WORK-IN-PROGRESS (JANUARY 29, 2020) PARALLEL CHART FOR

Paper 59 — The Marine-Life Era on Urantia

This chart is a revision of the March 8, 2012 and April 4, 2015 versions.
Endnotes and some Urantia Book cross-references have been deleted to enhance readability.

Sources for Paper 59, in the order in which they were published

(1) Thomas C. Chamberlin and Rollin D. Salisbury, *A College Text-book of Geology* (New York: Henry Holt and Company, 1909)

(2) Charles Schuchert, *A Text-book of Geology, Part II: Historical Geology, Second, Revised Edition* (New York: John Wiley & Sons, Inc., 1924)

(3) Thomas C. Chamberlin and Rollin D. Salisbury, *College Text-book of Geology, Part II: Historical Geology, Rewritten and Revised by* Rollin T. Chamberlin and Paul MacClintock (New York: Henry Holt and Company, 1930)

(4) Charles Schuchert and Carl O. Dunbar, *A Textbook of Geology, Part II—Historical Geology, Third Edition, Largely Rewritten* (New York: John Wiley & Sons, Inc., 1933)

Key

(a) Green indicates where **(1)** Chamberlin & Salisbury or **(2)** Schuchert first appear or reappear.

(b) Gold indicates where **(3)** Chamberlin & MacClintock or **(4)** Schuchert & Dunbar first appear or reappear.

(c) Yellow highlights most parallelisms.

(d) Tan highlights parallelisms not occurring on the same row.

(e) An underlined word or words indicates where the source and the UB writer pointedly differ from each other.

(f) Blue indicates original (or "revealed") information, or UB-specific terminology and concepts. (What to highlight in this regard is debatable; the highlights are tentative.)

(g) Red indicates where the UB writer apparently misread or reinterpreted the source text, resulting in a statement whose erroneousness would have been recognized at the time the paper was written as well as now.

See **Explanation of Red-marked Items** in the Appendix.

EXHIBIT A (from Schuchert & Dunbar)

"Let the height of the Woolworth building represent geologic time. We may then lay a nickel on its tower to represent the time of human existence. A thin sheet of paper on this will represent all historic time!"

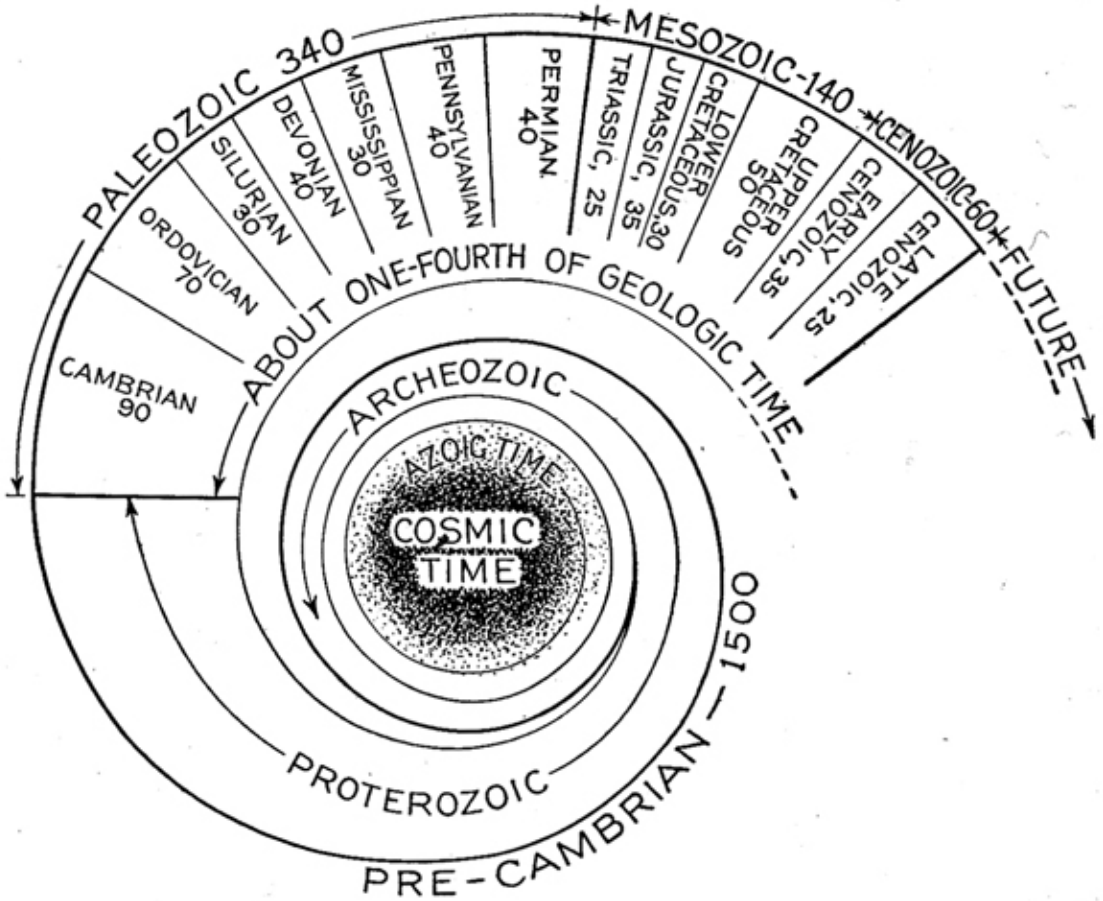

Fig. 38. — Duration of geologic time illustrated by a spiral graph. All numbers in million years. Modified after David White.

REFERENCES

[1] *The Varves and Climate of the Green River Epoch;* by W. H. Bradley. U. S. Geological Survey, Professional Paper 158, 1929, p. 107.

[2] *The Age of the Earth;* by Adolph Knopf and others. National Research Council, Bulletin 80, 1931, p. 66.

[3] Ibid., p. 202.

[4] Ibid., pp. 7, 351.

COLLATERAL READING

The Age of the Earth; by Arthur Holmes. 80 pages. Benn's Sixpenny Library, London, No. 102, 1926.

An elementary statement for the layman and student.

The Age of the Earth; by Adolph Knopf and others. 487 pages. National Research Council, Bulletin 80, 1931.

A critical and up-to-date treatise.

EXHIBIT B (from Schuchert & Dunbar)

GEOLOGIC CHRONOLOGY OF NORTH AMERICA *(continued)*

ERAS: DURATION %	SUBERAS	PERIODS		BIOLOGIC AND CLIMATIC CHANGES	OROGENIC TIMES	AGES: PLANTS	AGES: ANIMALS
PALEOZOIC OR ANCIENT ERA 17%	Late Paleozoic, 5%+	Permian 2%-		Periodic glaciations in southern hemisphere Extinction of trilobites and Paleozoic corals Spread of primitive insects and amphibians	Appalachian Rev.	Age of Medieval Seed Floras	Age of Amphibians
		Pennsylvanian 2%	"Carboniferous"	Warm, humid climate with extensive coal making Dominance of spore floras. Spread of reptiles	Repeated orogeny	Age of Spore-bearing Floras	
		Mississippian 2%-		Spread of ancient sharks and culmination of crinoids	Disturbance		
	Middle Paleozoic, 3%+	Devonian 2%-		Rise of amphibians, marine fishes, and primitive ammonites First spread of forests	Acadian Dist.		Age of Fishes
		Silurian 1%+		Rise of air-breathing invertebrates Spread of Paleozoic reef-corals First known occurrence of land plants			
	Early Paleozoic, 8%+	Ordovician 3%+		Rise of fresh-water fishes and of corals Spread of molluscs Culmination of trilobites	Taconian Dist.	Age of Marine Floras	Age of Marine Invertebrates
		Cambrian 4%+		Rise of shell-bearing molluscs Dominance of trilobites First appearance of well-known marine faunas	Disturbance		
PROTEROZOIC ERA of primitive marine life An early and a late glacial period For detail see table in Chapter VII					Penokean-Grand Canyon		
ARCHEOZOIC ERA of oldest known life Geologic history very obscure For detail see table in Chapter VII					Algoman Laurentian		Age of Larval Life

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PAPER 59 — THE MARINE-LIFE ERA ON URANTIA

[Compare *Exhibit A.*]

59:0.1 We reckon the history of Urantia as beginning about one billion years ago and extending through five major eras:

59:0.2 1. *The prelife era* extends over the initial four hundred and fifty million years, from about the time the planet attained its present size to the time of life establishment. Your students have designated this period as the *Archeozoic*.

[*Note:* The sources refer to the pre-life era as the *Azoic. Archeozoic* refers to the era of the oldest known life.]

59:0.3 2. *The life-dawn era* extends over the next one hundred and fifty million years. This epoch intervenes between the preceding prelife or cataclysmic age and the following period of more highly developed marine life. This era is known to your researchers as the *Proterozoic*.

[*Note:* The sources refer to the life-dawn era as the *Archeozoic. Proterozoic* refers to the era of primitive marine life.]

59:0.4 3. *The marine-life era* covers the next two hundred and fifty million years and is best known to you as the *Paleozoic*.

59:0.5 4. *The early land-life* era extends over the next one hundred million years and is known as the *Mesozoic*.

59:0.6 5. *The mammalian era* occupies the last fifty million years. This recent-times era is known as the *Cenozoic*.

59:0.7 The marine-life era thus covers about one quarter of your planetary history.

SOURCE OR PARALLEL	URANTIA PAPER 59
[Compare *Exhibit B.*]	It may be subdivided into six long periods, each characterized by certain well-defined developments in both the geologic realms and the biologic domains.
[See 58:7.11 and 58:6.1.]	59:0.8 As this era begins, the sea bottoms, the extensive continental shelves, and the numerous shallow near-shore basins are covered with prolific vegetation. The more simple and primitive forms of animal life have already developed from preceding vegetable organisms,
XIV: THE CAMBRIAN PERIOD (Chamberlin & MacClintock 455)	
[PREAMBLE] (Chamberlin & MacClintock 455)	
During this long interval [between the Proterozoic and the Cambrian], marine life was developing in whatever shallow seas then existed on the globe,	and the early animal organisms have gradually made their way along the extensive coast lines of the various land masses
so that when the seas again encroached on the continental lands, they were teeming with the life which constituted the early Cambrian faunas (C&M 455).	until the many inland seas are teeming with primitive marine life.
THE LIFE OF THE CAMBRIAN (Chamberlin & MacClintock 478)	
The animals of these earlier eras were probably largely of the simpler types with few hard parts, such as shells and skeletons,	Since so few of these early organisms had shells,
and hence not well adapted to preservation as fossils (C&M 478).	not many have been preserved as fossils.
[The Paleozoic is at present regarded as the third geologic era in the history of the earth, or the third volume of the "book of geologic time" (S 182).]	Nevertheless the stage is set for the opening chapters of that great "stone book" of the life-record preservation which was so methodically laid down during the succeeding ages.

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XIV: THE PALEOZOIC ERA (Schuchert 182)

Paleozoic of North America. (Schuchert 182)

[contd] North America is wonderfully rich in a long succession of Paleozoic formations that abound in fossils, and this is especially true for the eastern half of the United States and Canada (S 182).

59:0.9 The continent of North America is wonderfully rich in the fossil-bearing deposits of the entire marine-life era.

XV: CAMBRIAN TIME AND DOMINANCE OF TRILOBITES (Schuchert 185)

PART I. CAMBRIAN IN GENERAL, AND THE LOWER CAMBRIAN (Schuchert 185)

[*Preamble*] (Schuchert 186)

Significant Things about the Cambrian Period. (Schuchert 186)

[contd] The Cambrian period is the first one in the Paleozoic era, and is generally separated from the older rocks by one of the most marked unconformities known, representing a very long erosion interval (S 186).

The very first and oldest layers are separated from the later strata of the preceding period by extensive erosion deposits

which clearly segregate these two stages of planetary development.

1. EARLY MARINE LIFE IN THE SHALLOW SEAS THE TRILOBITE AGE

59:1.1 By the dawn of this period of relative quiet on the earth's surface, life is confined to the various inland seas and the oceanic shore line;

There is no trace of land animals, or of land plants, although the latter may have been present (S 186).

as yet no form of land organism has evolved.

SOURCE OR PARALLEL	URANTIA PAPER 59
	Primitive marine animals are well established and are prepared for the next evolutionary development.
[See 58:7.2 and 65:2.4.]	Ameba are typical survivors of this initial stage of animal life, having made their appearance toward the close of the preceding transition period.
	59:1.2 *400,000,000* years ago marine life, both vegetable and animal, is fairly well distributed over the whole world.
The Lower Cambrian (Schuchert 187)	
Lower Cambrian Climate. (Schuchert 192)	
[contd] From the world-wide distribution of the reef-making coral-like animals of this time described on a previous page, it is evident that the waters of at least the later half of the period were warm and equable over most of the earth, since these animals lived then not only in the equivalent temperate regions of the present but also in both polar areas (S 192).	The world climate grows slightly warmer and becomes more equable.
	There is a general inundation of the seashores of the various continents, particularly of North and South America. New oceans appear, and the older bodies of water are greatly enlarged.
	59:1.3 Vegetation now for the first time crawls out upon the land and soon makes considerable progress in adaptation to a nonmarine habitat.
[!]	59:1.4 *Suddenly* and without gradation ancestry the first multicellular animals make their appearance. The trilobites have evolved, and for ages they dominate the seas. From the standpoint of marine life this is the trilobite age.

SOURCE OR PARALLEL

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59:1.5 In the later portion of this time segment much of North America and Europe emerged from the sea. The crust of the earth was temporarily stabilized;

Lower Cambrian Paleogeography. (Schuchert 192)

The North American continent then, as now, was bordered by highlands, but these lands extended out into the oceans hundreds of miles farther than do the present shore-lines.

mountains, or rather high elevations of land, rose along the Atlantic and Pacific coasts,

On the west was the extensive land of Cascadis, and on the east were two land masses, the southern and greater one being Appalachis united with Antillis, which was more or less continuous with the northeastern one, known as Acadis (S 192).

over the West Indies,

and in southern Europe.

[See Plate 5.—Lower Cambrian paleophysiography. (S 193)]

The entire Caribbean region was highly elevated.

59:1.6 *390,000,000* years ago the land was still elevated.

XVI: THE CAMBRIAN PERIOD (Chamberlin & Salisbury 476)

FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 476)

The Subdivisions of the Cambrian and their Distribution (Chamberlin & Salisbury 476)

The Lower Cambrian. (Chamberlin & Salisbury 476)

[contd] The Lower Cambrian formations are known in North America only near the eastern and western borders of the continent (Fig. 357) (C&S 476).

Over parts of eastern and western America and western Europe may be found the stone strata laid down during these times,

SOURCE OR PARALLEL	URANTIA PAPER 59
In both the east and the west, the strata contain marine fossils.	and these are the oldest rocks which contain trilobite fossils.
The strata of the east were accumulated in straits, sounds, etc., rather than on the shores of the open sea (C&S 476).	There were many long fingerlike gulfs projecting into the land masses in which were deposited these fossil-bearing rocks.
XV: CAMBRIAN TIME AND THE DOMINANCE OF TRILOBITES (Schuchert 185)	
PART I. CAMBRIAN IN GENERAL, AND THE LOWER CAMBRIAN (Schuchert 185)	
The Lower Cambrian (Schuchert 187)	
Lower Cambrian Paleogeography. (Schuchert 192)	
	59:1.7 Within a few million years
We know that the Pacific Ocean in earliest Lower Cambrian time first invaded the land in the Great Basin area and gradually spread northward, forming throughout the Cordilleric geosyncline a sea which finally united with the Arctic Ocean (S 192).	the Pacific Ocean began to invade the American continents.
XVI: THE CAMBRIAN PERIOD (Chamberlin & Salisbury 476)	
FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 476)	
The Subdivisions of the Cambrian and their Distribution (Chamberlin & Salisbury 476)	
Deformation as a cause of submergence. (Chamberlin & Salisbury 480)	
2. **Adjustments between continental and oceanic segments, a possible cause of submergence.** (Chamberlin & Salisbury 481)	The sinking of the land was principally due to crustal adjustment,
1. **Lateral spread or continental creep.** (Chamberlin & Salisbury 480)	although the lateral land spread, or continental creep, was also a factor.

