NEW SPECIES OF CRETACEOUS INVERTEBRATES FROM NORTHERN COLORADO.

By Junius Henderson,

Curator of the Museum of the University of Colorado, Boulder

In working over collections of fossils recently made in northern Colorado by expeditions from the University of Colorado several species were found which are new to science. The types have been presented to the United States National Museum, and they are hereinafter described. The *Acanthoceras* is frequently found in a fragmentary condition at Left Hand Creek, a few miles north of Boulder, in the thin limestone bands which uniformly occur in the upper part of the Fort Benton shales along the base of the eastern Colorado foothills. The others came from the sandstone of Fossil Ridge, between Loveland and Fort Collins, which appears to be a continuation of the Hygiene sandstone described by Doctor Fenneman, occupying a position at about the base of the middle third of the Fort Pierre shales. The fauna of this sandstone is highly interesting. It includes about fifty species, quite a number of which have been reported from no other locality. Though the sandstone is so far down in the Pierre, a large proportion of the species are found also in the Fox Hills sandstones either in Colorado or in the upper Missouri and Yellowstone regions. A paper discussing this sandstone and its fauna has just been published.[a]

ACANTHOCERAS COLORADOENSIS, new species.

Plate XIII, figs. 10, 11.

Shell discoidal; whorls convex, oblong in cross-section, their height greater than width; umbilicus well defined, about equal to the greater diameter of the outer whorl; abdomen rounded, ornamented by two rows of sharp, longitudinally compressed nodes, each about midway between the medial line and the peripheral margin; each side of whorls ornamented by two other sets of nodes, one at the margin of the umbilicus, the other near the abdomen; nodes of all four sets connected by costæ which nearly encircle the whorls, some curving slightly but mostly passing somewhat forward in a straight diagonal

[a] University of Colorado Studies, V, pp. 179–192.

line as they pass from the umbilicus to the abdomen, the greater axes of the lateral nodes being parallel with the costæ, while the greater axes of the abdominal nodes are at right angles to the costæ; costæ about as strong in proportion to size of whorl on the smallest whorl found exposed as on the largest whorls and the nodes develop at an early stage; septa can not be figured from the specimens at hand; diameter of the type specimen 89 mm., outer whorl 31 mm. high and 14 mm. wide between the nodes, some fragments being larger than this.

The type now in the U. S. National Museum (Cat. No. 30877) and quite a number of more fragmentary specimens in the University of Colorado were found by Prof. D. W. Spangler, of Longmont, Colorado, and the writer, 10 miles north of Boulder in one of the limestone bands of the upper Fort Benton shales, associated with *Inoceramus labiatus* and other Benton species.

VOLUTODERMA ? CLATWORTHYI, new species.

Plate XIII, figs. 1, 2.

Shell of medium size, spindle-shaped; spire elevated, less than aperture in length above the complete last whorl; whorls about seven, convex, the inner casts of the upper ones roundly so, the lower ones somewhat flattened above and below the peripheral nodes; suture distinct but not deep in the shell, though very deep in the internal cast; last whorl and next one above it have a broad, shallow sulcus just below the suture, due in part to the prominence of the row of nodes below, but not entirely so, as shown by the general flattening of that part of the inner cast; surface rough, ornamented by thirty or more strong, rounded, nearly equal revolving ribs, crossed by about fourteen strong, rather irregular, doubly-curved vertical costæ, which develop into elongated nodes as they pass over the periphery, revolving and vertical costæ both becoming nearly obsolete above the nodes on the type-specimen and a smaller one, but on a fragment of a larger specimen which probably belongs to this species there are weaker and more crowded revolving ribs above the nodes and a tendency toward the intercalation of additional ribs below the nodes; inner casts of the three lower whorls have protuberances corresponding to the nodes, but none corresponding to the revolving ribs; aperture elongated, widest above the middle; length of type specimen about 65 mm., greatest breadth 27 mm. In general form (which, however, is variable in the genus), the cancellated sculpture of intersecting costæ developing into nodes at their intersections, the unglazed surface, the rather thick shell, conspicuous lines of growth and nearly straight pillar, this species shows its close relationship to the genus *Rostellites* Conrad as defined by Doctor

