

T H E S I S

on

A Contribution to the Paleontology
of the Paleozoic Faunas of Central
Oregon

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INTRODUCTION

The discovery, near Suplee, Crook County, Oregon, of an extensive area of Marine Paleozoic rocks containing the Productus giganteus fauna by E.L. Packard added an important chapter to the geology and paleontology of Oregon. Through a cooperative study of the geology and paleontology of this area undertaken by Mr. W.E. McKittrick and the writer it becomes possible to present various paleontological and geological data heretofore unavailable. This paper deals principally with the paleontology of these Mississippian beds and includes only such geological data as are necessary to an understanding of the fauna. The companion thesis by Mr. McKittrick is primarily concerned with the geology and physiography. The two should be read together to give a complete picture of the information now available relating to this significant area in Central Oregon.

The writer is greatly indebted to Dr. E.L. Packard who suggested the problem and under whose helpful instruction it was completed, to Mr. W.E. McKittrick, his colleague, who gave invaluable assistance in the field and who is responsible for much of the geological information, some of which is quoted from his thesis; to Dr. Simeon Muller, Mr. E.T. Schenk and Mr. H.E. Wheeler of Stanford University,

and Dr. Chas. Merriam of the University of California for the use of their collections and their most helpful assistance; to the geological staff of the University of Oregon and Oregon State College for their most beneficial criticisms; to Mr. I.M. and Mr. O.C. Mills of Paulina for the generous use of their maps and camp, and to Wayne Felts and Francis Peck, fellow students, for their assistance in the field work.

Previous Geologic Work Relating to the Suplee Area

Paleozoic fossils were first discovered in eastern Oregon by Thomas Condon, and the first written material related to them was reported by Waldemar Lingren (37), who stated that "Well defined Carboniferous fossils had been found by Condon from the drainage of the Crooked River." Chester Washburne (59) reported Paleozoic fossils found on Beaver Creek in Grant County, along the old Izee-Prineville road. The specimens were submitted to Dr. G.H. Girty for identification. The only one determinable was a Zaphrentis which he stated was "Carboniferous, though it may in fact be Devonian."

In 1928 Dr. E.L. Packard (43) reported the discovery, in the summer of 1924, of several areas of Paleozoic rocks. The most important of which was a locality southwest of the

Suplee Post Office. This area yielded a characteristic Baird Mississippian fauna including the species Productus striatus (Fischer) and Productus giganteus (Martin).

Later field work done in the summers of 1927 and 1928 lead to the recognition of three Carboniferous localities by Packard (45). They were designated at the Beaver Creek, the Big Flat and the Suplee areas.

The Paleozoic of the Beaver Creek was probably seen by Condon and referred to by Lingren. It also may have been rediscovered by Washburne. This was the only locality known prior to 1924. It includes several small exposures totaling a few acres in extent. The largest of these occur as conspicuous limestone knobs within the narrow valley of the South Fork of Beaver Creek about half a mile above the Bernard Ranch House, which is situated in Sec.13, T. 17 S., R. 25 E. These outcrops are surrounded by basal beds of the Bailey Formation according to E. T. Schenk (48). This area yielded a few fossils including Productus striatus (Fischer), which can be correlated with the fauna of the Suplee area.

The Big Flat area has since been determined by Edward T. Schenk and Dr. Ralph Lupper (personal communication) to be basal Triassic containing large Carboniferous boulders filled with fossils. This was accomplished while they were

doing extensive field work on the Triassic in the summer of 1932.

Packard (45) briefly describes the largest and most important locality of highly fossiliferous Paleozoic rocks now known in Oregon under the name of the Suplee area. These rocks lie southwest of Suplee in the drainage basins of Grindstone and Twelve Mile Creeks, both of which are headwaters of the Crooked River.

The Paleozoic of this general area has been incidentally referred to by Lupper (71 p.23) in a doctorate thesis entitled, "Stratigraphy and Correlation of the Marine Jurassic Deposits of Central Oregon", which is now on file in the Department of Geology at the California Institute of Technology. It is also involved in a similar study of the Triassic now being undertaken by Mr. Edward T. Schenk of Stanford University.

In the summers of 1932 and 1933 Mr. W.E. McKittrick and the writer, under the direction of Dr. E.L. Packard, who has contributed data and collections, made a study of the Suplee area, and the fauna obtained is described in this paper.

Geology of the Suplee Paleozoic Area.

The writer has spent parts of two summers in the Paleozoic area near Suplee, but has confined his attentions primarily to the collection of fossil material and the

stratigraphic position of the fauna. Therefore, geologic information will be drawn freely from previous workers and from the companion thesis now being submitted for a Masters degree by Mr. McKittrick.

The Suplee Paleozoic occurs as a window in the Tertiary lavas near the headwaters of the Crooked River. The tributaries of that stream, Grindstone and Twelve Mile creeks, head in this area and cut directly across it.

The area covers approximately 60 square miles. It is roughly rectangular in shape, elongated in a north-south direction, and is about twelve miles long and five miles wide at the widest part. It narrows at each end and is included in Townships 17-18-19 South, and Ranges 24-25 East, mostly in R. 25 E.

The climate is typically continental with a great range in temperature both daily and seasonal.

The vegetation consists chiefly of sage brush and bunch grass. The bunch grass occurs on the limestones and the sage brush is generally found on the mechanical sediments. There is also an occasional juniper tree on the higher hills and willows along the larger streams.

The topography consists of gentle rounded hills of low relief, the slopes contrasting strongly with the typical rim rock and box canyon topography developed in the nearby Tertiary lava area.

There are four master streams which cut directly across the structure and small subsequent streams developed along the strike of the beds, producing parallel ridges in the central part. The northern part is underlain by homogeneous sediments and the dissection is characteristically that developed in formations of uniform hardness, the dissection is subordinated by the size of the hills. In the southern part of the area the limestones form escarpments or limestone buttes. The escarpments at Tucker Butte and South Bucher Butte are the truncated edges of the southeast dipping limb of the anticline.

The first reference to the structure of the Suplee Paleozoic was by E.L. Packard (44 p.222) in which he states: "The most extensive section now known is obtainable across a well defined Paleozoic anticline trending southwest from near Suplee."

Further field evidence collected in the field in the summers of 1932 and 1933 have substantiated this earlier observation since the Paleozoic is seen to occur as an elongated anticline approximately twelve miles in length and with a maximum exposure of five miles in width.

The structure is covered on the south and west by Tertiary lavas and on the north by the Jurassic sediments

and Tertiary tuffs and lavas. In the central portion of the area both limbs of the anticline are exposed whereas in the northern section the exposures are predominantly on the eastern limb. Only a narrow strip on the western flank remains uncovered by the lavas. Exposures of the eastern limb also occur in the southern section.

The following field evidence indicates that the structure of the area is anticlinal:

1. Opposing dips in the Paleozoic strata.
2. Presence of younger (Mesozoic) strata on the flanks of the older Paleozoic.
3. Occurrence of faunules at equal distances from the supposed anticlinal axis.

The area contains five main types of Paleozoic sediments. They are:

1. Limestones
2. Grits and sandstones
3. Conglomerates, with both angular and rounded pebbles.
4. Cherts
5. Igneous intrusions.

The limestones, grits, and conglomerates occur as interbedded lenses, the limestones are predominant in the northern and southern parts of the area, the grits predominate in the central portion of the western limb

of the anticline, and also on the eastern limb between Grindstone and Twelve Mile creeks.

The rounded conglomerates occur interbedded in the limestone on the eastern flank of the anticline. No conglomerates with well rounded pebbles have been noted on the western limb. The angular conglomerates occur on the western flank and are interbedded with the sandstones and grits.

The grits and sandstones occur in the west central, eastern and southern portions of the area, a large band appears to occur in a northwest-southwest direction across the central part of the area. These sediments occur as distinct beds. Bedding planes are easily discernable and the best strikes and dips are obtained from such outcrops. The coarse sediments are primarily composed of angular vari-colored chert fragments with brown tints predominating. Some of the fragments range up to three and four centimeters in diameter.

The limestones vary from a light colored crystalline variety to a dark compact impalpable variety having a semi-conchoidal fracture. They also vary from a type which is extremely fossiliferous to those that are apparently barren of fossils. Grades are also found from calcareous grits through to gritty limestones. Some of the limestones contain distinct beds of chert, the chert layers alternating with the layers of limestone.

The cherts are green, red, brown, black, and white. They are always associated with the limestones. Some of them are apparently syngenetic having been precipitated as colloidal silica and interbedded with the limestones, but others are evidently secondary or epigenetic and may be the result of a highly silicious intrusion or may be the result of replacement as they occasionally contain silicious fossil corals. Microscopically they are composed of a mosaic of chalcedony and quartz. No amorphous silica is present.

The igneous rocks occur as dikes or sills near the top of the section and apparently are post-Paleozoic in age. These rocks contain at least seventy-five percent feldspars although they are dark colored. They have phenocrysts up to one centimeter, the average being one half a centimeter. This rock might be classed as close to a porphyritic andesite.

The greatest thickness exposed is found on the eastern side of the anticline. There is approximately 10,500 feet of sediments composed of about 40 percent grits, 40 percent limestones and 20 percent cherts. On the western limb there is approximately 8,400 feet of sediments and ten percent limestones.

The Fauna of the Productus giganteus Horizon

The assemblage designed as the "Productus giganteus fauna" has long been known in Europe and Asia and includes a rich and varied fauna assigned to the Viseen division of the Dinantian or Lower Carboniferous.

The place the Viseen horizon occupies in the standard European and Asiatic columns and their relation to the nearby horizons may be discussed briefly.

The European Dinantian or Lower Carboniferous has been divided into the following members: the lowest one, the Etroeungtian, is of very limited distribution and represents the transition from the Upper Devonian into the Dinantian, the middle one is the Tournaisian and the upper the Viseen:

Subdivisions of Western European Dinantian

III VISEEN - Limestones characterized typically by Productus giganteus, P. striatus, P. cora, P. pustulosus, P. corrugatus, P. semireticulatus var. concinus, Chonetes papilionaceous, Lithostrotion junceum, L. irregulare, Syringopora ramulosa, Goniatites striatus, G. sphaericus, G. obtusus, Glyphioceras mutabile, G. complicatum, Prolecanites serpentinus, Proneurites cyclolobus.

II TOURNAISIAN - Limestones contains Spiriferina peracula, S. octoplicata, Spirifer tornacensis, Rhynchonella acuticosta, Porcellia puzo, Michelinia favosa, Lithostrotion basaltiforme, Bellerophon sublaevis, and many others.

I ETROEUNGTIAN- Limestones with Spirifer tornacensis, Athyris oryssi, Productus scabricules, and many Devonian forms as given by Grabeau (27 p.213).

Eastern European Dinantian

In the valley of the Donetz River in Southern Russia, the Lower Carboniferous or Dinantian (there often called Donjetian), is developed to a remarkable extent ranging in thickness up to 7,000 meters according to Tschernyschew and Loutouguin (70). The section quoted by Grabeau (27) is as follows: (number 1 being the bottom of the section)

7. Shale, sandstone and oolitic limestone with Productus latissimus, P. elegans, P. longispinus, Schizophora resupinata.

6. Two beds of marine limestone separated by shale and sandstone with Productus latissimus, P. punctatus, Chonetes cf. variolarius and plant remains. The limestone contains: Leptaena sinuata, Productus longispinus, P. medusa, Retzia multiplicata, Spiriferina octoplicata, Sp. insculpta, Pugnax pugnus, Camarotoechina acuminata, C.

reflexa, Camarophoria globulina, Orthotetes resupinata,
Dielasma sacculus, Spirifer trigonalis and Phillipsia
derbyensis.

5. Coarse and fine grained micaceous sandstone,
with thin seams of coal and limestone with a fauna of
Productus lattisimus.

4. Grey limestone with Productus giganteus, P. elegans,
P. nysti, Pugnax pugnus, Rhynconella pleurodon, Chonetes
papilionaceus, Camarophora rhymboides, Spirifer ovalis
and S. trisulcosus.

3. Grey chalk-marl with Productus giganteus, Chonetes
hardrensis, C. papilionaceus, C. dalmani, Orthotetes arach-
inoides, and a bed of porphyry.

2. Massive grey and black limestone with Productus
corrugatus, P. semireticulatus, P. pyxidiformis, P. pust-
ulosus, P. undifer, Spirifer cincitus, Euomphalus pent-
angulatus, Davisiella comoides, Orthotetes arachinoides
Orthotetes arachinoides and Chonetes papilionaceus.

1. Grey dolomite with finely plicated Spirifers of
large size. ✓

Asiatic Dinantian

In the gorge of Araxes on the Russo-Armenian border
and Persian border the zone of Productus giganteus is as
follows:

Heavy bedded partly bituminous and somewhat gypsiferous limestone with Lonsdaleia, echinoid spines, Productus giganteus, P. semireticulatus, P. keyserlingianus, Euomphalus cf. pentangulatus and others

In Persia (Frecht 27 p.233) the Viseen limestones are characterized by Productus giganteus, P. punctatus, P. margaritaceus, P. semireticulatus, P. aculeatus, Martinia glaber, Dielasma hastata, Retzia buchiana, Spirifer triangularis, Hallia cylindrica, Zaphrentis sp., Syringopora sp. and Lithostrotion martini.

In Eastern Turkestan (Grabau 27, p.225) the Viseen horizon includes the following forms: Rhipidomella michelini, Productus giganteus, P. costatus, P. longispinus, P. punctatus, P. striatus, and many other Productids, Chonetes papilionaceus, Dielasma sacculus, Martini glaber, Spirifer bisulcatus, and others.

The Viseen fossils of the Karaton portion of the Tianshan had 20 forms of Productids represented in a very rich fauna. In the Sinkiang Province in China the Viseen deposits are well developed, here 21 species of Productids are found, all of which have been previously mentioned.

In Japan in the Province of Etchigo Productus giganteus and P. Latissimus have been reported by Hayasaki (69). ✓

North America Dinantian

In North America the first area of Viseen age to be described was the Baird Formation of California (Smith 52). At that time it was thought to be Waverlian in age. The fossil Productids were: Productus giganteus, P. striatus, P. semireticulatus, P. punctatus, P. cora, P. flemingi, P. subaculeatus and P. hebrascensis. All except the latter are found in the Viseen beds of Europe and Asia, and that might be Productus scabricula (Mart.) a very closely related specie which is found in Europe.

In Alaska the Productus giganteus zone was found at Cape Lisburne, the Productids collected according to Girty (54 p.182) were Productus giganteus, P. semireticulatus, P. cf. P. altonensis, P. cf. P. burlingtonensis, P. cf. P. concentricus, P. cf. P. longispinus, P. cf. P. ovatus, P. cf. P. setiger, P. cf. P. punctata, P. cf. P. scabricula and P. cf. P. indianensis.

Fossils collected in the vicinity of Klawak on the west coast of the Prince of Wales Islands, and on the Madre de Dios and Robbers Islands in Bucareli Bay by Chapin (71) were as follows: Productus giganteus, P. punctatus, P. striatus, P. cora, P. semireticulatus, P. P. concentricus and P. burlingtonensis. Girty described

the fauna and again he states: "These belong to the Upper Mississippian and apparently represent the Mountain limestone or *Productus giganteus* zone of European geologists."

Paleogeography of the *Productus*
Giganteus Sea

This Viseen fauna has been reported from many localities extending from Ireland on the western part of Europe, eastward across Asia, into Alaska, and southward to Baird, California. Detailed studies of this fauna have been made in Europe, especially within the extensive areas of the Mountain Limestone Series and its equivalents.

The distribution of this fauna implies an extensive Viseen sea having few if any direct connections with the other contemporaneous seas of the time.

Grabau (26 p.459) states: "The Upper Dinantian (Viseen) sea covered Ireland, North Wales, and Central England, it then swept over Belgium, and into central France. From Belgium and northern France the Dinantian Sea (Viseen) is traced into central and southern Russia, into the eastern Alps and into the Ural Mountains. Throughout southern Europe the Upper Dinantian is represented by limestones with fossils similar to those of western Europe, especially

the brachiopod Productus giganteus. These beds can be traced south to Sarajevo in the Balkans, and through Asia Minor, Persia, and the Kirgiz steppe, through central Asia north of the Tian-Shan Mountains, through North China, and so on into the western part of the Cordilleran trough of North America."

The Productus giganteus fauna living within that sea has been found in the Uppermost Dinantian or Viseen beds of Europe in England, Ireland, Wales, France, Belgium, Austria, Poland, Szechoslovakia, and Russia.

In Asia the Viseen occurs in seas that covered about one-half of the whole continent. Along the Euro-Asian border this fauna is found in Armenia, Persia, Asia Minor and along the Coast of the Black Sea. In Turkestan a very rich Viseen brachiopod fauna of 132 species has been described. The Productus giganteus fauna is also found in four provinces of China, in Japan in the Province of Echigo, and in northern and western Siberia.

The seaway which connected the Viseen seas of Europe and Asia with North America was apparently a Polar Sea extending over the North Pole and down into Northern Alaska. A similar open waterway between Northern Europe and Northern Alaska had existed in the Devonian time and that geosyncline may well have persisted into Late Viseen

time. Evidence for such a Polar Sea is found in the similarity of the fauna containing Productus giganteus and its distinctness from contemporaneous faunas elsewhere in North America and in parts of the Euroasian land mass of the time. The distribution around the polar regions include several localities.

Holtedahl (32) has found Productus giganteus in the district east of Archangle Bay on the Litchu Islands, on the Berkh Islands which are located in the northern part of Novya Zemlya, and in the Cape Cherney Limestone, in the southern islands of the Novya Zemlya group.

In referring to the stratigraphic position of the Cape Cherney Limestones, G.H. Lee (35 p.179) states: "The beds are in a series which is homotaxial with the Productus giganteus zone of Russia or the Upper Viseen of Western Europe."

The Danmark expedition collected along the east coast of northern Greenland. Gronwall (29 p.612) says the fauna collected is homotaxial with the Uppermost Lower Carboniferous of Russia. From the eastern part of Peary Land, Koch (34 p.198) reports a poor fauna, but the brachiopods indicate clearly a Lower Carboniferous age.

The Viseen Paleozoic geosyncline that connected Europe and Alaska extended from Northern Russia, just

south of the Scandinavian peninsula, passed over the Berkh Islands, the northern part of Novya Zemlya and then down into Northern Alaska.