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59:1.8 *380,000,000* years ago Asia was subsiding, and all other continents were experiencing a short-lived emergence. But as this epoch progressed, the newly appearing Atlantic Ocean made extensive inroads on all adjacent coast lines.

[See Plate 6.—Paleogeography of Cambrian time. (S 195)]

The northern Atlantic or Arctic seas were then connected with the southern Gulf waters.

XV: CAMBRIAN TIME AND THE DOMINANCE OF TRILOBITES (Schuchert 185)

PART I. CAMBRIAN IN GENERAL, AND THE LOWER CAMBRIAN (Schuchert 185)

[*Preamble*] (Schuchert 185)

Significant Things about the Cambrian Period. (Schuchert 186)

Finally should be pointed out the striking topographic fact that when the Lower Cambrian seas entered the Appalachic trough from the south,

When this southern sea entered the Appalachian trough,

their waves broke to the east against a mountain tract as grand as the present Alps of Europe (S 186).

its waves broke upon the east against mountains as high as the Alps,

PART II. THE MIDDLE AND UPPER CAMBRIAN (Schuchert 194)

Physical Considerations (Schuchert 194)

[contd] During Middle and Upper Cambrian times most of North America appears to have been a lowland devoid of scenic beauty (S 194).

but in general the continents were uninteresting lowlands, utterly devoid of scenic beauty.

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XVI: THE CAMBRIAN PERIOD (Chamberlin & Salisbury 476)

FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 476)

Sedimentation in the Cambrian Period (Chamberlin & Salisbury 484)

Sources and kinds of sediments. (Chamberlin & Salisbury 485)

[contd] The Cambrian formations include all common phases of sedimentary rocks.

59:1.9 The sedimentary deposits of these ages are of four sorts:

There are conglomerates, presumably accumulated near the shores of the time;

59:1.10 1. Conglomerates—matter deposited near the shore lines.

there are sandstones, the sand of which was deposited in shallow water where the waves were sufficiently vigorous to keep the mud from settling;

59:1.11 2. Sandstones—deposits made in shallow water but where the waves were sufficient to prevent mud settling.

shales representing the deposits made in stiller or deeper water;

59:1.12 3. Shales—deposits made in the deeper and more quiet water.

and beds of limestone representing, for the most part, the accumulations of shells, etc., where terrigenous sediments were not carried in quantity (C&S 485).

59:1.13 4. Limestone—including the deposits of trilobite shells in deep water.

Basis for the Subdivision of the Cambrian (Chamberlin & Salisbury 481)

Fossils. (Chamberlin & Salisbury 482)

[The successive Cambrian faunas] have some species in common, and such species do not distinguish the groups of strata which contain them from one another.

59:1.14 The trilobite fossils of these times present certain basic uniformities

SOURCE OR PARALLEL

But certain species are found only in the Lower, certain other species only in the Middle, and still others only in the Upper part of the system, and these species serve to distinguish the principal divisions (C&S 484).

The Subdivisions of the Cambrian and their Distribution (Chamberlin & Salisbury 476)

Great submergence during the Cambrian. (Chamberlin & Salisbury 478)

[contd] The distribution of the several series of the system shows that *the great physical event of the Cambrian period in North America was the progressive submergence of the continent* (C&S 478-79).

Gradation a possible cause of submergence. (Chamberlin & Salisbury 479)

If continued long enough, shore-cutting about the borders of the lands, down-cutting over the whole surface, and the accompanying rise of the sea-level, must inevitably cause the water to cover the continents, and to spread deposits over all but the last remnants of them, *provided there is no deformation of the body of the earth in the meantime* (C&S 479).

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coupled with certain well-marked variations.

The early animals developing from the three original life implantations were characteristic; those appearing in the Western Hemisphere were slightly different from those of the Eurasian group and from the Australasian or Australian-Antarctic type.

59:1.15 *370,000,000* years ago the great and almost total submergence of North and South America occurred,

followed by the sinking of Africa and Australia.

Only certain parts of North America remained above these shallow Cambrian seas.

SOURCE OR PARALLEL	URANTIA PAPER 59
XIV: THE CAMBRIAN PERIOD (Chamberlin & MacClintock 455)	
DISTRIBUTION AND OUTCROPS OF THE CAMBRIAN SYSTEM (Chamberlin & MacClintock 468)	
Close of the Cambrian. (Chamberlin & MacClintock 472)	
[contd] At the close of the Cambrian the shallow seas withdrew from a large part of the Interior of North America, as is shown by the areal extent of the unconformity (C&M 472).	Five million years later the seas were retreating before the rising land.
	And all of these phenomena of land sinking and land rising were undramatic, taking place slowly over millions of years.
XVI: THE CAMBRIAN PERIOD (Chamberlin & Salisbury 476)	
FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 476)	
Distribution and Outcrops of the Cambrian System (Chamberlin & Salisbury 486)	
Position of outcrops. (Chamberlin & Salisbury 487)	
[See Fig. 358.—Map showing the Upper Cambrian formations. The outcrops are shown in black. [Etc.] (C&S 477)]	59:1.16 The trilobite fossil-bearing strata of this epoch outcrop here and there throughout all the continents except in central Asia.
Changes in the Cambrian sediments since their deposition. (Chamberlin & Salisbury 489)	
Over great areas in the interior (Missouri, Wisconsin, Texas, etc.) the strata still remain in horizontal or nearly horizontal position,	In many regions these rocks are horizontal,
while in other regions they have been tilted, folded, and faulted.	but in the mountains they are tilted and distorted because of pressure and folding.

SOURCE OR PARALLEL	URANTIA PAPER 59
Where close folding has taken place, the rocks have been more or less metamorphosed.	And such pressure has, in many places, changed the original character of these deposits.
In extreme cases the sandstones have been converted into quartz schists, the shales into slates and schists, and the limestones into marble (C&S 490).	Sandstone has been turned into quartz, shale has been changed to slate, while limestone has been converted into marble.
	59:1.17 *360,000,000* years ago the land was still rising. North and South America were well up. Western Europe and the British Isles were emerging,
In Other Continents (Chamberlin & Salisbury 490)	
Europe. (Chamberlin & Salisbury 490)	
In Wales (Cambria), the country from which the system received its name, the system has a thickness of 12,000 feet or more (C&S 491).	except parts of Wales, which were deeply submerged.
Glacial formations. (Chamberlin & Salisbury 492)	
	There were no great ice sheets during these ages.
Glacial formations of about the same age [as those found in Norway and China] have been found in Australia, and perhaps in South Africa.	The supposed glacial deposits appearing in connection with these strata in Europe, Africa, China, and Australia
	are due to isolated mountain glaciers
The most probable interpretation, with present knowledge, is that these bowlder-bearing formations of Norway, China, and Australia (Fig. 370) belong either to the transition period that accompanied and followed the deformation that closed the Proterozoic, or to the opening stages of the Paleozoic, previous to the demonstrated Cambrian (C&S 492-93).	or to the displacement of glacial debris of later origin.

SOURCE OR PARALLEL	URANTIA PAPER 59
The testimony of Cambrian fossils, however, implies nearly uniform climatic conditions throughout all regions where fossils have been found, and the wide spread of the sea during the later part of the period would seem to point to oceanic, rather than continental climates at that time (C&S 493).	The world climate was oceanic, not continental.
IX: THE ORDOVICIAN PERIOD (Schuchert & Dunbar 145)	
CLIMATE (Schuchert & Dunbar)	
	The southern seas were warmer then than now, and they extended northward over North America up to the polar regions.
The present Gulf Current is deflected northeastward across the Atlantic to give a mild climate to western Europe as far as the north end of Norway, while eastern Greenland, in the same latitude, is ice-covered and uninhabited. But with the configuration of land and sea represented in our maps of Middle and Late Ordovician time (Pl.7, maps 2 and 3), the equivalent of the Gulf Current would stream northward across the United States and the Hudson Bay region, bearing its warmth directly to northern Greenland (S&D 155).	The Gulf Stream coursed over the central portion of North America, being deflected eastward to bathe and warm the shores of Greenland,
	making that now ice-mantled continent a veritable tropic Paradise.

SOURCE OR PARALLEL	URANTIA PAPER 59
XV: CAMBRIAN TIME AND THE DOMINANCE OF TRILOBITES (Schuchert 185)	
PART I. CAMBRIAN IN GENERAL, AND THE LOWER CAMBRIAN (Schuchert 185)	
The Lower Cambrian (Schuchert 187)	
Life of the Lower Cambrian. (Schuchert 188)	
The life of the Lower Cambrian seas is very much alike not only throughout America, but in Europe, Asia, and Australia as well. It is therefore said to be *cosmopolitan* in character (S 190).	59:1.18 The marine life was much alike the world over
[See C&S 495 and S 191.]	and consisted of the seaweeds, one-celled organisms,
This animal life, consisting entirely of marine invertebrates, ranges from simple sponges to complex forms of Crustacea (S 189-90).	simple sponges, trilobites, and other crustaceans—
[Trilobites were the first fossils to attract the attention of naturalists and have long been of popular interest.... The great Swedish naturalist, Linnæus, first correctly recognized their relationship with the Crustacea, animals such as shrimps, crabs, and lobsters (S 207).]	shrimps, crabs, and lobsters.
XVII: BRACHIOPODA OR LAMP SHELLS (Schuchert 214)	
Geologic Occurrence. (Schuchert 217)	
[contd] Brachiopods are particularly characteristic of Paleozoic time, and in North America about 2500 kinds are already known, while the known fossil forms of all countries and ages probably exceed 7000 in number.	Three thousand varieties of brachiopods

SOURCE OR PARALLEL	URANTIA PAPER 59
They appeared in some variety in the Lower Cambrian but it was in the Champlainian that they began their great specific and generic deployment and the class had its evolutional culmination in the Devonian, where 30 per cent of the American Paleozoic species occur (S 217).	appeared at the close of this period,
[**Preamble.**] (Schuchert 214)	
More than 215 living kinds are known, extending from the strand-line down to the great ocean abyss of more than 3 miles in depth (S 214).	only two hundred of which have survived.
Geologic Occurrence. (Schuchert 217)	
Brachiopods are among the longest-lived animal stocks known, the genera *Lingula* and *Crania* having persisted through all the physical changes since the Cambrian (S 218).	These animals represent a variety of early life which has come down to the present time practically unchanged.
[As the [trilobites] are the characteristic and most common fossils of the Cambrian, we speak of them as the dominant animals of this time (S 190).]	59:1.19 But the trilobites were the dominant living creatures.
XVI: TRILOBITES (Schuchert 207)	
Definition. (Schuchert 207)	
They were sexed animals (S 207).	They were sexed animals
History. (Schuchert 207)	
There are now more than two thousand kinds of trilobites known (S 207).	and existed in many forms;
Habits and Habitat. (Schuchert 207)	
In general they were rather sluggish animals, floating readily, but swimming probably in a jerking manner, and particularly backward, either with the ventral or dorsal side up.	being poor swimmers, they sluggishly floated in the water

SOURCE OR PARALLEL	URANTIA PAPER 59
Over the sea bottoms they crawled slowly with the aid of numerous stout legs (S 208).	or crawled along the sea bottoms,
Most trilobites could roll their bodies up like the sow-bugs or pill-bugs of our cellars ... This rolling up was for the protection of the softer and more delicate parts of the ventral side, thus presenting to the enemy the hard, thick carapace, an effectual armor against other trilobites but ineffective against the cephalopods and fishes (S 209).	curling up in self-protection when attacked by their later appearing enemies.
Size. (Schuchert 209)	
In size, the trilobites varied greatly at maturity, ranging in length from 0.38 of an inch up to 27.5 inches, but an average size was about 1.5 inches. Many species attained a length of from 3 to 4 and even 6 inches, but these were large individuals, and those above a foot in length were giants (S 209).	They grew in length from two inches to one foot
Habits and Habitat. (Schuchert 207)	
	and developed into four distinct groups:
As a rule, trilobites were carnivorous, and as scavengers kept the sea bottoms cleaned of their dead animals; some were omnivorous; others probably wholly vegetarians;	carnivorous, herbivorous, omnivorous,
and a few were "mud eaters," the digestive tract assimilating the organic matter in the muds for bodily sustenance (S 209).	and "mud eaters."
[*Contrast:* Plant cells have the power of organizing inorganic matter into living plasm; animal cells subsist on organic materials alone (S 8).]	The ability of the latter group largely to subsist on inorganic matter—being the last multicelled animal that could—explains their great increase and long survival.

59:1.20 This was the biogeologic picture of Urantia at the end of that long period of the world's history, embracing fifty million years, designated by your geologists as the *Cambrian*.

2. THE FIRST CONTINENTAL FLOOD STAGE
THE INVERTEBRATE-ANIMAL AGE

59:2.1 The periodic phenomena of land elevation and land sinking characteristic of these times were all gradual and nonspectacular, being accompanied by little or no volcanic action.

Throughout all of these successive land elevations and depressions the Asiatic mother continent did not fully share the history of the other land bodies. It experienced many inundations, dipping first in one direction and then another,[1] more particularly in its earlier history, but it does not present the uniform rock deposits which may be discovered on the other continents. In recent ages Asia has been the most stable of all the land masses.

59:2.2 *350,000,000* years ago saw the beginning of the great flood period of all the continents except central Asia. The land masses were repeatedly covered with water;

SOURCE OR PARALLEL

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XIX: CHAMPLAINIAN TIME AND THE REIGN OF INVERTEBRATE ANIMALS (Schuchert 229)

[PREAMBLE] (Schuchert 229)

General Characteristics of the Period (Schuchert 229)

The Three Champlainian Floods. (Schuchert 229)

[contd] North America during Champlainian time stood but little above sea-level, and it was only along the margins of the continent that there were uplands. For these reasons it was all the easier for the rising warm-water oceans to spread widely over the land.

only the coastal highlands remained above these shallow but widespread oscillatory inland seas.

There were three cycles of floodings and withdrawals, of which the oldest one was of the least extent (S 229).

Three major inundations characterized this period,

but before it ended, the continents again arose,

[See Plate 8.—Paleogeography of Champlainian time. (S 231)]

the total land emergence being fifteen per cent greater than now exists. The Caribbean region was highly elevated.

This period is not well marked off in Europe because the land fluctuations were less, while the volcanic action was more persistent.

59:2.3 *340,000,000* years ago there occurred another extensive land sinking except in Asia and Australia. The waters of the world's oceans were generally commingled.

Champlainian Sediments. (Schuchert 229)

Champlainian time in general may well be spoken of as one essentially of limestone making (S 229).

This was a great limestone age,

SOURCE OR PARALLEL	URANTIA PAPER 59
[See 59:2.11, below.]	much of its stone being laid down by lime-secreting algae.
	59:2.4 A few million years later large portions of the American continents and Europe began to emerge from the water.
[Compare Plate 8.—Paleogeography of Champlainian time. (S 231)]	In the Western Hemisphere only an arm of the Pacific Ocean remained over Mexico and the present Rocky Mountain regions,
	but near the close of this epoch the Atlantic and Pacific coasts again began to sink.
	59:2.5 *330,000,000* years ago marks the beginning of a time sector of comparative quiet all over the world, with much land again above water.
DIVISIONS OF CHAMPLAINIAN TIME (Schuchert 232)	
Middle Champlainian Epoch (Schuchert 237)	
Nelson's Volcano. (Schuchert 239)	
[After the long quiet of Cambrian times, local volcanoes burst forth in various parts of the Appalachian region during the Middle Ordovician, ... (S&D 153).]	The only exception to this reign of terrestrial quiet was the eruption of
[contd] At about the time when the Arctic waters were spreading most widely across North America, there stood a volcano somewhere in eastern Kentucky (between Fayette and Elliot counties).	the great North American volcano of eastern Kentucky,
	one of the greatest single volcanic activities the world has ever known.[2]
In 1921, W. A. Nelson directed attention to an ash bed in the Lowville formation covering an area of 360,000 square miles in the Southern States, and of a thickness ranging up to 7 feet (S 239).	The ashes of this volcano covered five hundred square miles to a depth of from fifteen to twenty feet.

