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REMARKS ON THE FOSSIL TURTLES ACCREDITED TO
THE JUDITH RIVER FORMATION.¹

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In my paper entitled *The Stratigraphic Relations and Paleontology of the 'Hell Creek beds,' 'Ceratops beds' and their equivalents, and their reference to the Fort Union Formation,*² I made, among others, the following statements regarding the turtles of the Judith River formation: "It has recently been confidently asserted on eminent authority that the turtles of the 'Ceratops beds' are very closely related to those of the Judith River formation; in fact that several species are identical, and others so close as to be separated with difficulty. Fortunately the work of Hatcher, published as late as 1905, has left us with a very complete annotated list of the Judith River forms, which makes a valuable basis of comparison of the two faunas. It needs, however, but a cursory examination to show that at least half of the species listed as belonging to the Judith River do not belong to this fauna at all, but come from the Fort Union, Arapahoe, etc., or are so fragmentary as to be unidentifiable. . . . Any comparison of the turtles of the Judith River formation with those of the 'Ceratops beds' as tending to support the Cretaceous age of the latter, does not make a very impressive case."

¹ Published with the permission of the Director of the United States Geological Survey.

² Wash. Acad. Sci., Proc., vol. xi, 1909, pp. 235, 236.

Proc. Wash. Acad. Sci., August, 1911.

Lack of space at that time precluded the full presentation of the data on which the above statements were based. Inasmuch as this mild remonstrance does not appear to have attracted attention, and since the turtles are still being used to "prove" close relationship between the Judith River and Lance ("Ceratops beds") formations, it seems opportune to set forth the facts as they are. In a paper³ just published Dr. O. P. Hay writes as follows: "My study of the fossil turtles indicates that the species of these animals rarely pass from one epoch to another. If they have ever done so they passed from the Judith River into the Lance Creek epoch. There are five or six species of Judith River turtles which are represented in the Lance Creek and Hell Creek beds by turtles of identical or very closely related species."

In the following pages it is proposed first to take up the species of turtles mentioned by Hatcher⁴ as belonging to the Judith River formation, and to indicate the type locality for each species as well as its subsequent distribution so far as this is a matter of published record. Later in this paper the species enumerated by Doctor Hay will be similarly treated, and finally some remarks will be presented on the results of this showing.

TURTLES OF THE JUDITH RIVER FORMATION ENUMERATED BY HATCHER.

1. *Trionyx foveatus* Leidy [*Aspideretes foveatus* (Leidy) Hay].

Type locality: "Bad Lands of the Judith River, Nebraska Territory." Fragments collected by Doctor Hayden and named and described by Doctor Leidy in 1856⁵. Subsequently Leidy figured two of the type specimens, together with another specimen, identified doubtfully as the same species, from Long Lake below old Fort Clark on the Missouri River, North Dakota, the latter belonging to the Lance formation. On this point Hatcher says: "Considering the difference in the age of these deposits, it is quite

³ Where do the Lance Creek ("Ceratops") Beds belong, in the Cretaceous or in the Tertiary? Indiana Acad. Sci., Proc., 1909 (issued Oct. 1910), p. 21 (of reprint).

⁴ U. S. Geol. Surv., Bull. 257, 1905, pp. 72-80.

⁵ Acad. Nat. Sci., Phila., Proc., vol. viii, 1856, p. 73.

probable that had better material been at the disposal of Doctor Leidy he would have found them to be at least specifically distinct." Specimens identified by Cope as *Trionyx foveatus* were collected by Sternberg in the Judith River area in 1876; it does not appear to have been found by Stanton and Hatcher when they visited the area in 1905. This species was reported by Marsh from the "Ceratops beds" near Denver, Colorado, but according to Hay these specimens "belong probably to *Aspideretes beecheri*" a species from the Lance formation of Converse County, Wyoming. *Trionyx foveatus* has also been identified by Lambe from the Belly River beds of the Red Deer River region in Canada, and by Barnum Brown in the "Hell Creek beds" (= Lance formation) of Montana.

From this review it appears possible that there are two and quite likely three species confused under the name of *Trionyx foveatus*, and hence any conclusion as to which part of the "species" belongs to the Judith River, and which to the Lance formation, must be a matter of more or less doubt.

