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## ON TWO NEW PALEOZOIC STARFISH (ONE OF THEM FOUND NEAR OTTAWA), AND A NEW CRINOID.

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PALÆASTER? WILSONI, SP. NOV. Plate V.

The remarkable starfish found by J. E. Narraway, Esq., at City View, near Ottawa, and described by Professor Hudson in the May and July numbers of THE OTTAWA NATURALIST as *Protopalæaster narrawayi*, naturally excited interest in City View as a collecting place. Specimens like Mr. Narraway's, which can be described as *order*, *family*, *genus* and *species nov.* are of infrequent occurrence, but such a discovery shows that the possibilities of even so old a collecting place as Ottawa are by no means exhausted.

In searching for another specimen similar to the one found by Mr. Narraway, Miss A. E. Wilson was fortunate enough to find a pretty starfish of a type hitherto quite unknown in strata so old as the Black River. The specimen is exposed from the abactinal side, and preserves the greater part of one arm, the disk, and the stumps of the other four arms. The diameter of the specimen, when complete, must have been about 75 mm. (3 inches), and the diameter of the disk is 20 mm. This is large for a starfish from the lower Ordovician. The arms are quite convex, with a gentle taper, reminding one somewhat of the common recent starfish, *Asterias vulgaris*, and as in that species, the arms were probably somewhat flexible. The greater part of the abactinal side of the disk and arms is covered with small convex, over-lapping, V-shaped plates, which are arranged with the point of the V directed toward the margins. Along the crest of each arm there is a single row of larger plates. These plates are quite large and hexagonal in outline near the disk, but become smaller, triangular, and alternate in position further out on the arm. (See upper right-hand figure on the plate). There are two rows of marginals, these plates being larger and flatter than the other plates, and covered with minute tubercles, which may be spine-bases. (See the middle figure on the plate). Close to the disk, the supra-marginals and mar-



ginals seem to be of the same size, both rectangular, and the plates of the supra-marginal row directly over those of the marginal series. Further out on the arms, the plates are pentagonal, those of the two rows alternating in position, and dove-tailing, and the supra-marginals are smaller than the marginals. One of the marginals, about half-way out on the arm, is 1.25 mm. high and of about the same breadth. The smaller triangular plates which cover the greater part of the arm average about .5 to .6 mm. in height. On one of the arms (the one directed downward in the upper left-hand figure on the plate), the small triangular plates seem to be arranged in rows parallel to the axis of the arm, but the plates on the longer arm seem to be more irregular, although a general arrangement in rows can be seen. On this arm there are a number of very small plates scattered about, especially on the top of the arm, thus adding to the irregularity. The triangular shape of these plates gives the arm a neat pattern, the plates making diagonal rows backward and forward from the row of large plates along the top of the arm. The madreporite, which is nearly circular in outline, and 2 mm. in diameter, is in position, but slightly tipped down at the inner side, in an interradius, and not far from the centre of the abactinal side of the disk. The surface is probably worn, for it appears perfectly smooth.

In the fragment of the arm which is directed upward in the upper left-hand figure and in the lowest figure on the plate, the small plates are broken away, disclosing the ambulacral plates. These plates, which are long and rather thick, seem to be alternate in position. Two of the plates, well shown in the lower figure, and indicated by an arrow, seem to be pierced by pores near their proximate ends, two pores piercing each plate vertically. Near the outer end of the more perfect arm there is a space where a few of the small triangular plates are missing, and here also the ambulacral plates can be seen from the upper side. Each plate has a narrow keel on that side. (See the middle figure on the plate, between the two brachiopods). Other details of the plates of the actinal side are unknown.