Evidence of this sea in Alaska is based on the work of several authors. Collier (10) in writing on the west coast of Alaska an imperfectly known area of Lower Carboniferous rocks found south of Cape Lisburne. At their base are beds made up primarily of Lepidodendron spitsbergense. Nathorst, and higher up in the column is found the *Productus giganteus*, Martin, zone. In speaking of the Cape Lisburne Limestones, Girty (10) states: "The Carboniferous faunas of Alaska are different from those of central and eastern United States, and comprise either a new species, or one described in more or less casual papers upon Russian and Asiatic paleontology." Speaking of the fauna he points out the common occurrence of Lithostrotion several forms of which seem to be identical with species found in the Mountain Limestone of England and the *productus giganteus* zone of European Russia.

Kindle (33) found similar conditions south of Cape Lisburne at Cape Thomas of which Girty said the fauna had a resemblance to that of the Mountain Limestone of Europe.

In the coast district northeast of Kotzebu Sound occur according to P.S. Smith (68) the Noatak Sandstone (With conglomerate, shales and limestones) which (cp. Girty's statement p.73) represent Upper Mississippian of the *Productus giganteus* zone.

In the Sadlerochit and Sublik Mountains at the Canning River just south of the Arctic Coast at about 145° west of Greenland occur Carboniferous formations described by Leffingwell (36) who says: "At a number of localities fossils were found, one a large brachiopod was found, a Productus giganteus 6 x 4 x 3 in size, but on account of the difficulty in transportation, it was reluctantly left behind." According to Leffingwell (36 p.112) Maddren reports fossils similar to the Lisburne formation from the 141st meridian north of the Porcupine.

The Lisburne formation has been reported from the Anaktuvuk River (68°-148°) by Schrader (47 p.107), Prindle and Hess (46 P.21), fossils correlating with those of the Lisburne.

In the Upper Yukon District, Brooks and Kindle (4 p. 291) report the Calico Bluffs formation made up of dark shales with limestone beds, which are Lower Carboniferous in age. On the Porcupine River, Kindle (33) found Lower Carboniferous beds. (Probably the Calico Bluffs Formation).

The fossils were determined by Girty.

Chapin (71) in writing on the geology of Southeastern Alaska reports on collections made in the vicinity of Klawak, on the west coast of the Prince of Wales Island, and on Madra de Dios and Robbers Island in the Bucharili Bay. Girty again states that the fauna is undoubtedly homotaxial with the *Productus giganteus* zone of the European geologists.

In Canada from the International Boundary Region, Cairnes (8) reports the Racquet limestone-chert group which contains both Mississippian and Pennsylvanian fossils.

In California in 1894, J. P. Smith (52) listed eighty-three forms from the Baird Formation, which outcrop just north of Redding in Shasta County, and on the basis of these fossils, he assigned the Baird to Lower Carboniferous, believing them to be homotaxial with the Waverley in the Eastern United States, but agreeing stratigraphically more closely with the higher divisions of the Lower Carboniferous of the Mississippi Valley.

Wheeler (64) states: "Some of the Baird fauna has been examined by Dr. F. Demanet, of the Royal Museum of Natural History of Belgium, who identified the *Productae*, *Gigantella gigantea* (Martin), *Gigantella Latissima*, (Sowerby), and *Pustula*(*Echinoconchus*) *Punctatus*, Martin, all of which are confined to the uppermost Dinantian of Western Europe. The occurrence of these restricted species within a few stratig-

raphic feet in the Baird shales is strongly suggestive, if not conclusive, of the Upper Dinantian age for at least a part of the formation."

Packard (43) first reported the finding of Productus giganteus and Productus striatus in central Oregon. The fossils were determined by Dr. Chas. Schuchert to be characteristically Baird Mississippian in age. Packard (44-45) later describes in more detail, the areas of Paleozoic rocks in central Oregon and it is upon his collections and those made by the writer that this paper is written.

The writer has endeavored to construct a paleogeographic map (Plate V) of the Northern hemisphere outlining the seas containing this fauna. This was accomplished by the use of all the evidence available to the writer which has been cited and by the use of maps drawn by De Lapparent, Obrutschew (42), Grabau (26-27), and Schuchert (50).

As shown below the Productus giganteus fauna is so distinctive that one must postulate a single sea with few if any connections with any of the contemporaneous waterways of the Visean time.

On the North American continent the known distribution of this fauna necessitates the plotting of a long narrow embayment entering northeastern Alaska in the region of the Colville and Canning rivers and extending southward into southern Alaska; western British Columbia, central Oregon

and north central California.

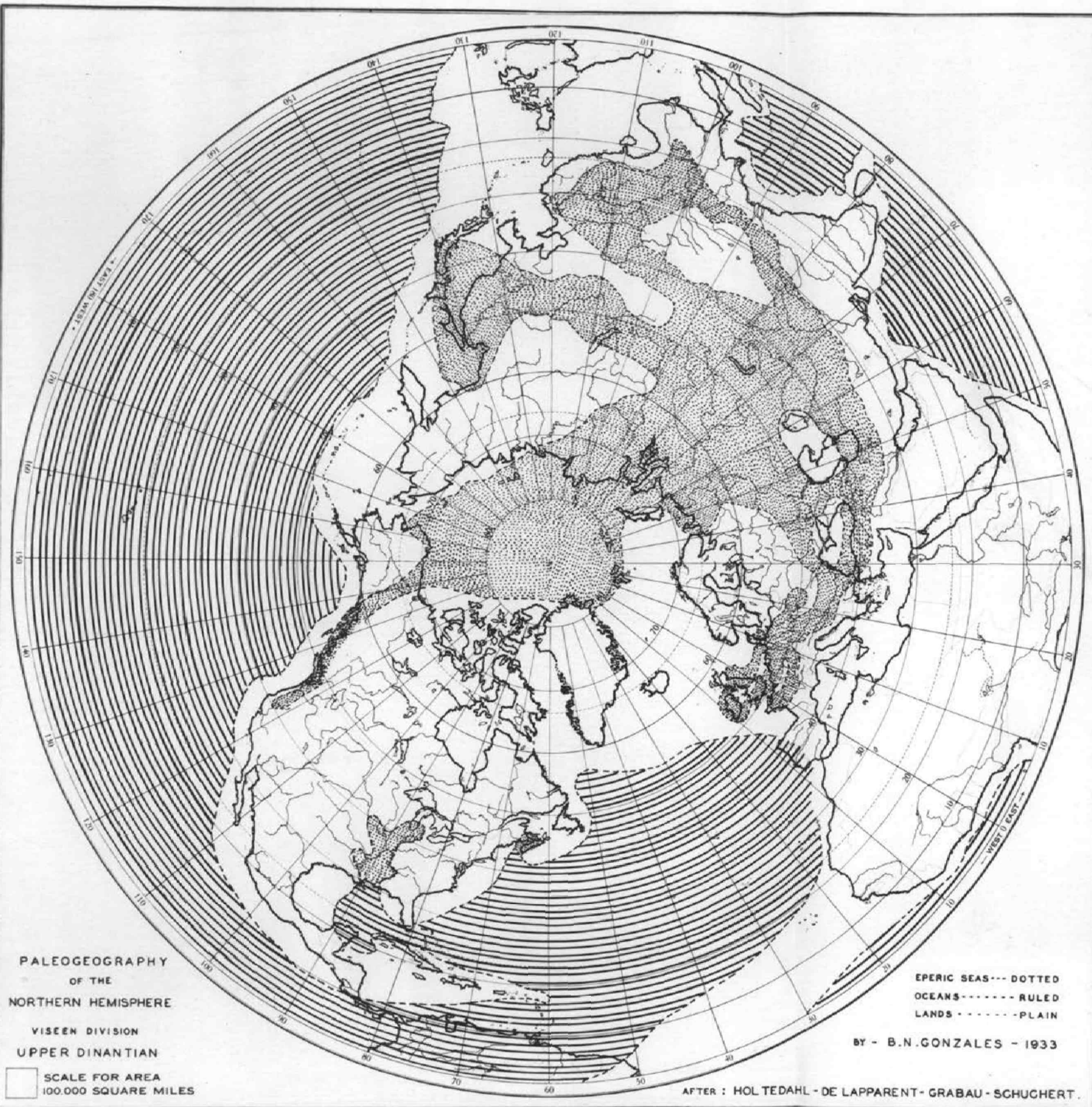
and north central California.

A land mass must have existed to the west preventing the intermingling of the fauna with one then living in the Pacific Basin. To the eastward lay a large continental land mass, part of which, according to Dr. Chas. Schuchert (personal communication) was covered at that time with a sea which has been designated as the St. Louis. The fauna of the typical Mississippian of the Mississippi Valley and that of the Visean which is found in western North America have very few species in common, proving that they were not directly connected.

As the Visean sea flowed down from Alaska to Central California it may have been only a few hundred miles in width, that is judging from the geological data which is now available. Until more data is collected and compiled in western North America its actual width cannot be ascertained.

The Fauna of the Suplee Area

This faunal study is primarily concerned with the brachiopods since that group is most abundantly represented in the fauna and since literature pertaining to contemporaneous Euroasiatic brachiopods was available. These Oregon beds have yielded a large and varied fauna much



of which is as yet unstudied representing Foraminifera, Anthrozoa, Crinoidea, Molluscoidea, and Mollusca. Only a few characteristic forms among these other groups are herein described.

The brachiopods constitute a large portion of the Suplee fauna and productids probably represent 75 percent of that group. Such a high percentage of those forms is indicative of Lower Carboniferous throughout the world. Next in abundance are the corals which will include at least ten species when studied in detail. In places they constitute large masses composed almost exclusively of the genus Lithostrotion. Although numerous specimens of round crinoid stems have been collected, heads have not been found. The bryzoans consist largely of the encrusting types such as Polypora, but they nowhere make up any considerable body of the limestone. Only a few clams, an occasional snail and a few cephalopods have been recognized. Foraminifera have been found in Paleozoic limestones in the overlying basal Triassic, but these have not been discovered in place by the writer and are not considered in this report.

This fauna contains a large percentage of brachiopods that have been described from the Paleozoic of Northern

Europe and from many places in Asia. These Euroasiatic species include such well known forms as: Dictyoclostus semi-reticulatus (Martin), D. flemingi (Sowerby), D. inflatus (Tschernyschew) Echinoconchus elegans (M'Coy), Buxtonia scabricula (Martin), Juresania juresanensis (Tschernyschew), Striatifera striata (Fischer), S. undata (Defrance), Gigantella giganteus (Martin), var. oregonensis, n. sp. Gigantella maxima (M'Coy), Linoproductus cora (d'Orbigny), Eomarginifera viseeniana (Chao), Productus sp., Lingula mytiloides, Sowerby, Derbya regularis Waagen, Spirifer striatus (Martin), Athyris lamellosa (L'Eveille), Dilesma sp., Schizophoria sp., Chonetina sp., Lithostrotion sp., and Polupora. Many of these forms have never before been recognized in North America. The list includes several of the characteristic species of the wide spread Productus giganteus fauna.

The species Productus giganteus (Martin), (Now referred to as Gigantella) for which the fauna is named is represented at Suplee by a form which is subspecifically separable from the typical form and is herein described as the variety oregonensis. This large productid occurs in great numbers in the Suplee area making up large limestone outcrops, some of which are 75 feet long and 15 feet wide. The shells are piled upon one another in such large numbers that it is

almost impossible to obtain a complete specimen. A reconstructed shell gives an inkling as to the size of this enormous brachiopod. It has a height of 140 mm., and a width of 240 mm. The large number of shells show that this species must have been very prolific in the seas. They are found in four large outcrops in the area and on both sides of the anticline equidistant from the anticlinal axis.

Gigantella maxima (M'Coy) another diagnostic species of the *Productus giganteus* zone, is very close to the type Gigantella giganteus and is found in two localities in the area with the variety oregonensis. M'Coy in writing the original description of this species says they are frequently one foot in width, but the Oregon shells do not exceed 7 inches.

Striatifera striata (Fischer) is the most abundant brachiopod found in this area and it is very widely distributed throughout all the localities. It is one of the type fossils of the Viseen of Europe and Asia and one of the forms which is nearly always found in the *Productus giganteus* horizon. In the localities where these fossils are found they are very abundant but very fragmentary, so that the complete specimens are quite rare.

Striatifera undata (Defrance) is common in the Viseen

rocks of Europe and Asia, it is a very good horizon marker, but not quite as common as Striatifera striata.

Dictyoclostus semireticulatus (Martin), Buxtonia scabricula, (Martin), Linoproductus cora (D'Orbigny), and Juresania juresanensis (Tschernyschew) are all long range specimens ranging from the Lower Carboniferous to the Permian, and consequently not of much value for the determination of stratigraphic zones, but they are of a major significance in inter-regional correlation.

The absence of the species Echinoconchus punctatus (Martin) in this area seems quite extraordinary as it is very common in all the Viseen beds of Europe and Asia. It has been set up as the genotype for the new genus Echinoconchus and two species of this genus are found in the Oregon collections. They both have many of the characteristics of E. punctatus and are undoubtedly derived from that stock.

The species Echinoconchus elegans (M'Coy) has been found widely distributed in Europe and Asia and survives even to the Uppermost Carboniferous. It was first described in the Mountain Limestones of England and is one of the characteristic fossils of those beds. This specie occurs in abundance in two Suplee localities.

New species are relatively few in this area. Since

certain foreign literature was not obtainable, it is more than possible that many of the forms which are classed in this paper as near to American species may have been described by foreign authors, but it is certain that they have not been reprinted heretofore in North America.

The presence of the coral Lithostrotion, which appears to have close affinities with L. irregulare (Phillips) of the European Viseen seems to indicate that the remainder of the corals of the area will undoubtedly show many more European and Asiatic forms.

A list of the fauna of the Suplee Paleozoic and the occurrence of each species is given on the following page. In the compiling of this chart Locality UO 2207 is considered on the axis of the anticline and all the other localities range out on either side of the structure. Locality UO 2220 is the most westerly one and UO 2210 the most easterly. This gives the reader an idea as to how the different fossil localities are arranged in the area and the fauna of each.

The correlation table which follows this discussion shows the complete fauna of the Suplee area and correlates it with the known areas of Viseen age in the Northern Hemisphere. Twenty-one species, or approximately 62 percent of

FAUNAL LIST ACCORDING TO LOCALITIES

	2220	2201	2213	2200	2212	2202	2209	2216	2222	2208	2207	2211	2221	2217	2203	2223	2204	2219	2205	2215	2206	2210
Lithostrotion sp.				X		X				X									X			
Polypora sp.								X										X	X			
Crinoid stems																						
Lingula mytiloides Sowerby		X		X		X		X	X			X	X			X	X	X	X			X
Schizophoria cf. subelliptica (W and W)																	X					
Derbya cf. regularis Waagen										X		X										
Chonetina sp.	X					X																
Dictyoclostus semireticulatus (Martin)	X			X		X		X				X					X		X		X	X
Dictyoclostus flemingi (Sowerby)	X																					X
Dictyoclostus inflatus (Tschernyschew)	X																X					
Echinoconchus elegans (M'Coy)						X																
Echinoconchus alternatus (Nor. and Pratt.)	X							X									X		X			
Buxtonia cf. scabricula (Martin)	X																X					
Buxtonia nadeani n. sp.	X							X														
Juresania juresanensis (Tschernyschew)	X					X											X					
Striatifera striata (Fischer)				X				X	X	X				X		X			X	X		
Striatifera cf. undata (Defrance)				X				X		X						X				X		
Gigantella giganteus var. oregonensis				X										X	X	X						
Gigantella maxima (M'Coy)				X										X								
Linoproductus cora (c'Orbigny)								X														
Linoproductus cf. ovatus (Hall)				X																		
Linoproductus cf. censtrensis (Worthen)	X							X									X					
Linoproductus cf. mammatus (Keyserling)	X					X											X					
Eomarginifera cf. viseeniana (Chao)	X							X														
Productus ? species a	X					X											X		X			
Productus ? species b																			X			
Rhynchopora ? cooperensis (Shumard)						X																
Dielasma species a	X																X					
Dielasma species b	X					X																
Spirifer striatus (Martin)				X																		
Spirifer cf. indianensis Weller																	X					
Athyris lamellosa (L'Eveille)										X		X										
Cleiothyridina roissy (L'Eveille)	X					X																
Gastrioceras globulosum (Meek and Worth.)						X																
Goniatites cf. striatus Sowerby	X																					

the Suplee fauna have been described from the *Productus giganteus* horizon of the Viseen of Asia. Twenty, or 59 percent of the fauna are common to the Viseen of Western Europe. Twelve of the species, or approximately 30 percent have been reported from the Viseen of the Donetz Valley in Russia. Thirty-three percent of the species are found, but of those that have been specifically determined only four species or twelve percent of the Suplee fauna is found in the type Mississippian of the Mississippi Valley. Eight of the Suplee species have been reported from the Baird Formation of north central California, but it is believed that if there had been more recent work done in that locality, this number would undoubtedly have been greatly increased. Ten of the Suplee forms have been described in the little known Lower Carboniferous of Alaska.

Without doubt the above evidence has proven that the *Productus giganteus* zone is represented in the Suplee area. As yet it is uncertain whether an earlier fauna occurs below this horizon. There is a possibility of lower beds existing between the lowest occurrence of Gigantella giganteus and the axis of the anticline. There is, however, a great thickness of Paleozoic sediments above the upper-

most known occurrence of the G. giganteus. However, more detailed field and laboratory correlations are necessary before other zones can be identified.

