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**DESCRIPTIONS OF SOME VERTEBRATE REMAINS FROM THE FORT UNION  
BEDS OF MONTANA.**

BY E. D. COPE.

*Aublysodon lateralis*, sp. nov.

Established on some teeth, one of which is of the size of those of the *A. horridus*, and which differ in some important particulars. The posterior crenate ridge is as in that species, lateral in position, separating a posterior face from the lateral at a right angle. The posterior face is separated from that of the other side by a very obtuse angle. The anterior aspect of the crown is without crenate cutting edge, but the latter is present as a border to the front, passing along the front of the side opposite to that which bears the posterior angle. It is directed laterally, and projects beyond an open groove which follows its posterior base. The base of the crown is broad elliptic in section. Enamel smooth.

A much smaller tooth was found with the preceding, and presented similar characters, excepting that the posterior face is not so strongly truncate.

<i>Measurements.</i>		M.
Length of crown preserved	. . . . .	.025
Diameter of base of crown	{ long . . . . .	.018
	{ short . . . . .	.010
Width of posterior face	. . . . .	.006
Length of smaller crown	. . . . .	.011
Long diameter of base of do.	. . . . .	.006

The apices of both crowns are considerably worn by use. Both were found by Charles H. Sternberg of my exploring party.

*Laelaps incrassatus*, sp. nov.

Represented by two teeth, a larger and a smaller, which were found near each other, but not sufficiently so as to warrant the belief that they pertain to the same individual.

The characteristic feature of these teeth is, that the transverse diameter of the base of the crown exceeds its anteroposterior, a point in which it differs from all the other carnivorous dinosaurs yet known from the formation. Nevertheless, the posterior cutting edge is median, and is denticulated. The anterior cutting edge, which is also denticulated, is nearly median at the apex, but

continues along one side of the widening anterior face to the base of the crown. The posterior cutting edge is nearly straight, while the anterior is rather abruptly curved at the apex.

The anterior and posterior edges are not lateral in position as in *Aublysodon lateralis*.

	<i>Measurements.</i>	<i>M.</i>	
		No. 1.	No. 2.
Length of crown . . . . .		.025	.014
Diameter at base {	anteroposterior . . . . .	.012	.006
	transverse . . . . .	.0135	.008

A large species. Discovered by Jno. C. Isaac.

*Laelaps explanatus*, sp. nov.

An abundant species, but as yet represented only by teeth which are about the size of those of the largest of living *Varanidæ*.

The crowns are strongly compressed and curved; one side is flat, the other gently convex; the posterior cutting edge is median and concave. The anterior edge is not continued to the base of the crown, and disappears before attaining the apex; it is feebly denticulate, and only at its convex curvature towards the apex; its course is median. The flat face has a slight bevel to the posterior edge. Surface smooth, without transverse undulations.

	<i>Measurements.</i>	<i>M.</i>
Length of crown . . . . .		.0110
Diameter crown at base {	anteroposterior . . . . .	.0066
	transverse . . . . .	.0028

*Laelaps falculus*, sp. nov.

Represented by several teeth of about half the size of those of the last described reptile. They differ in form in several respects, being relatively shorter and stouter, and less sectorial in character. The lateral surfaces are about equally convex, while the anterior face is narrowly obtuse, and without cutting edge. The posterior edge is concave and furnished with a serration of smaller denticles than in the *L. explanatus*; it is median in position.

	<i>Measurements.</i>	<i>M.</i>
Length of crown . . . . .		.0090
Diameter of base of crown {	anteroposterior . . . . .	.0056
	transverse . . . . .	.0040

Found by Jno. C. Isaac.

*Dysganus encaustus*, Gen. et sp. nov.

*Char. Gen.*—A large number of teeth exhibit the characters of this genus, which is a peculiar form of herbivorous *Dinosauria*. The crowns are compressed, so that the fore and aft diameter much exceeds the transverse. The body of the crown is a flattened shaft of dentine, one face of which is the denser, and produces the cutting edge. This face is flat or weakly keeled, while there are two other faces uniting at an open angle, thus giving a subtriangular section. On each of these faces is adherent a shaft of cementum-like material of a dense character, whose external face is longitudinally concave. These inclose between them on the median line a deep groove, which expands below into a wide concavity, which appears to be enlarged as the age of the tooth increases preparatory to shedding. The other parts of the base of the crown below the cutting face, are inclosed in a rather thick deposit of rugose cementum, which rises a distance on the sides of the tooth.