This species seems to be most nearly related to *Palæaster magnificus* Miller,\* to which species my attention has been called by Professor Schuchert, who has most kindly loaned me photographs of the type. *Palæaster? magnificus* is a large starfish (6 inches in diameter), found in the Waynesville division of the Richmond formation in Ohio. Like *Palæaster? wilsoni*, it has two rows of large marginals and a row of large plates

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\*Jour. Cincinnati Society Nat. Hist., vol. 7, p. 16, pl. 4, figs. 3, 3a, 1884.



along the top of each arm, while the greater part of the surface is covered with small convex triangular plates. Miller found the plates to be spine-bearing, a point which can not be definitely decided in the present species. From the photograph it appears that there are spaces between the small triangular plates on the abactinal surface in *Palæaster? magnificus*, while in *P.? wilsoni* these plates actually overlap each other.

There is a superficial resemblance between *Palæaster? wilsoni* and *Urasterella pulchella* (Billings), but the latter species does not have the double row of marginal plates, nor the large plates along the top of the arm. The arms are also much more slender in Billings' species.

Of course the reference of this species to *Palæaster* is purely a convention, as it has nothing in common with the type of the genus. The generic position of these starfishes will be discussed in the monograph by Professor Schuchert, which it is expected, will appear at an early date.

*Locality and formation.* The holotype was found by Miss A. E. Wilson in a fence near the large quarry in the Lowville formation at City View, a short distance south-west of Ottawa. While the Lowville is the only formation which is exposed at this particular spot, the starfish seems to have been derived from the Black River, which outcrops only a short distance away. The matrix contains, beside the starfish, *Rhynchotrema inæquivalve* (shown in the photograph), *Orthis tricenaria*, and *Rafinesquina alternata*. The species is dedicated to its discoverer, whose private collection contains the type.

#### GENUS MARIACRINUS HALL.

#### MARIACRINUS? INSUETUS, SP. NOV.

*Mariacrinus* sp. Raymond, 1907. American Journal of Science, Fourth Series, Vol. XXIII, p. 118.

Two fragmentary calices of crinoids from the Three Forks Shale at Logan, Montana, are of importance, as they are the only crinoids thus far known from the Devonian of the Rocky Mountains. These fragments were sent to Mr. Frank Springer for identification, and he reported that they probably belonged to the genus *Mariacrinus*.

One fragment (Figure 1) retains the base of a calyx and fragments of four radials. All sutures are obliterated, but the ornamentation makes possible the determination of the probable outline of the plates. From such parts as remain, the radials seem to have been in contact. The position of the two notches in the margin of the area of stem attachment suggest that there are four basals, though there may be only three, two large and one small. The ornamentation consists of raised lines



which connect the centres of the plates, forming a series of triangles.

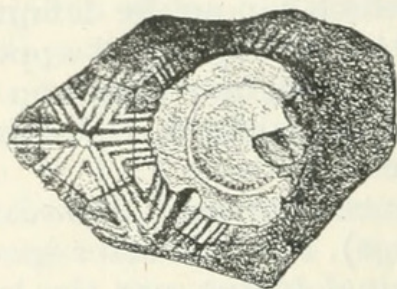


Figure 1 x 2.

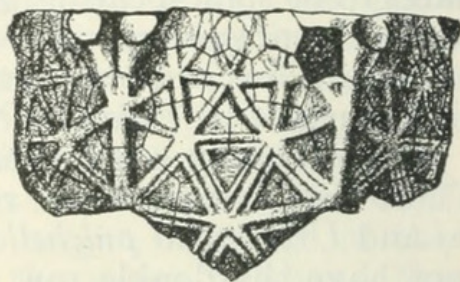


Figure 2 x 2.

The other specimen is a part of the dorsal cup, lacking the basal portion. Figure 2 shows this fragment, the ray lacking the distichial being the anterior radius. The rays show a strong longitudinal ridge crossing the first costal and bifurcating near the centre of the second, sending a branch onto each of the distichials. This species appears to agree with *Mariacrinus warreni* from the Niagara in having only two distichials, and no palmers in the calyx. In fact, none of the rays show more than one cycle of distichials, but there were probably two when the specimen was complete.