Correlation Table of the Fauna
of the
Suplee Paleozoic

	<u>Occurrence</u> <u>Elsewhere</u>					
	* <u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Lithostrotion sp.	x	x			x	x
Polypora sp.	x	x				
Lingula mytiloides Sowerby	x	x			x	x
Schizophoria cf. subelliptica (W & W)				x		x
Derbya cf. regularis. W aagen	x	x	x			x
Chonetina sp.	x	x	x			
Dictyoclostus semireticulatus (Martin)	x	x	x	x	x	x
Dictyoclostus flemingi (Sowerby)	x	x	x		x	x
Dictyoclostus inflatus (Tschernyschew)	x	x	x			
Echinoconchus elegans (M'Coy)	x	x	x			
Echinoconchus alternatus (N. and P.)				x		
Buxtonia cf. scabricula (Martin)	x	x				x
Buxtonia nadeani n. sp.						
Juresania juresanensis (Tschernyschew)	x		x			
Striatifera striata (Fischer)	x	x				
Striatifera cf. undata (Defrance)	x	x	x			
Gigantella giganteus var. oregonensis	x	x	x		x	x
Gigantella maxima (M'Coy)	x	x	x			
Linoproductus cora (D'Orbigny)	x	x	x	x	x	x
Linoproductus cf. ovatus (Hall)					x	
Linoproductus cf. cestriensis (Worthen)					x	
Linoproductus cf. mammatus (Keyserling)	x	x				
Eomarginifera cf. viseeniana (Chao)	x					
Productus ? species a						
Productus ? species b						
Rhynchopora ? cooperensis (Shumard)					x	
Dielasma species a						
Dielasma species b						
Spirifer striatus (Martin)	x	x			x	x
Spirifer cf. indianensis (Weller)				x		
Athyris lamellosa (L'Eveille)	x	x			x	
Cleiothyridina roissyi (L'Eveille)	x	x	x			
Gastrioceras globulosum (Meek & Worthen)					x	
Goniatites cf. striatus Sowerby		x	x	x		

- *1 - Viseen of Asia
 2 - Viseen of Western Europe
 3 - Viseen of Donetz Valley
 4 - Mississippian of Mississippi Valley
 5 - Baird Formation of California
 6 - Lower Carboniferous of Alaska

Systematic Description of a Portion
of the
Suplee Fauna

Phylum - Molluscoidea
Class - Anthozoa
Order - Tetracoralla
Family - Lithostrotionidea
Genus - Lithostrotion, Lhwyd.

Lithostrotion, Sp.und.

DESCRIPTION: - Corallines apparently grow in small tuffs. They are cylindrical, more or less flexuous and medium sized. Surface marked by small wrinkles of growth and costal striae. Rays from 44 to 50, about one-half of them extending to the columella, while the intermediate small ones only pass about 1/3 of the way in from the outer wall.

REMARKS: - This is something like L. Californensis, Meek, but is too small. It might better be compared to the form L. irregulare, or L. martini.

HORIZON AND LOCALITY: The genus Lithostrotion ranges from the Silurian to the Permian. L. irregulare and L. martini are types which are characteristic of the Viséen.

This genus was collected in the following Suplee localities: UO 2200, UO 2202, UO 2208 and UO 2205.

Phylum - Molluscoidea
 Class - Bryozoa
 Family - Polyporidae
 Genus - Polypora, M'Coy

Polypora, Sp. Und.

DESCRIPTION: Only a few very badly weathered specimens of this type were found. They have from 2 to 8 rows of zooecia on a branch and the median keel is reduced to a row of strong nodes or tubercles, apparently not thickened at the branches.

HORIZON AND LOCALITIES: This genus ranges from the Silurian through the Carboniferous and is common all over the world. It was collected in localities UO 2216, UO 2219, and UO 2205 in the Suplee Area.

Phylum-Molluscoidea
 Class -Brachiopoda
 Order -Atremata
 Family-Lingulidae
 Genus -Lingula Bruguiere 1792.

The genus Lingula is remarkable for its geologic range, for, although based upon a living species, it includes

abundant Paleozoic shells which are generically indistinguishable from the modern ones.

Genolectotype (Lamark), Patella
unguis, Linnaeus.

Lingula mytiloides, Sowerby

- 1815 *Lingula mytiloides*, Sowerby. The Min. Conc. of Gr. Britian.
- 1894 *Lingula mytiloides*, Smith, J.P., The Meta. Ser., Jour. Geol. Vol. 12, No. 6, p.596.
- 1924 *Lingula mytiloides*, Grabau. Strat. of China. Paleozoic, Pt. I, p.216.

DESCRIPTION: Shell small, subelliptical in outline, the width about one-half the length.

Valves gently convex, the anterior margin subsemicircular, the lateral margin gently convex, the posterolateral margin nearly straight or gently convex and meeting at the beak in a rounded, obtuse angle, Surface marked by very fine, exceedingly regular, concentric costae, from twelve to fifteen of which occupy the space of 1 mm., and concentric undulations usually rather obscure.

The dimensions of an Oregon specimen are: Length 18 mm., and width 9 mm.

HORIZON AND LOCALITY: Lingula mytiloides is quite common in the Viseen of Europe and has been reported in

the Baird of California. In the Suplee area it was collected at UO 2204.

- - -

Order - Protremata

Family - Schizophoridae

Genus - Schizophoria, King 1850.

The genus Schizophoria takes in biconvex orthids in which the hinge-line is relatively short, the cardinal areas small, and the ventral valve commonly develops a shallow sinus toward the front. The surface is covered with fine tubulose lirae, which arise at irregular intervals.

Genotype - Amonites resupinatus, Martin

Schizophoria resembles Enteletes but is distinguishable by its plications and its ventral median septum.

Schizophora cf. subelliptica
(White & Whitefield)

- 1862 *Orthis subelliptica*, White and Whitefield. Proc. Bost. Soc. Nat. Hist., Vol.8, p.292.
- 1901 *Schizophora subelliptica*, Weller. Trans. St. Louis Acad. Sci. Vol. 11, p.182, Pl.XVI, Figs. 4-6, Pl. XIX, figs. 6-7.
- 1914 *Schizophora subelliptica*, Weller. Ill. Geol. Sur. Mono. I, Pt. I, p.162, Pt. II, Pl.XXIII, figs. 1 - 5.

DESCRIPTION: Shell small, broader than long, transversely subelliptical in outline, the greatest width near the mid-length of the shell, hinge line about two-thirds the greatest width.

Pedicle valve most pronounced in the umbonal region, curving abruptly to the cardinal margin and gently to the anterior margin, compressed toward the cardinal extremities. The mesial portion of the valve distinctly flattened anteriorly, rather broad and ill-defined sinus. Beak is pointed and slightly incurved. Surface marked by fine, rounded, radiating costae, increasing by bifurcation and intercalation, every second or third one being slightly larger, about three occupying one millimeter anteriorly. The dimensions of a nearly complete pedicle valve are as follows: Length, 14.9 mm., Width 19.7 mm., length of hinge-line 16.4 mm.

REMARKS: The specimens collected in the Suplee area resemble quite closely Schizophora subelliptica from the Mississippi Valley. However, due to the preservation of the Oregon specimens an accurate determination is impossible.

HORIZON AND LOCALITY: Schizophora subelliptica is found in the Kinderhook series of the Mississippi Valley. Collected in the Suplee area at locality UO 2204.

Superfamily - Strophomenacea
 Family - Strophomenidae
 Subfamily - Orthotetinae
 Genus - *Derbya* Waagen 1824.

The genus *Derbya* takes in shells which are plano-convex, with the dorsal pedicle valve always more convex than the ventral brachial; hinge-line half the width of the shell. The surface is marked by fine radiating striae.

Genolectotype - *Derbya regularis* Waagen.

Derbya cf. *regularis*, Waagen.

1884 *Derbya regularis*, Waagen. Prod. Limestone Fossil Memo. Geol. Surv. of India, Paleo. Indica, Ser. XIII, Vol. IV, Fasc. 1-5, p. 591.

1909 *Derbya* (*Orthotetes*) *regularis*, Grabau and Shimer. No. Amer. Index Fossils. p. 231.

DESCRIPTION: Shell large, moderately biconvex, wider than long, with a marginal outline which is transversely subelliptical. In the pedicle valve the cardinal areas are high and more or less distorted. A few very concentric irregular undulations or strong varices of growth on the valve.

The surface is marked by rather fine striae, which increase by intercalation. From 22 to 28 of these striae

occupy the space of 10 mm. The fineness of the striae is maintained to the anterior margin. The whole surface of the shell is covered by sharp concentric lines of growth which are accentuated in crossing the striae.

Dimensions of an average Oregon specimen are: Length 55.2 mm., width 69 mm., and length of hinge-line 53.9 mm.

REMARKS: The state of preservation in which the Suplee specimens were found make accurate determination impossible, but they come very close to Derbya regularis.

HORIZON AND LOCALITIES: Derbya regularis is quite common in the Lower Carboniferous deposits of Europe and Asia, but has never before been described in North America.

This species was collected in the Suplee area in the following localities: UO 2206, UO 2208, and UO 2211.

Family - CHONETIDAE

Genus - Chonetina Krotow 1888.

The genus Chonetina is a specialized group of chonetids distinguished by a strongly convex ventral valve with a narrow and pronounced sinus. The shell is striated and shows all the other characters of Chonetes s.s.

Genotype - Chonetella artiensis Krotow

Chonetina, sp. und.

DESCRIPTION: Shell of small size with a distinct sinus

and fold. The hinge-line marking the widest part of the shell.

The pedicle valve is moderately convex, its depth not exceeding three-tenths of its length. The median sinus is deep and narrow, lying between a pair of sharply rounded folds that form the most convex portion of the valve. The fold diverge from the beak and are generally more distinctly defined on the inner than the outer side, which grades into the lateral slope of the valve. The surface bears fine but distinct radial striae of which 15 to 20 occupy a space of 5 mm. No cardinal spines were noted on the Oregon specimens. Growth lines are quite prominent.

The dimensions of an average Oregon specimen are: height 9.1 mm., and length of hinge-line 16.8 mm.

REMARKS: The Oregon specimens appear to be quite near the genus Chonetina flemingi, but the material was too fragmentary for specific determination.

HORIZON AND LOCALITIES: Chonetina ranges from the Lower Carboniferous to the Permian.

This genus occurs at localities UO 2201 and UO 2202 in the Suplee area.

Family - PRODUCTIDAE

The productids were the dominant brachiopods of the upper Paleozoic. No other group was so prolific in individuals and species. In all the older literature the genus Productus was broadly conceived and made to embrace a vast number of species.

A new impetus was given the study of Producti by Thomas (56) in 1914, wherein he suggests principle for the natural classification of the species and starts the generic discrimination that has since been carried forward by Weller (61), Chao (12-13), Fredericks (22), Muir-Woods (40), Dunbar and Condra (20) and Sarytscheva. Thus, while only eleven names have been introduced for Producti during the 100 years from 1814 to 1914, no less than 28 have been introduced in the last sixteen years.

In speaking of this tendency Dunbar and Condra (20, p. 9) make the following statement:

"The traditional conservatism in the generic subdivision of the Productidae has succumbed before the recent works of Thomas, Chao, Fredericks and Muir-Woods, yet the new genera have made but little headway into American literature. A critical study of the diverse forms still commonly embraced in the protean genus Productus lead to increased wonder that the sub-divisions recently proposed were not recognized long

LIST OF PRODUCTID GENERA *

<u>Name, Author and Date</u>	<u>Genotype</u>	<u>Present State</u>
†Productus Sowerby 1814	Amonites productus Martin	
†Productella Hall 1867	Productus subaculeatus Murchinson	
†Strophalosia King 1884	Orthis excavata Geinitz	
†Marginifera Waagen 1884	Marginifera typica Waagen	
†Aulosteges Helmerson 1887	A. variabilis Helmerson	
Etheridgina Oehlert 1887	Productus complectens Etheridge	
Proboscidea Oehlert	P. proboscidalis Verneuil	
†Scacchinella Gemmellaro 1896	S. variabilis Gemmellaro	
<u>Diaphragmus</u> Girty 1910	Productus elegans N. and P.	= Productus s.s.
Tschernyschewia Stoyanow 1910	T. typica Stoyanow	
<u>Septoproductus</u> Frech 1911	Productus abichi Waagen	= Tschernyschewia
†Avonia Thomas 1914	P. youngianus Davidson	
†Buxtonia Thomas 1914	P. scabriculus Martin	
Overtonia Thomas 1914	P. fimbriata DeKoninck	
Pustula Thomas 1914	P. pustulosa Phillips	
†Echinoconchus Weller 1914	P. punctatus Martin	
Tschernyschewiella Fredericks 1923	P. porrectus Kutorga	= Tschernyschewia?
†Linoproductus Chao 1927	P. cora D'Orbigny	
†Striatifera Chao 1927	P. striatus Fischer	
†Waagenoconcha Chao 1927	P. humboldti D'Orbigny	
Plicatifera Chao 1927	P. plicatilis Sowerby	
†Horridonia Chao 1927	P. horridus Sowerby	
Sowerbina Fredericks 1928	P. timanicus Stuckenberg	= Horridonia Chao
<u>Thomasella</u> Fredericks 1928	P. wrighti Davidson	= Plicatifera
<u>Ruthenia</u> Fredericks 1928	P. irginae Stuckenberg	= Waagenoconcha (pars), Avonia(pars)
†Krotovia Fredericks 1928	P. spinulosus Sowerby	
Cora Fredericks 1928	P. cora D'Orbigny	= Linoproductus
<u>Thomasina</u> Fredericks 1928	P. margaritaceus Phillips	name preoccupied; of doubtful value.
†Cancrinella Fredericks 1928	P. cancrini Verneuil	
†Juresania Fredericks 1928	P. juresanensis Tschernyschew	
Kansuella Chao 1928	P. Kansuensis Chao	
Gigantella Sarytscheva 1928	P. giganteus Martin	
Sinuatella Muir-Wood 1928	P. sinuata DeKoninck	
Euproductus Whitehouse 1928	P. cora D'Orbigny	= Linoproductus
Taeniothaerus Whitehouse 1928	P. subquadratus Morris	inadequately de- fined.
Anidanthus Whitehouse 1928	P. sp. undescr.	inad. defined
†Protoniella Bell 1929	P. beedei Bell	uncertain
†Eomarginifera Muir-Wood 1930	P. longispinus Sowerby	
†Dictyoclostus Muir-Wood 1930	P. semireticulatus (Martin)	
Wyndhamia Booker 1930	W. Dalwoodensis Booker	= Aulosteges?
Branxtonia Booker 1930	B. typica Booker	inad. defined
†Leptalozia Dunbar and Condra nov.	Strophalosia scintilla Beecher	

* Dunbar and Condra (20, p. 188) have compiled this list of productid genera.

† Types occur in America.

Synonyms are underlined.

ago. We have accepted these as genera rather than subgenera because most of them, at least, are undoubtedly of full generic rank. The increase in generic names will be only a temporary embarrassment and the refinement will make for permanent progress."

The writer in his determinations has endeavored to follow along these stated lines, whenever possible, giving the proposed subgenera full generic rank and regrets that he did not have access to Sarytscheva's new work on the genus Gigantella.

Genus - DICTYOCLOSTUS Muir-Woods 1930

"Productids of either elongate or subquadrate outline, with the hinge-line moderately long and with the pedicle valve strongly convex and usually geniculate, while the brachial valve is flat or moderately concave over the visceral disc and then geniculate, leaving a fairly deep visceral cavity and a short or moderate trail. The surface bears radial costae at all stages of growth and the visceral disc and then geniculate, leaving a fairly deep visceral cavity and a short or moderate trail. The surface bears radial costae at all stages of growth and the visceral disc of both valves is marked by concentric rugae which cross the costae to form the characteristic reticulate ornamentation of this group. There is no internal diaph-

ragm , and no marginal ridges in front of the visceral disc. The cardinal process is strong, but neither hinge-teeth nor dental sockets are present. Normally there is no cardinal area but a linear one is occasionally developed as an individual variation." (20, p.213).

Genotype - Productus semireticulatus (Martin)

This genus includes a large number of forms previously described under the name of Productus. Including such forms as Dictyoclostus semireticulatus, D. inflatus and D. flemingi. This is a long range genus extending from early Lower Carboniferous to Late Permian. Several of the species like Dictyoclostus semireticulatus and D. inflatus have a wide geographic distribution and are therefore valuable from the standpoint of inter-regional correlation.

Dictyoclostus semireticulatus (Martin)

Plate I, Figs. 4 - 6.

- 1845 Productus semireticulatus, Verneuil. Geologie de la Russie d'Europe et des Mont. de l' Oural, Vol. II, Pal. p. 262, Pl. XVI, Fig. 1.
- 1861 Productus semireticulatus, Salter. On the Fossils from the High Andes. Q.J., Vol. XVII, p. 64, Pl. IV, fig. 1.
- 1863 Productus semireticulatus, Davidson. Mon. of Brit. Carb. Brach. p.149, Pl. XLIII, Fig. 1-5, Pl. XLIV, fig. 1-4.

- 1864 *Productus semireticulatus*, Meek. *Paleo. of Calif.* Vol I, Sec. I, p.11, Pl. II, fig. 4-4a.
- 1922 *Productus semireticulatus*, Grabeau, *Bull. Geol. Sur. China*, No. 4.
- 1927 *Productus semireticulatus*, Chao. *Productidae of China*, Pt. I. *Pal. Sinica*, Ser. B. Vol. 5, Fasc. 2, P. 27, Pl. I, fig. 1-4.
- 1928 *Dictyoclostus semireticulatus*, Muir-Woods. *British Carb. Producti II*, *Productus Memo. Geol. Surv. Gr. Brit. Paleo.* Vol. III, Pt. I.

DESCRIPTION: The shell is large in size, transversely subquadrate in outline with hinge-line a little less than the greatest width.

The pedicle valves in the specimens collected are strongly inflated. The umbonal region is wide and regularly inflated. The ears are well developed. The median sinus is broad and deep, originating not far from the beak. The whole surface is marked by numerous fine radiating costae which are crossed in the umbonal region by concentric plications, giving that part of the shell a characteristic reticulation. The radiating costae are not coarse; they are well-rounded and separated by interspaces of about the same width. They increase in number by bifurcation. There is also a tendency for the surface to develop coarse radiating folds. No spines observed.

The brachial valve appears to be quite flattish in the visceral portion, but becomes geniculated at an angle

of about 90 degrees toward the front. The median fold is well defined. The surface is marked by a delicate and characteristic reticulation in the flattish visceral portion, but toward the geniculated part only radiating costae remain.

The dimensions of an Oregon specimen are as follows:

Maximum height of shell - - - - - 41.6 mm.
 Height from Hinge-line to anterior margin-34.5 mm.
 Length of curvature - - - - - 82.7 mm.
 Length of hinge-line - - - - - 52.0 mm.
 Width of shell - - - - - 44.3 mm.
 Thickness of the two valves - - - - - 15.3 mm.

REMARKS: This specie is both wide-spread and long-lived and there are scarcely any Carboniferous formations in which it fails to occur. In Chao, it is set up as a typical Productus, but Muir-Woods has proven that it does not belong to the genus Productus and has made it the genotype for the genus Dictyoclostus.

HORIZON AND LOCALITIES: D. semireticulatus (Martin) occurs abundantly in the Lower Carboniferous all over the world; is rare in the Upper Carboniferous, and the present typical D. semireticulatus is not known in the Permian.