2. *Trionyx vagans* Cope [*Aspideretes? vagans* (Cope) Hay].

Type locality: Bijou Basin (Bijou Creek), 40 miles east of Denver, Colorado, in beds regarded by Cross as probably Arapahoe in age. It was also reported by Cope from near the mouth of the Bighorn River, Montana, and near Long Lake, North Dakota, both localities in beds belonging in all probability to the Lance formation. Apparently on the basis of Lambe's reporting it from the Belly River beds of the Red Deer River in Canada, it was included by Hatcher in his list of Judith River species, though Hatcher himself points out the obvious distinctness between the type specimens and the specimens so identified by Lambe. Hay has referred Lambe's specimens to another species, and hence all pretense of *Trionyx vagans* as a Judith River species disappears.

3. *Plastomenus coalescens* Cope. [*Aspideretes coalescens* (Cope) Hay].

Type locality: "Bad Lands south of Woody Mountain, latitude 49°," longitude about 106°, Assiniboia, Canada.

Much confusion has arisen concerning this species, which can only be eliminated by a review of all the earlier references to it in the literature of the subject. It was first mentioned but without description in a list published by Cope in 1875,⁶ and was fully described later in the same year in an obscure paper published as an appendix to Dawson's Report on the Geology and Resources of the Region in the vicinity of the Forty-ninth Parallel, etc.⁷ Still later in 1875 this description was copied word for word, but without reference to either of the two preceding places of publication in Cope's *Vertebrata of the Cretaceous Formations of the West*.⁸ In the Report where it was first described the locality was given as The Bad Lands south of Woody Mountain, latitude 49°, a locality confirmed by Dawson in his description of the geology of the region.⁹ Dawson also mentions other vertebrate remains with which it was found associated, as well as several species of plants, and refers the beds to the "Lignite Tertiary," and in the latest published geological map of Canada,¹⁰ the area is still colored as "Laramie," which in the writer's opinion is the approximate equivalent of the Fort Union of the United States.

The confusion dates from the moment when Cope transferred the original description to his "*Vertebrata of the Cretaceous Formations of the West*," where as regards the locality he says: "This species is found near the Milk River in British America," where it was "collected by George M. Dawson near Woody Mount." As a matter of fact Woody Mountain (or Woody Mount) is *more than 150 miles east* of the valley of Milk River where it crosses the international boundary, and there is not the slightest evidence that it came from Milk River. But because it was supposed by subsequent writers that Woody Mountain was in the Milk River Valley, it was assumed that the age must be Judith River! Thus Hatcher,¹¹ who was apparently in ignorance of the original place of publication says: "This species is founded on fragments

⁶ Acad. Nat. Sci., Phila., Proc., 1875, p. 9.

⁷ Brit. N. A. Bound. Com., Montreal, 1875. Appendix B, p. 337.

⁸ Rept. U. S. Geol. Surv. Terr., vol. 2, 1875, p. 92.

⁹ Brit. N. A. Bound. Com., Montreal, 1875, p. 105.

¹⁰ Western Sheet, 1901.

¹¹ U. S. Geol. Surv., Bull. 257, p. 74.

collected by George M. Dawson near Milk River in Canada, from beds referred by Cope to the 'Transition series, probably the Fort Union or Lignite epoch,' but now known to belong to the Judith River." This error is also perpetuated by Hay in his Fossil Turtles of North America,¹² who, although obviously familiar with the original place of publication, still gives the locality as "in the basin of Milk River, south of Wood Mountain, Assiniboia, British Columbia."

The above exposition would seem effectively to dispose of the claim for Judith River age of the type material of *Plastomenus coalescens*, though it might possibly be considered to figure as a Judith River species if Doctor Hay's reference to it of a specimen identified by Lambe as *Trionyx vagans* is of valid standing. That is to say Lambe collected a large, finely preserved specimen, which he identified as Cope's *Trionyx vagans*, in the Belly River deposits in the region of the Red Deer River, below Berry Creek, in Alberta. Concerning this Doctor Hay says:¹³ "The present writer, regarding Cope's type of *Trionyx vagans* as too small and imperfect a fragment for satisfactory comparison with materials from any region, except the type locality in Eastern Colorado, is compelled to seek for some more probable disposition of Mr. Lambe's fine specimen. Since the plastron of Cope's *Plastomenus coalescens* indicates a large trionychid which lived in approximately the same region and in the same geological period, it appears to be best to refer the Red Deer River carapace to the same species." It appears, then, that the study of these specimens themselves is not sufficient to determine whether Lambe's specimen is really referable to Cope's species, so the burden is placed on stratigraphy!