Dall. The same author has since shown that name to be preoccupied, and has accepted Gabb's later name for the genus. In the only specimen of the present species yet found which preserves the beak the columellar plaits can not be detected, after cutting into the aperture as far as possible without risking the destruction of the specimen. The protoconch is also unknown. Therefore its assignment to this genus is tentative, though there is but little doubt about it. Among American species of *Volutoderma*, variously described as *Volutilithes*, *Rostellites*, *Scobinella*, *Fulguraria*, and *Volutoderma*, in general outline it agrees most nearly with *V. willistonii* Logan from the Benton group of Kansas, but not in the shape of the whorls. The somewhat more angular periphery of the body whorl and greater proportionate length above the aperture distinguishes this shell from *V. ambigua* Stanton, *V. dalli* Stanton, *V. abbotti* Gabb, and *V. gabbi* White. In the former particular it is easily distinguished from *V. gracilis* Stanton. From *V. dilleri* White it differs greatly in the character of the costæ. From *V. suciana* Dall (= *V. navarroensis* of Whiteaves) it differs in its more angular outline and more numerous revolving ribs. From *V. biplicata* Gabb it differs in the flattening of the body whorl above the nodes. *V. protracta* Dall, *V. texana* Conrad, *V. nasutus* Gabb, *V. angulatus* Whitfield, *V. texturatus* Whitfield, *V. biconatus* Whitfield, and *V. ovatus* Whitfield are mostly much narrower in proportion to height, with longer apertures, and usually have decidedly shouldered whorls.

The type and the large fragment hereinbefore mentioned, both now in the U. S. National Museum (Cat. No. 30878), and a smaller specimen in the University of Colorado cabinets, were broken from hard concretions in the sandstone member of the Fort Pierre Cretaceous at Fossil Ridge, about 7 miles south of Fort Collins, Colorado, by Mr. H. W. Clatworthy.

CAPULUS SPANGLERI, new species.

Plate XIII, figs. 5–7.

Shell of moderate size, length from apex to extreme margin of aperture a little less than width; spire curves strongly backward and twists to the left; aperture transversely and irregularly elliptical; surface ornamented by ten or twelve very prominent ridges radiating from the apex downward to the aperture, more crowded in front than at either side and only one or two faint ones behind in the excavation beneath the apex; otherwise the excavation is smooth except for the fine growth lines which are visible without a lens; height of the larger specimen measured vertically with the apertural margin in a horizontal position 17 mm., width of aperture 33 mm., length of aperture 28 mm., distance from apex to farthest margin of aperture

32 mm. Prof. D. W. Spangler found one specimen and Mr. G. S. Dodds found another, both in the sandstone member of the Fort Pierre Cretaceous in Fossil Ridge, about 6 miles south of Fort Collins.

The type is now in the U. S. National Museum (Cat. No. 30879) and the cotype in the University of Colorado cabinets. A juvenile example found by the writer at the same place shows that the apex is rather sharp.

ANATINA DODDSI, new species.

Plate XIII, figs. 3, 4.

Shell of medium size, transversely ovate in outline, rather shortly rounded behind and more broadly so in front, very thin; posterior end gaping, gently contracted above and below to the meeting of the valves on the dorsal and ventral margins; dorsal margin deeply excavated immediately behind the beaks and slightly concave immediately in front, thence sloping gently away and rounding somewhat abruptly into the anterior margin; basal margin forming a broad curve, subemarginate as a result of the broad sulcus in each valve; beaks rather prominent, behind the middle, incurved and almost touching; valves moderately convex, greatest convexity behind the medial sulcus; surface marked by strong, rounded, equidistant concentric undulations which nearly disappear on the posterior half, the interspaces of about the same width as the undulations; growth lines on and between the undulations visible without a lens, giving the undulations a rather irregular appearance; sides of valves divided by a broad, shallow sulcus extending from the beaks to the ventral margin, in and behind which are a number of sharp raised lines radiating from the beaks, some prominent, others indistinct; length of type, restored by comparison with other examples, about 50 mm., height 35 mm., convexity of both valves united 17 mm. This shell closely resembles *A. sulcatina* (Shumard) Whiteaves in outline, but differs from the latter in the somewhat narrower posterior margin, the proportionately broader sulcus, and in the radiating raised lines which are observed on all of our examples from three different localities and three horizons. The latter feature is not mentioned by Shumard or Whiteaves in their descriptions of *sulcatina*, but White has described and figured a specimen from Sucia Island which bears *impressed* radiating lines, thus being the exact reverse of ours in this respect. A very young specimen is much more pointed both before and behind.