SOURCE OR PARALLEL	URANTIA PAPER 59
	59:2.6 *320,000,000* years ago the third major flood of this period occurred.
[PREAMBLE] (Schuchert 229)	
General Characteristics of the Period (Schuchert 229)	
Then early in Upper Champlainian time (middle Richmond) the Arctic waters returned to almost all the places of the earlier [*i.e.,* the second] inundation (S 229).	The waters of this inundation covered all the land submerged by the preceding deluge,
	while extending farther in many directions all over the Americas and Europe.
DIVISIONS OF CHAMPLAINIAN TIME (Schuchert 232)	
Taconic Emergence or Disturbance (Schuchert 243)	
Evidence. (Schuchert 243)	
In eastern Pennsylvania this maximum sinking was over 15,000 feet during Cambrian and Champlainian time, and it was about the same, or even 1500 feet greater, along the eastern side of Lake Champlain. [Etc.] (S 243)	Eastern North America and western Europe were from 10,000 to 15,000 feet under water.
	59:2.7 *310,000,000* years ago the land masses of the world were again well up excepting the southern parts of North America.
[*Contrast:* Schuchert's Plates 6 and 8 indicate that Mexico and the Gulf Sea were already distinguishable in the Cambrian and that they remained intact in the Champlainian.]	Mexico emerged, thus creating the Gulf Sea, which has ever since maintained its identity.
	59:2.8 The life of this period continues to evolve. The world is once again quiet and relatively peaceful;

SOURCE OR PARALLEL	URANTIA PAPER 59
[PREAMBLE] (Schuchert 229)	
General Characteristics of the Period (Schuchert 229)	
Climate of Champlainian Time. (Schuchert 232)	
[contd] The vast limestone and dolomite accumulations of Champlainian time throughout North America ... point to warm and equable waters (S 232).	the climate remains mild and equable;
	the land plants are migrating farther and farther from the seashores. The life patterns are well developed,
Champlainian Life. (Schuchert 230)	
Of the land plants of this time, little has been recovered (Skiddaw of Wales and Maysville of Kentucky), and while fragments of peculiar armored fishes are abundant in Colorado, South Dakota, and Wyoming, they are not found elsewhere (S 230).	although few plant fossils of these times are to be found.
Fully 1200 species are known from the Cambrian of North America, but the Champlainian has four times as many. The period was, therefore, one of marvellously great evolutional progress among the lowly organisms (S 230).	59:2.9 This was the great age of individual animal organismal evolution,
	though many of the basic changes, such as the transition from plant to animal, had previously occurred.

SOURCE OR PARALLEL	URANTIA PAPER 59
XVI: THE CAMBRIAN PERIOD (Chamberlin & Salisbury 476)	
THE LIFE OF THE CAMBRIAN (Chamberlin & Salisbury 494)	
The Animal Fossils (Chamberlin & Salisbury 495)	
	The marine fauna developed to the point where
[contd] Every great division of the animal kingdom, except the vertebrate, had its representatives in Cambrian times (C&S 495).	every type of life below the vertebrate scale was represented in the fossils of those rocks which were laid down during these times.
All the representatives of these groups among the Cambrian fossils appear to be marine.	But all of these animals were marine organisms.
Of land animals there are no traces, but this does not prove that land animals did not exist (C&S 495).	No land animals had yet appeared
[See Fig. 375.—*Cambrian Vermes;* borings and trails.... Although the animal is not shown, the name *Arenicolites woodi* Whitfield, is assigned to it (C&S 499).]	except a few types of worms which burrowed along the seashores,
	nor had the land plants yet overspread the continents; there was still too much carbon dioxide in the air to permit of the existence of air breathers.
[*Preamble*] (Chamberlin & Salisbury 494)	
The scantiness of plant fossils. (Chamberlin & Salisbury 495)	
[contd] The existence of plants in the Cambrian period would perhaps be doubted were it not known that all animals depend on them, directly or indirectly, for food (C&S 495).	Primarily, all animals except certain of the more primitive ones are directly or indirectly dependent on plant life for their existence.

SOURCE OR PARALLEL	URANTIA PAPER 59
	59:2.10 The trilobites were still prominent.
The Animal Fossils (Chamberlin & Salisbury 495)	
Arthropoda. (Chamberlin & Salisbury 495)	
The upper surface of the body was ornamented variously with granules, spines, and other markings, the significance of which is little understood. These ornamentations varied as time went on, increasing in general, until after the climax of the trilobites had been passed (C&S 497).	These little animals existed in tens of thousands of patterns
The trilobites were well advanced in the scale of development, possessing nearly all the anatomical systems and physiological functions of modern crustaceans (C&S 496).	and were the predecessors of modern crustaceans.
In this and succeeding periods, the number of eyelets in the trilobites' eyes ranged from a score to several thousands.	Some of the trilobites had from twenty-five to four thousand tiny eyelets;
Some of the Cambrian trilobites, however, had no eyes, while others possessed abortive rudiments, implying that their ancestors had possessed eyes (C&S 496).	others had aborted eyes.
XVII: THE ORDOVICIAN (LOWER SILURIAN) PERIOD (Chamberlin & Salisbury 507)	
LIFE (Chamberlin & Salisbury 521)	
The Record of Marine Life (Chamberlin & Salisbury 523)	
[contd] The known fauna of the Ordovician was made up almost wholly of marine invertebrates, among which trilobites and brachiopods held the leading places (C&S 523-24).	As this period closed, the trilobites shared domination of the seas with several other forms of invertebrate life.

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Trilobites and other crustaceans. (Chamberlin & Salisbury 524)

[The trilobites'] climax in the Ordovician appears to have been reached by a rapid ascent, which was followed by a more gradual decline.... In the next period the numbers fell off a full half, and this decline continued until the tribe became extinct (C&S 524-25). [*Note:* See 59:3.5.]

But they utterly perished during the beginning of the next period.

XIX: CHAMPLAINIAN TIME AND THE REIGN OF INVERTEBRATE ANIMALS (Schuchert 229)

DIVISIONS OF CHAMPLAINIAN TIME (Schuchert 232)

Early or Lower Champlainian Epoch (Schuchert 233)

Life of the Appalachian Province. (Schuchert 234)

In most places the dolomites are marked near their base by growths of lime-secreting algæ known as *Cryptozoön* (Fig., p. 198) ... (S 235).

59:2.11 Lime-secreting algae were widespread.

Middle Champlainian Epoch (Schuchert 237)

Life. (Schuchert 237)

The waters swarmed with a vast variety of invertebrate animals, and there are known from North America alone more than 2600 species, chiefly of bryozoans (exceedingly small animals, remotely resembling corals), brachiopods, gastropods, cephalopods, and trilobites (See Pls., pp. 240, 242) (S 237).

There existed thousands of species of the early ancestors of the corals.

SOURCE OR PARALLEL	URANTIA PAPER 59
XVI: THE CAMBRIAN PERIOD (Chamberlin & Salisbury 476)	
LIFE OF THE CAMBRIAN (Chamberlin & Salisbury 494)	
The Animal Fossils (Chamberlin & Salisbury 495)	
Vermes and echinodermata. (Chamberlin & Salisbury 499)	
[contd] Sea worms left evidence of their abundance by borings, tracks, etc. (C&S 499).	Sea worms were abundant,
Coelenterata. (Chamberlin & Salisbury 499)	
Relics of graptolites, among the most delicate of animal forms, and of medusæ, among the softest of animals, were preserved, while some much less easily destroyed forms left scant record of themselves.	and there were many varieties of jellyfish
The *graptolites,* now extinct, were slender, plume-like organisms (C&M 483). [*Note:* The word 'jelly-fish' is substituted for 'medusæ' in C&M 483.]	which have since become extinct.
Obscure fossils of corals are present (Fig. 365, *a* and *b*), the forms of which resemble sponges so much that they were long regarded as such (C&S 500).	Corals
Lower types. (Chamberlin & Salisbury 500)	
[contd] *Sponges* were present in some abundance throughout the period (C&S 500).	and the later types of sponges evolved.
Mollusca. (Chamberlin & Salisbury 498)	
[contd] *Cephalopods* (chambered shells), the highest class of mollusks, are found in the uppermost beds of the Cambrian. As they were even then highly developed,	The cephalopods were well developed,

there is little doubt that the class had passed through a long history before the latter part of the period (C&S 498).

[Cephalopoda (means *head-footed*) are the most highly organized Mollusca and include such animals as the nautilus, ammonites, octopus, cuttlefish, and squid (S 225).]

and they have survived as the modern pearly nautilus, octopus, cuttlefish, and squid.

Implied life. (Chamberlin & Salisbury 500)

A large percentage of the known Cambrian animals were provided with shells, tests, plates, or other forms of hard coverings.

59:2.12 There were many varieties of shell animals,

In the main, these appear to have been protective devices, and imply enemies or combative rivals against which protection was needed.... The inference may be pushed a step further, and the deduction drawn that the conflicts which led to the evolution of the defensive devices were much like those throughout the period of their retention (C&S 500-01).

but their shells were not then so much needed for defensive purposes as in subsequent ages.

Mollusca. (Chamberlin & Salisbury 498)

Pelecypods (bivalves, *b.,* Fig. 374) lived even in the early part of the period, though their remains are not abundant. *Gastropods* (univalves, *c, d, e,* Fig. 374) were rather plentiful throughout the period (C&S 498).

The gastropods were present in the waters of the ancient seas,

[This class of molluscs [*i.e.,* the gastropods] ... are exceedingly varied and embrace not only such shelled forms as the limpets, drills, periwinkles, whelks, conchs, and snails, but also the naked sea slugs and the slugs of the land (S 223-24).]

and they included single-shelled drills, periwinkles, and snails.

The close resemblance of some of them to modern gastropods is worthy of note (C&S 498).

The bivalve gastropods have come on down through the intervening millions of years much as they then existed

[[The lamellibranchia or pelecypods] are therefore often called *bivalves,* and are popularly known as mussels, clams, oysters, cockles, and scallops (S 221).]

and embrace the muscles, clams, oysters, and scallops.

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XVII: THE ORDOVICIAN (LOWER SILURIAN) (Chamberlin & Salisbury 507)

LIFE (Chamberlin & Salisbury 521)

The Record of Marine Life (Chamberlin & Salisbury 523)

The Brachiopods. (Chamberlin & Salisbury 528)

[contd] The lower, inarticulate forms of brachiopods which predominated in the Cambrian, continued through the Ordovician (and to the present time), but the higher, articulate (hinged-shell) forms greatly outnumbered them. The expansion of the articulate types was attended with a progressive evolution of the mode of articulation.

[In geological importance, the brachiopods of the period were second to trilobites only; but unlike the trilobites, brachiopods still live, and are conspicuous representatives of stability and persistence (C&S 497-98).]

In some the length of the hinge was increased, apparently affording a better means of resisting the attempts of their enemies to reach them by sliding or rotating the valves past one another (*i* and *p,* Fig. 390), while in others the anterior margins of the valves were notched so that the valves interlocked *n*.... In addition to these devices for preventing the opening of the shell, there was generally a thickening of the shells and in many cases a ribbing of the exterior, giving strength without needless weight (C&S 528-29).

The valve-shelled organisms also evolved,

and these brachiopods lived in those ancient waters much as they exist today;

they even had hinged, notched, and other sorts of protective arrangements of their valves.

59:2.13 So ends the evolutionary story of the second great period of marine life, which is known to your geologists as the *Ordovician*.

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3. THE SECOND GREAT FLOOD STAGE
THE CORAL PERIOD—THE BRACHIOPOD AGE

59:3.1 *300,000,000* years ago another great period of land submergence began.

XXI: SILURIAN TIME AND THE FIRST AIR-BREATHING ANIMALS (Schuchert 261)

[*Preamble*] (Schuchert 261)

General Characteristics of the Period. (Schuchert 262)

Twice was the interior low area [of North America] transgressed by great floods, first during the Alexandrian epoch and later during the Niagaran epoch, when from 35 to 40 per cent of the continent was under water. These floods came in the main from the Arctic, spreading south into the United States, while smaller seaways spread from the Gulf of Mexico northward (S 262).

The southward and northward encroachment of the ancient Silurian seas made ready to engulf most of Europe and North America.

North America during the Silurian had about the same general topographical expression as the Champlainian time, that is, the greater interior basin region stood but little above sea-level, while the highlands, as heretofore, were toward the margins of the continent (S 262).

The land was not elevated far above the sea

SOURCE OR PARALLEL

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XVII: THE ORDOVICIAN (LOWER SILURIAN) PERIOD (Chamberlin & Salisbury 507)

FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 507)

Sedimentation During the Ordovician Period (Chamberlin & Salisbury 507)

All the common processes of weathering were operative on such lands as still existed, wasting the rocks and preparing sediment for removal to the sea; but the small area of land within North America yielded but little sediment, and during much of the period the deposition of land-derived sediment was confined to littoral tracts.

so that not much deposition occurred about the shore lines.

The seas teemed with lime-shelled life,

Farther from the land the shells, skeletons, and other secretions of marine animals and plants were accumulating, making limestone (C&S 507).

and the falling of these shells to the sea bottom gradually built up very thick layers of limestone.

Sections of the Ordovician (Chamberlin & Salisbury 509)

General conditions in the eastern part of the continent. (Chamberlin & Salisbury 510)

At no previous epoch was there anything like such wide-spread deposition of limestone within the limits of our continent (C&S 510).

This is the first widespread limestone deposit,

and it covers practically all of Europe and North America

[See Fig. 382.—Map showing the general condition of the North American continent in Mid-Ordovician (Trenton) time. The black portions represent areas where the Middle Ordovician beds appear at the surface (C&S 514).]

but only appears at the earth's surface in a few places.

SOURCE OR PARALLEL	URANTIA PAPER 59
General Conditions and Relations of the Ordovician System (Chamberlin & Salisbury 513)	
Thickness. (Chamberlin & Salisbury 515)	
In the Appalachian Mountains it is to be measured by thousands of feet, while in the interior it is to be measured by hundreds instead. [Etc.] (C&S 515)	The thickness of this ancient rock layer averages about one thousand feet,
Condition of the formations. (Chamberlin & Salisbury 513)	
The larger part of the Ordovician sands are now in the conditions of sandstone, the larger part of the muds in the condition of shale, and most of the limestone is still essentially non-metamorphic. But where dynamic action has been great and where the original position of the strata has been greatly changed, the changes in the rock have been greater.	but many of these deposits have since been greatly deformed by tilting, upheavals, and faulting,
Thus in the Taconic Mountains (southeastern New York and southwestern New England), the limestone is mainly in the condition of marble, the sandstone and quartzite have been largely changed to quartz schist, and the shales to slate and schist (C&S 513-15).	and many have been changed to quartz, shale, and marble.
Sections of the Ordovician (Chamberlin & Salisbury 509)	
Igneous rocks. (Chamberlin & Salisbury 513)	
[contd] Igneous rocks of Ordovician age attain little importance in North America (C&S 513).	59:3.2 No fire rocks or lava are found in the stone layers of this period

SOURCE OR PARALLEL	URANTIA PAPER 59
XXI: SILURIAN TIME AND THE FIRST AIR-BREATHING ANIMALS (Schuchert 261)	
Caledonian Disturbance of Western Europe (Schuchert 277)	
[contd] No mountains were made in North America during Silurian time. Active volcanoes of the explosive type, however, were common in southern Maine throughout the Middle Silurian, as indicated by thick Silurian deposits which consist almost wholly of ashes.	except those of the great volcanoes of southern Europe and eastern Maine
At the same time other volcanoes throughout a great part of Gaspé Peninsula were pouring out vast volumes of lava ... (S 277).	and the lava flows of Quebec.
	Volcanic action was largely past. This was the height of great water deposition; there was little or no mountain building.
XVII: THE ORDOVICIAN (LOWER SILURIAN) PERIOD (Chamberlin & Salisbury 507)	
Close of the Ordovician Period (Chamberlin & Salisbury 515)	
	59:3.3 *290,000,000* years ago
The greatest change was the withdrawal of the epicontinental waters from a large part of North America, converting extensive stretches of shallow-sea bottom into land.	the sea had largely withdrawn from the continents,
The cause of this change may have been the sinking of the ocean bottoms and the drawing off of the epicontinental waters.	and the bottoms of the surrounding oceans were sinking.

