

Article V.—OBSERVATIONS ON AND EMENDED DESCRIPTION OF HETERO CERAS SIMPLICOSTATUM WHITFIELD.

By R. P. WHITFIELD.

PLATES XXIII—XXVII.

In the 'Geology of the Black Hills' I described a fossil cephalopod under the name *Helicoceras* (*Heteroceras*?) *simplicostatum*, having for study only a fragment consisting of less than one volution of the non-septate portion of the shell. The specimen was from ferruginous sandstone on the East Fork of Beaver Creek in the western part of the Black Hills, and was supposed to be from the Fort Benton group of the Meek and Hayden section. The fragment being without septa, a full description of the characters of the species could not be given, and it was doubtfully referred to the genus *Heteroceras* on account of the disconnected character of the whorls and the general marking of the shell.

During the present summer (1901) the Museum sent Dr. E. O. Hovey to the Black Hills to collect marine invertebrate fossils. Among the material which he collected and sent in from the Cretaceous beds near Buffalo Gap, South Dakota, are quite a number of examples of this species, showing more or less perfectly the features of the shell. By carefully manipulating the specimens the entire character of the species has been obtained, not only of the external features but also of the septa; and some features of this group of shells which were previously very imperfectly understood are distinctly revealed.

During the year 1876, while working at the collections brought from the Black Hills by Henry Newton, the geologist of the Jenney expedition, I uncovered what proved to be a part of a helicoid shell of an ammonitic genus which I

¹ Report on the Geology and Resources of the Black Hills of Dakota. With Atlas. By Henry Newton, E.M., and Walter P. Jenney, E.M., Washington, 1880. Palaeontology by R. P. Whitfield.

described and figured in the 'Report' as *Heteroceras newtoni*. While freeing the shell from the matrix, I found in the opening through the whorls a specimen of *Ptychoceras*, with a second one lying obliquely across the upper whorl, but entirely unconnected with the *Heteroceras*. Their position, however, struck me as being peculiar and impressed me strongly with the idea that there must have been some connection between the two shells, as I had noticed several other imperfect examples or parts of examples of *Ptychoceras* on or near the larger cephalopods of this group while I had been freeing them from the rock. I did not, however, feel certain enough of the connection to venture a statement to that effect, but left the matter as one to be investigated, should material ever be obtained to allow of it. When the present collection was opened and an unusual number of *Helicoceras*-like shells observed, an effort was at once made to obtain the upper whorls of some of the individuals, with the results detailed in the following pages, which enable me to complete the description of the species and to add some features of the group previously only surmised. Accordingly a revised description of the species is given below.

***Heteroceras simplicostatum* Whitf.**

PLATES XXIII-XXVII.

Helicoceras (*Heteroceras* ?) *simplicostatum* WHITF., Palæontology of the Black Hills of Dakota. Explanation of plate xiv, foot-note.

Shell, as seen on a number of more or less imperfect individuals, rather large and in the end somewhat ponderous in character, consisting in the middle portion of several very laxly coiled volutions with a large umbilical opening. The earlier and later parts are irregularly bent or coiled, sometimes dextrally, but most frequently sinistrally. Section circular, except near the outer extremity of nearly entire individuals. The earlier portion of the shell is straight, *Hamites*-like in character, being bent upon itself after attaining a certain length as a straight tube, and returning on nearly the same plane and parallel to the first part for a considerable

distance (five or six centimeters), when it resembles the genus *Ptychoceras*, except that the two straight limbs may not be in close contact. The second return bending is of greater breadth, beyond which the tube takes a broad sweeping curve to beyond the first bend, when it curves downward and assumes beyond this point a more regular, helicoid curving, forming the middle portion of the organism. The space between the first and second sharp bendings, including the geniculated parts, if found separated from the other parts of the shell, would readily be taken for a section of an *Ancyloceras*. From the point above indicated the tube is deflected downward and becomes openly helicoid, with a broad, open umbilicus and laxly coiled volutions. Continuing this form of volution for one and a half to two turns, the tube is then suddenly directed downwards vertically for several inches, and again recurved upward to near the under surface of the last body whorl, forming a large vertical loop. None of the specimens in the collection shows satisfactorily whether this loop is parallel with or at right angles to the straight *Hamites*-like limbs of the initial parts of the shell.

In all the bendings of the coils, whether the shell is dextral or sinistral, the position of the siphuncle is always on the back of the volution and generally a little above the upper of the two lines of nodes or subspines subsequently to be mentioned. This constant position of the siphon in relation to the coils would indicate that the direction of the coiling of the tube was an embryonic condition.