This specie occurs in the following Suplee localities:
 UO 2201, UO 2200, UO 2202, UO2222, UO 2221, UO 2204, UO 2205,
 UO 2206 and UO 2210.

Dictyoclostus flemingi (Sowerby)

- 1861 Productus flemingi, Davidson. Mono. of British Carb. Brach.
- 1923 Productus flemingi, Grabau. Stratigraphy of China, Pt. I, Paleozoic, p. 225.
- 1926 Productus flemingi, Obrutschew. Geologie von Sibirien, p. 225.
- 1928 Dictyoclostus flemingi, Muir-Woods. British Carb. Producti II Productus. Memo. Geol. Sur. Gr. Brit., Paleo. Vol. III, Pt. I.

DESCRIPTION: Shell medium size to large, broader than long. Hinge-line equaling or greater than the greatest width of the shell, the lateral margins sinuate in front of the cardinal extremities; convexly rounded anteriorly into the anterior margin which is sinuate in the central portion.

Pedicle valve strongly ventricose, umbonal region protruding posteriorly beyond the hinge-line, beak strongly incurved, lies nearly opposite the center of the valve. Surface of valve marked by rounded radiating costae which increase by bifurcation and intercalation posteriorly, but anterior to the center they usually continue without further division to near the front margin, where they tend to become obsolete. In the umbonal region the costae are crossed by distinct, wrinkle-like concentric markings, giving this portion of the valve a distinct semireticulate ornamentation.

No brachial valves were collected.

REMARKS: Dictyoclostus flemingi resembles D. semireticulatus but the semireticulate ornamentation is not as

distinct, the medial sinus is not as broad or deep, and the costae continue from the anterior umbonal region to the trail without bifurcation and become quite large. D. flemingi differs from D. inflatus in the above reasons and size.

HORIZONS AND LOCALITIES: D. flemingi occurs in the Viséen of Europe and Asia and a closely related form Productus burlingtonensis, which is thought to have been derived from the flemingi stock, is found in the Mississippi Valley.

This specie occurs in the following Suplee localities: UO 2201, and UO 2210.

Dictyoclostus inflatus (Tschernyschew)

- 1902 Productus inflatus, Tschernyschew (non McChesney).
Die obercarbonischen Brach. des Ural
und des Timan, p.612, Pl.XVIII, figs .
1 - 6.
- 1909 Productus inflatus, Grover. Carbon und Carbonfossilien
des nordlichen und zentralen Tian-shan,
p. 378, Pl. II, fig. 7 a-c; Pl. III,
fig. 5 2-c.
- 1924 Productus inflatus, Grabau. Stratigraphy of China,
Pt. I, Paleozoic, p. 229.
- 1914 Productus inflatus, Weller. Ill. St. Geol. Surv.
Mono. I, Pt. I, p. 111, Pt. II, Pl.X,
Figs. 1 - 6.
- 1927 Productus inflatus, Chao. Productidae of China, Pt. I,
Pal. Sinica, Ser. B, Vol. 5, Fasc. 2, p. 36,
36, Pl. II, fig. 13, Pl. III, figs. 1-5.
- 1930 Dictyoclostus inflatus, Muir-Woods. British Carb.
Producti II, Productus, Memo. Geol. Surv.
Gr. Brit., Paleo., Vol. III, Pt. I.

DESCRIPTION: Shell of medium size, strongly enrolled, elongate rectangular in outline exclusive of ears, with hinge-line marking the greatest width of the shell.

Pedicle valve very strongly inflated in both directions with the visceral portion protuberant beyond the hinge-line. The umbonal region is somewhat flattish. The beak is pointed, strongly incurved, but only sparingly turned over the hinge-line. Mesial sinus originating in the umbonal region, rather narrow and of moderate depth. Surface of valve marked by rounded, radiating costae which increase by bifurcation on the posterior slope, tending to become faint and nearly obsolete toward the margin; crossing the radiating costae upon the posterior slope of the valve are concentric, wrinkle-like markings which give to the surface a semireticulate ornamentation. Spine bases very sparsely and irregularly scattered upon the body of the shell.

No brachial valves were collected.

The dimensions of an Oregon specimen are as follows:

Maximum height of shell - - - - - 27.5 mm.
 Height from hinge-line to anterior margin - 22.5 mm.
 Length of curvature - - - - - 52.0 mm.
 Length of Hinge-line - - - - - 34.4 mm.
 Width of shell - - - - - 31.5 mm.

REMARKS: Dictyoclostus inflatus is distinguished from D. semireticulatus by the radiating costae which are com-

paratively coarser, the pedicle valve is more strongly geniculate, and the size of the adult specimen which is much smaller. In D. flemingi the radiating costae are much coarser especially noticeable in the trail. The American specie Productus inflatus McChesney is a synonymy, there being two distinct species by the same name. The writer has followed Chao.

HORIZONS AND LOCALITIES: This species is of wide distribution in Europe and Asia and has been reported from various formations ranging from the Viseen to the Lower Permian.

This species occurs in the following Suplee localities: UO 2201 and UO 2204.

Genus - ECHINOCONCHUS Weller 1914.

"Pedicule valve strongly convex, brachial valve flattish to slightly concave, often upturned at the margins. There is thus formed a thick and uniform visceral cavity through the entire length of the shell. Hinge-line less than the greatest width of the shell. Median sinus usually well-defined. Surface marked by conspicuous concentric bands and wrinkles, bearing rows of spines." (12, p.63)

Genotype - Amonites punctatus Martin

This genus was proposed as a subgenus in 1914 by

Weller for shells like Productus punctatus which he regarded as quite distinct from the remaining Producti. In his British Carboniferous Producti published in 1914 Thomas introduced another name for apparently the same kind of shells. This is the well known Pustula. Muir-Woods recognizes the two genera and says that they are both of generic rank.

This genus is of wide distribution in the Carboniferous deposits in the world. The majority of the species are divided into two groups, the E. punctatus and E. elegans. Both of these groups are represented in the Suplee fauna.

Echinoconchus elegans (M'Coy)

- 1844 Productus Elegans, M'Coy. Synopsis of Carb. Fossils Ireland, Pl. XVIII, fig. 13.
- 1861 Productus punctatus, var. ? elegans, Davidson. Mono. Br. Carb. Brach. p. 173, Pl. XLIV, fig. 15.
- 1914 Pustula elegans, Thomas. The Br. Carb. Producti.; Memo. Geol. Sur. Gr. Brit. Pal., Vol. I, Pt. 4, p. 292, Pl. XVII, fig. 1-4.
- 1927 Echinoconchus elegans, Chao. Productidae of China. Pt. I, Pal. Sinica, Ser. B, Vol. 5, Fasc. 2, Pg. 64, Pl. Vi, fig. 1-6.

DESCRIPTION: Shell of small size, ovate in outline, with hinge-line less than the greatest width of the shell.

Pedicle valve regularly and strongly inflated. Beak pointed, incurved and rapidly expanded towards the front.

Hinge-line straight, always less than the greatest width of shell. Ears small, not very well differentiated from the remainder of the shell. Median sinus absent or nearly so.

Surface marked by many regular, obtusely angulated concentric ridged, generally 10 in number. They are separated by broad and smooth depressions, and are as a rule, more pronounced and broader in the median portion, but become attenuated and crowded together toward the lateral parts and upon the ears. The summits of the concentric ridges are decorated with a row of comparatively large elongated spine-bases, bearing forward-projected cylindrical spines at the anterior extremities. Just anterior to these large spines, there are also one or two rows of smaller ones. The spines of the posterior row are by far the strongest. The smooth depressed inter-spaces between the ridges are marked by many faint concentric growth-lines.

Brachial valve slightly and uniformly concave, forming a thick and uniform visceral cavity between the two valves. Surface marked by many prominent, angulated concentric ridges, generally about 10 in number. The latter are characterized by a narrow steep posterior and a broad flat anterior slope, the two uniting at about the middle

in a sharp edge. The surface relief thus produced, is just like a semi-circular pavement, one step above another towards the margins. The posterior slope of the concentric ridges is marked by a posterior row of large spines, the anterior slope is crossed only by several faint concentric growth-lines.

The measurements of one individual Oregon specimen are as follows:

Maximum height of shell - - - - -	21.5 mm
Height from hinge-line to anterior margin -	18.1 mm.
Length on curvature - - - - -	34.4 mm.
Length of hinge-line - - - - -	13.2 mm.
Greatest width of shell - - - - -	21.6 mm
Thickness between two valves - - - - -	-----

REMARKS: Echinoconchus elegans differs from E. punctatus and E. alternatus not only in its small size, but in the absence of a median sinus, the concentric ridges are less and in its internal structure. In Professor M'Coy's original description he said it was a shell combining all the characteristics of both Productus fimbriatus and P. punctatus.

HORIZONS AND LOCALITIES: This specie is widely distributed in Europe and Asia and survives even to the Uppermost Carboniferous. It was first described in the Mountain Limestone of England. This specie occurs in the Suplee area at locality UO 2202.

Echinoconchus cf. alternatus
(Norwood & Pratten)

Plate III, figs. 2-3.

- 1855 *Productus alternatus*, Norwood and Pratten. Jour
Acad. Sci., Phil., (2), Vol.3,
p. 20, Pl. II, figs. 1a-6.
- 1883 *Productus alternatus*, Hall. Rep. N.Y. State Geol.
for 1882 Pl. (18) 49, fig. 14.
- 1914 *Echinoconchus alternatus*, Weller. Ill. State Geol.
Sur. Mono.I, Pt. I, p. 138, Pt.
II, Pl. XVII, figs. 1-7.

DESCRIPTION: Shell medium to large, usually as wide
or wider than long, but occasionally longer than wide, the
hinge line a little shorter than the greatest width.

Pedicle valve strongly inflated, with the curve
more pronounced in the posterior third. Transversely, the
impressed umbonal region falls rather abruptly along the
umbonal flanks to the small ears, but the curve becomes
rather uniform and gradual towards the anterior part of
the shell except at the middle where it is indented
slightly by the median sinus. Peak pointed, and strongly
incurved. Ears small and ill defined. Median sinus
commencing a short distance from the apex of the beak,
and extends to the front where it is very shallow and broad
sometimes hardly distinguishable. Surface of valve marked
by strong regular, concentric, bands which are rather
abruptly elevated at their anterior margin with the surface

sloping regularly to the line of elevation of the next posterior band, these bands vary in width from 1 to 5 mm. usually being the narrowest toward the beak, with the broadest band in the middle portion of the valve. The surface between the bands is characterized by numerous spine bases, somewhat irregularly disposed in several rows.

The brachial valve is gently concave, sometimes almost flat, with a broad, ill-defined mesial fold originating in the middle and grows more prominent anteriorly. Surface marked by concentric bands and fine spine bases similar to those of the opposite valve.

The dimensions of the specimen pictured are:

Maximum Height of shell - - - - -	32.3 mm
Height from hinge-line to anterior margin - -	32.2 mm
Length of hinge-line - - - - -	17.4 mm.
Length of curvature - - - - -	62.8 mm.
Width of shell - - - - -	33.7 mm.
Thickness between the two valves - - - - -	14.0 mm.

REMARKS: Echinoconchus alternatus resembles E. punctatus in many respects but the beak is more pointed, the hinge-line proportionally longer, and a broader umbonal region. It is undoubtedly derived from E. punctatus stock. The Oregon species resemble E. alternatus quite closely but with more

European literature to work with it will undoubtedly prove to be a new specie because the rest of the Productids all have Euroasiatic characteristics.

HORIZON AND LOCALITIES: E. alternatus is quite common in the Upper Mississippian of the Mississippi Valley.

This species occurs in the Suplee area in the following localities: UO 2201, Uo 2216, UO2204, and UO 2205.

Genus - BUXTONIA Thomas 1914

This name was proposed by Thomas for the reception of the British Amonites scabriculus Martin. The shell is essentially echinoconchoid in outline. Its generic diagnosis lies chiefly in the surface sculpture which is characterized by a costate and spinose ornamentation in the young and adult stages, but by spinosity alone in old age. The shell is further marked by many concentric wrinkles. The umbonal regions may be more or less reticulate.

Genotype - Amonites scabriculus Martin

This genus includes a small number of forms which were formally described under the name of Productus. One of which is found in Oregon and that is Buxtonia scabricula. This is found widely distributed in the Dinantian of Europe, Russia, and China.

Buxtonia cf. scabricula (Martin)

Plate III, Fig. 4.

- 1845 *Productus scabriculus*, Verneuil. Geologie de la Russie d'Europe et des Mont. l'Oural. Vol. II, Paleo., p.271, Pl.XVI, fig. 5, Pl. XVIII, fig. 5.
- 1862 *Productus scabriculus*, Davidson. Mono. of British Carb. Brach. p. 169, Pl. XLII, figs. 5-8.
- 1914 *Buxtonia scabricula*, Thomas, The British Carb. Producti I, Memo, Geol. Sur. Gr. Brit. Paleo Vol. I, Pt. 4.
- 1927 *Buxtonia scabricula*. Chao. Productidae of China, Pt. I, p. 78, Pl. VIII, figs. 1-3.

DESCRIPTION: This species is apparently represented by several fragmentary individuals from the Suplee Formation, which check quite closely with those described by Chao, (12 p.79), but it is possible that better preserved fossils may give evidence of another specie.

Shell of medium size, rotundato-quadrant in outline, with hinge-line just slightly less than the greatest width of the shell, the hinge-line being 39.6 mm. in length.

Pedicle valve strongly and more or less regularly inflated. Beak pointed, incurved but only slightly overhanging the hinge-line and rapidly expanded toward the visceral portion. The umbonal region is characterized by somewhat steep cardinal and umbonal flanks. Hinge-line straight produced at the extremities into short flattish ears which

are marked off from the rest of the shell by a slight concavity.

Surface marked by concentric wrinkles and a spinose and costate ornamentation. The concentric wrinkles are somewhat indistinct in the median portion of the shell. The sculpter of the shell consists of many radially elongated tubercles merging into spines or rather tubercles which are isolated from one another and arranged in quincunx.

No brachial valves were found in the Suplee area. In Chao (12, p. 78) he gives the following description of his valves: "The brachial valves are flattish in the visceral portion, slightly geniculate at the margins. Not far from the beak commences a low fold, corresponding to the median sinus of the opposite valve. The surface is marked by many concentric wrinkles, short tubercular spines, and tubercle-pits. In the interior the cardinal process is strong, the lateral ridge is well marked and the surface is covered with many spinose tubercles.

REMARKS: Buxtonia scabricula differs from Juresania juresanensis in that the latter's spines are not so well isolated from one another and also show a tendency toward arrangement into radiating rows. The characteristic feeble concentric wrinkles and the spinose and costate

ornamentation of the shell is the distinguishing feature of B. scabricula. This is the first record of this specie being found in North America.

HORIZON AND LOCALITY: Buxtonia scabricula is widely distributed in the Dinantian of Europe and Asia, and a few specimens have been found in the Upper Carboniferous of Asia.

This species occurs in the Suplee area in the following localities: UO 2201 and UO 2204.

Buxtonia nadeani n. sp.

DESCRIPTION: Shell of large size, generally as high as wide, essentially echinoconchoid in outline, with the hinge-line less than the greatest width of the shell.

Pedicle valve inflated but not strongly. Beak is pointed and rapidly expanding to the front and overhanging the hinge-line. Median sinus very prominent, commencing on the beak and becoming more pronounced in the anterior part of the shell, and is shallow but broad. The umbonal region is characterized by gentle sloping cardinal and umbonal flanks. Ears small, flattish, and rectangular at the cardinal extremities. The hinge-line is straight.

The surface is covered with small spine tubercles which are closely packed together, these follow the costae, starting at the beak and extending to the anterior margin

and each one is on what seems to be a concentric wrinkle or growth-line. The whole surface is marked by numerous undulating growth-lines, and these and the costae which are also numerous and rounded and start at the beak and increase by bifurcation give the shell a somewhat semi-reticulate ornamentation.

No brachial valves were found in the Suplee area.

REMARKS: This specie has all the characteristics common to the genus *Buxtonia*, but the surface sculpture is different from anything that has ever been described. It is larger than *Buxtonia scabricula* and the spines are not in concentric lines, and it has the concentric growth-lines which are so prominent. *Juresania juresanensis* another closely related form is much smaller, and the surface ornamentation is considerably different.

LOCALITY: This specie is found in localities UO 2201 and UO 2216 in the Suplee area.

Genus - JURESANIA Fredricks 1928.

"Shells of the pustulose group of productids characterized in the youthful and adolescent stages by more or less obscure concentric bands, each of which bears a single row of spines that pass at a very low angle through the substance of the shell and emerge at a

tangent to its surface, forming elongate, pustulose spine bases. On the mature part of the shell the concentric bands become more pronounced and bear two distinct kinds of spines, one or more rows of minute spines being added in front of the row of large spines along the anterior margin of each band. The shell is geniculate and the visceral cavity moderately deep. The ventral beak usually bears a small cicatrix of attachment and a small ventral cardinal area is commonly present." (20 p.192)

Genotype - Productus juresanensis Tschernyschew

This genus closely resembles Pustula in its earlier growth stages, but at maturity develops an ornamentation like that of Echinoconchus. It is closely related to both genera and is probably a development out of Pustula, through apparently along lines independent from Echinoconchus. Chao confused this type of shell with Buxtonia in Part I, of his Productidae of China, but in Part II he recognizes the genus Juresania. Juresania juresanensis the genotype of this genus was the only one found in the Suplee area.

JURESANIA juresanensis (Tschernyschew)

Plate II, figs. 2-3.

- 1902 *Productus juresanensis*, Tschernyschew. Die obercarbonischen Brachiopoden des Ural und Tinnian. p. 620, Pl. XXIX, figs. 1-2, Pl. XLVII, figs. 1-2.
- 1925 *Productus juresanensis*, Chao. On the age of the Yai-yuan Series. Bull. Geol. Soc. of China, Vol. IV, No. 3-4, p.240, Pl II, Fig.5.
- 1927 *Buxtonia juresanensis*, Chao. Productidae of China, Pt.I, Pal. Sinica, Ser. B, Vol.5, Fasc. 2, p. 81, Pl. VIII, figs. 4-8.
- 1928 *Juresania juresanensis*, Fredricks. Cont. to Class. of the genus *Productus*. Bull. Com. Geol. Bol. XLVI, No.7.

DESCRIPTION: "Shell of medium size, generally as high as wide, subquadrate in outline, with hinge-line equaling or a little less than the greatest width of shell.