SOURCE OR PARALLEL

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The altitude of this new land must have been slight or its exposure brief, for it suffered little erosion before much of it was again submerged and covered by sediments of later age (C&S 515).

The land masses were little changed until they were again submerged.

XXI: SILURIAN TIME AND THE FIRST AIR-BREATHING ANIMALS (Schuchert 261)

[*Preamble*] (Schuchert 261)

General Characteristics of the Period. (Schuchert 262)

Toward the close of the Silurian all of western Europe was in the throes of a most marked time of mountain making, giving rise to the Caledonian and other chains of grand mountains (S 264).

The early mountain movements of all the continents were beginning,

and the greatest of these crustal upheavals were the Himalayas of Asia

Caledonian Disturbance of Western Europe (Schuchert 277)

In Great Britain, toward the close of the Silurian, arose the majestic Caledonian ranges, extending from Ireland and Scotland into far northern Spitzbergen (S 277).

and the great Caledonian Mountains, extending from Ireland through Scotland and on to Spitzbergen.

XVII: THE ORDOVICIAN (LOWER SILURIAN) PERIOD (Chamberlin & Salisbury 507)

FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 507)

Economic Products (Chamberlin & Salisbury 517)

[contd] In Ohio and eastern Indiana the Trenton formation yields much gas and oil (C&S 517).

59:3.4 It is in the deposits of this age that much of the gas, oil,

SOURCE OR PARALLEL	URANTIA PAPER 59
The Galena and Trenton formations in Wisconsin and in the adjacent parts of Iowa and Illinois contain ores of lead and zinc, mainly in the form of sulphides and carbonates (C&S 517).	zinc, and lead are found,
[contd from two rows up] Both these substances [*i.e.,* gas and oil] are believed to be products of the decay or distillation of organic matter which was included in the sediments at the time of their deposition (C&S 517).	the gas and oil being derived from the enormous collections of vegetable and animal matter carried down at the time of the previous land submergence,
[Compare C&S 517.]	while the mineral deposits represent the sedimentation of sluggish bodies of water.
XXI: SILURIAN TIME AND THE FIRST AIR-BREATHING ANIMALS (Schuchert 261)	
Economic Products (Schuchert 278)	
Silurian Salt in New York. (Schuchert 279)	
[contd] The Salina deposits (see table, page 264) of central New York, southern Michigan, and Ontario, are one of the very important sources of salt in the United States. The salt is obtained by deep mining of rock salt, or by underground solution ... (S 279).	Many of the rock salt deposits belong to this period.
XVII: THE ORDOVICIAN (LOWER SILURIAN) PERIOD (Chamberlin & Salisbury 507)	
LIFE (Chamberlin & Salisbury 521)	
The Record of Marine Life (Chamberlin & Salisbury 523)	
Trilobites and other crustaceans. (Chamberlin & Salisbury 524)	
[*Note:* Contrast this statement with the one about trilobites in 59:2.10: "But they utterly perished during the beginning of the next period."]	59:3.5 The trilobites rapidly declined,

SOURCE OR PARALLEL	URANTIA PAPER 59
The Cephalopods. (Chamberlin & Salisbury 525)	
[contd] The largest, most powerful, and perhaps most predaceous of the known forms of Ordovician life were the cephalopods, which seem to have developed into prominence with extraordinary suddenness (C&S 525).	and the center of the stage was occupied by the larger mollusks, or cephalopods.
Some of the shells were 12 or 15 feet in length, and a foot (maximum) in diameter (C&S 527).	These animals grew to be fifteen feet long and one foot in diameter
Unless the fishes, of which little is known, contested their supremacy, they were doubtless the undisputed masters of the sea (C&S 525-26).	and became masters of the seas.
	This species of animal appeared *suddenly* and assumed dominance of sea life.
FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 507)	
Foreign Ordovician (Chamberlin & Salisbury 517)	
	59:3.6 The great volcanic activity of this age was in the European sector.
This is one of the most extensive, as well as one of the most ancient, volcanic tracts of Europe.	Not in millions upon millions of years had such violent and extensive volcanic eruptions occurred
	as now took place around the Mediterranean trough
From north England and Wales the system thins in all directions (C&S 519).	and especially in the neighborhood of the British Isles.
The system is represented in the British Isles by great thicknesses of strata (something like 24,000 feet maximum). Locally (Wales), nearly half the system is composed of igneous rock, consisting of sheets of lava and beds of fragmental igneous rocks of various sorts (C&S 518).	This lava flow over the British Isles region today appears as alternate layers of lava and rock 25,000 feet thick.

SOURCE OR PARALLEL	URANTIA PAPER 59
In Wales, ... the igneous rocks are interstratified with sedimentaries, and are therefore thought to have been ejected beneath water (C&S 518-19).	These rocks were laid down by the intermittent lava flows which spread out over a shallow sea bed, thus interspersing the rock deposits,
The strata are exposed about various mountains where local disturbances have upturned them, and where erosion has cut off the beds which once overlay them (C&S 519).	and all of this was subsequently elevated high above the sea.
In the highlands of northwestern Scotland, the dynamic action seems to have been exceptionally severe (C&S 520).	Violent earthquakes took place in northern Europe, notably in Scotland.
Duration and Climate (Chamberlin & Salisbury 520)	
All that is known of the life of this area would seem to indicate that the climate was much more uniform than now throughout the areas where the strata of the period are known (C&S 520).	59:3.7 The oceanic climate remained mild and uniform,
XXI: SILURIAN TIME AND THE FIRST AIR-BREATHING ANIMALS (Schuchert 261)	
Silurian Climate (Schuchert 275)	
[contd] As the Silurian seas abounded in varied life and as the deposits in the main were limestones and dolomites even as far north as the Arctic regions, it is safe to infer that these waters were warm.	and the warm seas bathed the shores of the polar lands.

SOURCE OR PARALLEL	URANTIA PAPER 59
XI: THE DEVONIAN PERIOD (Schuchert & Dunbar 195)	
CLIMATES OF DEVONIAN TIME (Schuchert & Dunbar 210)	
The same disregard for polar climatic zones is seen in the migration into the Mackenzie Valley of several faunas of brachiopods and other invertebrates that must have come from Eurasia by way of the polar seas (S&D 211).	Brachiopod and other marine-life fossils may be found in these deposits right up to the North Pole.
XVII: THE ORDOVICIAN (LOWER SILURIAN) PERIOD (Chamberlin & Salisbury 507)	
LIFE (Chamberlin & Salisbury 521)	
The Record of Marine Life (Chamberlin & Salisbury 523)	
Other Molluscs. (Chamberlin & Salisbury 527)	
[contd] The *gastropods* were well represented in the early Ordovician fauna by diverse forms (Fig. 388) (C&S 527).	Gastropods,
The Brachiopods. (Chamberlin & Salisbury 528)	
[See 59:2.12, above.]	brachiopods,
Other forms. (Chamberlin & Salisbury 532)	
[contd] Sponges were present and sometimes attained notable size (Fig. 395) (C&S 532).	sponges,
The cœlenterates. (Chamberlin & Salisbury 532)	
[contd] *Corals* are few in the lower part of the system, and though more abundant in higher beds, are nowhere a leading element in the fauna (C&S 532).	and reef-making corals continued to increase.

SOURCE OR PARALLEL	URANTIA PAPER 59
[See 59:3.1, above, where Schuchert wrote: "Twice was the interior low area [of North America] transgressed by great floods, first during the Alexandrian epoch and later during the Niagaran epoch, when from 35 to 40 per cent of the continent was under water" (S 262).]	59:3.8 The close of this epoch witnesses the second advance of the Silurian seas with another commingling of the waters of the southern and northern oceans.
[See 59:3.5, above.]	The cephalopods dominate marine life, while associated forms of life progressively develop and differentiate.
	59:3.9 *280,000,000* years ago the continents had largely emerged from the second Silurian inundation.
XVIII: THE SILURIAN (UPPER SILURIAN) PERIOD (Chamberlin & Salisbury 536)	
FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 536)	
Silurian of the East (Chamberlin & Salisbury 537)	
The Niagaran series. (Chamberlin & Salisbury 538)	
[contd] The Clinton formation was succeeded by the *Niagara formation* (subdivided in New York into Rochester shale, Lockport limestone, and Guelph dolomite, p. 537), which extends farther west than any of the preceding Silurian formations, showing that the progressive submergence of the earlier epochs still continued in the upper Mississippi basin. The falls of the Niagara River are over the limestone of this series (Fig. 113).	The rock deposits of this submergence are known in North America as Niagara limestone because this is the stratum of rock over which Niagara Falls now flows.
North of Missouri, the formation is not known to occur far west of the Mississippi,	This layer of rock extends from the eastern mountains to the Mississippi valley region but not farther west

SOURCE OR PARALLEL	URANTIA PAPER 59
but it extends into Missouri, Arkansas, and perhaps even to the Arbuckle Mountains of Oklahoma. It is also found in the trans-Pecos region of Texas (C&S 539).	except to the south.
It occurs in patches in Manitoba, west of Hudson Bay, and at numerous points farther north, up to latitude 80º.	Several layers extend over Canada,
	portions of South America, Australia,
The patches appear to be remnants of a once continuous formation, and since the fossils are much the same throughout, and very like those of northern Europe, it is inferred that there was water connection between the Mississippi basin and northern Europe ... (C&S 539).	and most of Europe,
Thickness and structure. (Chamberlin & Salisbury 541)	
In the east, indeed, where the [Niagara] formation is exposed, it has a thickness of but 100 to 300 feet, while in Wisconsin it attains a maximum of 800 feet (perhaps including some Clinton), all of which is limestone (C&S 541).	the average thickness of this Niagara series being about six hundred feet.
The Cayugan (Salina) series. (Chamberlin & Salisbury 542)	
[contd] The Salina formation, which overlies the Niagaran in parts of New York, Pennsylvania, Ohio, Michigan, and Ontario, is much less widespread, and its distribution points to the emergence of a considerable area in the Mississippi basin at the close of the Niagaran epoch (C&S 542).	Immediately overlying the Niagara deposit, in many regions
[contd] The Salina series embraces several varieties of rock including conglomerate, sandstone, limestone, shale, and rock salt (C&S 542).	may be found a collection of conglomerate, shale, and rock salt.

SOURCE OR PARALLEL	URANTIA PAPER 59
	This is the accumulation of secondary subsidences.
The salt beds seem to imply the existence of great lagoons or inclosed seas, in which the Salina series was deposited (C&S 542).	This salt settled in great lagoons
Occasional incursions of the sea, bringing in new supplies of salt water, followed by periods when the lagoons were cut off from the sea,	which were alternately opened up to the sea and then cut off
and when they suffered rapid evaporation, would seem to meet the conditions demanded for the formation of the salt (C&S 542).	so that evaporation occurred with deposition of salt
[Ocean water contains, on the average, about 3.5 per cent of solid matter in solution, most of which is sodium chloride or rock salt (78 per cent of the sea salts), and it contains also calcium sulphate or gypsum (about 3.5 per cent) (see Pt. I, p. 91) (S 436).]	along with other matter held in solution.
Single beds of it are locally 40 to 80 feet thick (C&S 542).	In some regions these rock salt beds are seventy feet thick.
Climate and duration. (Chamberlin & Salisbury 545)	
[contd] There is nothing to indicate great diversity of temperatures in the Silurian period, and much to suggest that uniformity extended through great ranges of latitude,	59:3.10 The climate is even and mild,
for the fossils of warm-temperate regions are in part the same as those in Arctic regions (C&S 545-46).	and marine fossils are laid down in the arctic regions.

SOURCE OR PARALLEL

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THE SILURIAN LIFE (Chamberlin & Salisbury 546)

The Closing Restrictional Stage (Chamberlin & Salisbury 555)

[contd] Following the luxuriant life of the mid-Silurian epoch, there came, in North America at least, a notable decline, due to the withdrawal of the epicontinental waters from the larger part of the interior, and to the conversion of the remainder into an excessively salt sea, in the deposits of which few fossils are found (C&S 555-56).

But by the end of this epoch the seas are so excessively salty that little life survives.

The Expansional Stage and the Mid-Silurian Fauna (Chamberlin & Salisbury 547)

The echinoderms. (Chamberlin & Salisbury 548)

59:3.11 Toward the close of the final Silurian submergence

[contd] A distinguishing feature of the Silurian fauna was the rich and varied development of the echinoderms, involving at once the rise or the decline of previous forms, and the introduction of new ones.

there is a great increase in the echinoderms—

The great feature of the period, in connection with the echinoderms, was the rise of the *crinoids*. They attained such abundance in certain congenial localities that their fragments formed the larger part of the limestone. These spots were veritable "flower-beds" of "stone lilies" where beautiful and varied forms grew in groves, as it were (C&S 548).

the stone lilies—as is evidenced by the crinoid limestone deposits

SOURCE OR PARALLEL	URANTIA PAPER 59
The trilobites. (Chamberlin & Salisbury 553)	
[contd] No new families of trilobites appeared, though some new genera were added and many species; but these did not offset the disappearance of old ones, and the class, though still important, had already entered upon its decline numerically (C&S 553).	The trilobites have nearly disappeared,
The mollusks. (Chamberlin & Salisbury 550)	
[contd] The *cephalopods* appear to have remained the most powerful inhabitants of the seas (C&S 550).	and the mollusks continue monarchs of the seas;
XXI: SILURIAN TIME AND THE FIRST AIR-BREATHING ANIMALS (Schuchert 261)	
Life of the Silurian (Schuchert 269)	
Coral Reefs. (Schuchert 271)	
[contd] Corals were not common until the Middle Silurian, and then at many places in America they made reef limestones (see Fig. 88, p. 272, and Fig., p. 183 of Pt. I) (S 271).	coral-reef formation increases greatly.
Marine Invertebrates. (Schuchert 269)	
Throughout the Silurian, but more particularly in the Upper Silurian, the "sea scorpions" or eurypterids were common (see p. 276). They usually occur in brackish-water deposits that otherwise are devoid of fossils, and very similar kinds are found in both eastern America and western Europe (S 271).	During this age, in the more favorable locations the primitive water scorpions first evolve.

SOURCE OR PARALLEL

The eurypterids are particularly interesting in this connection, not only because they are so characteristic of late Silurian time, but also because they indicate the stock out of which in an earlier period arose the air-breathing or true scorpions (S 271).

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Soon thereafter, and *suddenly,* the true scorpions—actual air breathers—make their appearance.

59:3.12 These developments terminate the third marine-life period, covering twenty-five million years and known to your researchers as the *Silurian*.

4. THE GREAT LAND-EMERGENCE STAGE
THE VEGETATIVE LAND-LIFE PERIOD
THE AGE OF FISHES

59:4.1 In the agelong struggle between land and water, for long periods the sea has been comparatively victorious, but times of land victory are just ahead. And the continental drifts have not proceeded so far but that,

[See 59:4.14, below, and Fig. 145, p. 431, in Schuchert.]

at times, practically all of the land of the world is connected by slender isthmuses and narrow land bridges.

59:4.2 As the land emerges from the last Silurian inundation, an important period in world development and life evolution comes to an end. It is the dawn of a new age on earth.

SOURCE OR PARALLEL	URANTIA PAPER 59
XXIV: DEVONIAN TIME AND THE DOMINANCE OF THE FISHES (Schuchert 306)	
[*Preamble*] (Schuchert 306)	
Significant Things about the Devonian Period. (Schuchert 307)	
This is the time when the former nakedness of the lands becomes clothed with a deeper verdure	The naked and unattractive landscape of former times is becoming clothed with luxuriant verdure,
and the first forests appear, providing the needed homes and food for the invasion of the continents by the ever-hungry descendants of the denizens of the sea (S 307).	and the first magnificent forests will soon appear.
XIX: THE DEVONIAN PERIOD (Chamberlin & Salisbury 559)	
DEVONIAN LIFE (Chamberlin & Salisbury 574)	
I. *The Marine Faunas* (Chamberlin & Salisbury 574)	
[**Preamble**] (Chamberlin & Salisbury 574)	
[contd] When the sea partially withdrew from the North American continent near the close of the Silurian period, the shallow-water faunas were restricted to limited bodies of water about the continental border. There appears to have been a want of free communication between these, and the life of each developed different aspects according to the conditions of each embayment (C&S 574).	59:4.3 The marine life of this age was very diverse due to the early species segregation,
As each in turn came in contact with the previous fauna, there was a commingling and conflict of the two, resulting in the destruction of some species and the adjustment of others to one another (C&S 575).	but later on there was free commingling and association of all these different types.

