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*Notice of NEW FOSSILS FROM THE PERMIAN STRATA OF NEW MEXICO AND TEXAS, collected by DR. GEORGE G. SHUMARD, Geologist of the United States Government Expedition for obtaining Water by means of Artesian Wells along the 32d Parallel, under the direction of Capt. JOHN POPE, U. S. Corps Top. Eng.*

BY B. F. SHUMARD, M. D.

[Read March 22, 1858.]

PRODUCTUS POPEI, *N. sp.*

*Shell* of medium size, subquadrate, wider than long, greatest width at the cardinal border. *Dorsal valve* (receiving valve) gibbous, very strongly arched, somewhat enrolled, flattened convex near the beak; anterior prolongation of moderate length, forming a gentle curve from the visceral region to the front; sinus commencing near the beak, where it is very shallow, but it soon increases in depth, and becomes very profound on the anterior prolongation, so as to give this portion of the shell a very marked bilobed appearance; *surface* with from six to ten unequally rounded, coarse ribs on each side of the sinus, their number sometimes increased by division and implantation. These ribs are usually quite prominent and broad on the anterior prolongation, but on the posterior third of the shell they become obsolete, leaving a nearly smooth surface for some distance before the beak; sides falling abruptly to the margins, near which they are usually marked with a series of eight or nine rather strong tubes, which extend from the beak to the front. Besides these, most of the specimens exhibit a few smaller tubes, sometimes scattered promiscuously over the surface, but generally ranging in oblique lines across the dorsum of the shell; beak small, pointed, slightly incurved, and passing a little beyond the cardinal margin; *ventral valve* elliptico-subquadrate, gently concave or flattened on the visceral disk, its sides with a row of spines, which, with other surface ornaments, correspond to those of the opposite valve.

We dedicate this, one of the most beautiful species of the American *Productus*, in compliment to Capt. John Pope, of the U. S. Corps Top. Eng., whose Expedition has the honor of having first procured palæontological evidence of the existence of Permian Strata in New Mexico and Texas.



PRODUCTUS MEXICANUS, *N. sp.*

*Shell* of medium size, subrectangular, width greater than the length; *dorsal valve* elevated, strongly arched, marked with a broad, very slight mesial depression, which is scarcely developed into a sinus; *sides* rounded, falling abruptly to the margins, front very gently convex; *beak* small, pointed, convex, moderately prominent; *surface* ornamented with from eighteen to twenty-four prominent, rounded, longitudinal ribs, their number somewhat increased by implantation or bifurcation. The ribs are separated from each other by spaces as wide as themselves, and both ribs and spaces are crossed at somewhat irregular intervals by rounded concentric folds, which give to the ribs at the points of crossing a handsome subnodulose character. The concentric folds are not as prominent as the ribs except on the sides, where, in one of the specimens before us, two or three of those nearest the border are developed into strong wrinkles. *Ventral valve* unknown.

*Dimensions*.—Length, 0.64; width, 0.70; height, 0.54. These proportions were taken from a young specimen on account of its being more perfect than the others. The collection contains fragments of full-grown shells, which, if perfect, would perhaps measure one-third greater.

White Limestone of the Guadalupe Mountains.

PRODUCTUS PILEOLUS, *N. sp.*

*Shell* small, strongly arched, gibbous, outline approaching to subquadrate, length greater than the width, widest at the cardinal margin. *Dorsal valve* gibbous, without mesial sinus, sides and front rounded, terminating below in a projecting band or rim, which is rounded and extends to the cardinal edge; *umbo* prominent, somewhat flattened anterior to the beak, slopes falling rather abruptly to the ears; *beak* prominent, rounded, strongly incurved, passing beyond the cardinal border; *ears* triangular, of medium size, incurved at the cardinal edge, convex in the middle and depressed at their junction with the umbones; surface of visceral region marked with several slightly elevated, concentric folds, which are most prominent on the sides and are continued on the ears, where they are directed backwards and become obsolete before reaching the cardinal edge; anterior prolongation smooth or marked with very obscure concentric folds.

The collection contains but one specimen of this little species and this is partially deprived of its test.

*Dimensions*.—Length, 0.36; width, 0.32; height, 0.24.

Occurs in the White Permian Limestone of the Guadalupe Mountains.