4. *Plastomenus costatus* Cope.

Type locality: "Bad Lands south of Woody Mountain, latitude 49°."

This species was found in the same locality and horizon as the last; and the same confusion and compounding of error has resulted. Simply because Woody Mountain was supposed to be in the valley

¹² 1908, p. 489.

¹³ Op. cit., p. 489.

of Milk River it followed that the age must be Judith River! Upon this assumption alone rests the claim.

This species has been found by Barnum Brown in the Lance formation ("Hell Creek beds") 12 miles south of the Missouri River, on Hell Creek, Montana. This locality is about 100 miles directly south of the type locality in Canada.

5. *Plastomenus punctulatus* Cope.

Type locality: Bijou Creek, 40 miles east of Denver, Colorado, in beds that are of Arapahoe age according to Whitman Cross. Cope also states that he had the same species from beds at Long Lake, "Nebraska" (now North Dakota), the age of which is Lance formation.

Hatcher's reason for including this species in the Judith River fauna is interesting. He quotes¹⁴ Cope's statement, evidently from his *Vertebrata of the Cretaceous Formations of the West*, to the effect that it was "found in association with the preceding species," which, in this book happens to be *Plastomenus costatus*, but in the place where *P. punctulatus* was originally described,¹⁵ the "preceding species" happens to be *Trionyx vagans*, the status of which has already been considered above. As the original description was transcribed without change from the Annual Report into the Monograph the error arose as stated above and as has been pointed out by Doctor Hay. *Plastomenus punctulatus* can, therefore, lay no claim to having been found in the Judith River.

6. *Plastomenus insignis* Cope.

Type locality: Bijou Creek, 40 miles east of Denver, Colorado.

This species was introduced into the Judith River fauna by Hatcher¹⁶ who, consulting Cope's *Vertebrata* only, and ignoring the original place of publication, concludes that by "inference" it came from south of Woody Mountain, and if from this locality it was assumed, as in the cases of the several species above considered, that

¹⁴ U. S. Geol. Surv., Bull. 257, p. 74.

¹⁵ U. S. Geol. and Geogr. Surv. Terr., Ann. Rept., 1873 (1874), p. 453.

¹⁶ U. S. Geol. Surv., Bull. 257, p. 75.

it must be of Judith River age. It is clear enough when the original description is consulted that this species came only from Bijou Creek, Colorado, and this is confirmed by Doctor Hay who has examined the type now in the American Museum of Natural History and finds it labeled in Cope's handwriting as "*Plastomenus insignis*. 10-9-1873, Colorado." It is therefore to be excluded from the Judith River fauna, but not for the reasons given by Hatcher.

7. *Adocus lineolatus* Cope.

Type locality: Bijou Creek, 40 miles east of Denver, Colorado, in beds believed to be Arapahoe in age. Also reported by Cope from the mouth of the Bighorn River, Montana, and it appears in his list of Judith River vertebrates, though according to Hatcher this last reference is probably "due to an oversight." Fragments that have been identified as this species have been found by Lambe in Belly River beds of Red Deer River, Alberta, by Barnum Brown in the Lance formation on Hell Creek, Montana, and by others in the "Ceratops beds" (Lance formation) of Converse County, Wyoming. Hatcher has expressed as his opinion¹⁷ that the reference of Lambe's specimens "may be incorrect" and Doctor Hay¹⁸ says: "It is the writer's opinion that it is unsafe to identify as belonging to *Adocus lineolatus* specimens from the Judith River and Laramie beds before far better materials of the species have been collected from the type locality." He adds: "It is improbable that the same species continued from the Judith River epoch to the Arapahoe epoch," which latter, be it remembered, is the probable age of the type material.

8. *Basilemys ogmius* (Cope). *Basilemys variolosa* (Cope).