SOURCE OR PARALLEL	URANTIA PAPER 59
The Southern Hamilton fauna. (Chamberlin & Salisbury 582)	
The climax of the *brachiopods* was somewhere about this time (C&S 583).	The brachiopods early reached their climax,
[See 59:4.10, below.]	being succeeded by the arthropods,
At this time appeared the first known *barnacles* of the northern sessile type (C&S 585).	and barnacles made their first appearance.
	But the greatest event of all was the sudden appearance of the fish family. This became the age of fishes, that period of the world's history characterized by the *vertebrate* type of animal.
XXIV: DEVONIAN TIME AND THE DOMINANCE OF THE FISHES (Schuchert 306)	
American Devonian (Schuchert 309)	
Submergences of the Continent. (Schuchert 314)	
[contd] At the beginning of the Devonian time almost all of North America had emerged, and at no time during the Lower Devonian was more than 10 per cent of the continent covered with marine waters (See Pl., p. 313) (S 314).	59:4.4 *270,000,000* years ago the continents were all above water.
	In millions upon millions of years not so much land had been above water at one time; it was one of the greatest land-emergence epochs in all world history.

SOURCE OR PARALLEL

Probable Cause of Submergences. (Schuchert 314)

[contd] The great Middle Devonian flood was also common to Europe, Asia, South America, and Australia, the strata in New South Wales alone having a thickness of 10,000 feet (S 314).

Submergences of the Continent. (Schuchert 314)

Late in Oriskanian time the submergence became markedly positive, and attained its maximum flood in the late Middle Devonian (Hamilton), when at least 38 per cent of North America was covered by the sea (see Pl., p. 317) (S 314).

[In eastern New York and Pennsylvania the Helderberg limestones have a thickness of 300 to 600 feet (C&M 545).]

[Six thousand feet of limestone and 2,000 feet of shale are reported from the Eureka district of Nevada (C&M 548).]

[See Plate 19.—Late Middle Devonian paleophysiography. (S 317)]

[See Plate 19.—Late Middle Devonian paleophysiography. (S 317)]

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59:4.5 Five million years later the land areas of North and South America, Europe, Africa, northern Asia, and Australia were briefly inundated,

in North America the submergence at one time or another being almost complete;

and the resulting limestone layers run from 500

to 5,000 feet in thickness.

These various Devonian seas extended first in one direction and then in another so that

the immense arctic North American inland sea found an outlet to the Pacific Ocean through northern California.

59:4.6 *260,000,000* years ago, toward the end of this land-depression epoch,

North America was partially overspread by seas having simultaneous connection with the Pacific, Atlantic, Arctic, and Gulf waters.

The deposits of these later stages of the first Devonian flood average about one thousand feet in thickness.

SOURCE OR PARALLEL

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XIX: THE DEVONIAN PERIOD (Chamberlin & Salisbury 559)

FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 559)

Devonian of the East (Chamberlin & Salisbury 561)

The Middle Devonian. (Chamberlin & Salisbury 561)

The *Onondaga limestone* is found from New York to the Mississippi (Fig. 408).... The epicontinental sea in which the limestone was formed was relatively clear and shallow, as shown by the composition of the rock and the character of the fossils it contains. In many places the limestone is rich in coral, and locally the coral-reef structure is as perfectly shown as in the reefs of modern times.

The coral reefs characterizing these times indicate that the inland seas were clear and shallow.

This is true, for example, at the rapids of the Ohio near Louisville.

Such coral deposits are exposed in the banks of the Ohio River near Louisville, Kentucky,

The formation is not a thick one, rarely more than 100 to 200 feet (C&S 561-63).

and are about one hundred feet thick,

[From the rapids of the Ohio at Louisville, more than 200 species have been collected, embracing both the simple cup form (*a*, Fig. 416) and the compound type (C&S 579).]

embracing more than two hundred varieties.

These coral formations extend through Canada and northern Europe to the arctic regions.

Following the Onondagan epoch of clear seas, conditions changed so as to give origin to

59:4.7 Following these submergences, many of the shore lines were considerably elevated so that

deposits of mud where limestone had been accumulating.... In the east, shale is the most common rock ... (C&S 563).

the earlier deposits were covered by mud or shale.

SOURCE OR PARALLEL	URANTIA PAPER 59
THE FOREIGN DEVONIAN (Chamberlin & Salisbury 571)	
The British Isles. (Chamberlin & Salisbury 572)	
The second phase of the Devonian is the *Old Red Sandstone,* widely distributed in Great Britain and Ireland and found at some points on the continent (C&S 572).	There is also a red sandstone stratum which characterizes one of the Devonian sedimentations,
	and this red layer extends over much of the earth's surface, being found in
Other continents. (Chamberlin & Salisbury 574)	
The system has considerable development in South America, and carries an indigenous fauna akin to the Hamilton fauna of North America (C&S 574).	North and South America,
West central Europe. (Chamberlin & Salisbury 572)	
[contd] The Devonian of Germany is remarkable for the proportion of igneous rock interbedded with the sedimentaries (C&S 572-73).	Europe,
Russia. (Chamberlin & Salisbury 573)	
[contd] The Devonian of Russia is made up of beds of arenaceous and calcareous rocks, the former containing fossils related to those of the Old Red Sandstone, the latter containing fossils of a marine fauna (C&S 573).	Russia,
Other continents. (Chamberlin & Salisbury 574)	
[contd] The Devonian system has a wide distribution in Siberia and China, and is known at many points in southern Asia.	China,
It occurs in North and South Africa, and in the Falkland Islands.	Africa,

It has great thickness in New South Wales, and has been recognized in Victoria (C&S 574).

and Australia.

Climatic Conditions (Chamberlin & Salisbury 574)

[contd] Certain evidences of great diversity of climate, or of variations of climate during the period, are not at hand. The Old Red Sandstone and the Catskill formation perhaps point to aridity, but this can hardly be affirmed (C&S 574).

Such red deposits are suggestive of arid or semiarid conditions,

but the climate of this epoch was still mild and even.

FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 559)

Devonian of the East (Chamberlin & Salisbury 561)

The Middle Devonian. (Chamberlin & Salisbury 561)

The Cincinnati arch may have been land throughout the Hamilton epoch, though this cannot be affirmed (C&S 563). [See also Fig. 408 on p. 562.]

59:4.8 Throughout all of this period the land southeast of the Cincinnati Island remained well above water.

THE FOREIGN DEVONIAN (Chamberlin & Salisbury 571)

The continent of Europe. (Chamberlin & Salisbury 571)

During the progress of the period, the European continent was progressively submerged, for the Middle and Upper Devonian formations are more wide-spread than the Lower (Fig. 413) (C&S 572).

But very much of western Europe, including the British Isles, was submerged.

SOURCE OR PARALLEL	URANTIA PAPER 59
The British Isles. (Chamberlin & Salisbury 572)	
The Old Red Sandstone of the British Isles has at its maximum a thickness of more than 20,000 feet, but this includes much igneous rock (C&S 572).	In Wales, Germany, and other places in Europe the Devonian rocks are 20,000 feet thick.
XXIII: THE RISE OF FISHES AND THE PROPHECY OF VERTEBRATE DOMINANCE (Schuchert 289)	
	59:4.9 *250,000,000* years ago witnessed the appearance of the fish family, the vertebrates,
[The study of fishes] has a special interest for the philosopher who sees in the fishes a step on the path of evolution that leads from the wormlike invertebrates to the pinnacle of organic independence in reasoning man (S 289).	one of the most important steps in all prehuman evolution.
XIX: THE DEVONIAN PERIOD (Chamberlin & Salisbury 559)	
DEVONIAN LIFE (Chamberlin & Salisbury 574)	
II. *The Life of the Land Waters* (Chamberlin & Salisbury 588)	
The ostracoderms. (Chamberlin & Salisbury 588)	
[See three rows down.]	59:4.10 The arthropods, or crustaceans, were the ancestors of the first vertebrates.
	The forerunners of the fish family were two modified arthropod ancestors;

SOURCE OR PARALLEL

Another strange class of organisms related to the fishes, but not true fish, was represented by the singular little lamprey-like cyclostome *Palæospondylus* (Fig. 422), which, it has been conjectured, was really an ancestral lamprey. In any case, this animal represents the vertebrate idea in great simplicity; a slender column of vertebræ, modified at one end into a head and finned at the other for a tail, without ribs or paired fins, or any suggestion of limbs, make up the known structure (C&S 590).

The center of interest in this fauna is found in the *ostracoderms* (Figs. 420 and 421), which were first interpreted as placoderm fishes, later as jawless fishes, and now as a distinct class between the arthropods and the vertebrates. Their chief interest lies in their suggestion that the vertebrates sprang from the arthropods.... But no vertebræ (or notochord) has been found, or appendages or jaws of the vertebrate type (C&S 589-90).

Their disappearance is not surprising in view of the development of powerful fishes, for the ostracoderms were obviously not a masterful race (C&S 590).

I. *The Marine Faunas* (Chamberlin & Salisbury 574)

The Onondaga fauna. (Chamberlin & Salisbury 578)

[It is not improbable that fish were inhabitants of the northern seas from Silurian times onward (C&S 579).]

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one had a long body connecting a head and tail,

while the other was a backboneless, jawless prefish.

But these preliminary types were quickly destroyed

when the fishes, the first vertebrates of the animal world, made their *sudden* appearance from the north.

SOURCE OR PARALLEL

The Southern Hamilton fauna. (Chamberlin & Salisbury 582)

The *fishes* played a conspicuous part in the new fauna. The *arthrodirans* reached their climax, and some of the species were among the largest and most formidable fish ever known.

Dinichthys (Fig. 417) had an estimated length of 20 feet, and was armed with formidable mandibles 2 feet in length which, in lieu of teeth, had cutting edges that closed shears-like, much like the mandibles of a turtle (C&S 582-83).

The *sharks* left abundant relics in the form of teeth and fin spines, some of the latter reaching a foot in length (C&S 583).

II. *The Life of the Land Waters* (Chamberlin & Salisbury 588)

The ostracoderms. (Chamberlin & Salisbury 588)

Perhaps the strangest of [the fresh-water fishes] were the *arthrodirans* (Fig. 423), whose relations to other fishes are puzzling, but most paleontologists regard them as a specialized and rather divergent branch related to the ancestors of the lung-fishes (*Dipnoi*) which reached their climax at about this time (C&S 591).

In the Devonian period [sharks] seem to have lived in the open sea, but their remains are also found in the Old Red Sandstone and equivalent formations, so that they probably lived in fresh and brackish waters, as well as in the ocean (C&S 591-92).

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59:4.11 Many of the largest true fish belong to this age,

some of the teeth-bearing varieties being twenty-five to thirty feet long;

the present-day sharks are the survivors of these ancient fishes.

The lung and armored fishes reached their evolutionary apex,

and before this epoch had ended, fishes had adapted to both fresh and salt waters.

SOURCE OR PARALLEL

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I. *The Marine Faunas* (Chamberlin & Salisbury 574)

The Onondaga fauna. (Chamberlin & Salisbury 578)

A notable feature of the Onondaga formation consists of thin layers ("bone-beds") made up almost wholly of the plates, teeth, spines, etc., of the fishes, whose numbers must have risen into the millions ... (C&S 578).

59:4.12 Veritable bone beds of fish teeth and skeletons may be found in the deposits laid down toward the close of this period,

and rich fossil beds are situated along the coast of California since many sheltered bays of the Pacific Ocean extended into the land of that region.

[The lands were clothed with vegetation and in the lowlands there were forests, with trees up to 35 feet in height (pp. 327-330) (S 317).]

59:4.13 The earth was being rapidly overrun by the new orders of land vegetation.

Heretofore few plants grew on land except about the water's edge. Now, and *suddenly,* the prolific *fern family* appeared and quickly spread over the face of the rapidly rising land in all parts of the world.

XXIV: DEVONIAN TIME AND THE DOMINANCE OF THE FISHES (Schuchert 306)

Devonian Fresh-Water Deposits and the Prophecy of Vertebrate Dominance (Schuchert 324)

Plants and the Climate. (Schuchert 327)

In the Upper Devonian there was a considerably diversified flora, forming the oldest or first forest, in which florished fern-like plants, fern-like seed trees (*Eospermatopteris*), rushes, tall ground pines (lycopods), and primitive evergreens with woody trunks nearly 2 feet in diameter (S 327-28).

Tree types, two feet thick

SOURCE OR PARALLEL	URANTIA PAPER 59
At Gilboa in the Schoharie valley, New York, have been found about thirty great stumps and spreading roots of tall trees still standing in their native soil. They attained a height of 30 to 40 feet and are thought to have been seed-ferns (S 328).	and forty feet high, soon developed;
XIX: THE DEVONIAN PERIOD (Chamberlin & Salisbury 559)	
DEVONIAN LIFE (Chamberlin & Salisbury 574)	
III. *The Land Life* (Chamberlin & Salisbury 592)	
The Devonian plants were, on the whole, but sparsely foliate, their leaves being spinoid and small. They perhaps descended from amphibious ancestors, which, in turn, were derived from some of the various types of plants which lived in the sea. If so, the expansion of leafage and the development of an aërial system of transpiration were probably evolved slowly as the plants were weaned from their aqueous habitat (C&S 593).	later on, leaves evolved,
	but these early varieties had only rudimentary foliage.
The record of the lower land plants is almost negative, except that, singularly enough, bacteria have been reported. The identification of such simple forms in fossilized woody tissue at so ancient a period is remarkable, though the presence of bacteria is altogether probable in itself, for the record of plant life should have been more perfect than it is, had decay not been promoted by bacteria (C&S 594).	There were many smaller plants, but their fossils are not found since they were usually destroyed by the still earlier appearing bacteria.

SOURCE OR PARALLEL

The Middle Devonian flora of Maine (Chapman sandstone) is so like a flora of Scotland, Belgium, and the Rhine provinces, as to indicate the probability of the migration of land plants between our continent and Europe, perhaps by way of a land bridge between high latitudes of America and Europe (C&S 593).

XXIV: DEVONIAN TIME AND THE DOMINANCE OF THE FISHES (Schuchert 306)

American Devonian (Schuchert 309)

The Great Northern Transverse Continent Eris. (Schuchert 315)

[A]t the very beginning of Devonian time there came into existence an almost circumpolar land, whose only submerged portion lay in the North Pacific, and which was formed by the union of Laurentis [*i.e.,* Canadian Shield-Greenland], Baltis [*i.e.,* Sweden-Finland], and Angaris (see Fig., p. 431).

The great Canadian geologist, Sir William Dawson, of McGill University, labored long to make known the plant life of the Devonian, and since he termed it the Erian flora after the Erian rocks in which it is entombed, taking the name from Lake Erie and the Erie division of the New York state geologists, Suess in 1909 gave the continent the name of *Eria* (here changed to *Eris*). It is the ancestral continent of the modern Holarctic region of the zoölogists (S 315-16).

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59:4.14 As the land rose, North America became connected with Europe by land bridges

extending to Greenland.

And today Greenland holds the remains of these early land plants beneath its mantle of ice.

SOURCE OR PARALLEL	URANTIA PAPER 59
	59:4.15 *240,000,000* years ago the land over parts of both Europe and North and South America began to sink. This subsidence marked the appearance of the last and least extensive of the Devonian floods. The arctic seas again moved southward over much of North America, the Atlantic inundated a large part of Europe and western Asia, while the southern Pacific covered most of India.
Plate 18.—Paleogeography of Devonian time. (Schuchert 313)	
In Devonian time there was but one slowly developing flood, coming from the Arctic Ocean with Euro-Asiatic faunas and attaining maximum spread as depicted in Plate 19 and Map 3 of this plate, with slow recession in Map 4 (S 313).	This inundation was slow in appearing and equally slow in retreating.
Appalachian Area. (Schuchert 309)	
The Catskills on the west side of the Hudson River are the most imposing single Devonian pile in the United States (S 309).	The Catskill Mountains along the west bank of the Hudson River are one of the largest geologic monuments of this epoch to be found on the surface of North America.
	59:4.16 *230,000,000* years ago the seas were continuing their retreat. Much of North America was above water,
Acadian Disturbance. (Schuchert 316)	
Throughout the Devonian, and especially in the Upper Devonian, volcanic activity occurred here on a large scale, many of the lavas and intruded granites being preserved in the Maritime Provinces.	and great volcanic activity occurred in the St. Lawrence region.