The septa of the adult or middle portions of the species are very complicated in their ramifications, but in the straight parts of the earlier portions they are correspondingly simple. The older parts have the septa distant on the outer side of the whorl, but on the inner side they interlock and are so crowded that they seem almost to blend with each other. The variation between the different septa is very great, so great, in fact, that I can see no utility in figuring any one, or even several, as there is no possibility of specific determination from them.

The ornamentation of the shells of the species consists of a somewhat strongly marked, oblique annulation of the tube

throughout its entire length, growing stronger as the tube increases in size and age, and of two lines of nodes which mark the lower portion of the shell and which are developed into sharp spines of considerable length. On one fragment of a tube less than 12 mm. in diameter the spines, one on each row, are fully 2 mm. long. The nodes on the specimen of the vertical, non-septate portion of the tube figured are fully a centimeter high above the general surface, and only represent the cavity left on the inside of the shell, the shell having been entirely removed. The annulations are separated by rounded, concave interspaces and are generally rather sharp on the crests and quite generally simple, but with occasional intermediate ones on the outer surface of the volution. On the outer vertical portion of the tube the annulations become very strong and are interrupted at the nodes, and the section of this part of the tube becomes somewhat quadrangular toward the last. So far as observed, there is no minute surface marking beyond the annulations, though we are not sure that we have seen the actual outer surface, as the shell is very readily exfoliated, separating into numerous laminæ, often with very beautiful iridescence. On the middle or helicoid volutions the annulations are rather closely arranged, are directed backward on the upper side of the tube, forward on the face of the coil, and more strongly so on the lower surface. This gives a rather strongly retral curvature on the upper inner surface of the volution.

On a single specimen of an upper coil from the first abrupt bending of the shell backwards, the shell does not present the *Hamites*-like feature, but is, on the contrary, a very open spiral, rising fully six centimeters in making one volution from the point of the first abrupt bending of the shell. Hence it cannot be safely asserted that this *Hamites*-like feature of the earlier portions of the shell is a specific or even a generic characteristic.

If the slender tube described below is a feature of these shells, as I am inclined to believe, the straight part of the tube has extended some distance beyond the limits of the *Hamites*-like part and has necessarily passed over the top of

the second bending of the coil. On the best specimen in the collection this is shown to have been the case, as the lower shell is indented by it.

While working out some of the specimens of *Heteroceras simplicostatum* in the collection, we obtained a very slender shell which has a length of 26 mm. and a diameter of 1.5 mm. at the larger end, cylindrical in form and very gently curved, tapering to an almost hairlike point at the smaller extremity, where it seems to penetrate into the stone in the form of a minute, club-like point. The tube is obscurely annulated and the outer coating is highly iridescent. On scaling away the laminated iridescent shell from a portion of the specimen, it is found to be distinctly septate, with very simple septa, arranged, at the point measured, so that four of the chambers are 3 mm. in length. The septa appear to be simple undulations, three at least on the half-diameter, and one of these somewhat stronger or longer than the others. This specimen I take to be the initial part of the *Hamites*-like straight limb of this *Heteroceras simplicostatum*, which would, if this view be correct, extend far beyond the outer limit of the second geniculation. This view is strengthened by the best individual in the collection, in which the shell at the second bend is impressed where the straight limb has crossed it and lies partly imbedded therein. A second specimen of *Ptychoceras* has been obtained, where the tube is traced to where its diameter is less than half a millimeter.

In the 'Geology of the Black Hills,' at page 457, the statement is made, that, from the fact that the thickening of the shell of *Ptychoceras* appears to have taken place on the outside of the tube and not on the inner surface, the inference would be that the shell might have been at one time during life an internal appendage like that of *Spirula*. The same thickening of the external surface on the earlier parts of *Heteroceras simplicostatum* has been observed in this collection. And as there are numerous examples of *Ptychoceras mortoni* M. & H. among these fossils, this thickening has shown itself frequently by the exfoliation of the outer layers of the shells.

After having written the above description and remarks

on these shells, Prof. C. E. Beecher and Mr. C. Schuchert called my attention to the fact that Prof. Alpheus Hyatt had mentioned the compound feature of this species in his 'Phylogeny of an Acquired Characteristic,' where I find that he has placed it under *Heteroceras? nebrascense* Meek, referring it to his genus *Didymoceras*. On a direct comparison of the type of this species, figured in the Black Hills report with Meek's type of the above species, it was concluded that *Heteroceras nebrascense* was more nearly identical with *Heteroceras newtoni* Whitfield. Dr. E. O. Hovey also suspected, while in the field collecting the specimens, that these compound features existed.

In Eastman's translation of Prof. Zittel's 'Text-Book of Palæontology,' on p. 588, Family 33, Nostoceratidæ, it is stated that "the young of *Emperoceras* may remain Hamitean for a prolonged period, and then suddenly become Helicoceran or turrilitiform." But I cannot find that anyone has produced examples where *Hamites*, *Ancyloceras*, and *Heteroceras*, or the allied genera, are all combined in the one individual, though it would seem to have been considered a possibility. Then why the necessity of multiplying genera to so great an extent when Nature apparently has tried hard to reduce them?