Type locality: "From six miles west of the first branch of Milk River, near latitude 49°," in the province of Alberta, British America. Because this locality is in the vicinity of Milk River it has been assumed by Hatcher and others that the age must be Judith River,

¹⁷ U. S. Geol. Surv., Bull. 257, p. 76.

¹⁸ Fossil Turtles of North America, p. 248.

but a careful reading of Dawson's account¹⁹ of the geology of the place where he actually obtained the specimens shows that in all reasonable probability it should be referred to the "Ceratops beds," that is the Lance formation. Dawson considered the beds as "belonging probably to the base of the Lignite Tertiary," and compares them to the beds south of Woody Mountain, adding: "The bones, in the manner of their preservation, much resemble division β of the Bad Lands south of Woody Mountain, which these beds may possibly represent." The lithology is described as similar in the two areas, and associated with the remains of the turtles Dawson reports finding many bones of dinosaurs, and large *Unio* shells. In any event it seems unsafe to refer these beds to the Judith River merely on geographical position and without corroborative data.

The type specimens of *Basilemys ogmius* are said to be very poor, and Doctor Hay states that: "It is doubtful whether new materials could be identified by means of the type." However this may be, this species has been combined with *Basilemys variolosa* (Cope), which has as its type locality "Bad Lands of the Judith, Montana," and was described a year or more later. Material that has been identified as *Basilemys* (or *Adocus*) *variolosa* has been mentioned by Lambe from the Belly River beds of Red Deer River, Alberta, and by Hatcher in the Judith River formation of Montana. It seems not improbable that there may be two species represented, but in any event it would appear that the undoubted Judith River material has been that identified with "*B. variolosa*," whereas the *B. ogmius*, being very poor, has not been certainly recognized.

The conclusion reached is that that part of the "species" named "*B. ogmius*" came from beds that are not certainly of Judith River age, and has not been subsequently recognized, while the part known as "*B. variolosa*" came from beds of Judith River age, and is the only part of the "species" that has been distinguished by later authors.

9. *Basilemys imbricarius* (Cope).

Type locality: Judith River Basin, Montana, in beds of the Judith River formation; it has not been found elsewhere. It was founded on very unsatisfactory materials, according to Doctor Hay.

¹⁹ Brit. N. A. Boundary Com., 1875, p. 130 *et seq.*

10. *Polythorax missouriensis* Cope.

Type locality: Judith River Basin, Montana, in beds of the Judith River formation. It has not been reported from any other locality or horizon.

11. *Baëna antiqua* Lambe.

Type locality: Red Deer River, Alberta, British America, in beds supposed to be of Belly River age; it has not been obtained elsewhere.

12. *Baëna hatcheri* Hay.

Type locality: South side of Lance Creek, opposite mouth of Dogie Creek, Converse County, Wyoming, in beds of the Lance formation ("Ceratops beds").

A specimen from the Belly River beds of the Red Deer River, Alberta, was referred to this species by Lambe,²⁰ and it was upon this ground that it was included by Hatcher²¹ in the Judith River fauna. Later, however, Doctor Hay²² referred Lambe's specimen to a totally different genus and species (*Boremys pulchra*), and hence *Baëna hatcheri* is to be eliminated from the Judith River fauna.

13. *Neurankylus eximius* Lambe.

Type locality: Red Deer River, Alberta, British America, in beds regarded as of Belly River age; it is monotypic and has not been collected elsewhere.

There is one naïve bit of history connected with this genus that should not be omitted. Doctor Hay in his Fossil Turtles of North America (p. 93) remarks as follows: "Mr. Lambe placed the genus provisionally among the Chelydridae, but as no genera of this family are known from deposits older than the Tertiary and as the type has some resemblance to the Baënidae, which flourish at that time, it seems better to refer *Neurankylus* to this family until more is known about it."

²⁰ Cont. Canadian Pal., vol. 3, 1902, pt. ii, p. 43.

²¹ U. S. Geol. Surv., Bull. 257, p. 79.

²² Fossil Turtles of North America, 1908, p. 92.

TURTLES MENTIONED BY HAY AS TENDING TO SHOW IDENTITY
OR CLOSE SIMILARITY BETWEEN SPECIES OF THE JUDITH
RIVER AND LANCE FORMATIONS.