PRODUCTUS SEMIRETICULATUS, *Mart. sp.*

This widely distributed species is contained in Capt. Pope's collection from the White Limestone of the Guadalupe Mts. The specimens resemble most the variety *P. antiquatus*, but the sinus of the receiving valve is more profound and narrower than in the example figured by De Koninck, which are generally marked with a broad shallow sinus. One of our fossils exhibits a group of fifteen tubes on a smooth space just under the reticulated portion of the sides, arranged as represented in De Koninck's figures of some examples from Vise, Belgium. (*Monog. Prod. et Chon.*, pl. IX., fig. 1 b, c.)

AULOSTEGES GUADALUPENSIS, *N. sp.*

*Ventral valve* large, outline subelliptical, gibbous, flattened convex at the umbo, enlarging rapidly from beak to front and forming a pretty regular curve in the same direction; greatest width about the middle of the valve; lateral margins rounded, front slightly sinuate; a broad, shallow sinus commences some distance in advance of the beak and continues to the front in one of the specimens, and in the other the sinus is somewhat profound and narrow on the umbonal region and becomes shallow towards the front; *beak* elongated, flattened, straight or slightly curved upwards at the extremity, which is pointed; area triangular, very much elevated; lateral edges sharp and strongly defined. *Surface* marked with numerous slightly prominent, radiating, interrupted ribs, crossed by obscure, rounded, concentric ridges, which give to the former a subnodulose character; intervals marked with small circular pits, probably the points of attachment for spines. *Dorsal valve* unknown.

*Dimensions*.—Length of ventral valve, 1.40; width, 1.48; height, about 0.59.

This shell is very interesting as no species of the genus has heretofore been observed in American strata. In Europe it has not been found below the Permian.

*Geol. Pos. & Loc.*—White Limestone of the Guadalupe Mts., New Mexico and Texas.

SPIRIFER MEXICANUS, *N. sp.*

*Shell* rather large, broad ovate, moderately gibbous in young age, extremely so in full-grown specimens, greatest gibbosity near the middle, length and breadth nearly equal, cardinal margin considerably less than the greatest width, which is found near the middle of the smaller valve, lateral margins rounded, front sinuate. *Ventral valve* (receiving valve) regularly arched, much more prominent than the opposite one,



having a deep narrow sinus extending from beak to front, sides rounded, cardinal margin equal to about one-half the width of the valve, cardinal angles rounded and obtuse; beak prolonged, elevated, incurved, pointed at extremity; *area* small, triangular, concave, arcuated, longitudinally striated, sides forming an angle of about  $76^\circ$ , deltoid opening a little wider than long. *Dorsal valve* broad elliptical, regularly convex, gibbous in full-grown specimens; *beak* small, pointed, incurved and slightly passing the cardinal border; *area* narrow, its margin gently arcuate. Surface marked with rounded, irregular, radiating, usually trifurcate ribs, which are indistinct on the lateral margins; they are separated by shallow furrows, and the number on the border amounts to from 18 to 24, on each side of the mesial sinus.

The dimensions of a young specimen are: Length and width, 0.76; thickness, 0.48. Of a full-grown individual: Length and width, about 1.34; thickness, 0.98.

Abundant in the White Guadalupe Limestone of Permian age, Guadalupe Mts., New Mexico and Texas.

#### SPIRIFER SULCIFERA, *N. sp.*

*Shell* rather small, ovate, subpentagonal; length about one-fifth greater than the width; greatest transverse diameter near the middle; cardinal extremities slightly auriculated. *Ventral valve* (receiving valve) gibbous, more prominent than the opposite one, greatest convexity a short distance behind the beaks; mesial sinus distinct, commencing at the point of the beak and increasing gradually in breadth and depth to the front; *area* broad, triangular; lateral margins sharply rounded; deltoid aperture rather large, triangular; surface marked with six broad, rounded, prominent folds, those next to the sinus being double the size of the others; ribs bearing one or more shallow longitudinal sulci, which become entirely obsolete before reaching the beak; intervals marked with obscure longitudinal striæ. *Dorsal valve* semi-elliptical, convex, a little longer than wide; mesial fold moderately elevated, having a distinct median groove extending its whole length, and on either side a broad sulcus, which bears one or more slender, slightly prominent, rounded ribs; intervals marked with longitudinal striæ as in the opposite valve. Under a magnifying glass, the surface exhibits very fine, concentric lines of growth.

*Dimensions.*—Length, 0.66; width, 0.57; height, 0.39; length of dorsal valve, 0.48; height of same, 0.16.

*Geol. Pos. & Loc.*—White Guadalupe Limestone, occupying the same geological position as the preceding species.