SOURCE OR PARALLEL

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The volcanic cones are now eroded away, and what is left are the deeper seated volcanic necks, seen today in Mt. Royal, back of McGill University, Montreal, and in the Monteregian hills farther east (S 316).

Mount Royal, at Montreal, is the eroded neck of one of these volcanoes.

Appalachian Area. (Schuchert 309)

[contd from four rows up] The greatest thickness is in Pennsylvania,

The deposits of this entire epoch are well shown in the Appalachian Mountains of North America

where the Susquehanna River has cut through the Appalachian Mountains;

where the Susquehanna River has cut a valley exposing these successive layers,

here the Pennsylvania Geological Survey has determined a maximum depth of nearly 13,000 feet of Devonian shales and sandstones, becoming increasingly coarser, redder, less marine, and more rapid in accumulation with the progress of time, that is, toward the top (S 309).

which attained a thickness of over 13,000 feet.

59:4.17 The elevation of the continents proceeded, and the atmosphere was becoming enriched with oxygen.

XXVIII: THE RISE OF THE LAND FLORAS (Schuchert 373)

[PREAMBLE] (Schuchert 373)

Swamp Life of the Pennsylvanian. (Schuchert 373)

[The coal floras'] most striking representatives in number and size are the scale trees, a sort of evergreen having comparatively small needle-like leaves; some of these trees grew to over 100 feet in height, and to a diameter ranging up to 6 feet (see Pl., p. 377) (S 374-75).

The earth was overspread by vast forests of ferns one hundred feet high

and by the peculiar trees of those days, silent forests;

SOURCE OR PARALLEL

No insects of this time, so far as known, produced chirping or other sounds, and the soughing of the wind among the trees was interrupted only by the croak of amphibians in the marshes (S 378).

[Contrast Plate 27.—Ferns; and Plate 28.—Scale trees of the Pennsylvanian. (S 376-77)]

XX: THE MISSISSIPPIAN (EARLY CARBONIFEROUS) PERIOD (Chamberlin & Salisbury 596)

THE LIFE OF THE MISSISSIPPIAN (SUBCARBONIFEROUS) (Chamberlin & Salisbury 606)

1. *The Marine Faunas.* (Chamberlin & Salisbury 606)

The Genevieve (St. Louis-Kaskaskia) fauna. (Chamberlin & Salisbury 613)

With the close of the Mississippian period, the chief center of life interest passes from the sea to the land ... The history of the marine invertebrates will hereafter be followed with less fullness. [*contd next pg.*]

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not a sound was heard,

not even the rustle of a leaf, for such trees had no leaves.

59:4.18 And thus drew to a close one of the longest periods of marine-life evolution, *the age of fishes.* This period of the world's history lasted almost fifty million years; it has become known to your researchers as the *Devonian*.

5. THE CRUSTAL-SHIFTING STAGE
THE FERN-FOREST CARBONIFEROUS PERIOD
THE AGE OF FROGS

SOURCE OR PARALLEL

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With the introduction of fishes it had reached its great adjustments, and its further history bears a close likeness to the struggles and adaptations of the history already sketched (C&S 617).

59:5.1 The appearance of fish during the preceding period marks the apex of marine-life evolution.

From this point onward the evolution of land life becomes increasingly important.

And this period opens with the stage almost ideally set for the appearance of the first land animals.

XXV: THE MISSISSIPPIAN PERIOD AND THE CLIMAX OF CRINIDS AND ANCIENT SHARKS (Schuchert 333)

MISSISSIPPIAN PERIOD (Schuchert 334)

Early Mississippian Time (Waverlian) (Schuchert 335)

Waverlian Seas. (Schuchert 335)

[contd] The Devonian period closed with marked retreat of the seas of North America and it appears that all parts of the continent were emergent (S 335).

59:5.2 *220,000,000* years ago many of the continental land areas, including most of North America, were above water.

The land was overrun by luxurious vegetation;

[All the great divisions of [the pteridophytes] were present, and all of them were nearly or quite at their climax. Hence the Carboniferous has often been called the Age of Ferns (C&M 616).]

this was indeed the *age of ferns.*

Carbon dioxide was still present in the atmosphere but in lessening degree.

The submergence of Waverlian time began first in the Gulf States and along the western side of the Cincinnati uplift. At this early stage of the inundation the seas were small in extent but in Middle Kinderhookian time the waterways were greatly expanded (S 335-36).

59:5.3 Shortly thereafter the central portion of North America was inundated,

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[*I.e.,* the Cordilleric sea and the Central Interior sea (S 336).]	creating two great inland seas.
	Both the Atlantic and Pacific coastal highlands were situated just beyond the present shore lines.
XX: THE MISSISSIPPIAN (EARLY CARBONIFEROUS) PERIOD (Chamberlin & Salisbury 596)	
THE LIFE OF THE MISSISSIPPIAN (SUBCARBONIFEROUS) (Chamberlin & Salisbury 606)	
1. *The Marine Faunas* (Chamberlin & Salisbury 606)	
The Great Basin fauna. (Chamberlin & Salisbury 611)	
The yielding of [the barrier which enforced the distinctness of the Great Basin and the Kinderhook-Osage seas] about the close of the Osage epoch, by erosion or submergence, permitted this singular semi-Devonian, semi-Mississippian fauna of the west to invade the greater eastern sea.	These two seas presently united,
The commingling of the two faunas gave rise to the Genevieve fauna of the interior (C&S 612-13).	commingling their different forms of life,
The Genevieve (St. Louis-Kaskaskia) fauna. (Chamberlin & Salisbury 613)	
The Genevieve fauna, representing the two stages,	and the union of these marine fauna
may be regarded as including the culmination of the cosmopolitan evolution of the marine life of the Mississippian period on the North American continent, and the initiation of its decline (C&S 613).	marked the beginning of the rapid and world-wide decline in marine life

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and the opening of the subsequent land-life period.

59:5.4 *210,000,000* years ago the warm-water arctic seas covered most of North America and Europe. The south polar waters inundated South America and Australia, while both Africa and Asia were highly elevated.

59:5.5 When the seas were at their height, a new evolutionary development *suddenly* occurred. Abruptly, the first of the land animals appeared.

XXX: THE RISE OF LAND VERTEBRATES AND THE DAWN OF REPTILES (Schuchert 405)

Amphibia, Living and Fossil (Schuchert 405)

Living Amphibia. (Schuchert 405)

The class name Amphibia, which means *living a double life,* was given to them because many live both on the land and in the fresh water (S 405).

There were numerous species of these animals that were able to live on land or in water.

XVII: THE DEVONIAN PERIOD (Chamberlin & MacClintock 543)

DEVONIAN LIFE (Chamberlin & MacClintock)

III. *The Land Life* (Chamberlin & MacClintock)

First Amphibians. (Chamberlin & MacClintock 567)

The amphibians are thought to have evolved from the crossopterygian fishes whose air bladder functioned as a primitive lung leading to the air-breathing habit, and whose skull bones, intricate (labyrinthine) tooth structure, and limb-like fins suggest the approach to the early amphibians (C&M 567-68).

These air-breathing amphibians developed from the arthropods, whose swim bladders had evolved into lungs.

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[**Preamble**] (Chamberlin & MacClintock 567)

59:5.6 From the briny waters of the seas there crawled out upon the land

The known land life of the Devonian period consisted of plants, snails, myriopods, scorpions, and a trace of amphibians, but the record of land life is very imperfect (C&M 567).

snails, scorpions, and frogs.

XIX: THE PENNSYLVANIAN (UPPER CARBONIFEROUS) PERIOD (Chamberlin & MacClintock 592)

THE LIFE OF THE PENNSYLVANIAN PERIOD (Chamberlin & MacClintock 616)

II. *The Land Animals* (Chamberlin & MacClintock 623)

Early Reptiles. (Chamberlin & MacClintock 623)

An amphibian usually lays its eggs in the water, as did its fish ancestors.

Today frogs still lay their eggs in water,

The eggs are soft and unprotected; they contain but little yolk material, and the young amphibian must soon seek his own food in the water, breathing by means of gills. If the amphibian is to become a land form there must come the metamorphosis from the "tadpole" into the adult stage; the entire body must be recast to fit it for its new existence (C&M 625-26).

and their young first exist as little fishes, tadpoles.

This period could well be known as the *age of frogs.*

The Marked Development of Insects. (Chamberlin & MacClintock 626)

[contd] When insects first began their long career is not yet known with certainty. But in any case, they developed rapidly and strongly during the time of the Coal Measures (C&M 626).

59:5.7 Very soon thereafter the insects first appeared

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XXI: THE PENNSYLVANIAN (UPPER CARBONIFEROUS) PERIOD (Chamberlin & Salisbury 620)	
II. THE LAND ANIMALS (Chamberlin & Salisbury 652)	
The marked development of insects. (Chamberlin & Salisbury 654)	
Spiders and myriapods (Fig. 454) were plentiful. *Scorpions* (*g*) also were present, and several species of *land snails* (*d* and *e*) have been identified (C&S 654).	and, together with spiders, scorpions,
The *orthopters* (cockroaches, *i,* Fig. 454, locusts, crickets, etc.) were greatly in the lead, followed by the *neuropters* (represented by ancestral mayflies) (C&S 654).	cockroaches, crickets, and locusts,
	soon overspread the continents of the world.
XXVII: THE PENNSYLVANIAN PERIOD, THE TIME OF GREATEST COAL MAKING (Schuchert 351)	
Life of the Pennsylvanian Period (Schuchert 359)	
Insects. (Schuchert 361)	
The Pennsylvanian was the time of giant insects, the largest ever known. The maximum size was reached by those of the dragon-fly type, one of which, found in the Coal Measures in Belgium, measured 29 inches across the wings (S 361).	Dragon flies measured thirty inches across.
The Pennsylvania well deserves its title of the Age of Cockroaches, since more than eight hundred kinds are known from rocks of this period.	One thousand species of cockroaches developed,
They were mainly carnivorous, and as a rule large, several attaining a length of 3 to 4 inches (S 361).	and some grew to be four inches long.

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XXV: THE MISSISSIPPIAN PERIOD AND THE CLIMAX OF CRINIDS AND ANCIENT SHARKS (Schuchert 333)	
MISSISSIPPIAN PERIOD (Schuchert 334)	
Life of Mississippian Time (Schuchert 340)	
Marine Life. (Schuchert 340)	
In the Tennesseian, two groups of echinoderms were well developed.	59:5.8 Two groups of echinoderms became especially well developed,
These were the blastids (*Pentremites,* Pl., p. 337, Figs. 6, 7) described elsewhere (p. 349), which are the guide fossils to the marine deposits of this time, and in places are so common that geologists have called the beds the Pentremital limestone ... (S 341).	and they are in reality the guide fossils of this epoch.
Shell-feeding Sharks of Mississippian Seas. (Schuchert 341)	
In the American Devonian there are 39 species [of large sharks of the shell-feeding type], in the Mississippian 288, in the Pennsylvanian 55, and in the Permian 10. Therefore there was apparently a very rapid evolution of the sharks in the Waverlian,	The large shell-feeding sharks were also highly evolved,
when they were the dominant marine fishes, with a quick decline during the Tennesseian, the history being the same in Europe (S 342).	and for more than five million years they dominated the oceans.
Climate of Mississippian Time (Schuchert 343)	
[contd] The marine life of Mississippian time appears to indicate warm and equable waters throughout North America, though the seas were never warm enough to produce great numbers of corals or coral reefs, nor were the cephalopods ever present in great variety (S 343).	The climate was still mild and equable;

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XX: THE MISSISSIPPIAN (EARLY CARBONIFEROUS) PERIOD (Chamberlin & Salisbury 596)	
THE LIFE OF THE MISSISSIPPIAN (SUBCARBONIFEROUS) (Chamberlin & Salisbury 606)	
1. *The Marine Faunas* (Chamberlin & Salisbury 606)	
[**Preamble.**] (Chamberlin & Salisbury 606)	
[contd] Just as there was no great stratigraphic break between the Devonian and Mississippian systems in the American continent, so there was no radical break in the succession of life (C&S 606).	the marine life was little changed.
[Contrast C&S 618 and S 342.]	Fresh-water fish were developing
The Kinderhook fauna. (Chamberlin & Salisbury 607)	
Trilobites were few and small. Their high stage of ornamentation had passed, and the day of their disappearance was drawing near (C&S 607).	and the trilobites were nearing extinction.
The Osage fauna. (Chamberlin & Salisbury 607)	
It is a matter of surprise that the corals had so small a place in this fauna, in view of the favorable physical conditions (C&S 609).	Corals were scarce,
The crinoids made large contributions to the limestone of the period, the "encrinital limestone" taking its name from the numerous plates and stems which make up much of its substance (C&S 609).	and much of the limestone was being made by the crinoids.

SOURCE OR PARALLEL

FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 596)

East of the Great Plains (Chamberlin & Salisbury 597)

The St. Louis stage. (Chamberlin & Salisbury 598)

It was during this epoch that the Bedford limestone of Indiana (*Salem* or *Spergen formation*), famous as a building stone, was deposited (C&S 598).

THE LIFE OF THE MISSISSIPPIAN (SUBCARBONIFEROUS) (Chamberlin & Salisbury 606)

1. *The Marine Faunas* (Chamberlin & Salisbury 606)

The Genevieve (St. Louise-Kaskaskia) fauna. (Chamberlin & Salisbury 613)

An odd feature was the diminutive size of the brachiopods in the Bedford limestone of Indiana at Spergen Hill and elsewhere. The associated fossils of other kinds were also dwarfed, implying pauperizing conditions of some sort ... It is not improbable that this limestone was deposited in a partially isolated body of water that was so highly charged with lime and other salts as to be somewhat unfavorable to life (C&S 615).

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The finer building limestones were laid down during this epoch.

59:5.9 The waters of many of the inland seas were so heavily charged with lime and other minerals as greatly to interfere with the progress and development of many marine species.

SOURCE OR PARALLEL	URANTIA PAPER 59
FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 596)	
East of the Great Plains (Chamberlin & Salisbury 597)	
The Osage stage. (Chamberlin & Salisbury 597)	
[contd] In the second (*Osage* or *Augusta*) stage of the period, the sea of the interior became clearer, and the deposition of purer limestone was in progress (C&S 597).	Eventually the seas cleared up as the result of an extensive stone deposit,
The rich deposits of zinc ore (with some lead) in southwestern Missouri and eastern Kansas are chiefly in the Osage beds, though the metallic compounds were concentrated into ores at a much later time (C&S 597).	in some places containing zinc and lead.
General Considerations (Chamberlin & Salisbury 601)	
Thickness and outcrops. (Chamberlin & Salisbury 601)	
In Pennsylvania, there is a thickness of 1,400 feet of sandstone (Pocono), with 3,000 feet of shale (Mauch Chunk) above it; but so rapidly do the formations thin westward, that in the western part of the same state the equivalent formations have a thickness of only 300 to 600 feet. [Etc.] (C&S 601-02)	59:5.10 The deposits of this early Carboniferous age are from 500 to 2,000 feet thick,

SOURCE OR PARALLEL

The Lower Carboniferous of Other Continents (Chamberlin & Salisbury 603)

Europe. (Chamberlin & Salisbury 603)

The Lower Carboniferous system of western Europe, like that of North America, is largely of limestone, sometimes known as the *Carboniferous Limestone*.... East of the Rhine the Lower Carboniferous limestone is replaced by shale, sandstone, and even conglomerate, collectively known as the *Culm* (C&S 604).

East of the Great Plains (Chamberlin & Salisbury 597)

The Kinderhook stage. (Chamberlin & Salisbury 597)

[contd] In the early part of the Mississippian period, coarse sediments (sands and gravels, now a part of the *Pocono formation*) were gathering along the western border of Appalachia.... In the central part of the Mississippi basin, the sediments of this stage (*Kinderhook*) were partly clastic and partly calcareous ... Of these formations most are marine, but the Pocono has yielded many fossils of lands and plants (C&S 597).