The interradiar areas are not depressed as in most species of this genus, a section through the calyx at the second cycle of interbrachials being almost circular in outline. There is, however, a slight depression in the interdistichial spaces. The first interbrachial is large, the next two slightly smaller. The three plates of the third series and the four of the fourth are not regularly hexagonal, but laterally compressed. The posterior interradius is very badly preserved, but there appear to be five interbrachials in the third row. As shown in the figure the plates are ornamented with raised lines connecting the centres of the plates.

*Locality.*—The specimens were found by the writer in the limestone of the Three Forks Shale at Logan, Montana, associated with the fossils of the brachiopod facies of the *Clymenia americana* fauna. The types are in the Carnegie Museum, Pittsburgh, Penna.

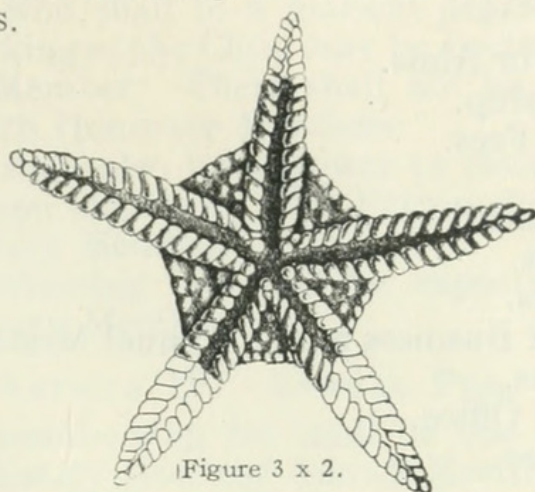
#### GENUS SCHÆNASTER MEEK AND WORTHEN.

##### SCHÆNASTER? MONTANUS SP. NOV.

Animal small, about an inch in diameter. Rays short, slender, extending about one-half their length beyond the disk. Disk large, pentagonal, the margin slightly concave between the rays. The five proximal plates of the adambulacreal series function as orals, while on the arms beyond the disk the adam-



bulacreals become marginals. The adambulacreal plates are rather small, oval, placed with the long axis diagonal to the axis of the arm. On the most perfect arm there are 16 of these plates on each side of the groove, not counting the proximal and distal plates.



The ambulacreal ossicles are small, arranged alternately. On this specimen they are mostly displaced. The plates on the disk between the rays are few and small. The marginals are small, rounded, and do not appear to bear spines, but this appearance may be due to poor preservation.

*Locality.*—This species is described from a single specimen collected by the writer in the Madison Limestone at Spring Canon in the Ruby Mountains, near Alder, Montana. The type is in the Carnegie Museum, Pittsburgh, Penna.

#### EXPLANATION OF PLATE.

1. Upper left-hand figure. *Palæaster? wilsoni* Raymond. All that is preserved of the specimen. The brachiopods are *Rhynchotrema inæquivalve*. One-half larger than natural size.