SPIRIFERINA BILLINGSII, *N. sp.*

*Shell* of moderate size, wider than long, gibbous, cardinal line less than the width of the shell, extremities rounded. *Ventral valve* gibbous, strongly arched, marked with a deep, moderately broad, angular sinus, extending from tip of beak to front, sides convex; beak prominent, prolonged, rather sharply incurved, extremity pointed; *area* well developed arcuate, broad triangular, lateral edges rounded, deltoid aperture large. Surface with from six to eight prominent, rounded ribs on each side of the sinus; they are simple and gradually enlarge from the beak to the margins. *Dorsal valve* semi-elliptical, convex, having five or six prominent ribs on each side of the mesial fold, which is angulated, rather broad, and towards the front much elevated above the general convexity; cardinal line straight, or very slightly angulated; beak scarcely passing the cardinal line. The surfaces of both valves are thickly studded with extremely fine granulae and delicate lines of growth.

*Dimensions*.—Length, 0.74; width, 0.90; thickness, 0.58. Length of dorsal valve, 0.44; thickness of ventral valve, 0.36.

This species is very similar to *S. cristata* (Schlot. sp.), to which we at first were disposed to refer it. Our shell is, however, larger, the beak more elongated, and the area narrower and higher.

The specimens in the collection obtained by Dr. G. G. Shumard are from the White Limestone of the Guadalupe Mts., the dark limestone subordinate to the White Limestone, and the Quaternary Conglomerate at the mouth of Delaware Creek, New Mexico.

Dedicated to E. Billings, Esq., Palæontologist of the Geological Survey of Canada.

RETZIA PAPILLATA, *N. sp.*

*Shell* small, ovate, longer than wide, gibbous, front and sides rounded, valves nearly equally convex; *surface* marked with numerous extremely fine papillæ, each valve having eleven or twelve well-rounded, prominent ribs, those on the sides curving rather strongly to the margins and their number increased by insertion; intervals between the ribs rather deep, and as wide, or wider, than the ribs. *Ventral valve* without sinus, regularly convex, most prominent between the beak and the middle; cardinal edge straight and very short; *area* small, slightly arcuate, well defined by a sharply angulated margin; *beak* elongated, incurved extremity truncated, having a large circular foramen. *Dorsal valve* broad ovate, strongly and pretty regularly arcuate from beak to front;



*cardinal margin* very short, straight, forming an obtuse angle with the sides; *beak* small, strongly incurved, and passing a little beyond the cardinal line.

*Dimensions*.—Length, 0.40; width, 0.32; thickness, 0.27. Length of dorsal valve, 0.36.

This shell differs from the *Retzia punctilifera* (*nobis*) in having fewer ribs, and a smaller cardinal area.

Its geological position is in the dark limestone immediately under the White Limestone of the Guadalupe Mountains, New Mexico and Texas.

#### RETZIA (?) MEEKANA, *N. sp.*

*Shell* rather small, ovate, gibbous, length slightly greater than the width, valves nearly equally convex, umbonial slope flattened, anterior portion of sides and front regularly rounded, surface of each valve marked with from eight to ten prominent, radiating plications, rounded for some distance from the beak, but becoming subangular towards the front; they expand very gradually from their origin to the borders, and are separated by rather deep sulci, as wide as themselves. The sides of the ribs are each marked with three or more small ribs, which are usually quite distinct at the borders of the valves, but become obsolete before reaching the beaks; shell structure finely punctate. *Ventral valve* (receiving valve) without any trace of mesial sinus, greatest convexity near the middle; *area* very small; *beak* moderately prolonged, rounded, incurved. *Dorsal valve* elevated near the beak; umbo rounded, sides somewhat flattened; cardinal margin short; beak moderately prominent, strongly incurved.

*Dimensions*.—Length, 0.46; width, 0.42; height, 0.36.

*Geol. Pos. & Loc.*—The specimens of the collection are marked, White Limestone, Guadalupe Mts.; dark limestone under White Limestone, Guadalupe Mts., and Conglomerate near mouth Delaware Creek, New Mexico.