The Lower Carboniferous of Other Continents (Chamberlin & Salisbury 603)

Europe. (Chamberlin & Salisbury 603)

The coal-field of Moscow covers 13,000 square miles, but the beds of coal are mostly thin and poor. The coal-field of Donetz covers 11,000 square miles, and contains 44 workable beds (some of them Upper Carboniferous) which have an aggregate thickness of 114 feet. [Etc.] (C&S 604).

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consisting of sandstone, shale, and limestone.

The oldest strata yield the fossils of both land and marine animals and plants, along with much gravel and basin sediments.

Little workable coal is found in these older strata.

SOURCE OR PARALLEL	URANTIA PAPER 59
The post-Devonian Paleozoic systems of Europe resemble the corresponding systems of North America in some ways, and are in contrast with them in others (C&S 603).	These depositions throughout Europe are very similar to those laid down over North America.
XVIII: THE MISSISSIPPIAN (LOWER CARBONIFEROUS) PERIOD (Chamberlin & MacClintock 571)	
EAST OF THE GREAT PLAINS (Chamberlin & MacClintock 572)	
Meramec Series. (Chamberlin & MacClintock 574)	
[contd] At the close of the Osage epoch there was a partial withdrawal of the Interior seas,	59:5.11 Toward the close of this epoch the land of North America began to rise.
	There was a short interruption,
but they were soon back again submerging much of the area which had been covered during Osage time (C&M 574).	and the sea returned to cover about half of its previous beds.
Chester Series. (Chamberlin & MacClintock 574)	
	This was a short inundation,
[contd] After the deposition of the Meramec limestones the epeiric seas were withdrawn from a large part of the Interior (C&M 574)	and most of the land was soon well above water.

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XX: THE MISSISSIPPIAN (EARLY CARBONIFEROUS) PERIOD (Chamberlin & Salisbury 596)

THE LIFE OF THE MISSISSIPPIAN (SUBCARBONIFEROUS) (Chamberlin & Salisbury 606)

II. *The Land Life of the Mississippian* (Chamberlin & Salisbury 619)

Seventy-five per cent of the species of a Mississippian flora of Argentina are identical with European species, a fact which suggests strongly a land bridge between South America and the continents just named [*i.e.,* Europe, Africa and Australia] (C&S 619).

South America was still connected with Europe by way of Africa.

FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 596)

The Lower Carboniferous of Other Continents (Chamberlin & Salisbury 603)

Thickness. (Chamberlin & Salisbury 604)

It was at this time that a great system of mountains, sometimes called the *Paleozoic Alps,* began its development. These mountains crossed central Europe from east to west. Their remnants are seen in the Vosges, Black Forest, Harz, Sudetes, etc., mountains of the present time. The development of the Ural Mountains appears to have begun at the same time (C&S 605).

59:5.12 This epoch witnessed the beginning of the Vosges, Black Forest, and Ural mountains.

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XXVII: THE PENNSYLVANIA PERIOD, THE TIME OF GREATEST COAL MAKING (Schuchert 351)

The Mountains of Pennsylvanian Time (Schuchert 367)

Paleozoic Alps of Europe. (Schuchert 367)

In the heart of Europe there arose a mighty chain of folded mountains, the *Paleozoic Alps of Europe,* whose stumps of massive rocks may be seen in Germany, France, Belgium, England, and Ireland to-day (see map, p. 352; their general distribution is shown in Fig., p. 387, of Pt. I) (S 367).

Stumps of other and older mountains are to be found all over Great Britain and Europe.

59:5.13 *200,000,000* years ago the really active stages of the Carboniferous period began.

XXV: THE MISSISSIPPIAN PERIOD AND THE CLIMAX OF CRINIDS AND ANCIENT SHARKS (Schuchert 333)

MISSISSIPPIAN PERIOD (Schuchert 334)

Early Mississippian Time (Waverlian) (Schuchert 335)

Waverlian Seas. (Schuchert 335)

Here [*i.e.,* in the northern Appalachic basin] also occur the oldest American coal beds, thin accumulations of little commercial value but prophetic of the thicker beds occurring in later formations. However, coal was forming early in Waverlian time in other and widely separated places ... (S 336).

For twenty million years prior to this time the earlier coal deposits were being laid down,

but now the more extensive coal-formation activities were in process.

SOURCE OR PARALLEL	URANTIA PAPER 59
	The length of the actual coal-deposition epoch was a little over twenty-five million years.
XXVII: THE PENNSYLVANIA PERIOD, THE TIME OF GREATEST COAL MAKING (Schuchert 351)	
[*Preamble*] (Schuchert 351)	
Significant Things about the Pennsylvanian Period. (Schuchert 351)	
The seas, due to the marked instability of the earth's surface during this period, oscillated back and forth over the low lands more actively than before.	59:5.14 The land was periodically going up and down due to the shifting sea level
[Compare C&S 639.]	occasioned by activities on the ocean bottoms.
As a consequence	This crustal uneasiness—the settling and rising of the land—
	in connection with
there developed great fresh-water swamp areas replete with a varied flora ... (S 351).	the prolific vegetation of the coastal swamps,
The plants were buried in the swamps where they had lived, and they accumulated in such vast quantities as to make the greatest of the world's coal reserves (S 351).	contributed to the production of extensive coal deposits,
[The Upper Paleozoic rocks were once regarded as comprising but a single period of time, and because coal (carbon) is common in them, they were called the *Carboniferous System* (S 333).]	which have caused this period to be known as the *Carboniferous*.
The climate of Pennsylvanian time was warm and genial the world over, and the land bordering the epeiric seas were moist, with an abundant and well distributed rainfall (S 351).	And the climate was still mild the world over.

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XXI: THE PENNSYLVANIAN (UPPER CARBONIFEROUS) PERIOD (Chamberlin & Salisbury 620)

THE COAL MEASURES (Chamberlin & Salisbury 621)

[**Preamble**] (Chamberlin & Salisbury 621)

[contd] Above the Pottsville conglomerate and its equivalents in the central and eastern parts of the continent, lie the formations known collectively as the Coal Measures. They consist of a succession of alternating beds of shale, sandstone, conglomerate, limestone, coal, and iron ore (C&S 621).

59:5.15 The coal layers alternate with shale, stone, and conglomerate.

Although there are many beds of coal in some regions, and although some of them have great thickness (40 to 50 feet), the proportion of coal in the Coal Measures is rarely so much as 1:40, and that of iron ore is much less (C&S 621).

These coal beds over central and eastern United States vary in thickness from forty to fifty feet.

Distribution and outcrops between the Appalachians and the Rockies. (Chamberlin & Salisbury 623)

[contd] The distribution of the unburied part of the Pennsylvanian system is shown in Fig. 435; also the areas where the system is believed to exist, though concealed, and where it is thought to have been removed by erosion (C&S 623).

But many of these deposits were washed away during subsequent land elevations.

SOURCE OR PARALLEL

PRODUCTIVE COAL-FIELDS (Chamberlin & Salisbury 624)

Thickness. (Chamberlin & Salisbury 630)

In the interior, the corresponding formations rarely much exceed 1,000 feet; but in Arkansas, the Coal Measures have been assigned the remarkable thickness of more than 18,000 feet, from which it is inferred that there must have been land close at hand capable of supplying sediments in great quantity (C&S 630).

COAL (Chamberlin & Salisbury 630)

[*Preamble*] (Chamberlin & Salisbury 630)

Origin. (Chamberlin & Salisbury 630)

Some of the facts which support the theory that the vegetation grew where the coal-beds are, may be noted. Thus (1) beneath each coal-bed there is, as a rule, a layer of clay with roots (or root marks) in the position of growth. The clay seems to have been the soil in which the coal vegetation was rooted. [Etc.] (C&S 631)

Other Products of Economic Value (Chamberlin & Salisbury 638)

Iron ore. (Chamberlin & Salisbury 638)

The Pennsylvania system yields *oil and gas* in some places, as in Oklahoma, Kansas, and Illinois (C&S 639).

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In some parts of North America and Europe the coal-bearing strata are 18,000 feet in thickness.

59:5.16 The presence of roots of trees as they grew in the clay underlying the present coal beds demonstrates that coal was formed exactly where it is now found.

Coal is the water-preserved and pressure-modified remains of the rank vegetation growing in the bogs and on the swamp shores of this faraway age.

Coal layers often hold both gas and oil.

SOURCE OR PARALLEL	URANTIA PAPER 59
XXIX: COAL AND ITS OCCURRENCE IN NATURE (Schuchert 389)	
Nature and Varieties of Coal (Schuchert 389)	
Proofs of the Derivation of Coal from Plants. (Schuchert 391)	
LeConte has truly said that "a perfect gradation may be traced from wood or peat, on the one hand, through brown coal, lignite, bituminous coal, to the most structureless anthracite and graphite, on the other ... Lastly, the best and most structureless peat, by hydraulic pressure, may be made into a substance having many of the qualities and uses of coal" (S 392).	Peat beds, the remains of past vegetable growth, would be converted into a type of coal if subjected to proper pressure and heat.
XXI: THE PENNSYLVANIAN (UPPER CARBONIFEROUS) PERIOD (Chamberlin & Salisbury 620)	
COAL (Chamberlin & Salisbury 630)	
Varieties of coal. (Chamberlin & Salisbury 637)	
In general it is true that the anthracite coal occurs in mountainous regions, where the coal and other layers of rock with which it is associated have been subject to more or less dynamic action (C&S 637).	Anthracite has been subjected to more pressure and heat than other coal.
Summary. (Chamberlin & Salisbury 636)	
	59:5.17 In North America the layers of coal in the various beds,
[Compare C&S 636.]	which indicate the number of times the land fell and rose,
In Illinois the number of workable beds is nine (C&S 636-37).	vary from ten in Illinois,
In Pennsylvania it frequently (but not everywhere) exceeds 20;	twenty in Pennsylvania,

SOURCE OR PARALLEL	URANTIA PAPER 59
in Alabama, 35 (not all workable) have been enumerated;	thirty-five in Alabama,
in Nova Scotia, the number, including dirt-beds, is said to be about 80; but in the Mississippi basin west of the Appalachians, the number is often less than a dozen (C&S 636-37). [... in Nova Scotia over 70 ... (C&M 608).]	to seventy-five in Canada.
Some of the great coal-swamps probably came into existence along the sea-shores, and some in shallow basins or undrained areas remote from the sea, for fresh-water shells are found in association with some coal-beds, and marine fossils with others (C&S 636).	Both fresh- and salt-water fossils are found in the coal beds.
XXVII: THE PENNSYLVANIAN PERIOD, THE TIME OF THE GREATEST COAL MAKING (Schuchert 351)	
The Mountains of Pennsylvanian Time (Schuchert 367)	
The Rising Mountains of North America. (Schuchert 367)	
[See Fig. 126.—Stereographic map of the western hemisphere, showing the position of the Appalachian and other mountain ranges elevated toward the close of the Paleozoic. (S 368)]	59:5.18 Throughout this epoch the mountains of North and South America were active,
These mountains, *the ancestral southern Rockies,* were also the source for most of the red beds of central Texas and Oklahoma ... (S 368).	both the Andes and the southern ancestral Rocky Mountains rising.
	The great Atlantic and Pacific high coastal regions began to sink, eventually becoming so eroded and submerged that the coast lines of both oceans withdrew to approximately their present positions. The deposits of this inundation average about one thousand feet in thickness.

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[See Plate 24.—Paleogeography of Pennsylvanian time. (Map 3) (S 355)]

59:5.19 *190,000,000* years ago witnessed a westward extension of the North American Carboniferous sea over the present Rocky Mountain region, with an outlet to the Pacific Ocean through northern California.

Coal continued to be laid down throughout the Americas and Europe, layer upon layer, as the coastlands rose and fell during these ages of seashore oscillations.

59:5.20 *180,000,000* years ago brought the close of the Carboniferous period, during which coal had been formed all over the world—

XXI: THE PENNSYLVANIAN (UPPER CARBONIFEROUS) PERIOD (Chamberlin & Salisbury 620)

IN FOREIGN COUNTRIES (Chamberlin & Salisbury 641)

Europe (Chamberlin & Salisbury 641)

The Coal Measures of western Europe, like those of eastern North America, consist principally of shales (and clays), with subordinate amounts of sandstone and limestone. Associated with these commoner sorts of rock, there are beds of coal and clay-ironstone ... (C&S 641).

in Europe,

Other continents. (Chamberlin & Salisbury 642)

The Carboniferous of some parts of China has been reported to contain coal-beds of great thickness. The Carboniferous system is also present in India (C&S 643).

India, China,

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[contd] The Carboniferous formations of northern Africa correspond in a general way with those of southern Europe. They are generally of marine origin, so far as now known, and without coal, but in southeastern Africa, a coal basin has been reported in Zambesi (C&S 643).	North Africa,
The system [of rocks of Late Carboniferous age in South America] has wide distribution in the lower part of the basin of the Amazon ... and is not generally coal-bearing, but is so in places. In southern Brazil the system contains much coal (C&S 643).	and the Americas.
COAL (Chamberlin & Salisbury 630)	
General Considerations (Chamberlin & Salisbury 639)	
Close of the period. (Chamberlin & Salisbury 641)	
[contd] After the long period of oscillation above and below the critical level recorded by the Coal Measures, the interior east of the Mississippi was brought above the level of the sea,	At the close of the coal-formation period North America east of the Mississippi valley rose,
not to sink again beneath it during the Paleozoic era, and some of it at no later time.	and most of this section has ever since remained above the sea.
This emergence marks at once the close of the Carboniferous, and the inauguration of the Permian period.	This land-elevation period marks the beginning of the modern mountains of North America,
It is also probable that the deformative movements which were to develop the Appalachian Mountains began at this time.	both in the Appalachian regions
There were notable changes also in the western half of the continent, for the Permian system is much less wide-spread than the Carboniferous (C&S 641).	and in the west.

SOURCE OR PARALLEL	URANTIA PAPER 59
XXXI: PERMIAN TIME AND ITS GLACIAL CLIMATE (Schuchert 419)	
The Great Mountain Making of Permian Time (Schuchert 426)	
Appalachian Revolution. (Schuchert 426)	
Volcanoes were then active from California to Alaska (S 426).	Volcanoes were active in Alaska and California
Permian Mountains of Eurasia. (Schuchert 427)	
	and in the mountain-forming regions of Europe and Asia.
XXVII: THE PENNSYLVANIAN PERIOD, THE TIME OF GREATEST COAL MAKING (Schuchert 351)	
Life of the Pennsylvanian Period (Schuchert 359)	
Cosmopolitan Land Floras. (Schuchert 359)	
[T]he floras, and to a lesser extent the faunas, were cosmopolitan, and their similarity was undoubtedly due to equable climates and easy migration across the extensive east-west continent Eris (S 359-61).	Eastern America and western Europe were connected by the continent of Greenland.
[*Preamble*] (Schuchert 351)	
This greater crustal unrest [during the Pennsylvanian] is also the prophecy of a coming marked climatic change along with larger and higher lands.	59:5.21 Land elevation began to modify the marine climate of the preceding ages
The previous warm and moist climate finally gives way to trying ones of aridity and wide glaciation (S 352).	and to substitute therefor the beginnings of the less mild and more variable continental climate.