EXPLANATION OF PLATE XXIII.

Heteroceras simplicostatum Whitf.

The figure is enlarged to less than five-fourths of the natural size. It is a top view of a specimen showing the prolongation of the *Hamites*-like straight limb across the second bending of the tube, into which it is distinctly impressed.



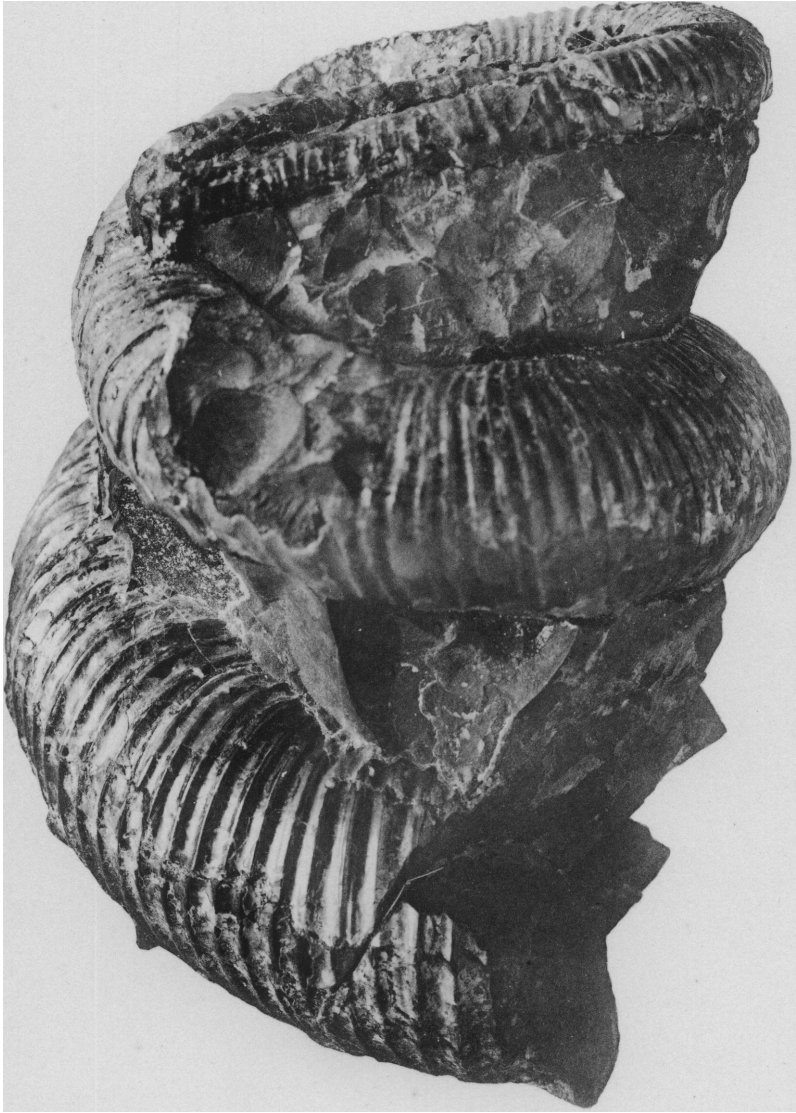
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HETEROCERAS SIMPLICOSTATUM, WHITE.

EXPLANATION OF PLATE XXIV.

Heteroceras simplicostatum Whitf., page 68.

Side view of the specimen figured on Plate XXIII, and enlarged to about the same extent. It shows the back of the second limb of the *Hamites*-like portion of the shell and the coils of the *Heteroceras* features.



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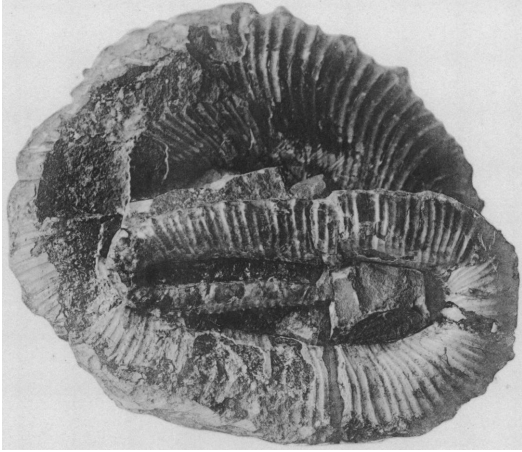
HETERO CERAS SIMPLICOSTATUM, WHITE.

EXPLANATION OF PLATE XXV.