The method of replacement of the teeth in this genus appears to resemble that of *Cionodon*, except that there is no indication of the existence of as many series in the transverse direction. The longitudinal grooves in the anterior and posterior cement columns are probably occupied by the borders of the apices of successional teeth. The presence of these columns, etc, distinguishes this genus from that and other allied genera.

*Char. Specif.*—The cutting face is more or less concave, and is impressed or sunken, its lateral borders, and the cement of the basis, projecting beyond it. The inferior border is also usually oblique, that of one of the sides rising diagonally. In the same proportion, a weak keel is also unsymmetrically placed, lying close to the opposite border, and dividing the face into a wide and a narrow concavity. The oblique border is also incurved, the edge of the posterior cement column curving round the cutting face of the dentine. The latter is delicately rugose in unworn specimens. The external basal cementum rises highest on the incurved border of the crown; its surface is minutely rugose, the rugosity being generally punctiform. It is also of a different color from the dentine in the specimens as preserved, and is occasionally found nearly worn away. The edge of unworn teeth is not serrate.

<i>Measurements.</i>		<i>M.</i>
Length of basis of tooth . . . . .		.012
Diameter of crown {	anteroposterior . . . . .	.009
	transverse . . . . .	.004
Transverse diameter below crown . . . . .		.008

The teeth are rather smaller than those of *Hadrosaurus foulkei*, The borders present no indication of the crenation seen in that and other species, either in worn or unworn specimens.

*Dysganus haydenianus*, nov. sp.

Represented by a number of teeth found in such relation that they are supposed to belong to two individuals.

They differ materially in form from those of the *D. encaustus*, and exceed any of them in size.

The base of the tooth possesses the thick investment of rough cementum, and has a slope away from the base of the crown. The form of the crown is peculiar in possessing a lateral face placed at a strong angle to the usual face, and separated from it by a strong protuberant angular ridge. This angular cutting face would resemble that of the *Diclonii* were it not that the body of dentine of which it is composed is a flat plate instead of a triangular segment of a subquadrate prism. Each face has a separate plate, which is separated from the other by a suture. A solid mass fills the angle between them, which is divided by a groove produced by the pressure of the angle of the face of the succeeding tooth which fits it. The wider of the "front" faces is divided by a low longitudinal ridge. Both of the faces are bounded by an external incurved ridge which cause them to have a concave surface.

A tooth of a size equal to that of the one just described was found with it, has a form more nearly like that of *D. encaustus*, in the less degree of prominence of the lateral angle. It displays but a single posterior cementum-like mass, which presents considerable lateral faces as well as a posterior one, as in the first described tooth.

<i>Measurements.</i>		<i>M.</i>
Length of base of crown . . . . .		.010
Elevation of remaining part of crown . . . . .		.006
Diameter of crown {	anteroposterior . . . . .	.015
	transverse, total . . . . .	.010
	"    dentine . . . . .	.004

Dedicated to Doctor F. V. Hayden, U. S. Geologist.



*Diclonius pentagonus*, Gen. et sp. nov.

*Char. Gen.*—Herbivorous dinosaurians, in which the teeth are elongate and without distinct root, and present dense material only on one side of the crown (the "front"), whose section produces a cutting edge. The other face of the tooth (the "back") is coated with cementum, and is absorbed during the protrusion of the successional tooth from below, which thus rises from "behind." In the anteroposterior direction the teeth are protruded alternately, and the lower parts of the crowns are contracted to give space for the apices of the adjacent young teeth. In the type of the genus there is but a single series of teeth.

In the known species of this genus, the dense face ("front") of the crown presents a longitudinal keel, but this is not necessarily a generic character. The terms "front" and "back" are not intended to be accurate, as the faces so termed are either external or internal, the direction being probably reversed in the two jaws.

This genus is allied to *Hadrosaurus* and *Cionodon*. From the former it differs in the mode of succession of the teeth, which, as determined by Prof. Leidy in that genus, is from the "front" of the base of the tooth, whereas, in *Diclonius*, the succession is as in *Cionodon*, from the "posterior" base of the tooth. This arrangement allows of a more continuous use of the dense face than in *Hadrosaurus*, where that face terminates as the young crown rises into functional position. A species from the Fort Union bad lands of the Judith River was described by Dr. Leidy as *Trachodon mirabilis*. Specimens of this species from the locality furnishing those of *Diclonius*, present the mode of succession ascribed by that author to *Hadrosaurus*, to which genus he afterwards referred the species under the name of *H. mirabilis*.

The dentition of species of this genus shows that but one tooth in mature functional use existed in a line transverse to the axis of the jaw at one time, and that alternating with these, one partially protruded crown, and one stump of a crown, present masticating surfaces in transverse relation. The formula for this genus should then be written 2—1, while in *Cionodon* it is 3—3—2.