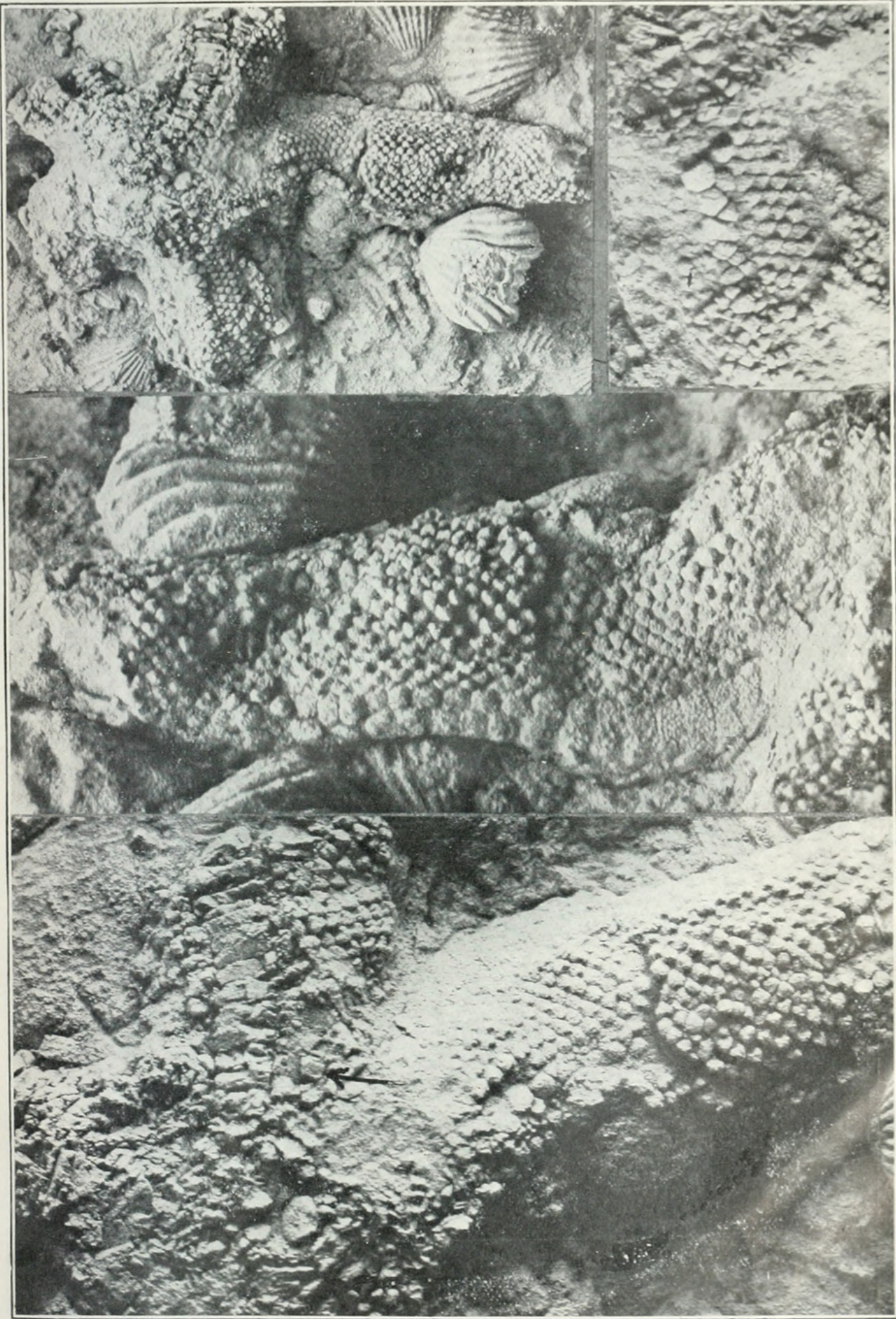
2. Upper right-hand figure. An enlargement of the ray which extends downward to Fig. 1, to show the character of the large plates along the top of the arm. X 3.

3. Central figure. The most perfect arm, viewed from the side. Notice the two rows of large marginals, the overlapping triangular plates above them near the middle of the arm, and the flatter and more nearly square plates to the right, nearer the disk. X 3.

4. Lower figure. An enlargement of part of the specimen, to show the ambulacral plates in the ray pointing upward, the madreporite, and the small, irregular plates along the top of the arm. The arrow points to the two ambulacrals which are pierced by vertical pores. X 3.

All the photographs were made at the Geological Survey of Canada, and are published by permission of the Director.





PALÆASTER? WILSONI, RAYMOND





Raymond, Percy E. 1912. "On two new Paleozoic Starfiish, and a new Crinoid."  
*The Ottawa naturalist* 26(7), 77-81.

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