearpaw assemblage is likely palaeoecological in nature and not the result of sampling bias.

In their examination of ammonoid depth zonation, Tsujita and Westermann (1998, p. 157) reported that the “bottom-waters were of normal salinity and generally dysoxic” in the southern Alberta region of the WIS during the deposition of the Bearpaw Formation. This may have been the result of the Sweetgrass Arch (a submarine topographic high) that “inhibited the exchange of bottom-waters between the restricted Alberta Basin and the open seaway (to the southeast) during times of improved oxygenation in the seaway” (Tsujita and Westermann 1998, p. 153). The location of the euselachian assemblage described herein would have been situated west of this arch. Accordingly, the apparent absence of benthic euselachians corroborates the notion of adverse bottom waters in this region of the seaway during this time.

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Figure captions

Figure 1. Specimen locality and horizon. A, map of southern Alberta showing the Bearpaw Formation exposures in grey. Black star indicates the locality along the Red Deer River near Dorothy, east of Drumheller. Inset map represents the late Campanian North America, showing the new locality (solid arrow) within the embayment along the western margin of the Western Interior Seaway. B, stratigraphic column along with a locality photo, indicating approximate horizon the euselachian material was collected from. Dry, bulk sampling was done near the top of the 10-m-thick Dorothy Bentonite. Abbreviations used in figures: D.B., Dorothy bentonite; D.P., Dinosaur Park Formation; D.S., Dorothy sandstone; H.C., Horseshoe Canyon Formation. Geological map and

locality photo modified from Konishi (2012:fig. 1), late Campanian paleogeography from Tsujita and Westermann (1998), and stratigraphic column modified from Lerbekmo (2002:fig. 2). A person for scale in the locality photo.

Figure 2. Hybodontiform, hexanchiform, and squaliform teeth recovered from the late Campanian Bearpaw Formation of southern Alberta. **A.** *Meristodonoides montanensis* (Case, 1978), TMP 2011.048.0232 (incomplete tooth); **B.** *M. montanensis*, TMP 2011.048.0325 (incomplete tooth); **C.** *Paraorthacodus andersoni* (Case, 1978), TMP 2011.048.0097 (incomplete lateral tooth); **D.** *Squalus worlandensis* (Case, 1987), TMP 2011.048.0196 (nearly complete lateral tooth); **E.** *S. worlandensis*, TMP 2011.048.0323 (complete lateral tooth); **F.** *S. worlandensis*, TMP 2011.048.0269 (incomplete lateral tooth); **G.** *S. worlandensis*, TMP 2011.048.0324 (incomplete lateral tooth). Views: labial (left) and lingual (right) for A, B, C, E, and G; labial (top) and lingual (bottom) for D and F. Scale bars = 1 mm.

Figure 3. Lamniform and carcharhiniform teeth recovered from the late Campanian Bearpaw Formation of southern Alberta. **A.** *Carcharias* cf. *C. samhammeri* (Cappetta and Case, 1975), TMP 2011.048.0291 (incomplete lower anterior tooth); **B.** *Carcharias* cf. *C. samhammeri*, TMP 2011.048.0156 (incomplete upper anterior tooth); **C.** *Carcharias* cf. *C. samhammeri*, TMP 2011.048.0187 (incomplete upper lateral tooth); **D.** *Carcharias* cf. *C. samhammeri*, TMP 2011.048.0228 (incomplete posterior tooth); **E.** *Odontaspis aculeatus* (Cappetta and Case, 1975), TMP 2011.048.0221 (incomplete anterior tooth); **F.** *O. aculeatus*, TMP 2011.048.0215 (incomplete lower lateral tooth); **G.** *O. aculeatus*,

TMP 2011.048.0222 (incomplete upper lateral tooth); **H.** *O. aculeatus*, TMP 2011.048.0217 (incomplete upper lateral tooth); **I.** *Cretoxyrhina mantelli* (Agassiz, 1843), TMP 2011.048.0274 (incomplete lateral tooth); **J.** *Archaeotriakis ornatus* (Case, 1987), TMP 2011.048.0237 (incomplete tooth). Views: labial (left) and lingual (right) for A, B, D, E, F, G, and H; labial (left), profile (center), lingual (right) for I; labial (top) and lingual (bottom) for D and J. Scale bars = 1 mm.

Draft

Figure 1

117x75mm (300 x 300 DPI)

Figure 2

220x266mm (300 x 300 DPI)

Figure 3

236x305mm (300 x 300 DPI)

Supplementary Data

Number of specimens recovered from microsites and surface collection of the Bearpaw Formation in Dorothy, Alberta, Canada

Taxa	DSnail	MSnail-1	MSnail-2	MSnail-3	TSnail	Surface Collected
<i>Meristodonoides montanensis</i>	1	2	-	-	-	-
<i>Paraorthacodus andersoni</i>	1	-	-	-	1	-
<i>Squalus worlandensis</i>	-	4		-	2	-
<i>Carcharias</i> cf. <i>C. samhammeri</i>	4	3	-	1	1	3
<i>Odontaspis aculeatus</i>	1	7	-	-	1	-
<i>Cretoxyrhina mantelli</i>	-	-	-	-	-	1
<i>Archaeotriakis ornatus</i>	-	1	-	-	-	-
Lamniform indet. (highly incomplete)	40	58	5	2	10	21