Heteroceras simplicostatum Whitf., page 68.

- FIG. 1.—Top view, natural size, of a small specimen which retains the *Hamites*-like portion and also the *Ancyloceras*-shaped portion.
- FIG. 2.—Top view of another individual, showing only *Heteroceras* features, with indications of the septa where the outer shell is absent.

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HETERO CERAS SIMPLICOSTATUM, WHITE.

EXPLANATION OF PLATE XXVI.

Heteroceras simplicostatum Whitf., page 68.

FIG. 1.—A figure, natural size, of the upper coil, above the *Ancylloceras*-like portion of the other individuals of a specimen which does not present the *Hamites*-like feature, but has been very laxly coiled.

FIGS. 2 and 3.—Two specimens, natural size, retaining only the upper coils, which present the *Ancylloceras*-like features.

FIGS. 4 and 5.—Back and side views enlarged to one and a half diameters of a portion of an outer coil from which the shell has been removed to show the character of the septa.

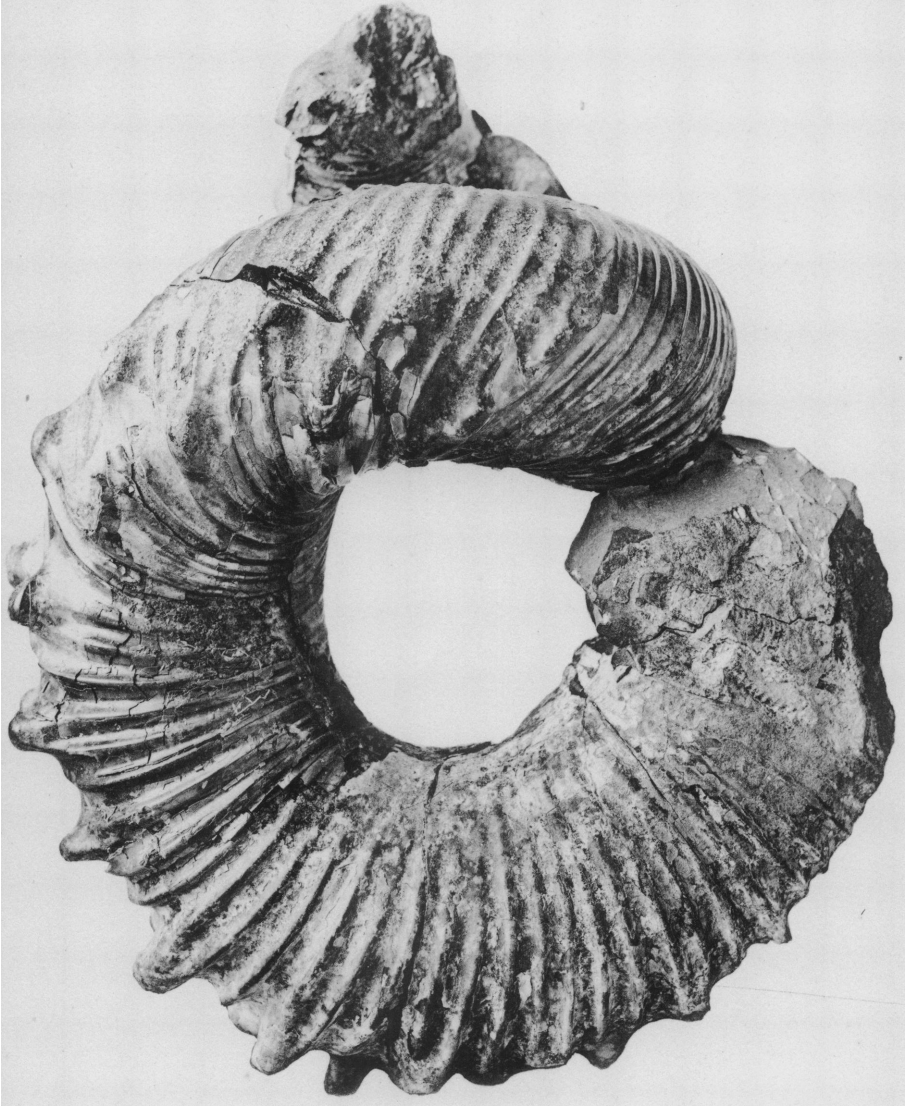


HETEROCERAS SIMPLICOSTATUM, WHITF.

EXPLANATION OF PLATE XXVII.

Heteroceras simplicostatum Whitf., page 68.

The figure is reduced to four-fifths of the natural size, and shows the last coil, vertically deflected and presenting the exaggerated features of the nodes and costæ of the apertural portion of the shell. The part where the large nodes occur is of a subquadrangular shape in section.



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HETEROCERAS SIMPLICOSTATUM, WHITE.