Mr. G. S. Dodds and the writer found the type-specimen, now in the U. S. National Museum (Cat. No. 30880) and another in the sandstone member of the Pierre Cretaceous at Fossil Ridge, 7 miles

south of Fort Collins, Colorado, the small one at the same horizon 6 miles north of Fort Collins, two medium examples in the bluffs southeast of Windsor just below what is usually considered the dividing line between Pierre and Fox Hills strata, and another southwest of Windsor at a slightly lower horizon. All but the type are in the University of Colorado cabinets.

SERPULA MARKMANI, new species.

Plate XIII, figs. 8, 9.

Tube irregular in form, sometimes abruptly bending, perfectly circular in cross-section, tapering rapidly enough for the detection of the larger and smaller ends of specimens only 5 mm. in length. Outer surface of the larger specimens roughened by irregular, interrupted transverse ridges, some of the larger ones appearing to encircle the tube and possibly all doing so obscurely; no growth lines visible; inside of tube perfectly smooth, showing no traces of the ridges or other roughness, so that the surface of inner casts, though composed of fine grains of sand, are as smooth as glass; walls of the tube rather thin, exhibiting two layers, the inner one of much darker color than the outer; tubes often attached to each other for considerable distances, but none found attached to other organic remains; length of largest example 45 mm., diameter at larger end 6 mm., at smaller end 4.5 mm., while another example having the same diameter at the respective ends is only 30 mm. long, thus showing much more rapid tapering. Though fossil *Serpula* do not show characters of much specific value, this species seems to be distinct from any American Cretaceous species yet described, and can not be readily confused with any except *S. plana* Logan from the Benton group of Kansas, which it would certainly closely resemble if preserved under the same exact conditions. The species is common in the sandstone member of the Pierre Cretaceous in Fossil Ridge from 5 to 7 miles south of Fort Collins, Colorado, and less common at the same horizon 6 miles north of Fort Collins, but being fragile and occurring only in hard concretions it is almost impossible to obtain perfect specimens. I have seen none which appears to show either extremity. I have named this in acknowledgment of the services of Mr. Harvey Markman on the expedition which brought it to light.

The types are in the U. S. National Museum (Cat. No. 30881) and many other specimens in the University of Colorado cabinets. In Monograph XXVII of the U. S. Geological Survey[a] a *Serpula* is mentioned as occurring in the lower Pierre of the Denver Basin, which may possibly be of this species, but it has not been described and I have not seen it.

[a] Page 78.

EXPLANATION OF PLATE XIII.

FIGS. 1–2. *Volutoderma clatworthyi*, new species. Cat. No. 30878, U.S.N.M. Two views of the type, slightly less than natural size.