Pedicle valve strongly inflated with the curve more pronounced in the posterior part. The beak is pointed, rapidly expanded toward the visceral portion whence the shell increases but slightly in width toward the anterior margin. The beak is incurved but only slightly turned over the hinge-line. The cardinal and umbonal flanks ascend very steeply to the high umbonal region which forms a subrectangular arch. The venter in the anterior part, bends at first along the main flank at a round angle and

then falls more rapidly to the lateral margins. Ears small, flattish, rectangular at the cardinal extremities, and marked off from the highly protuberant visceral part by a concavity. Immediately below the beak commences a not very pronounced median sinus which either continues to the anterior margin, or more commonly becomes faint anteriorly." (Chao 12, p.81).

Brachial valve flattish in the visceral portion, slightly upturned at the margins, forming a thick visceral cavity between the two valves. A low median fold commences not far from the beak, and extends to the anterior margin. Surface marked by numerous regular concentric wrinkles upon which many tubercle-pits and short spine-bases are distributed.

The surface sculpter of the shell consists of many broad concentric bands, ornamented with two kinds of spines on top and separated by slightly depressed interspaces. The concentric bands vary greatly in strength among different individuals, but they can always be recognized by the two kinds of spines they bear.

At the very anterior end of each concentric band, commence many low longitudinal costae which increase rapidly in strength and extend to a place a little back of the

HORIZONS AND LOCALITIES: Juresania juresanensis from the lowermost Upper Carboniferous to the Permian in Europe and Asia.

This species occurs in the Suplee area at the following localities: UO 2201, UO2202, and UO2204.

Genus-STRIATIFERA Chao 1927

Productids with the pedicle valve strongly to slightly convex, brachial valve concave and following the curve of the opposite valve, forming a thin but uniform visceral cavity between them through the whole length of the shell. Surface marked by fine radiating striae and generally also by concentric wrinkles.

Genotype - Amonites striatus Fisher

In 1927, when Chao did his first work on Productids, this was classed as a subgenus and included shells belonging to three different sections. Since then they have been divided, leaving Productus striatus (Fischer) as the genotype for the genus Striatifera and the new genera are Gigantella and Kansuella.

The specimens belonging to this genus found in the Suplee area are Striatifera striata and S. undata, they are both very good markers as they are found in Europe and Asia and only in the Viseen formations.

Striatifer striata (Fischer)

Plate I, Figure 1.

- 1845 *Productus striatus*, Verneuil. Geol. de la Russie d'Europe et des Mont. d'Oural. Vol.II, Pal. p.254, Pl. XVII, figs. 1 a-b.
- 1861 *Productus striatus*, Davidson. Mono on British Carb. Brach., p. 139, Pl.XXXIV, figs. 1-5.
- 1908 *Productus striatus*, Vaughan. Faunal succession and Correl. in the Carb. rocks of Loughshinny; Quart. Jour. Geol. Soc Vol.64,p.466, Pl.50, fig. 2.
- 1928 *Productus striatus*, Packard. New series Paleozoic Rocks in Central Oregon. Amer. Jour. Scil. Vol. 15.
- 1932 *Productus striatus*, Packard. A Cont. to the Paleozoic Geology of Central Oregon. Carnegie Inst. Pub. No.418, p. 107.
- 1927 *Striatifera striata*, Chao. Productidae of China I, Pal. Sinica, Ser.B, Vol.5, Fasc.2, p.95, Pl. IX, figs 4-6,Pl.X,fig.6.

DESCRIPTION: Shell very large, elongated, with the hinge-line very much shorter than the greatest width of shell, and about twice as long as wide, with an acuminate beak and rounded in front.

Pedicle valve very moderately inflated. In the longitudinal direction, the valve is uniformly but very slightly vaulted; in some cases it is somewhat flattened. Transversely, the curve is rather pronounced in the apical region,

forming a semi-circular arc, but it becomes greatly reduced anteriorly. Most commonly, however, the median portion of the shell is flattened and bends down at either margin. Beak sharply pointed and strongly incurved, projecting slightly beyond the hinge line. Hinge-line straight and very short. Ears extremely small, flattish, and marked off from the remainder of the shell. Median sinus entirely absent.

Brachial valve slightly concave to nearly flat, following the curve of the opposite valve. There is a very thin but uniform visceral cavity the two valves.

Surface marked by numerous rounded radiating striae which originate at the beak, increasing greatly usually by bifurcation and spread out radially and slightly wavy toward the margins. Six or seven occur within a space of 5 mm. The lateral margins and especially the ears are covered with many indistinct concentric wrinkles which are less noticeable and may disappear on the median portion of the shell. Fine delicate growth-lines are supposed to be common on the ears, and the median portion of the shell, but probably due to the kind of preservation, none were found on the Oregon specimens. The inner layer is covered with numerous radially arranged spinules like those of Gigantella gigantea.

The dimensions of the specimen figures are:

Maximum height of shell - - - - - 136.1 mm.
 Height from hinge-line to anterior margin - 130.0 mm.
 Length of hinge line - - - - - 41.4 mm.
 Length of curvature - - - - - 152.3 mm.
 Width of shell - - - - - 80.2 mm.

REMARKS: Striatifer striata although very common in the Viseen formations of Europe and Asia had never been described in the North American literature until 1928 when it was reported by D. r E. L. Packard from the Suplee area.

HORIZON AND LOCALITY: Striatifer striata is one of the type fossils of the Viseen of Europe and Asia, and one of the types which is nearly always found in the Productus giganteus horizon.

This specie occurs in the Suplee area in the following localities: UO 2200, UO 2216, UO 2208, UO 2217, UO 2205, and UO 2215.

- - -

Striatifera cf. undata (DeFrance)

- 1844 Productus tortilis, McCoy. Synopsis of the Carb. Foss. of Ireland. p.116, Pl. XX, fig. 14.
 1845 Productus undatus, Verneuil. Geol. de la Russie d'Europe et des Mont. d'Oural, Vol. II, Pl. p.261, Pl. XV, figure. 15.
 1863 Productus undatus, Davidson. Br. Carb. Brach. p.161, Pl. XXIV, figs. 7-13.

- 1913 *Productus undatus*, Yanishevsky. Study of L. Carb.
Fauna of Ferbana. Mem. du Com. Geol.
Nouv. Ser. Livr. 162, p.45, Pl.V,
fig. 10, Pl. VIII, fig. 12.
- 1927 *Striatifera undata*, Chao. Productidae of China, Pt.I,
p. 114, Pl. IX, figs. 7-9.

DESCRIPTION: Shells medium size, elongate, with the hinge-line much shorter than the greatest width of shell.

The pedicle valve is moderately convex, the median portion of the valve is flattened and bends down to either margin. The beak is quite flat, not at all prominent and only slightly turned over the hinge line. No brachial valves were found.

One of the most diagnostic features of this genus is its surface sculpture which consists of numerous fine radiating striae and many prominent undulating concentric wrinkles. The radiating striae are well rounded, separated by interspaces of about the same width, and increase in number by frequent intercalation. There are generally six to seven within a space of 5 mm. The concentric wrinkles are rather regular and persistent in some, while interrupted and less regular in others.

REMARKS: All of the Oregon species found are strongly crushed and fragmentary, and appear to be considerably flattened. According to Chao (12, p.115): "In the type-specimen of England, it is of a suborbicular or slightly transverse outline, with strongly to very moderately convex pedicle valve and a regularly concave brachial valve."

This is the first time this specie has been described in North America.

HORIZON AND LOCALITY: Common in the Viseen rocks of Europe and Asia. It is a very good marker, but is not quite as common as Striatifera striata.

This specie occurs in the Suplee area in the following localities: UO 2200, UO 2216, UO2208, UO 2216, UO 2223, and UO 2215.

Genus - GIGANTELLA Sarytscheva 1928

This name was proposed by Sarytscheva for the very large Productids which are finely costate or lirate throughout their entire growth, and have reticulate ornamentation on their umbones. Irregular wrinkles may occur on the ears and extend on to the umbonal slopes. Spines are erect and are confined to the ventral valve. The visceral chamber is thin. The hinge-line is quite long and the cardinal areas are exceptionally rare in the pedicle valve.

Genotype - Productus giganteus Martin.

This form was formally in one of the three groups of the genus Striatifera which was set up by Chao. Since that time each one of the three have been given generic rank. The genus Gigantella differs from Striatifera in that in Gigantella the hinge-line is very long, and the outline

is not elongate triantular. It differs from Kansuella in that Kansuella has a linear cardinal area in both valves, while Gigantella is without cardinal areas except rarely in the ventral valve.

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Gigantella giganteus, var. oregonensis n.var.

- 1809 Amonites giganteus, Martin. Petrefacta Derbiensia, p. 6, Pl. XV, fig. 1.
- 1845 Productus giganteus, Verneuil. Geol. de la Russie d'Europe et des Mont. d'Oural, Vol. II, Pal. p.225, Pl. XVI, fig. 12, Pl. XVII, fig.2.
- 1861 Productus giganteus, Davidson. Brit. Carb. Brach., p. 141 Pl. XXXVII, figs. 1-4, Pl. XXXVIII, figs. 1-3, 5; Pl. XL, figs. 1, and 3.
- 1883 Productus giganteus, White. Twelfth Ann. Rep. U.S.G.S. of Terr. p. 132, Pl. XXXVI, fig. 1.
- 1894 Productus giganteus, Smith, J.P. Jour. Geol. Vol. 12, No. 6, p. 597.
- 1927 Striatifera gigantea, Chao. Prod. of China, Pt. I, Pal. Sinica, Ser. B, Vol. 5, p. 105, Pl. X, fig. 3, Pl. XII, fig. 1.
- 1928 Productus giganteus, Packard. Amer. Jour. Sci. Vol. 15.
- 1932 Productus giganteus, Packard. Carn. Inst. Wash. Publ. No. 418, p. 113.
- 1928 Gigantella giganteus, Sarytscheva.

DESCRIPTION: The shell is of enormous size, very wide in outline, with the hinge-line marking the greatest width of the shell. From the fragments they seem to be two and

possibly three times as wide as high. Shell is very thick.

Pedicle valve moderately inflated with apical region never protruding beyond the hinge-line, the curve is flattish and uniform throughout. Beak slightly developed, low, scarcely projecting beyond, and not overhanging the hinge-line. Ears are very large enrolled, and marked off from the remainder of the shell by a distinct cavity. Median sinus entirely absent.

Brachial valve comparatively thin, concave, and follows the curve of the opposite valve. The visceral cavity is very small. Surface marked by the same kind of radiating striae.

Surface marked by numerous fine, flexuous, low radiating striae, five to six of which generally occupy a space of 5 mm. The striae are never straight and regular in their course, being, as in the case of typical Gigantella giganteus, "at times confluent bifurcating, or suddenly disappearing and again reappearing and increasing in number toward the margin of the valves." At irregular intervals the striae give rise to slender spines, before the point of occurrence of which two or more of the striae become also confluent. Normally the surface is not longitudinally grooved as in the typical G. giganteus, nor is it concentrically wrinkled.

Approximate dimensions of a reconstructed Oregon specimen are as follows:

Height of shell - - - - - 137 mm.
 Length of curvature - - - - - 180 mm.
 Greatest width of shell - - - - 240 mm.

REMARKS: Gigantella giganteus var. oregonensis can be distinguished from G. giganteus, by the radiating striae, which are finer in oregonensis. The shell is larger, and the striae are a little more regular. The inner layer of the Oregon specie can be distinguished from its very close ally, G. kansuensis in that they have a very orderly arrangement of the nodose ribs. The internal structure of the Oregon specimens were not studied.

HORIZON AND LOCALITIES: Gigantella giganteus as well as its different varieties is the index fossil of the Viseen. (Chao 12, p.106).

The specimens collected in the Suplee area were collected in localities UO 2200, UO 2217, UO 2203, and UO 2223.

Gigantella maxima (M'Coy)

- 1844 *Productus maxima*, McCoy. Synopsis of the Characters of the Carb. Limestone Fossils of Ireland, p. 112, Pl. XIX, fig. 12.
- 1861 *Productus giganteus*, var. *maximus*, Davidson. Br. Carb. Brach. Pl. XXXIX, fig. 4.
- 1912 *Productus* cf. *maximus*, Garwood. On the Lower Carb. Succession in the North-west of England. Quart. Jour. Geol. Soc. Vol. 58, p. 570, Pl. LI, fig. 8.
- 1927 *Striatifera maxima*, Chao. Productidae of China, Pt. I. Pal. Sinica, Ser. B, Vol. 5, Fasc. 2, p. 111, Pl. XI, figs. 2-3, Pl. XIX, fig. 12.
- 1928 *Gigantella maxima*, Sarytscheva.

DESCRIPTION: The shells are very transverse in outline with the long hinge-line marking the greatest width of the shell. In size they range from individuals 130 mm. in width to those of only a little more than 40 mm. The shell is rather thick, but much thinner than Gigantella giganteus.

The pedicle valve is strongly inflated. Beak low, not at all prominent, strongly incurved, but only slightly turned over the hinge-line. Ears large, much dilated, and slightly enrolled. Median sinus entirely lacking. Brachial valve concave, following the curve of the opposite valve and marked with the same kind of sculpture.

Surface marked by numerous fine radiating striae. The latter are sharp, well-defined, flattened on the top, and

separated by interspaces as wide as the striae themselves. The striae are somewhat irregular and wavy, varying in size and strength in different parts of the shell. There are generally 5 or 6 of them within a space of 5 mm. Concentric wrinkles are noted in the lateral parts of the shell.

REMARKS: The identity of the Oregon shells seem to fit quite closely with the description of Striatifera maxima as given by Chao. McCoy in his original description says: "Twice as wide as long; gibbous; front flattened; beak large, undefined; both valves coarsely striated; striae slightly wavy The hinge-line is wide, the beak is gibbous, but the front is broad and flattened." McCoy spoke of his species as frequently being one foot in width, but none of the Oregon shells have exceeded 7 inches. Gigantella maxima differs from G. giganteus in the absence of longitudinal furrows, regularly convex apical region, broad flattened front, and is much thinner.

HORIZON AND LOCALITIES: This specie is quite abundant in the Viseen of Europe and Asia. It is one of the most diagnostic species that is found in the Productus giganteus horizon.

This species occurs at localities UO 2200 and UO 2217 in the Suplee area.

Genus - LINOPRODUCTUS Chao 1927.

Productids with the pedicle valve strongly convex and the brachial flattish or slightly concave over the visceral portion and more or less strongly geniculate toward the front, having a rather spacious visceral cavity and an extended trail. The surface is covered by fine radiating costae. The umbo is not reticulate though wrinkles are more or less strongly developed on the ears and the postero-lateral slopes. Slender, erect spines are scattered over the pedicle valve and one or two rows of spines are borne along the cardinal margin of this valve. The brachial valve is without spines. The shell substance is very thin.

Genotype - Productus cora d'Orbigny.

The following species of Linoproductus are recognized from the Suplee area: Linoproductus cora (d'Orbigny), Linoproductus cf. ovatus (Hall), Linoproductus cf. cestriensis (Worthen), and Linoproductus ? cf. mammatus (Keyserling).

Linoproductus cora (d'Orbigny)

- 1863 *Productus cora*, Davidson. Mono. Br. Carb. Brach. p. 148 Pl. XXXVI, fig. 4, Pl. XLII, fig. 9.
- 1863 *Productus cora*, Davidson. Lower Carb. Brach. of Nova Scotia. Quart. Jour. Geol. Soc. London, XIX, p. 174. Pl. IX, fig. 22-23.
- 1884 *Productus cora*, Waagen. *Productus Limestone Fossils*. Pal. Indica Ser. XIII, Vol. I, p. 677, Pl. LXVI, figs. 1-2, Plate LXVII, fig. 3.
- 1903 *Productus cora*, Girty. The carb. Form and Fauna of Colo. U.S.G.S. Prof. Paper No. 16, p. 364, Pl. IV, fig. 1-4.
- 1924 *Productus cora*, Grabeau. Stratig. China. Pt. I, p. 214.
- 1927 *Linoproductus cora*, Chao. *Productidae of China*, Pal. Sinica Ser. B, Vol. 5, Fasc. 3, p. 132, Pl. XIII, figs. 17-18, Pl. XIV, figs. 1-4.

DESCRIPTION: Shells varying in size, triangular-ovate in outline exclusive of the ears, with hinge-line long, marking the greatest width of the shell.

Pedicle valve strongly and regularly inflated, with a pronounced curve in the posterior region. Beak pointed, enrolled, but only lightly turned over the hinge-line with both sides diverging smoothly to the anterior margin, giving the shell a characteristic triangular outline. Ears wide, short, convex anterior-posteriorly and curved outward at the extremities, and marked off from the rest of the shell by a concave sinus. Mesial sinus is entirely

absent in most specimens and the shell has the triangular ovate outline from youth to adulthood.

No brachial valves were found in the Suplee area. According to Chao (12, p.133): "The brachial valves are slightly concave in the visceral portion, geniculated towards the front. Ears flattish, marked off from the visceral portion by a blunt ridge. Median fold absent in some, ill-defined in others. Spines absent. Surface marked by the same kind of sculpture as those of the opposite valve, but the concentric folds are much more pronounced and cross the visceral portion of the valve as well."

Surface marked by numerous fine, radiating striae which increase in number by bifurcation and intercalation 7 to 9 of them occupying the space of 5 mm. They are separated by interspaces of the same width, and are straight except where they are interrupted by the spine, where they become crowded together. One incomplete spine 16 mm. long was observed. The radiating striae are crossed in the umbonal region by concentric plications, or growth lines which give the shell a characteristic reticulation.

REMARKS: Linoproductus cora is a specie that has been found in Europe, Asia, North America, and recently Kozlowski has reported it from Bolivia. In regard to the

shape of the brachial valve, paleontologists seem to differ somewhat in opinion. But whether it is flattish or concave in the visceral portion, it is always geniculate towards the front and forms an anteriorly produced long trail with the pedicle valve.

HORIZON AND LOCALITIES: Linoproductus cora is valueless for stratigraphic correlation. It appears in the Lower Carboniferous and survives to the Permian. It is found every place in the world that the later Paleozoic sediments occur.

In the Suplee Area it was collected in locality UO 2216.