The type of this genus exhibits a mode of nutrition of the young teeth similar to that seen in the genus *Saurocephalus* among fishes. The bone is perforated by a series of foramina, each of which conveyed an artery directly into the base of the growing crown.

*Char. specif.*—The front of the crown is divided longitudinally by a prominent median keel and the borders are not serrate. The keel is only moderately prominent at the lower part of the crown. The back of the crown is divided into three faces by two straight longitudinal parallel solid angles, and the crown is contracted near the base by the lateral bevels for the adjacent growing teeth. All these faces are covered by cementum, whose roughness is granular in character. The external surface of the jaw-bone has precisely the same character, so that the apices of the teeth only appear as prominences of its border.

The typical specimen is that of an individual of moderate dimensions; measurements of a tooth of a gigantic individual are given below.

<i>Measurements.</i>	M.
Length of a series of five teeth . . . . .	.023
Protrusion of crown of largest tooth . . . . .	.006
Diameter " " " " . . . . .	.006
Length of crown above lateral apical facets of larger animal	.013
Diameter of crown at same point { antero-posterior . . . . .	.011
{ transverse . . . . .	.009
Width of median face of "back" . . . . .	.005

*Diclonius perangulatus*, sp. nov.

This abundant species of herbivorous dinosaur has left its shed teeth in many localities of the Fort Union horizon, in company with those of the *Trachodon mirabilis*, *Palæoscincus costatus*, and other large reptiles. Teeth with complete apices are rare. The marked character of the species is seen in the prominence of the median angular ridge which divides equally the cutting face of the crown from apex to base. The prominence increases downwards so that the transverse diameter becomes greater than the antero-posterior, in some cases being diamond-shaped in the transverse direction. Its position is symmetrical, or nearly so. The lateral borders are smooth, one specimen displaying a faint trace of crenation near the apex. There is no shank or root in any of the teeth preserved, and the basis is excavated on the side away from the cutting edge for the apex of the successional tooth. A band of roughened cementum extends round the base, and is continued upwards on each side opposite the cutting face. This side presents three faces, a narrow median, and two wider lateral. The latter are slightly concave, and are probably adapted to the apices

of the successional teeth; the former is often slightly concave, and is the seat of most rapid attrition. The lateral facets disappear at a distance below the apex, where the non-cutting side is strongly convex, and covered with a coarsely rugose cementum; the rugosity including pits.

<i>Measurements.</i>		m.
Length of a shed tooth . . . . .		.011
Diameter of crown {	antéro-posterior . . . . .	.010
	transverse . . . . .	.012
Width of facet for successional crown . . . . .		.006
Width of posterior facet . . . . .		.005
Width of cutting face of another near apex . . . . .		.008
Antero-posterior diameter of do. at do. . . . .		.010

The prominence of the median angle with other points distinguishes this species from the *Cionodon arctatus*. The size is larger than that of the known specimens of that species, equaling that of the largest of the order. (See Report of U. S. Geological Surv. Terrs. II., 4to, for description of genus *Cionodon*.)

Specimens of this species have been referred by Dr. Leidy to his *Trachodon mirabilis*.

**Diclonius calamarius, sp. nov.**

This species, as represented by teeth, is the smallest of the genus, but the adult size is a point, however, not easily determined among extinct reptiles. The teeth are slender, and the front has parallel borders and a median keel. The borders are entire, and, in two of the crowns, twisted slightly round the long axis of the tooth. The keel is thus twisted also, and towards the base, when it becomes quite low, is nearer one border than the other. The back of the tooth displays two lateral facets, separated by a narrow median facet. The former have a thin, delicately rugose, cement investment, with a minute rugosity; the latter is smooth in the specimens, apparently from friction. The characters of this saurian readily distinguish it from its congeners.

<i>Measurements.</i>		m.
Length of portion of crown . . . . .		.012
Diameter of crown {	antéro-posterior . . . . .	.004
	transverse . . . . .	.004

**Monoclonius crassus, Gen. et sp. nov.**

*Char. Gen.*—Teeth with obliquely truncate face and distinct root, which is grooved for the successional tooth on the front.

No external cementum layer, caudal vertebræ biconcave, and brim narrow. Fore limbs large and massive.

The teeth of this genus resemble those of *Hadrosaurus*, and like them, are replaced from the "front," an arrangement which precludes the possibility of more than one series of teeth being in functional use at one time. The robust fore limbs and elongate ilium distinguish *Diclonius* from *Hadrosaurus*. From *Trachodon* it differs in the absence of the rough cementum layer on the back of the tooth.