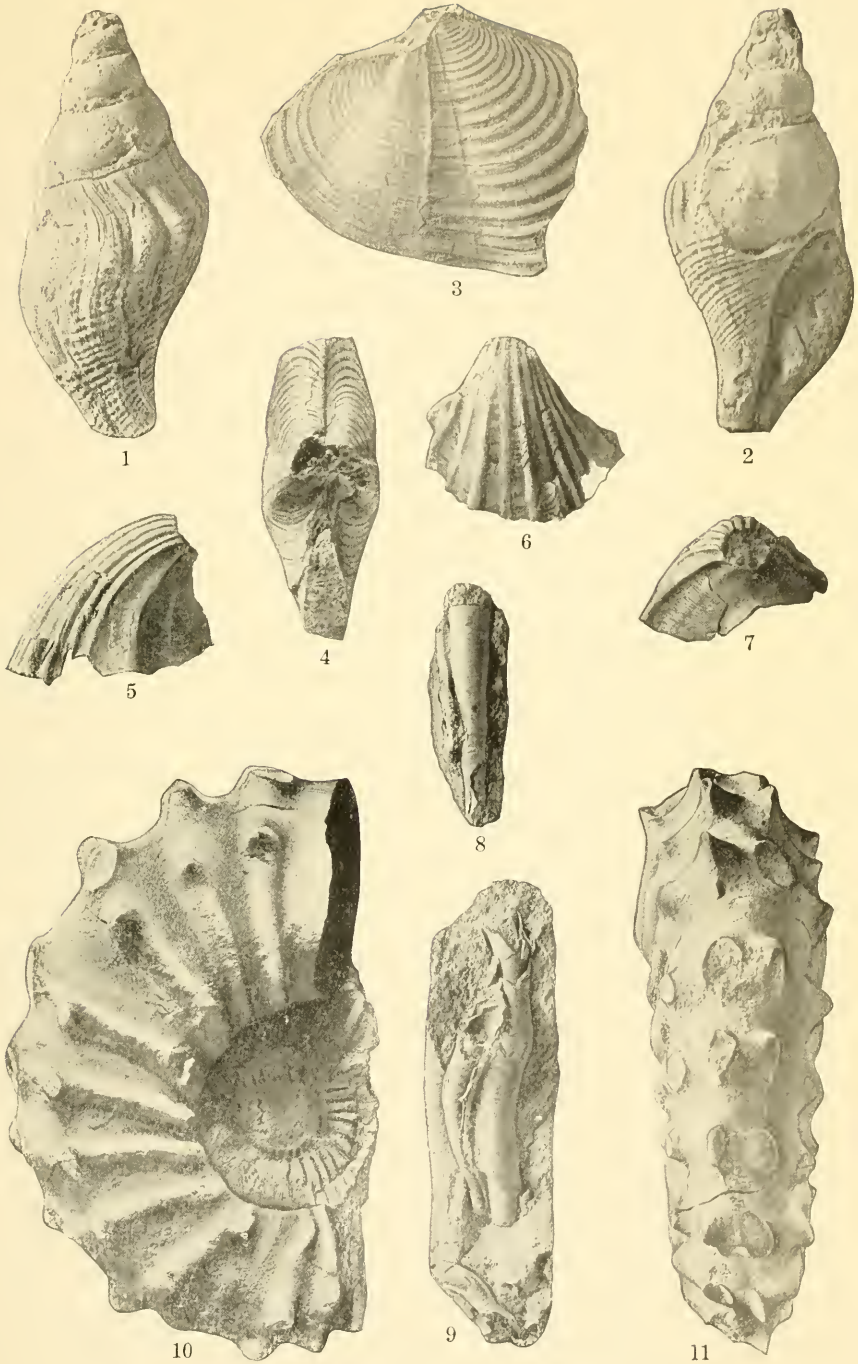
3–4. *Anatina doddsi*, new species. Cat. No. 30880, U.S.N.M. Two views of the type. Fig. 4 is slightly less than natural size.

5–7. *Capulus spangleri*, new species. Cat. No. 30879, U.S.N.M. Three views of the type, natural size.

8. *Serpula markmani*, new species. Cat. No. 30881, U.S.N.M. A small nearly straight specimen with a smaller tube attached, slightly less than natural size.

9. *Serpula markmani*, new species. Cat. No. 30881, U.S.N.M. A group of more irregular specimens, slightly less than natural size.

10–11. *Acanthoceras coloradoensis*, new species. Cat. No. 30877, U.S.N.M. Two views of the type, slightly less than natural size.



NEW CRETACEOUS INVERTEBRATE FOSSILS FROM COLORADO.

FOR EXPLANATION OF PLATE SEE PAGE 264.