#### RHYNCONELLA GUADALUPÆ, *N. sp.*

*Shell* subtriangular with the angles rounded, convex, wider than long; lateral margins nearly straight, converging at an angle of about 85°; sides presenting a large, well-defined, elliptical, concave, or flat, smooth area, which is carinated at the commissure of the valves, and extends from the beaks nearly to the front; front strongly or slightly sinuate. *Ventral (receiving) valve* not as prominent as the opposite one; umbonial region flattened convex, having a broad, shallow mesial sinus extending from beak to front, lateral edges gently arcuate; *beak* flattened convex, rather strongly incurved. *Dorsal valve* presents a regularly convex and rather gentle curve



from beak to front, and a low, broad mesial elevation, which is scarcely perceptible except near the front; *beak* depressed, gently convex and closely incurved. *Surface* marked with numerous rather coarse, rounded, radiating striæ, their number increased by bifurcation and insertion. The bifurcations generally take place near the beak. At the border the number of striæ amount to from thirty to thirty-five on each valve.

*Dimensions*.—Length, 0.58; width, 0.76; thickness, 0.48.

A handsome species, and quite characteristic of the White Limestone of the Guadalupe Mts. of New Mexico and Texas.

CAMARAPHORIA (?) BISULCATA, *N. sp.*

*Shell* variable, outline varying from nearly circular to sub-pentagonal, with angles obtusely rounded, sometimes very gibbous and sometimes moderately so, usually a little transverse, sides always rounded, front sinuate; shell structure fibrous. *Ventral* or *receiving valve* very depressed, gently convex, greatest convexity near the beak; cardinal margins forming an obtuse angle; mesial sinus broad at the front, scarcely reaching the middle of the valve, shallow, or rather deep, perfectly smooth, or bearing from two to five obscure, rounded ribs; tongue of sinus moderately produced, broadly truncate at extremity, and curved upwards, sometimes at nearly a right angle with the general surface of the valve; *beak* imperforate, pointed, incurved nearly in contact with the opposite valve. *Dorsal valve* strongly rounded in most specimens, much more gibbous than the opposite valve, marked with a broad, shallow depression or false sinus extending from beak to front, which is bounded on either side by a ridge very obscure on the rostral half of the shell, but forming together a broad mesial fold towards the front, which is smooth, or marked with two or more slightly prominent plications; beak rounded, obtuse, extremity usually hidden by the beak of the opposite valve.

*Dimensions* of an average specimen: length, 0.58; width, 0.63; height, 0.35.

Resembles *Terebratula superstes*, Verneuil, from which it is distinguished by the greater convexity of the dorsal valve, and its more flattened ventral valve.

Restricted to the dark limestone of Permian age at the base of the White Limestone of the Guadalupe Mountains; found also abundantly in the Conglomerate at the mouth of Delaware Creek, New Mexico.

PHILLIPSIA PERANNULATA, *N. sp.*

*Pygidium* deltoid, as wide as long, elevated; border narrow, smooth, inflected behind, outer edge sinuate, inner edge



obtusely subangulated, the anterior two-thirds marked with a shallow furrow; *posterior extremity* narrow, very strongly arched; *axal lobe* elevated, nearly as wide as one lateral lobe, tapering very gradually from front to posterior extremity, which is bluntly rounded and nearly terminal; *axal rings* from twenty-eight to thirty, rounded, distinct on the dorsum; becoming obsolete on the sides, margins sinuate, surface of each ring studded with a single row of four or five granules, the granules of one ring alternating with those of the adjoining ones, transverse furrows much narrower than the rings and not deeply impressed; lateral lobes arched, somewhat flattened superiorly; segments eight, subangulated, simple, gently arched forwards, posterior ones directed obliquely backwards, the last one being nearly parallel with the longitudinal axis; transverse furrows deep and rather broad; surface of rings garnished with a row of distinct granules.

*Dimensions*.—Length and width, 0.74; height, 0.28.

*Geol. Form. & Loc.*—White Limestone of Guadalupe Mts., New Mexico. The collection of the Expedition contains several examples of the pygidium of this species.

#### FUSULINA ELONGATA, *N. sp.*

*Shell* nearly cylindrical, very slender and much elongated, pointed at the extremities, which are slightly curved; chambers very numerous; aperture very narrow, linear, extending the entire length. *Surface* covered with fine, somewhat flexuous striæ.

*Dimensions*.—Length, from one to two inches; width, from one to two lines. This species is at once distinguished from *F. cylindrica* by its remarkable length.

Occurs in the White Limestone, Dark Limestone, and Sandstone, of the Guadalupe Mts. of New Mexico and Texas.

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### *An Hypothesis concerning the formation of Hail.*

BY SPENCER SMITH.

Meteorologists were long since convinced that hailstones, while in the process of formation, must be retained in the atmosphere a much longer time than they would occupy in falling freely. The reasons upon which they have based this conclusion, are the great size to which these stones often attain, and their rounded and amorphous form, so different from