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Linoproductus cf. ovatus (Hall)

- 1858 Productus ovatus, Hall. Geol. Iowa, Vol.I, pt. 2, p. 674, Pl. XXIV, fig. 1
- 1892 Productus ovatus, Hall and Clarke. Pal. N.Y., Vol.8, Pt. 1, Pl.XVIII, fig. 19.
- 1914 Productus ovatus, Weller. Ill. St. Geol. Sur. Mono. 1,Pt. 1, p. 132, Pt. II, Pl. XVI, figs. 1-15.
- 1927 Linoproductus ovatus, Chao. Productidae of China, Pal. Sinica, Ser.B, Vol. 5, Fasc. 3, p. 128.

DESCRIPTION: Shell thin and delicate, variable in size but usually of medium size, longer than wide, the hinge-line

shorter than the greatest width, the cardinal extremities angular.

Pedicle valve gibbous, the greatest convexity posterior to the middle, the umbonal region prominent and protuberant beyond the hinge-line; mesial sinus entirely absent; the beak small, pointed, and closely incurved. Surface marked by very fine, rounded radiating, more or less flexuous costae, on the posterior portion of the valve they are more regular and increase frequently by intercalation, these increase in size very gradually. There are generally 13 to 15 of the costae within a space of 5 mm.

The dimensions of an average Oregon specimen are as follows:

Maximum height of shell - - - - -	32.3 mm.
Height from hinge-line to anterior margin -	27.3 mm.
Length of hinge-line - - - - -	21.5 mm.
Length of curvature - - - - -	35.1 mm.
Width of shell - - - - -	27.1 mm.

REMARKS: The specimens of the genus Linoproductus cf. ovatus which were collected in the Suplee area were quite fragmentary and although they resembled Linoproductus ovatus, a Mississippi Valley specimen, quite closely they will undoubtedly comprise a new genus when better material is collected.

HORIZON AND LOCALITIES: Linoproductus ovatus is found from the Kinderhook up to the Chester groups in the Mississippi Valley. The specimens collected in the Suplee area were found at locality UO 2200.

Linoproductus cf. cestriensis
(Worthen)

- 1860 *Productus cestriensis* Worthen. Trans. St. Louis
Acad. Sci. Vol. 1, p. 570.
- 1894 *Productus cestriensis*, Keys. Mo. Geol. Sur. Vol.
5, p. 44.
- 1897 *Productus cestriensis*, Weller. Trans. N.Y. Acad
Sci. Vol. 16, p. 256, Pl. 18, Figs. 7-9.
- 1911 *Productus cestriensis*, Morse. Proc. Ohio St. Acad.
Sci. Vol. 5, p. 372, figs. 9 a-g.

DESCRIPTION: Shell very small, slightly longer than wide, the hinge-line equalling or a little shorter than the greatest width. The dimensions of one of the Oregon specimens are as follows: Length of hinge-line 12 mm., maximum height 15 mm., width 13.5 mm.

Pedicle valve strongly convex, brachial valve flattish to slightly concave in the visceral portion, strongly geniculated toward the front, resulting in the formation of an anteriorly produced long trail. Surface marked by numerous fine, radiating striae and indistinct, concentric wrinkles. A double row of spines is invariably present along the margin of the hinge-line. The beak small, pointed, and closely incurved.

REMARKS: The Oregon specimens of Linoproductus cf. cestriensis have many of the characteristics of the L. cestriensis of the Mississippi Valley, but due to the state of preservation it might well belong to some Euroasiatic

specie or some new genus which has never been described in the North America Lower Carboniferous. More specimens will have to be collected before it can be specifically determined.

HORIZON AND LOCALITIES: Linoproductus cestriensis is found in the Chester Group of the Mississippi Valley.

The Suplee specimens were collected at localities UO 2201, UO 2216, and UO 2204.

- - -
Linoproductus ? cf. mammatus
 (Keyserling)

- 1902 *Productus mammatus*, Tschernyschew. Die obercarbon. Brach. des Ural and des Timan; Mem. du Com. Geol. Vol. XVI, No. 2, p. 631, Pl. XXXV, figs. 4-6.
- 1927 *Linoproductus ? mammatus*, Chao. Productidae of China. Pt. I, p. 146, Pl. XV, figs. 10-14.

DESCRIPTION: "Shell of medium size, transverse in outline, with hinge-line marking the greatest width.

Pedicle valve moderately inflated, with the curve very unequal in the longitudinal direction. The shell remains almost flat in the visceral portion but becomes abruptly geniculated downwards beyond it, rounding so that the frontal part is at right angles to the earlier part of the shell. Transversely the apical region projects but slightly above the ears, but toward the front the strongly impressed median portion falls rapidly along

the main flanks to the lateral margins. Beak low and insignificant, neither turned over nor projecting beyond the hinge-line. Ears large and flat. They are sharply layed off from the rest of the shell by a shallow concavity. Median sinus commences not far from the beak, and is quite broad and deep at anterior margin.

Surface marked by numerous, fine, radiating striae which increase in number toward the front by intercalation. Concentric wrinkles are entirely absent. There are generally 9 to 10 striae within a space of 5 mm.

The brachial valve is flattish in the visceral portion, geniculated vertically downwards toward the front, following the curve of the opposite valve. The median fold, represented by depression, is low in the posterior but becomes strong and high from the geniculated part onward. Surface marked by the same kind of fine radiating striae as in the opposite valve." (Chao, 12, p.146)

REMARKS: The above description fits the Oregon specimens very closely. The diagnostic characters of this genus are: very transverse outline, fine radiating striae, and pronounced median sinus. The Oregon specimens are slightly larger than the Asiatic specimens. This genus has never before been described in North America.

HORIZON AND LOCALITY: The genus Linoproductus mammatus ranges from uppermost Lower Carboniferous to Permian of Russia and Asia. Occurs in Suplee localities UO 2201, 2202, 2204.

Genus -EOMARGINIFERA Muir-Woods 1930

Small productids with reticulate umbones characterized from Marginifera by the lack or rudimentary form of the internal structure of a flange-like ridge which arises from the margin of the visceral disc of the brachial valve. The shells are costate at all stages of growth and the pedicle valve bears erect spines.

Genotype - Productus longispinus Sowerby.

There has been a controversy ever since Waagen set up the genus Marginifera in 1884 because the British paleontologists could not find the marginal flange in their specimens. In Muir-Woods latest work she sets up the genus Eomarginifera for those species which do not have the marginal flange and are found in the Lower Carboniferous, and the genus Marginifera takes in those species that do have the marginal flange and are found in the Upper Carboniferous and Permian deposits. Not heretofore recognized in the North American P. giganteus sea.

Eomarginifera cf. viseeniana, (Chao)

- 1927 Marginifera viseeniana, Chao. Productidae of
 China. Pt. I, Pal. Sinica. p. 158, Pl.
 II, figs. 14-19, Pl. XVI, fig. 22.
- 1930 Eomarginifera viseeniana, Muir-Woods. The Class.
 of Brit. Carb. Brach. Ann. Mag. Nat.
 Hist., Vol. V, p. 107.

Shell of small size, squarish in outline, and just a little longer than wide.

Pedicle valve strongly inflated, with the umbonal region protuberant beyond the hinge-line. It increases in width very rapidly toward the visceral portion. The umbonal region thus formed is essentially triangular in outline, somewhat flattish on top and characterized by steep, but smoothly sloping cardinal flanks. The median sinus is not well defined.

No brachial valves were found.

Surface marked by radiating costae which are straight and regular, prominent, and separated by grooves about equal to their width, they increase in number toward the front by intercalation and bifurcation. There is generally eight to nine costae within a space of 5mm. in the anterior portion of the shell. The concentric plications are regular and persistent in the median portion of the valve. No spines were noted on the Oregon specimens. The dimensions of the specimen pictured are:

length 12.2 mm, and width 11.4 mm.

REMARKS: The genus Eomarginifera viseeniana differs from Marginifera longispinus in that the marginal ridge is only faintly developed and rudimentary. The Oregon specimens resemble Chao Chinese genus, but the material is too fragmentary for certain identification.

HORIZON and LOCALITY: E. viseeniana, is found in China only in association with typical Viseen fossils.

The Oregon specimens were collected at locality UO 2201 and UO 2216.

Genus - PRODUCTUS Sowerby 1814

The genus Productus in the restricted sense takes in those costate shells, with reticulate umbonal regions. With flange-like diaphragm at the margin of the dorsal visceral disc, separating the visceral chamber from the long, flaring trail. Spines are erect, long, and confined to the ventral valve. Dorsal valve usually geniculate.

Genotype - Amonites productus Martin

This genus differs from Dictyoclostus in the Dic-

tyoclostus is without diaphragm or marginal ridges or strong internal pali. Eomarginifera differs from Productus in that it has a small shell, the marginal ridges are very rudimentary, while in Marginifera we again find a very small shell, but the marginal ridges are well developed.

Productus, (?) Sp. a

Shell of medium size, strongly enrolled, the hinge-line marking the greatest width of the shell.

Pedicle valve is inflated in both directions with the visceral portions protuberant behind the hinge-line. The beak is pointed, strongly incurved, and turned over the hinge-line. The ears are somewhat fragmentary but appear large and flattish, and enrolled toward the front. The median sinus originates very close to the beak and is well defined in the adult specimens, in the young species it is deep and narrow and remains at the same depth from the visceral portion to the frontal margin.

The valve is covered with two systems of plications, one concentric and one radial. The concentric plications are broad and regular. The radiating costae are fine and evenly spaced, separated by narrow furrows. There is usually eight to ten radiating costae within a space of 5 mm.

Brachial valves are very fragmentary, but they appear to produce a long trail with the opposite valve.

The dimensions of a pedicle valve are as follows:

Maximum height of valve -----	23.5 mm.
Height from hinge-line to anterior margin	17.4 mm.
Length of curvature -----	47.7 mm.
Length of hinge-line -----	26.1 mm.
Width of body of shell -----	18.7 mm.

HORIZON and LOCALITIES: This species was collected at the following Suplee localities: UO 2201, UO 2202, and UO 2205.

Productus, Sp. b

Shell of medium size, gibbous, with the hinge-line apparently marking the greatest width of the shell.

The pedicle valve is quite elongate and gibbous. The beak is pointed, strongly incurved, and turned over the hinge-line. A broad shallow median sinus begins a little way from the tip of the beak and runs the full length of the shell, gradually enlarging anteriorly.

No brachial valves were found.

The surface is covered with radial plications. These radiating costae are quite large and round, and separated by a wide interspace.

REMARKS: All the material collected of this specie

is very fragmentary and is in a very poor state of preservation, so that accurate determination can not be made. In outline they are entirely different than any of the other specimens collected in the area, and they have a much larger type of radiating costae.

HORIZON and LOCALITY: This species was found in the same beds with such well known forms as Striatifera striata, and Dictyoclostus semireticulatus, and Echinoconchus cf. alternatus.

This species was only found in locality UO 2205 in the Suplee area, but they were very abundant there.

Order	TELOTREMATA		
Superfamily	TEREBRATULACEA		
Family	CENTRONELLIDAE		
Genus	Rhynchopora	King	1865

Rhynchonelliform shells usually subpentagonal in outline, with dorsal fold and ventral sinus well defined in the anterior half of the shell. The surface is covered by simple subangular costae.

Genotype - Rhynchonella geinitziana Verneuil.

Rhynchopora ? cooperensis (Shumard)

- 1855 Rhynchonella Cooperensis, Shumard. I and II Rep.,
Geol. Surv. Mp., p. 204, Pl. C, figs. 4a-d
- 1910 Rhynchopora ? cooperensis, Weller. Bull. Geol. Soc.
Am., Vol. 21, p. 515, fig. 18.
- 1914 Rhynchopora ? cooperensis, Weller. Ill. Geol. Surv.,
Mono. I pt. 1, p. 235, pt. 2, Pl. XXX,
figs. 7-15, 22-25.

Shell usually below medium size, broader than long, the postero-lateral margins meeting at the beak in an obtuse angle, the lateral margins rounded and the anterior margin nearly straight. The dimensions of a small specimen are: length 13.4 mm., width 16.6 mm., thickness 11.1 mm., width of sinus in front 9.5 mm.

Pedicle valve depressed convex in the posterior,

along the median line the surface is gently convex to near the anterior margin of the shell where it is strongly curved toward the opposite valve. Mesial sinus originates near the middle of the valve as a shallow, flattened depression, it is but little depressed to near the anterior margin of the valve where it is rather abrupt and strongly curved toward the opposite valve and produced in a broad lingual extension whose surface lies in nearly a right angle to the plane of the valve. Beak is rather small, pointed, slightly incurved, and rather conspicuous beyond the opposite valve. Plications originate at the beak, from four to six occupy the sinus, with about six others on the lateral slopes.

Brachial valve much more strongly convex than the pedicle. The mesial fold obsolete in the posterior half of the shell and only moderately elevated above the lateral slopes in the front. The beak broadly pointed and strongly incurbed beneath that of the opposite valve.

HORIZON: Kinderhook and base of the Burlington in Mississippi Valley.

OCCURENCE: Found in the following Suplee localities. UO 2202 - (638-639).

Family DIELASMATIDAE

Genus Dielasma King 1859

Shells terebratuliform, smooth, and abundantly perforated with fine punctae arranged in quincunx. The pedicle ventral valve may possess a broad, shallow sinus and the brachial valve may or may not have a fold. The ventral beak is strongly incurved and perforated.

Genotype: Terebratulites elongatus Schlotheim

DESCRIPTION: Shell medium sized, subovate in outline, longer than wide, the greatest width near the mid-length, the anterior margin rounded. The dimensions of a somewhat restored specimen are: length of pedicle valve 27.8 mm., length of brachial valve 23.2 mm., greatest width 17.5 mm. thickness 13.9 mm.

Pedicle valve strongly convex, the greatest convexity posterior to the middle, the umbonal region projecting conspicuously beyond the beak of the opposite valve. Mesial sinus originating near the middle of the valve, rather narrow, with subparallel sides, and slightly flattened on the bottom. Beak prominent, strongly incurved.

Brachial valve less convex than the pedicle, the surface arched from beak to front with curvature more convex toward the beak. Mesial portion of the valve not differentiated as a fold, but the anterior exhibits a

rounded sinuosity. Beak pointed and incurved beneath the opposite valve.

REMARKS: A large number of species of this genus have been described in the foreign literature, but the descriptions are not all available therefore it has been deemed advisable not to name them.

LOCALITY: This species was collected from localities UO 2201 and UO 2204 in the Suplee area.

Dilesma Sp. b.

Shell about medium size, subovate in outline, longer than wide, the greatest width a little in front of the middle. The dimensions of a nearly complete specimen are: length of pedicle valve 25.1 mm., length of brachial valve 22.3 mm., greatest width 17.7 mm., thickness 13.9 mm.

Pedicle valvule rather strongly convex. Mesial sinus narrow and shallow, ill defined laterally, originating at or near the mid-length and frequently nearly obsolete. Beak strongly incurved.

Brachial valve less convex than the pedicle. Mesial portion of the valve not differentiated from the general convexity of the valve. Beak acutely pointed and incurved beneath the opposite valve.

Surface of both valves smooth or nearly smooth, marked only by generally obscure, concentric lines of growth. Shell structure finely and closely punctate.

REMARKS: As in Dilesma species a it was thought not advisable to name this species. It differs from sp. a in that it is much smaller, sinus not so pronounced, is much flatter and much wider for its size.

LOCALITIES: This species was collected at localities UO 2201, UO 2203, and UO 2205 in the Suplee area.

Superfamily	SPIRIFERACEA
Family	SPIRIFERIDAE
Subfamily	SPIRIFERINEA
Genus	Spirifer Sowerby 1814-18

Shells of spiriferoid contour, with simple plications on the fold and sinus as well as on the lateral slopes. The pedicle beak is larger than the brachial, and more or less strongly overarches a well defined cardinal area. The entire surface is covered with fine and closely spaced concentric lirae which are crossed by very fine radial lirae, making a very fine textured grill.

Genotype: *Anomites striatus* Martin.

Spirifer striatus (Martin)

- 1809 *Amonites striatus*, Martin. *Petrefacta Derbiensia.*, Pl. 23.
- 1857 *Spirifer striatus*, Davidson. *Mono. Brit. Carb. Brach.*, Pal. Soc., p. 19, Pl. II, figs. 12.21. Pl. III, figs. 2-6.
- 1878 *Spirifer striatus*, Hartt. *Dawsons Acadian Geology*, 3rd Ed. p. 301.
- 1894 *Spirifer striatus*, Smith, J. P. *Jour. Geol.*, Vol. II, No. 6, p. 596.
- 1930 *Spirifer striatus*, Smith and Merite. *USGS Bull.* No. 815, p. 182.

DESCRIPTION: Shell large, the hinge-line marking the greatest width. The dimensions of a fragmentary Oregon specimen are: length 60 mm. and width 96 mm.

Pedicle valve is convex and marked by a broad mesial depression which is well defined. The beak is small, pointed, and closely incurved. The entire surface of the valve is marked by plications which are nearly uniform in size, with eight to ten covering a space of 10 mm. They increase in number by bifurcation, and have a tendency to become fasciculate near the anterior margin.

Brachial valve is not quite as convex as the pedicle valve. Mesial fold quite prominent. Surface covered with the same kind of markings as the opposite valve.

REMARKS: The specimens of Spirifer striatus collected in the Suplee area were few in number and in a very poor state of preservation.

HORIZON AND LOCALITIES: Spirifer striatus has been reported from the Visean of Europe and Asia, Baird of California, Windsor of Nova Scotia and the Cape Lisburne of Alaska.

The Oregon specimens were collected at localities UO 2200 and UO 2215.

Spirifer cf. indianensis Weller

Pl. IV, Fig. 4-5.

1914 *Spirifer indianensis*, Weller. Ill, Geol. Surv.
Mono. I, Pt. I, p. 352, Pt. II, Pl. L, figs.
6-12.

DESCRIPTION: Shell below medium size, longer than wide, the greatest width a little in front of the cardinal line. The dimensions of a nearly complete specimen are: length of pedicle valve 23.5 mm., length of brachial valve 17.4 mm., thickness 17.2 mm.

Pedicle valve with its greatest convexity near or a little posterior to the middle, the surface curving abruptly from the umbonal region to the cardinal margin. Beak pointed and strongly incurved. The mesial sinus originates at the beak where it is shallow and rounded in the bottom and becomes well defined anteriorly. Lateral slopes of the valve each bearing 9 to 10 simple, rounded plications which grow smaller toward the cardinal extremities.

Brachial valve less convex than the pedicle, its greatest convexity posterior to the middle, the beak extends a little beyond the hinge-line and slightly incurved over the narrow cardinal area. Mesial fold de-

finned to the beak, but slightly elevated posteriorly, attaining a moderate height toward the anterior margin. The lateral slopes are marked by plications which are similar in size and number to those of the opposite valve.