*Char. Specif.*—The faces of the teeth are acuminate oval in form, and are divided by an elevated keel, which is median above, but turns to one side at the base. Margin crenate, the grooves extending more or less on the convex "back," which is otherwise smooth.

Sacrum with ten vertebræ, the last centrum much compressed, the diapophyses extending horizontally from the neural arch above, and connected by a vertical lamina with the iliac supports; length 27.33 inches. The bones of the limbs are robust, the hinder the longer, but not so much so as in some other genera. Length of femur 22 inches; width, proximally, 7.4 inches; distally 6 inches. Length of tibia 20 inches; greatest diameter, proximally, 8 inches; distally 7.25 inches. The three anterior dorsal vertebræ are co-ossified, and the first exhibits a deep cup for articulation with the preceding vertebra. The episternum is a T-shaped bone, thin and keeled on the median line below. Length of transverse portion 21 inches.

*Paronychodon lacustris*, Gen. et sp. nov.

*Char. Gen.*—The teeth which characterize this genus have the general character of those of *Plesiosaurus*, *Elasmosaurus*, etc. The crowns are subconic, and the enamel is thrown into longitudinal plicæ. The special characters of the genus are seen in the form of the crown, one side of which is convex, and the other side plane, so that the section instead of being circular is semicircular. It is also strongly curved in the direction of its plane face.

*Char. Specif.*—Both anterior and posterior edges are curved, and are not acute nor denticulate. There are four plicæ on the flat face, only two of which approach the apex. There are six keels on the convex face, all of which approach the apex. All the carinæ are rather obtuse, and the enamel is otherwise smooth. The apex is very acute.

		<i>Measurements.</i>	M.
Length of tooth	. . . . .		.0130
Diameter at base	{ antero-posterior . . . . .		.0040
		{ transverse . . . . .	.0024
Length of crown	. . . . .		.0100

It is probable that portions of skeleton of this reptile are in my possession, but the means of positive identification are yet wanting.

*Compsemys imbricarius*, sp. nov.

This species, like the others of the genus, has the scutal sutures well defined, and the superficial surface of the carapace sculptured. The character of this sculpture distinguishes the species, and in the present instance in a special manner. It consists, in the *C. imbricarius*, of excavations bounded on the sides by a short ridge each, which alternate with each other. Thus each bounding ridge terminates abruptly at the fundus of one of the fossæ, while the other end of the fossa rises and contracts to another ridge. The result is precisely that seen in the interior sculpture of Sarcenic domes or niches, and is one which is quite unique among tortoises. The direction of the ridges is at right angles to the costal dermal sutures. This species was about as large as the snapping tortoise (*Chelydra serpentina*).

		<i>Measurements.</i>	M.
Thickness of a costal bone	. . . . .		.0050
Three fossæ measure	{ lengthwise . . . . .		.0065
		{ crosswise . . . . .	.0050

*Compsemys variolosus*, sp. nov.

One of the most abundant, and the largest species of the Fort Union beds. The carapace is convex and the plastron flat; the marginal bones are heavy and strongly convex on the inferior side. The margin of the plastron is thickened and heavy, characters which also belong to all parts of the carapace. The sutures of the dermal scuta are deeply impressed, and the surface of the bone is strongly sculptured above and below, and even on the superior face of the thickened margins of the free lobes of the plastron. The sculpture consists of round fossæ, which are deeply impressed and are arranged quincuncially, so that their borders never form straight lines. The latter are also more or less angulate on the edge, so that the surface has a more than usually rugose character.

The typical specimen equals those of the large land tortoises of the Eocene in dimensions.'

Discovered by C. H. Sternberg.

*Polythorax missouriensis*, Gen. et sp. nov.

*Char. Gen.*—Plastron with contracted fixed lobes and wide bridge; carapace with well-developed marginal bones; mandibular ramus narrow; alveolar face with acute external margin; the symphysis neither produced nor recurved. Dermal scuta everywhere distinct, those of the plastron the usual ones, with the addition of the two marginal intergulars, and two large interhumeral. The latter scuta are separated from the humerals by sutures running parallel with the humeral margin of the anterior lobe between the gular and pectoral scuta.

In the possession of interhumeral scuta, *Polythorax* differs from any known genus of *Testudinata*. The general structure is much like that of *Adocus* and *Baëna*, with nearer resemblance to the latter in its double intergular scuta. It is impossible to ascertain whether there are intersternal bones, as the plastron is coössified throughout. The presence or absence of intermarginal scuta cannot yet be determined, although it is clear, that if existing, their position is quite external.