Following is the list of six species given by Doctor Hay²³ and of which he says: "I shall take pains to give some details."

1. *Compsemys obscura* (Leidy).

Type locality: Near Long Lake, on the Missouri River below Fort Clark, North Dakota, in beds regarded as belonging to the Lance formation. It has otherwise been collected only in beds of the Lance formation ("Hell Creek beds") on Hell Creek, Montana.

This species was included by Cope²⁴ in his list of Judith River vertebrates, but without giving any evidence in support of such reference, and presumably on the authority of Cope's list it is included by Osborn²⁵ in his list showing the "distribution of the land and fresh-water Cretaceous vertebrates in the west," as occurring in Montana and hence "by inference" in the Judith River fauna. *Compsemys obscura* as well as its companion species, *C. victa*, was excluded from the Judith River fauna by Hatcher, who says, "In no descriptions of either of these species can I find any suggestion that remains of either have been described from Montana." That *C. obscura* is properly excluded from the Judith River is shown by Doctor Hay, who says,²⁶ "This species is included by Cope in his list of Judith River fossils, but the writer knows of no specimens that confirm the statement." Curiously enough, however, this species is the first one given by Doctor Hay²⁷ as occurring in both Judith River and Lance formations!

2. *Compsemys victa* Leidy.

Type locality: Long Lake, on the Missouri River below Fort Clark, North Dakota, in beds regarded as belonging to the Lance formation, that is the same locality and formation as the last.

²³ Proc. Indiana Acad. Sci., 1909, p. (of reprint) 21.

²⁴ U. S. Geol. and Geogr. Surv. Terr., Bull. vol. 3, 187, p. 573.

²⁵ Cont. Canadian Paleont., vol. 3, 1902, pt. ii, p. 12.

²⁶ Fossil Turtles of North America, 1908, p. 236.

²⁷ Proc. Indiana Acad. Sci., 1909, p. (of reprint) 21.

The history of this species is much the same as that of the last, except that specimens identified under this name have a somewhat wider distribution. It was included by Cope in his list of Judith River vertebrates, but, as stated under the last species, was excluded from this fauna by Hatcher. It is accepted by Doctor Hay²⁸ as of Judith River age on the ground that it was found in the region about Milk River, Alberta. This occurrence in the "Milk River region" is traceable to Dawson's Report on the Geology and Resources in the Vicinity of the Forty-ninth Parallel, but, as in the case of *Plastomenus coalescens*, a reading of the geological part of the report shows that it came from south of Woody Mountain, and 150 miles east of the Valley of Milk River, in beds of "Lignite Tertiary" age.

This species was reported by Cope from supposed Arapahoe deposits east of Denver, Colorado, and is said to be "very common in the Lance Creek beds," of Converse County, Wyoming. It was also found by Brown in the Lance formation ("Hell Creek beds") on Hell Creek, Montana, and an allied but undescribed species is reported by Doctor Hay from the Fort Union.

From this brief exposition it is clear that *Compsemys victa* must be excluded from the Judith River fauna, and the only horizons in which it is authenticated are Arapahoe and Lance formations. In the treatment of this species in his Fossil Turtles of North America (p. 234), Doctor Hay opines that there is so much difference in age between Judith River, Arapahoe and Denver, and Lance formations that it is "not improbable" that three species are represented instead of one. Again would the responsibility be shifted from paleontology to stratigraphy!

3. *Aspideretes foveatus* (Leidy) Hay.

The status of this species has been already considered under its synonym, *Trionyx foveatus*, ante, p. 52.

4. *Aspideretes beecheri* Hay.

Type locality: East side of Lance Creek, Converse County, Wyoming, in beds belonging to the Lance formation. Two cara-

²⁸ Fossil Turtles of North America, p. 234.

paces from the Judith River of Fish Creek, Montana, have been referred to this species by Doctor Hay, who makes the following statement concerning them: "No characters are observed which serve to distinguish these carapaces from that of the type of *A. beecheri*. It is not improbable, however, that they belong to a distinct species."

5. *Adocus lineolatus* Cope.

The status of this species has been considered, ante, p. 57.

6. *Basilemys variolosa* (Cope).

This has already been considered at length under its synonym *Basilemys ogmius*, p. 57.