REMARKS: In the Suplee area only one specimen of Spirifer cf. indianensis was collected and although it resembled S. indianensis quite closely, it was not well enough preserved for certain identification.

HORIZON and LOCALITY: Spirifer indianensis is found in the Keokuk Limestone of Indiana. It was collected at locality UO 2204 in the Suplee area.

Superfamily	ROSTROSPIRACEA
Family	ATHYRIDAE
Subfamily	ATHYRINEA
Genus	Athyris McCoy

Shells generally transversely elliptical in outline. Beak of pedicle valve incurved, perforated by a round foramen which encroaches upon the umbo. Surface medially sinuate. Teeth prominent and recurved at the tips, supported by stout dental lamellae.

Genotype: Athyris concentrica von Buch

Athyris lamellosa (L'Eveille)

Pl. II., Figs. 4-5.

- 1835 *Spirifer lamellosus* L'Eveille. Mem. Soc. Geol. de France, 1st Ser. vol. 2, p. 39, fig. 21-23.
- 1875 *Athyris lamellosa* Meek. Pal. Ohio, vol. 2, p. 283, pl. XIV, fig. 6a-b.
- 1894 *Athyris lamellosa* Smith J. P. Jour. Geol. Vol. 2, No. 26, p. 1595. IV, fig. 1.
- 1895 *Athyris lamellosa* Hall and Clarke. Pal. N. Y. vol. 8, pt. 2, Pl. XLVI, figs. 16-20.
- 1904 *Athyris lamellosa* Girty. P. P. U. S. G. S. No. 21, p. 49, pl. X, figs. 12-13.
- 1914 *Athyris lamellosa* Weller. Ill. State Geol. Surv., Mono. I, pt. 1 p. 465, pt. 2, pl. LXXVIII, figs. 1-5, 15-20.

DESCRIPTION: Shell of medium size or larger, transversely subelliptical in outline, the valves moderately convex, the length two-thirds or more than two-thirds the width, the greatest width near or a little posterior to the mid-length of the shell, the hinge-line much shorter than the greatest width of the shell, cardinal extremities rounded.

Pedicle valve moderately convex, the greatest convexity near to the middle, the surface curving abruptly from the umbonal region to the cardinal margin and gently to the lateral and anterior margins, frequently with that of the opposite valve, pierced by a subcircular foramen; cardinal area very narrow and inconspicuous; mesial sinus originates at or near the beak, shallow, rounded in the bottom, rather narrow and ill-defined laterally.

Brachial valve equally or a little more convex than the pedicle, the greatest convexity posterior to the middle, the surface curving rather abruptly to the cardinal margin and more gently to the anterolateral margins, sometimes a little compressed toward the cardinal extremities; the beak rather strongly incurved beneath that of the opposite valve.

Surface of both valves marked by strong, subparal-

1el concentric lamelliform extensions 3 to 5 mm., apart, toward the front of the shell they are often very crowded, and on the body of the shell weaker lamellae are often intercalated between the stronger frequent ones.

The dimensions of an average Oregon specimen are as follows:

Maximum height of shell-----	38.5 mm.
Height from hinge-line to anterior margin-	33.7 mm.
Length of hinge line-----	16.1 mm.
Length of curvature-----	49.5 mm.
Width of shell-----	45.4 mm.

HORIZON and LOCALITIES: Athyris lamellose is quite common in the Viseen of France and China and has been reported in the Upper Kinderhook to the Keokuk Limestones in the Mississippi Valley.

This specimen was collected at localities UO 2208 and UO 2211 in the Suplee area.

Genus Cleiothyridina Buckman 1906.

Shells of sublenticular form with subcircular to transverse subelliptical outline and with subequally concentric valves. The beak of the pedicle valve is usually small and incurved. The surface is marked by broad, concentric, fimbriate lamellae.

Genotype: Athyris roissy (L'Eveille)

Cleiothyridina roissyi (L'Eveille)

- 1906 *Cleiothyridina* (*Athyris*) *roissyi*, Buckman. Brach.
Homoeomorphy Quart, Jour. Geol. Soc. Vol. LXVI.
- 1924 *Athyris roissyi*, Grabau. Stratigraphy of China,
Paleozoic., Part I, p. 233.

DESCRIPTION: Rather small shell of subcircular outline, with the valves subequally convex. The greatest width slightly anterior to the hinge-line, the pedicle beak is small and tightly incurved against the brachial valve. The greatest thickness is a little beyond the middle of the shell.

Very fine unevenly spaced growth lines cover both of the valves. The dimensions of one of the Oregon specimens is: length 17.3 mm., width 17.1 mm., thickness 10.7 mm., and the length of the hinge-line is 9.8 mm.

HORIZON and LOCALITIES: *Cleiothyridina roissyi* is very common in the Upper Dinantian rocks of Europe and Asia.

In the Suplee area it was collected at localities UO 2201 and UO 2202.

Phylum	MOLLUSCA
Class	CEPHALOPODA
Order	AMMONOIDEA
Family	GLYPHIOCERATIDAE
Genus	Goniatites de Haan

Goniatites cf. striatus Sowerby

- 1814 *Ammonites striatus*, Sowerby. Min. Conchol., Vol. I, p. 115, Pl. LIII, fig. 1.
- 1825 *Goniatites striatus*, de Haan. Mon. Ammonet Gon. p. 159.
- 1844 *Goniatites striatus*, M'Coy. Synop. Carb. Foss. of Ireland, p. 16.
- 1903 *Goniatites striatus*, Smith J. P. U. S. G. S. Mono. No. XLII, p. 80, Pl. X, figs. 1-11, Pl. XXVI, figs. 6-13.

DESCRIPTION: "Shell globulose, involute, with slightly flattened sides, and broadly rounded abdomen. Height of whorls about the same as the breadth, and a little more than one half the diameter. Shorl indented more than one half its height by the preceding whorl. Umbilicus narrow. Three or four distinct constrictions to a revolution; these form a broad shallow saddle on the abdomen, showing on both the shell and cast.

Surface ornamented with fine, sharp, spiral striae, with slightly broader interspaces and fine cross striae, giving the shell a reticulate aspect." (Smith 53, p. 80)

REMARKS: Only one specimen of the type Goniatites cf. striatus was found in the Suplee area, it was fragmentary and very poorly preserved so it could not be accurately determined but it does come very close to the above description given by Smith. Dr. S. Muller of Stanford University examined the specimen and said it was close to the form Gastrioceras?roemeri Gimmilaro, but the literature on that species could not be found.

HORIZON and LOCALITY: The species Goniatites striatus appears in the Lower Carboniferous of Gt. Britan, Belgium and Germany and is a typical fossil of that region, it also occurs in the St-Louis-Chester stage in North America.

The Oregon specimen was collected at Locality UO 2201.

Genus: GASTRIOCERAS Hyatt

Gastrioceras globulosum (Meed and Worthen)

Pl. fig.

- 1860 Goniatites globulosum, Meek and Worthen. Proc. Acad. Nat. Sci., Phil., p. 471.
- 1898 Glyptioceras globulosum, Haug. Etude sur les Goniatites p. 26.
- 1903 Gastrioceras globulosum, Smith j. p. U. S. G. S. Mono. No. XLII, p. 89, PL. VI, fig. 1, Pl. XXI, figs. 7-9.

DESCRIPTION: "The angle of umbilicus is 45° , which remains constant notwithstanding the fact that the shell grows more involute with age, being in its youth a comparatively open coil. As many as six whorls are known.

The sutures show nine lobes and nine saddles. The siphonal lobes are narrow and pointed. The siphonal saddle is rather deep notched, long, and narrow; the two lateral saddles are broad and rounded." (Smith 53, p. 89).

REMARKS: This species was sent to Dr. F. Demanet of the Royal Museum of Natural History of Belgium for determination and it is upon his suggestion that this species is called Gastrioceras globulosum.

HORIZON and LOCALITY: This species is found in the Upper Carboniferous of Texas.

It was collected at locality UO 2202 in the Suplee area.

REGISTER OF FOSSIL LOCALITIES

- UO - 2200 "The Productus Giganteus Locality". Limestone outcrop located in the center of sec. 30, T. 18 S., R. 25 E., One-quarter of a mile due east of the Old Wade Place, now the Mill's Shearing Corrals. Suplee Quad., Crook Co., Oregon. No. 633 Syn.
- 2200-1-Located 50 feet west of the main outcrop.
- 2200-2-The Productus giganteus locality proper.
- UO - 2201 Large limestone butte immediately south of the S. W. corner of Sec. 6, T. 19 S., R. 25 E., Suplee Quad., Harney Co., Oregon.
- 2201-1-On the north side of the butte at the base.
- 2201-2-Between 50 and 100 feet up the side of the butte.
- 2202-3-From the very top of the hill.
- 2201-4-Outcrop just north of the main point right in the corner of Section 1.
- UO - 2202 "Triangulation Hill" Large hill 2200 feet from the S. W. corner of Sec. 30, on the section line fence. T. 18 S., R. 25. E., Suplee Quad., Crook Co., Oregon.

2202-1-Locality at the top of the hill.

2202-2-Ledge on south side of hill.

2202-3-Lowest ledge on north slope of hill. (Peck's
Locality).

2202-4-100 yards due west of triangulation point.

2202-5-Outcrop 450 feet due west of triangulation
point.

2202-6-East slope of hill 210 feet from the top.

UO - 2203 "Old Baldy" North slope of large bald lime-
stone butte in the center of Sec. 20, T. 18 S.,
R. 25 E., Suplee Quad., Crook County Oregon.

2203-1-On the top of the butte.

2203-2-On the north slope about half way to the top.

UO - 2204 Tucker Butte, fossil locality on North South
section line midway between Sections 17 and
18, T. 19 S. R. 25 E. The strong of hills
trend NE-SW between the two sections. Suplee
Quad., Harney County, Oregon.

2204-1-Eastern most butte of the string.

2204-2-Approximately 1 mile north of Tucker Butte.

2204-3-From the top of the Western most butte.

UO - 2205 "Lunch Rock" Small limestone knob just west
of the road in the S. W. corner of the N.E.
one-quarter of Sec. 33, T. 18 S., R. 25 E.
on the north side of Grindstone Creek and the

east side of Lunch Creek. Suplee Quad., Crook County, Oregon.

2205-1-The Original locality just north of the road.
No. 637 Syn.

2205-2-Limestone outcrop just east of above locality.

2205-3-Limestone outcrop 150 feet east of above.

2205-4-Float between -2 and -3.

2205-5-Starting 100 yards from Lunch Rock and working
the outcrops up Lunch Creek to the north 250
yards. No 636 Syn.

U0 - 2206 Sandstone on the contact, located on S. E. one-
quarter of Sec. 2, T. 18 S., R. 25 E., House is
in corner of S. W. one-quarter of Section 1.

U0 - 2207 Central Bucher Butte, about 100 feet down the
south slope, near the east central edge of Sec.
23, T. 19 S., R. 24 E., Suplee Quad., Crook
County, Oregon.

U0 - 2208 "Striatus Ledge" a small limestone outcrop one-
half a mile west of Old Baldy east central
edge of Sec. 19, T. 18 S., R. 25 E., Suplee
Quad., Crook County, Oregon.

U0 - 2209 Small outcrop on the Little Grindstone Flat
275 yards south of locality U0 2202, Triangu-

lation Hill, on the north central edge of Sec. 31, T. 18 S., R. 25 E. Suplee Quad., Crook County, Oregon.

UO - 2210 Very small limestone outcrop due west from Iron Mt., and just west of the road, and N. 15 W. of Christenson Bros. Ranch. In S E one-quarter of Sec. 22, T. 18 S., R. 25 E., Suplee Quad., Crook County, Oregon.

UO - 2211 Small outcrop right behind Suplee just due south of the Mesozoic rim. N.E. one-quarter of Sec. 35, T. 17 S., R. 25 E., Suplee Quad., Crook County, Oregon.

2211-1-The above locality.

2211-2-On rim in limestone lens on central north edge of Sec. 35.

UO - 2212 Shale outcrop in S. W. one-quarter of Sec. 27, T. 17 S., R. 25 E., Suplee Quad., Crook County, Oregon.

2212-1-Sandstone outcrop in N. E. one-quarter of Sec. 33, T. 17 S., R. 25 E.

2212-2-Same as -2 only 100 yards to the east.

UO - 2213 Sandstone grit outcrop found in central part of N. W. one-quarter of Sec. 30, T. 18 S.R.

25 E., not found in place, very close to the Wade Ranch house, Suplee Quad., Crook County, Oregon.

UO - 2214 Limestone outcrop in the N W one-quarter of Sec. 32, T. 18, R 25 E., on the north side of Grindstone Creek, Suplee Quad., Crook County, Oregon.

UO - 2215 Large limestone knob on the south side of Grindstone Creek, in the S. W. corner of N. E. one-quarter of Sec. 33, T. 18 S., R. 25 E. Suplee Quad., Crook County, Oregon.

2215-1-The above locality.

2215-2-Limestone outcrop 250 yards west of -1.

2215-3-Limestone outcrop 500 yards west of -1

UO - 2216 "Petrified Snake Locality" A limestone ledge made up primarily of crinoids, on the second ridge south of Clark's Place. In S. E. one-quarter of Sec. 33, T. 17 S R. 25 E., Suplee Quad., Crook County, Oregon.

2216-1-The above locality.

2216-2-Massive limestone ledge due west of -1

UO - 2217 Small limestone ledge on section line between

Sections 3 and 4, T. 18S., R. 25 E. Slightly north of the center and S 55 W to Lava Cap.

- UO - 2219 Large White Butte, located on White Butte Creek, in the S W one-quarter of the N. E. one-quarter of Sec. 16, T. 18 S., R. 25 E., Suplee Quad., Crook Co., Oregon.
- UO - 2220 Outcrop in the N. E. corner of Sec. 25, T. 18 S., R. 24 E., about one-half a mile from Wade Place on the road down Coffee Creek, to the Angell Place. Right in the section corner and near the Paleozoic contact. Suplee Quad., Crook Co., Oregon.
- UO - 2221 South Bucher Butte. Large limestone butte the southernmost one of the Bucher Buttes located in the N. E. one-quarter of Sec. 23, T. 19 S., R. 24 E., on the south east side of the butte. Suplee Quad., Crook County Oregon. (Some of the material from this locality is marked with the field No. 1207-2.)
- UO - 2222 North Bucher Butte. The northernmost large limestone of the three Bucher Buttes located in the S. E. corner of Sec. 14 T. 19 S., R. 24 E. The Butte is just west of the road leading

to the Bucher Ranch which is about one-half a mile south. Suplee Quad., Crook County, Oregon.

- UO - 2223 Small limestone outcrop near the south edge, center, of Sec. 5, T. 19 S., R. 25 E., and just north of Twelve Mile Creek and the road. Suplee Quad., Harney County, Oregon.

2223-2-Float from S W corner of Sec. 5 and on small hill just north of the dam.

- UO - 2224 Small limestone outcrop in S. E. Corner of Sec. 5 T. 19 S., R. 25 E. about 350 feet west of UO 2223 - just over the first hill and the same distance from Twelve Mile Creek and the road. Suplee Quad., Crook County, Oregon.

- UO - 2225 Flatiron Point. On easterly dipping Limestone outcrop located in S E corner of Sec. 5 T. 19 S., R 25E. Suplee Quad. Crook County Oregon.

- UO - 2226 Shale outcrop in the S E corner of Sec. 34 T. 18 S., R. 25 E. Near little flat by roadside once occupied by a ranch building and

BIBLIOGRAPHY

1. Bell, W.A., Horton-Windsor District, Nova Scotia,
Geol. Surv. Canada, Mem. 155, 1929
2. Branson, E.B. - Correlation of the Mississippian
Section of the Rocky Mts. States and
the Mississippi Valley States. Pan.
Amer. Geol. Vol. 45, No.3, p.248,
April, 1928.
3. ---- - Productidae of the Basal Mississippian of
Missouri. Geol. Soc. Amer., Bull.,
Vol.41, No. 1, p. 121, Mar. 1930
4. Brooks and Kindle, - Paleozoic and associated Rocks
of the Upper Yukon, Alaska. Bull.
Geol. Soc. Amer., Vol.19, 1908.
5. Brooks and Prindle. - The Mt. McKinley Region, Alaska.
U.S.G.S. Prof. Paper No. 70, 1911.
6. Buckman, S.S., Brachiopod Homoeomorphy Spirifer
glaber. Quart. Jour. Geol.Soc. Vol.LXXV,
1908.
7. Butts, Chas., The Mississippian Series of Eastern
Kentucky. Kent. Geol. Sur. Ser. 6, Vol.7
1908.
8. Cairnes, D.D. - The Yukon-Alaska International Bound-
ary between Porcupine and Yukon rivers.
Geol. Sur. Can. Mem. No. 67, 1914.
9. Capps, S.R. - The Chisna-White River District, Alaska.
U.S.G.S. Bull. No. 630, 1916.
10. Collier, A.J. - Geol. and Coal Resources of the Cape
Lisburne Region, Alaska. U.S.G.S. Bull
No.278, 1906.
11. Croneis, Carey. - Geology of the Arkansas Paleozoic
Areas. Ark. Geol. Sur. Bull.No.3, 1930.
12. Chao, Y.T. - Productidae of China; Pt. I, Producti,
Geol. Sur. China. Paleo. Sinica, Ser.B,
Vol. 5, Fasc. 2, 1927.