This genus is interesting as connecting in its stratigraphical position allied types of Cretaceous No. 5 (*Adocus*), with those of the Wahsatch and Bridger Eocenes (*Baëna*).

*Char. Specif.*—Carapace with openly dentate posterior border. The surface is irregularly swollen, especially on the median line near the margins of the vertebral scuta. The vertebral scuta are wide, the costals short, and the marginals narrow. The anterior lobe of the plastron is a little shorter and more contracted than the posterior; its base is narrower than the antero-posterior extent of the bridge. Its extremity is rounded, while that of the posterior lobe is truncate with rounded angles. The gular and intergular scuta are each wider than long, while the interhumeral are much longer than wide. The humerals are narrow while the pectorals are wide from the anterior position of the pectoro-humeral suture. Each anal scutum is longer than wide.

The surface of the plastron is obsoletely but coarsely rugose; the roughness greatest anteriorly, where it consists of short raised lines irregularly disposed.

	<i>Measurements.</i>	M.
Length of plastron . . . . .		.183
Length of anterior lobe . . . . .		.049
Length of bridge . . . . .		.076
Width of bridge . . . . .		.076
Width of extremity of posterior lobe . . . . .		.035
Thickness at inguinal region . . . . .		.010

**Hedronchus sternbergii**, Gen. et sp. nov.

*Char. Gen.*—The bone on which this genus reposes has the appearance of the crown of a young tooth. Its central cavity is large and expands to the margin of the basis; its apex is unworn. It appears to be too protuberant for the position of a dermal tubercle. It may be distinguished as a short crown on a shorter slightly constricted portion or neck. The crown culminates in three crests, which together form a letter T, and which descend towards the neck. There is no investment of enamel or cement, and the material of which it is composed resembles dense bone.

*Char. Specif.*—The faces on each side of the stem of the T, are concave and divided by an oblique crest, which descends from the common apex. The other face is gently convex, and the inferior part of each of its bounding crests projects ear-like. The base is an oval.

	<i>Measurements.</i>	M.
Elevation of crown . . . . .		.006
Diameter of base {	longitudinal . . . . .	.005
	transverse . . . . .	.004

Discovered by Charles H. Sternberg.

**Ceratodus eruciferus**, sp. nov.

A basal lamina separable from the dentigerous lamina. The latter supports ribs which diverge from a single marginal rib which extends along one side. The marginal rib is separated by a deep groove from the radiating ribs, which is continuous with the grooves between the latter. The ribs are of irregular diameter and not perfectly straight; they are interrupted by weak transverse ridges which project beyond the margins. The ridges rises abruptly from their common base and are separated distally by notches of the margin.

<i>Measurements.</i>	M.
Long diameter of dental surface . . . . .	.011
Short diameter of dental surface . . . . .	.007
Thickness of plate . . . . .	.003

There are six ridges in the length.

*Ceratodus hieroglyphus*, sp. nov.

This species is materially different from the last, and was more abundant, judging from the occurrence of its remains.

The dentigerous plate is thin and dense, and has the appearance of a short toothed comb with a handle. The tooth-like points are the extremities of low ridges, which are arranged nearly at right angles to a wide longitudinal elevated half of the osseous base. They are separated by shallow grooves from each other, and are not continuous with the basis just mentioned, which rises abruptly above them. They are smooth. The "handle" above alluded to is triangular in section having two bevels on the side supporting the tooth ridges. The lower face of the bone is smooth.

<i>Measurements.</i>	M.
Total length . . . . .	.013
Length of dentigerous portion . . . . .	.010
Total width . . . . .	.0045
Width of dentigerous portion . . . . .	.0020

There are thirteen teeth in the length.

*Myledaphus bipartitus*, Gen. et sp. nov.

*Char. Gen.*—Crowns of the teeth molar in character, truncate, wider than long, standing table-like on the root. The latter partaking of the shape of the crown, short, straight, split equally and at right angles to the greatest diameter of the tooth. The crowns form a pavement having a regularly hexagonal outline. Their composition is different in the halves on each side of a line which divides the crown equally, running in the long direction. On one side the dentine is striate at right angles to the long diameter; the structure is not distinguishable by the hand lens on the opposite side of the line.

The affinities of this genus cannot now be stated, but the form of the root recalls the *Elosmobranchii*, and that of the crown, some of the rays.

*Char. Specif.*—The staining on opposite sides of the line that divides the crown, is different, on the one paler than on the other.