DISCUSSION OF EVIDENCE REGARDING "JUDITH RIVER" TURTLES AS BROUGHT OUT IN THE FOREGOING REVIEW.

On combining the lists given by Hatcher and Hay it appears that sixteen species of turtles have been accredited to the Judith River formation. Of these sixteen species it has been demonstrated that only three species have the type specimens from the original Judith River area in Montana, while two additional species have the types from the Belly River (= Judith River?) of the Red Deer River region of Alberta. The three species from Montana are the following:

Trionyx foveatus

Basilemys imbricarius

Polythorax missouriensis

The two Canadian species are:

Baëna antiqua

Neurankylus eximius

Of the remaining species four, as follows, have the types described from Bijou Creek, Colorado, in beds supposed to be of Arapahoe age:

Trionyx vagans

Plastomenus punctulatus

Plastomenu sinsignis

Adocus lineolatus

The types of two species came from south of Woody Mountain, Assiniboia, in beds referred to the "Lignite Tertiary" by Dawson, Cope, and others, but are now considered to belong to the Lance formation. They are:

Plastomenus coalescens

Plastomenus costatus

From Long Lake, North Dakota, in beds of the Lance formation, the following types are supplied:

Compsemys obscura

Compsemys victa

The types of two species were obtained from the Lance formation of Converse County, Wyoming:

Baëna hatcheri

Aspideretes beecheri

The remaining species is *Basilemys ogmius* which as already shown is of mixed position. Strictly speaking the type came from near Milk River, Alberta, in beds that are probably younger than the Judith River, while *B. variolosa*, the "species" with which it has been combined, came from the Judith River formation near Judith River, Montana.

A further analysis of the evidence adduced indicates that the following species should be excluded from the Judith River fauna on the sufficient ground that they do not occur in beds of this age:

Trionyx vagans

Plastomenus costatus

Plastomenus punctulatus

Plastomenus insignis

Baëna hatcheri

Compsemys obscura

Compsemys victa

To return again to the five species having their type locality in Judith River and Belly River beds, it appears that the four following have never been found outside the Judith River or Belly River horizons.

Basilemys imbricarius

Polythorax missouriensis

Baëna antiqua

Neurankylus eximius

The fifth species—*Trionyx foveatus*—is the only one that appears to be distributed into higher beds, but it will be recalled on referring to the discussion of this species on page 53, that, while it has been reported from Long Lake, North Dakota, Hell Creek, Montana, and near Denver, Colorado, both Hatcher and Hay have expressed the opinion that there may be two and possibly three species confused under this name, each being confined to one of the three horizons involved.

The following forms, although having their types from beds higher than the Judith River formation (Arapahoe, Lance formation etc.), appear on more or less questionable evidence to have ranged downward into the Judith River:

Plastomenus coalescens (?)

Adocus lineolatus (?)

Aspideretes beecheri (?)

The reasons why these are regarded as questionably present in the Judith River formation are set forth in the discussions of these species in the preceding pages. Not a single one has a clear title.

CONCLUSIONS.

1. The Judith River fauna has had accredited to it by Hatcher and Hay at least sixteen species of fossil turtles.
2. Of these sixteen species seven are to be excluded on the sufficient ground that they do not occur in beds of Judith River age.
3. Of the nine remaining species that may have a more or less valid claim to membership in the Judith River fauna, five have their type localities in beds of Judith River and Belly River age, and four in horizons above that of the Judith River.
4. Of the five typically Judith River species, four are absolutely confined to these beds, while the remaining one which has an alleged higher range, is shown to be probably a composite species possibly including three species which correspond respectively to the three horizons involved.
5. Of the four species, the types of which came from post-Judith River beds, and which are claimed to range downward into the Judith River, not a single one enjoys a clear title to be so regarded.

6. It is plain, then, that the comparisons that have been made between "Judith River" turtles and those of higher horizons (Lance formation, "Laramie," "Ceratops beds," "Hell Creek beds," "somber beds," etc.), have not been made with species that really belong to the Judith River fauna, but with forms that actually belong to these higher beds. It is not to be wondered at that such a comparison has resulted in showing "identity" and "striking similarity," since it is in accord with the ancient axiom, that "Things equal to the same thing are equal to each other."

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