13. Chao, Y.T. - Productidae of China, Pt.II, Chonetina, Productinae and Richthofeniidae, Geol. Sur. China. Paleo. Sinica, Ser.B, Vol. 5, Fasc. 3, 1928.
14. Davidson, Thomas, - Mono of British Carboniferous Brach. Paleo. Soc. London. Vol. 13, Pt. 5, 1857.
15. " " Mono. of British Carboniferous Brachio-
poda. Paleo. Soc. London. Vol.13, Pt. 5
1861
16. " " On some Carboniferous Brachiopoda collect-
ed in India by A. Fleming and W. Purdon.,
Quart. Jour. Geol. Soc. London, Vol.XVIII
1862.
17. " " On the Lower Carboniferous Brachiopoda of
Nova Scotia. Quart. Jour. Geol. Soc.
London. Vol. XIX, 1863.
18. " " Notes on Carboniferous Brachiopoda collect-
ed in the Valley of Kashmere, Quart. Jour.
Geol. Soc. London. Vol. XXII, 1866.
19. Diller, J.S. - Description of the Redding Quadrangle,
Geol. Atlas of the U.S. Folio No.138
1906.
20. Dunbar and Condra. - Brachiopoda of the Pennsylvanian
System of Nebraska. Neb. Geol. Sur. Bull.
No. 5, 2nd Ser. 1932.
21. Eakin, H.M. - The Porcupine Gold Placer District, Al-
aska, U.S.G.S. Bull. No.699, 1919.
22. Fredricks, Geo. - Cont. to the Classification of the
Genus Productus.(In Russian with Eng.
summary) Bull. Com. Geol. Vol. XLVI,
No.7, 1928.
23. Girty, G.H. - Carboniferous Formations and Faunas of
Colorado. U.S.G.S. Prof. Paper No.16,
1903.
24. " Fauna of the Moorefield Shale of Arkansas
Ibidem, 439.

25. Girty, G.H. - Fauna of the Wewoka Formation of Oklahoma. Ibidem, 544, 1915.
26. Grabau, A.W. - Historical Geol. Pt. II, 1921
27. " - The Stratigraphy of China. Vol.I, Paleozoic, 1923-24.
28. Grabau and Shimer. - North American Index Fossils Vol. I, 1902.
29. Gronwall, K.A. - The marine Carboniferous of Northeast Greenland and its Brachiopoda Fauna. Meddelelser om Grønland, Vol. XLIII, 1917.
30. Hall and Clarke, - Natural History of New York. Palaeo. Brachiopoda, I, Geol.Surv. N.Y. 1892.
31. Høltedahl, Olaf - Paleogeography and Diastrophism in the Atlantic-Arctic Region during Paleozoic Time. Am. Jour.Sci. Vol. XLIX, 1920.
32. " On the rock formations of Novya Zemlya with Notes on the Paleozoic Stratigraphy of other Arctic Lands. Det Norske Videnskaps-Akademi., Oslo, 1930.
33. Kindle, E.M. - Geol. Reconnaissance of the Porcupine Valley, Alaska, Geol. Soc. Am. Bull., Vol.XIX, 1907.
34. Koch, L. - Preliminary report on the geology of Peary Land, Arctic Greenland. Am. Jour. Sci. 5th Ser. Vol.V, 1923.
35. Lee, G.W. - Notes on the Arctic Paleozoic fossils from the Hecla and Fury Collections. Proc. R. Phys. Soc. Edinb. Vol.XVIII, 1912.
36. Leffingwell, E, deK. - The Canning River Region, Northern Alaska, U.S.G.S. Prof. Paper No. 109, 1919.
37. Lindgren, Waldemar - Goldbelt of the Blue Mounts. of Oregon. U.S.G.S. 22nd An. Rep. Pt. II, 1901.

38. McCoy, F. - A synopsis of the characters of the carboniferous Limestone Fossils of Ireland. 1844.
39. Moffit and Mertie - The Kotsina-Kuskulana District, Alaska. U.S.G.S. Bull No. 745.
40. Muir-Woods, Helen M. - British Carboniferous, Producti II, Productus (sensu stricto) Semireticulatus and longspinus groups. Memo. Geol. Sur. Gr. Brit. Paleo. Vol. III, Pt. I, 1928.
41. Nathorst, A.G. - Contributions to the Carboniferous of Northeastern Greenland. Meddelelser om Gronland, Vol. XLIII, 1911
42. Obrutschew, W.A. - Geologie von Sibirien von Gebruder Borntraeger, Berlin. 1926.
43. Packard, E.L. - Discovery of the Baird Mississippian Fauna in Central Oregon, Pan-Amer. Geol. Vol. 49, No.4, 1928.
44. " - A new section of Paleozoic and Mesozoic Rocks of Central Oregon. Amer. Jour. Sci. Vol. 15, 1928.
45. " - A contribution to the Paleozoic Geology of Central Oregon. Carn. Inst. Wash. Paleo. Pub. No.418, 1932.
46. Prindle and Hess - The Rampart Gold Placer Region, Alaska. U.S.G.S. Bull No.280,1906.
47. Schrader, F.C. - A reconnaissance in Northern Alaska. U.S.G.S. Prof. Paper No. 20, 1904.
48. Schenk, Edward T. - The Stratigraph and Paleoltology of the Triassic of the Suplee region of Central Oregon, Masters thesis, Univ. Oregon, 1931.
49. Schuchert, Chas. - A synopsis of the Amer. Fossil Brachiopoda (Bibliography and synonymy) U.S.G.S. Bull. 87, 1897.
50. " - Outlines of Historical Geology,1931.

51. Schuchert and Cooper - Brachiopod Genera of the suborders Orthoidea and Pentamer oidea. Memoir, Peabody Mus. Nat. Hist. Vol. IV, Pt. I, 1932.
52. Smith, J.P. - Metamorphic Series of Shasta County, California. Jour. Geol. Vol. II, No. 6, 1894.
53. " - The Carboniferous Ammonoids of Amer. U.S.G.S. Mono. No. 42, 1903.
54. Smith, P.S. and Mertie - Geology and Mineral resources of Northwestern Alaska. U.S.G.S. Bull. No. 815, 1930.
55. Snider, L.C. - Geology of Northeastern Oklahoma. Okla Geol Sur. Bull. No. 24, 1915.
56. Thomas, Ivor - The British Carboniferous, Producti I, Genera Pustula and Overtonia. Memo. Geol. Sur. Gr. Brit. Paleo. Vol. I, Pt. 4, 1914.
57. VanTuyl, F.M. - The Stratigraphy of the Mississippian Formations of Iowa. Iowa Geol. Sur. Vol. XXX, 1925.
58. Waagen, W. - Productus Limestone Fossils. Paleo. India, Series XIII, Salt Range Fossils, Fasc. 3, Vol. I, Pt. 4, 1884.
59. Washburne, Chester - Notes on the Marine Sediments of Eastern Oregon. Jour. Geol. Vol. XI, 1903.
60. Weller, Stewart - A Bibliographic Index of North Amer. Carboniferous Invertebrates. U.S.G.S. Bull. No. 153, 1895.
61. " - Mississippian Brachiopoda of the Mississippi Valley Basin., Ill. Geol. Sur. Mono I, Two Parts. 1914.
62. " - Faunal zones in the standard Mississippian Section. Jour. Geol. Vol. 34, No. 4, 1926.

63. Weller and Butts - The Geology of Hardin County, Ill.
Geol. Sur. Bull. No. 41, 1920.
64. Wheeler, Harry I. - Stratigraphy and Paleontology
of the McCloud Formation of North-
ern California. Masters Thesis,
L.S.J.U. 1932.
65. White, C.A. - Cont. to Invertebrate Paleontology No.
6. Certain Carboniferous Fossils from
Western United States. U.S.G.S.
Terr. (Hayden) An. Rep. 12, Pt. 1, 1883.
66. Whitfield E.J.- Notes on Carboniferous Fossils and
semi-fossil shells brought home by
members of the Peary Expedition. Bull.
Am. Mus. Nat. Hist. Vol. 24, 1908.
67. Wills, L.J. - The physiographic Evolution of Gr. Brit.,
Arnold and Co. London, 1929.
68. Smith, P.S. - U.S.G.S. Bull. 536. 1913.
69. Hayasaki, T. - The limestones of Omi-Mura, Prof. of
Etchigo (Japan) Jap. Jour. Geol. &
Geog. Vol. I, No. I, p. 1-7, 1922.
70. Tschernyschew and Loutouguin - Le Bassin du Dometz.
Guide des excursions du le Congress
Geol. Intern. XVI - 1897.
71. Buddington and Chapin - Geology and Mineral Deposits
of Southeastern Alaska. U.S.G.S. Bull
No. 800, 1929.
72. Lusher, R.L. - Stratigraphy and Correlation of the
Marine Jurassic Deposits of Central
Oregon. Doctorate Thesis, Cal. Inst.
Tech. 1930.

PLATE I

(All pictures natural size unless stated)

Fig. 1 - Striatifera striata (Fischer) - - - p. 63

A large pedicle valve showing the
characteristic radiating striae.
2/3X. Suplee Series. Locality UO
2200.

Figs. 2-3- Dictyoclostus inflatus (Tschernyschew)

Side and pedicle view of a nearly
perfect pedicle valve. Suplee Ser.
Locality UO 2204 - - - - - - - - - - -p.45

Figs. 4-6- Dictyoclostus semireticulatus (Martin)

Pedicle, side, and lateral view of
a nearly complete internal cast of
both valves. Suplee Series. Local-
ity UO 2200. - - - - - - - - - - -p.41

PLATE I

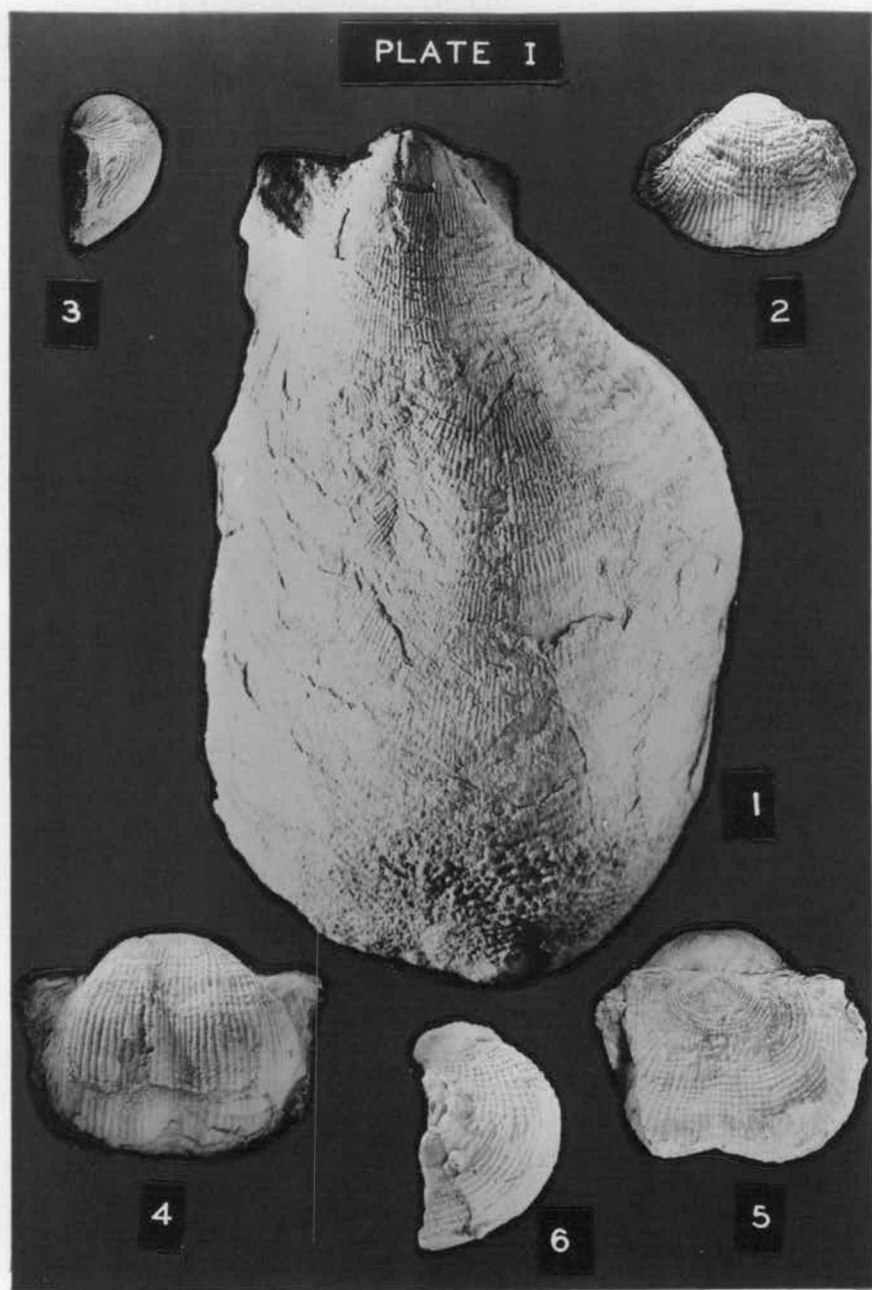


PLATE IIFig. 1 - Gigantella giganteus var. oregonensis

Ventral view of part of a very large
pedicle valve showing the surface
sculpture and a small portion of
the internal shell structure. 3/5X.
Suplee Series. Locality UO 2200 - - - p.68.

Figs. 2-3- Juresania juresanensis (Tschernyschew)

Side and pedicle view of a nearly
complete pedicle valve. Suplee
Series. Locality UO 2204 - - - - - p.59

Figs. 4-5 - Athyris lamellosa (L'Eveille)

Pedicle and lateral view of a
complete specimen. Suplee Series.
Locality UO 2208 - - - - - p.96

PLATE II



PLATE IIIFig. 1 - Spirifer striatus (Martin)

Partial view of part of a pedicle
valve of a very large specimen.

Suplee Series. Locality UO 2200 - - - p.92

Figs. 2-3 - Echinoconchus alternatus (Nor.&Pratt)

Pedicle and brachial views of a
nearly complete specimen. Suplee

Series. Locality UO 2201 - - - - - p.51

Fig. 4 - Buxtonia cf. scabricula (Martin)

View of a nearly complete pedicle
valve showing the surface ornament-
ation. Suplee Series. Locality UO

2204 - - - - - p.54

Fig. 5 - Gastrioceras cf. globulosum (Meek
and Worth)

Ventral View of a partial specimen
showing the sutures. Suplee Series

Locality UO 2202 - - - - - p.102

PLATE III



2



3



1



5



4

PLATE IV

Fig. 1 - Linoproductus cestriensis (Worthen)

Pedicle view of a nearly perfect
pedicle valve. Suplee Series.

Locality UO 2201 - - - - - p.78

Figs. 2-3- Productus, specie b

Side and pedicle view of a nearly
perfect shell, this shows the char-
acteristic ornamentation. Suplee

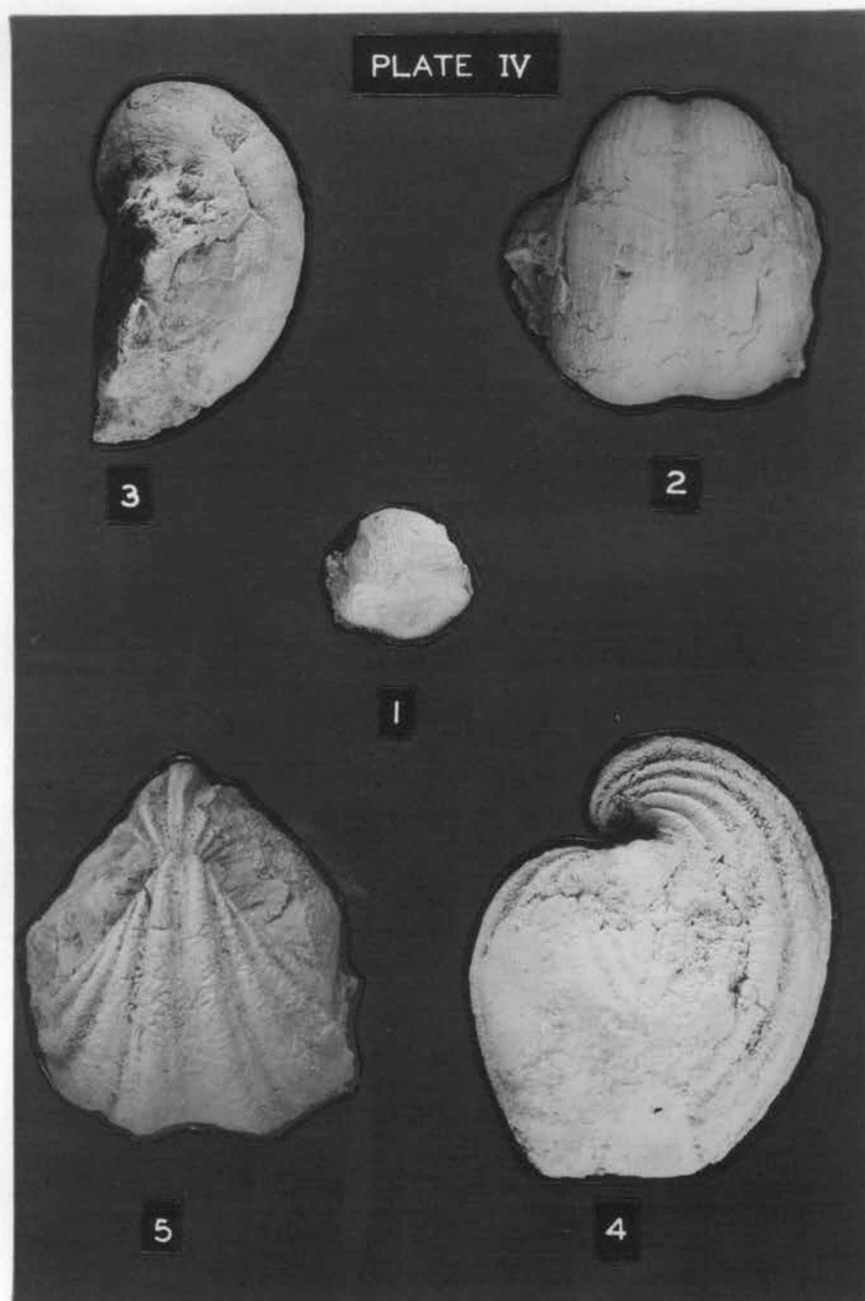
Series. Locality UO 2205 - - - - - p.85

Figs. 4-5 - Spirifer cf. indianensis Weller

Top and side view of a nearly com-
plete shell. 3X. Suplee Series.





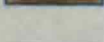




Locality UO 2204 - - - - - p.94

PLATE IV



MAP OF
THE
SUPLEE PALEOZOIC
OF CENTRAL OREGON

LEGEND

- | | | |
|-----------------|---|----------------------------|
| TERTIARY RECENT |  | RECENT ALLUVIUM |
| |  | UNDIFFERENTIATED LAVAS |
| MESOZOIC |  | JURASSIC |
| |  | JURA-TRIAS |
| |  | TRIASSIC |
| |  | ANDESITE PORPHYRY |
| CARBONIFEROUS |  | CHERTS |
| |  | LIMESTONE |
| |  | SANDSTONE AND CONGLOMERATE |