SOURCE OR PARALLEL	URANTIA PAPER 59
Life of the Pennsylvanian Period (Schuchert 359)	
Cosmopolitan Land Floras. (Schuchert 359)	
[contd from three rows up] Their distribution was further facilitated by the fact that most of the plants had *spores,* or microscopic reproductive germs,	59:5.22 The plants of these times were *spore* bearing,
which could be widely blown about the air currents (see Pl., p. 377, Figs. 4-6) (S 361).	and the wind was able to spread them far and wide.
XXI: THE PENNSYLVANIAN (UPPER CARBONIFEROUS) PERIOD (Chamberlin & Salisbury 620)	
THE LIFE OF THE PENNSYLVANIAN PERIOD (Chamberlin & Salisbury 643)	
I. THE PLANT LIFE (Chamberlin & Salisbury 643)	
The Lycopodiales. (Chamberlin & Salisbury 647)	
The *sigillarians* differed from the lepidodendrons in being mostly without branches. They were perhaps the largest of the Carboniferous trees, their trunks reaching six feet in diameter, and 100 feet or more in height (C&S 648).	The trunks of the Carboniferous trees were commonly seven feet in diameter and often one hundred and twenty-five feet high.
The Filicales. (Chamberlin & Salisbury 645)	
The ferns are a strangely persistent type. Species still live which, so far as outer form is concerned, might be referred to Carboniferous genera ... (C&S 646-47).	The modern ferns are truly relics of these bygone ages.
III. THE FRESH-WATER LIFE (Chamberlin & Salisbury 655)	
Aside from the developments of the fresh-water fish and of the amphibians,	59:5.23 In general, these were the epochs of development for fresh-water organisms;

perhaps the most suggestive feature was the association of the arthropods with other forms of life. [Etc.] (C&S 656)

[Compare C&S 656-57 and S 364.]

little change occurred in the previous marine life.

But the important characteristic of this period was the *sudden* appearance of the frogs and their many cousins.

[See Fig. 124.—Pennsylvanian flora and amphibia, as restored by J. Smith. (S 360)]

The life features of the coal age were *ferns* and *frogs*.

6. THE CLIMATIC TRANSITION STAGE
THE SEED-PLANT PERIOD
THE AGE OF BIOLOGIC TRIBULATION

59:6.1 This period marks the end of pivotal evolutionary development in marine life

XXII: THE PERMIAN PERIOD (Chamberlin & Salisbury 660)

FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 660)

Correlation. (Chamberlin & Salisbury 662)

The Permian period is best looked upon as a transition period from the Carboniferous to the Trias, and so from the Paleozoic to the Mesozoic (C&S 662).

and the opening of the transition period leading to the subsequent ages of land animals.

SOURCE OR PARALLEL

URANTIA PAPER 59

THE LIFE OF THE PERMIAN (Chamberlin & Salisbury 668)

The impoverishment of life. (Chamberlin & Salisbury 669)

[contd] In the early days of geology it was commonly held that a complete destruction of all things living on the face of the earth attended the close of the Paleozoic era, and that a re-creation followed ... It is now known that some species bridged the interval, and it is believed that others underwent modifications which enabled them to live.... Notwithstanding all this, it appears that life of the period was greatly impoverished.

59:6.2 This age was one of great life impoverishment.

Thousands of marine species perished, and life was hardly yet established on land. This was a time of biologic tribulation, the age when life nearly vanished from the face of the earth and from the depths of the oceans.

A census made not many years ago gave the known animal species of the Carboniferous period as 10,000,

Toward the close of the long marine-life era there were more than one hundred thousand species of living things on earth.

while those of the Permian period were only 300. A census to-day would probably increase the Permian ratio, but the contrast would still be great (C&S 669).

At the close of this period of transition less than five hundred had survived.

SOURCE OR PARALLEL	URANTIA PAPER 59
THE PROBLEMS OF THE PERMIAN (Chamberlin & Salisbury 677)	
It is to be noted that none of the factors in this combination [*i.e.,* glaciation, aridity, red beds, marked restrictions of life, extensive geographic changes, pronounced crustal foldings] were wholly new to geological history.... The peculiarity of the Permian	59:6.3 The peculiarities of this new period
was the complexity of the combination, and the extent of the glaciation and aridity (C&S 677).	
No appeal can be taken to a supposed final cooling of the earth, or to any senile condition (C&S 677).	were not due so much to the cooling of the earth's crust or to the long absence of volcanic action
	as to an unusual combination of commonplace and pre-existing influences—restrictions of the seas and increasing elevation of enormous land masses.
	The mild marine climate of former times was disappearing, and the harsher continental type of weather was fast developing.
XIV: THE PERMIAN PERIOD: CLOSE OF AN ERA (Schuchert & Dunbar 270)	
[PREAMBLE] (Schuchert & Dunbar 270)	
[contd] Momentous changes ushered the Paleozoic era to its close (S&D 270).	59:6.4 *170,000,000* years ago great evolutionary changes and adjustments were taking place over the entire face of the earth.

SOURCE OR PARALLEL	URANTIA PAPER 59
GREAT MOUNTAIN MAKING OF PERMIAN TIME (Schuchert & Dunbar 277)	
Permian Mountains of Eurasia. (Schuchert & Dunbar 280)	
It should be emphasized here that the immensely long and worldwide crustal unrest beginning at the close of the Mississippian attained its climax in the Late Pennsylvanian and Early Permian, and then slowly declined during the remainder of the last-named period, when all the continents were rising and the oceans deepening (S&D 280).	Land was rising all over the world as the ocean beds were sinking.
	Isolated mountain ridges appeared.
XXII: THE PERMIAN PERIOD (Chamberlin & Salisbury 660)	
FORMATIONS AND PHYSICAL HISTORY (Chamberlin & Salisbury 660)	
[**Preamble.**] (Chamberlin & Salisbury 660)	
[contd] At the close of the Pennsylvanian period much of the central and eastern parts of the United States became dry land,	The eastern part of North America was high above the sea;
and the sea-covered area in the west was greatly restricted (C&S 660).	the west was slowly rising.
The waters which still lay upon the continent were partly in the form of lakes and inland seas,	The continents were covered by great and small salt lakes and numerous inland seas
and partly connected with the open ocean, but the areas which the sea overspread at the beginning of the period were largely abandoned before its close (C&S 660).	which were connected with the oceans by narrow straits.

SOURCE OR PARALLEL

URANTIA PAPER 59

Thickness. (Chamberlin & Salisbury 662)

[contd] In the Appalachian region, the Lower Permian beds, sandstone and shale with thin seams of coal, have a thickness of about 1,000 feet.

The Upper Permian is wanting. In Kansas the thickness is twice as great, while in Texas it reaches 7,000 feet (C&S 662).

XIV: THE PERMIAN PERIOD: CLOSE OF AN ERA (Schuchert & Dunbar 270)

[PREAMBLE] (Schuchert & Dunbar 270)

As the mobile borderlands continued to rise and were thrust against the emerging continents, several of the great Paleozoic geosynclines were uplifted into fold mountains (S&D 270).

PERMIAN LIFE (Schuchert & Dunbar 284)

Gondwana Land Bridges. (Schuchert & Dunbar 292)

Similar faunal and floral evidence in some of the Paleozoic and Mesozoic formations of India, Africa, South America, and Antarctica strongly suggests transverse land bridges spanning the present Atlantic Ocean from Brazil to Africa and, by way of Madagascar, across the Indian Ocean to India.

The width of the land bridge across the Atlantic is entirely conjectural and its position problematical. Indeed, many geologists deny that it ever existed because they are unable to account for the complete disappearance of so large a land mass into oceanic depths (S&D 292).

The strata of this transition period vary in thickness from 1,000

to 7,000 feet.

59:6.5 The earth's crust folded extensively during these land elevations.

This was a time of continental emergence

except for the disappearance of certain land bridges,

including the continents which had so long connected South America with Africa and North America with Europe.

SOURCE OR PARALLEL

URANTIA PAPER 59

59:6.6 Gradually the inland lakes and seas were drying up all over the world.

XXXI: PERMIAN TIME AND ITS GLACIAL CLIMATE (Schuchert 419)

Glacial Climate near the Close of Lower Permian Time (Schuchert 428)

[contd] For nearly fifty years geologists have been describing unmistakable glacial deposits of Permian age in the continents of the southern hemisphere,

Isolated mountain and regional glaciers began to appear, especially over the Southern Hemisphere,

but it is only during the present century that their results have been widely accepted (S 428).

The evidence is now unmistakable that early in Permian times, ... most of the lands of the southern hemisphere were under the influence of a glacial climate as severe as the polar one of recent times, and that, like the latter, the Permian one also had warmer interglacial periods, for coal beds occur associated with the glacial deposits in Australia, South Africa, and Brazil (S 429).

and in many regions the glacial deposit of these local ice formations may be found even among some of the upper and later coal deposits.

XXII: THE PERMIAN PERIOD (Chamberlin & Salisbury 660)

THE LIFE OF THE PERMIAN (Chamberlin & Salisbury 668)

[**Preamble.**] (Chamberlin & Salisbury 668)

The salient facts in connection with the physical conditions of the Permian were *glaciation* and *aridity* (C&S 669).

Two new climatic factors appeared—glaciation and aridity.

Many of the earth's higher regions had become arid and barren.

SOURCE OR PARALLEL

URANTIA PAPER 59

XXXI: PERMIAN TIME AND ITS GLACIAL CLIMATE (Schuchert 419)

Life of the Permian (Schuchert 430)

Cool Climate Cosmopolitan Flora of the Southern Hemisphere. (Schuchert 432)

[contd] In the southern hemisphere, due in all probability to the cool climate brought about by the glacial period of late Lower Permian time,

59:6.7 Throughout these times of climatic change,

the more characteristic elements of the older cosmopolitan fauna were in part wiped out and some of the elements which remained were evolved into new forms that soon took possession of the ancient land Gondwana (see p. 431), and finally of the entire southern hemisphere, including Antarctis.

great variations also occurred in the land plants.

This plant assemblage is known as the *Glossopteris* or *Gangamopteris flora,* because of the prominence in it of these two plants (see Fig., above)....

... It appears that *Glossopteris* is seed-bearing (the seeds are called *Nummulospermum* and *Samaropsis*) and is a Cycadophyte (S 432-33).

The *seed plants* first appeared,

[*Preamble*] (Schuchert 419)

Most Significant Things about the Permian. (Schuchert 420)

This flora provided a different, and probably a better food for the insects and reptiles of the land, and accordingly we see a marked evolution among them (S 420).

and they afforded a better food supply for the subsequently increased land-animal life.

SOURCE OR PARALLEL	URANTIA PAPER 59
Life of the Permian (Schuchert 430)	
Permian Insects. (Schuchert 433)	
During the Lower Permian a great change took place among the insects, for they became not only smaller but more like modern forms (S 433).	The insects underwent a radical change.
Judging from the insects of Triassic times, we see that those of the later Permian must have introduced complete "metamorphosis" (a transformation, as maggot to fly or caterpillar to butterfly) in their growth from the egg to the adult, and also resting stages because of winters or seasons of drought and absence of food, as is done by modern forms (S 433).	The *resting stages* evolved to meet the demands of suspended animation during winter and drought.
XXII: THE PERMIAN PERIOD (Chamberlin & Salisbury 660)	
THE LIFE OF THE PERMIAN (Chamberlin & Salisbury 668)	
II. *The Land Animals* (Chamberlin & Salisbury 672)	
The Amphibians. (Chamberlin & Salisbury 672)	
[contd] The amphibians which reached their climax in the later portion of the Pennsylvanian period,	59:6.8 Among the land animals the frogs reached their climax in the preceding age
were still abundant in the early Permian, but before the end of the period, they were overshadowed by the rise of the reptiles, which were without doubt their descendants (C&S 672).	and rapidly declined,
[The drying-up of small intermittent streams and pools during times of drought, or distributary streams changing their channels from time to time, would naturally place a premium on those individuals who could survive a brief existence in the air or a tiny trip to another pool of water still remaining in the stream bed (C&M 568).]	but they survived because they could long live even in the drying-up pools and ponds of these far-distant and extremely trying times.

SOURCE OR PARALLEL	URANTIA PAPER 59
Primitive reptiles. (Chamberlin & Salisbury 672)	
[Contrast C&S 672.]	During this declining frog age, in Africa, the first step in the evolution of the frog into the reptile occurred.
[*Note:* This clause apparently contradicts 59:6.5.]	And since the land masses were still connected,
The rapid and diverse deployment of the early reptiles in a period of general life-impoverishment is not a little remarkable, but as the reptiles were air-breathers,	this prereptilian creature, an air breather, spread over all the world.
the key to their rise may lie in a more oxgenated atmosphere, a point to which we shall return (C&S 673).	By this time the atmosphere had been so changed that it served admirably to support animal respiration.
[T]he Permian vertebrate fauna of North American is so unlike the corresponding faunas of other continents as to imply the absence of migration of land animals between North America and other continents. This isolation seems to have lasted from the later part of the preceding period, until well into the Triassic (C&S 673-74).	It was soon after the arrival of these prereptilian frogs that North America was temporarily isolated, cut off from Europe, Asia, and South America.
	59:6.9 The gradual cooling of the ocean waters contributed much to the destruction of oceanic life.

SOURCE OR PARALLEL	URANTIA PAPER 59
IV. *The Marine Faunas* (Chamberlin & Salisbury 674)	
The retreatal tracts of the marine life. (Chamberlin & Salisbury 676)	
[contd] As in previous transition epochs when epicontinental waters were largely withdrawn, the marine faunas found special refuge in certain embayments or border tracts which, in connection with the coastal belts, permitted them to re-form themselves, regenerate their species, and prepare for a succeeding invasion of the continental areas (C&S 676).	The marine animals of those ages took temporary refuge in three favorable retreats:
The border of the Gulf of Mexico,	the present Gulf of Mexico region,
the Mediterranean tract, notably in the region of Sicily and southeast Europe, and the Ganges-Indus tract of southern Asia, seem to have been special areas of refuge and regeneration (C&S 676).	the Ganges Bay of India, and the Sicilian Bay of the Mediterranean basin.
The restriction, compared with the expansional stage of the Mississippian period, was great; but the faunas emerged with new species born in adversity, ready for conquest when the re-advancing seas should give them an expanding realm (C&S 676).	And it was from these three regions that the new marine species, born to adversity, later went forth to replenish the seas.
	59:6.10 *160,000,000* years ago the land was largely covered with vegetation adapted to support land-animal life, and the atmosphere had become ideal for animal respiration.

Thus ends the period of marine-life curtailment and those testing times of biologic adversity which eliminated all forms of life except such as had survival value, and which were therefore entitled to function as the ancestors of the more rapidly developing and highly differentiated life of the ensuing ages of planetary evolution.

59:6.11 The ending of this period of biologic tribulation, known to your students as the *Permian,* also marks the end of the long *Paleozoic* era, which covers one quarter of the planetary history, two hundred and fifty million years.

59:6.12 The vast oceanic nursery of life on Urantia has served its purpose. During the long ages when the land was unsuited to support life, before the atmosphere contained sufficient oxygen to sustain the higher land animals, the sea mothered and nurtured the early life of the realm. Now the biologic importance of the sea progressively diminishes as the second stage of evolution begins to unfold on the land.

59:6.13 [Presented by a Life Carrier of Nebadon, one of the original corps assigned to Urantia.]

1. *Compare:* Thus in the Appalachian Mountains, where the sediments were derived principally from the land to the east, and where the beds doubtless had a slight dip to the west at the time of deposition, they now dip in various directions and at various angles, as the result of folding (C&S 513).

2. It was originally thought that this ash all came from a single volcano, but we now see that there must have been numerous local ones, since the ash beds vary in number and in thickness in different regions (S&D 153).

Explanation of Red-marked Items

59:0.2: Archeozoic

Explained in chart.

59:0.3: Proterozoic

Explained in chart.

59:0.9: erosion deposits

Schuchert points to the marked unconformity between the Cambrian rocks and the Proterozoic rocks. He ascribes the unconformity to a long erosion interval, in which the intervening deposits were *washed away* by erosion before the Cambrian rocks were laid down. The UB writer interprets "very long erosion interval" to mean "extensive erosion deposits." But it is the *absence* of such deposits that accounts for the marked unconformity.

59:1.18: shrimps, crabs, and lobsters

Schuchert explains that trilobites were the earliest forms of Crustacea, being the ancient progenitors of shrimps, crabs, and lobsters. These latter forms evolved hundreds of millions of years later, in the Mesozoic. (See 60:2.9, where the UB writer points to the emergence of modern crustaceans in the Jurassic.) In 59:1.18, the UB writer joins two of Schuchert's widely separated remarks to make one sentence, resulting in the misstatement that shrimps, crabs and lobsters were present in the Cambrian.

59:1.19: trilobites subsisted on inorganic matter

Schuchert makes clear that the "mud-eating" trilobites were nourished not by the mud itself but by the organic matter contained therein. The UB writer insists, however, that the trilobites were indeed largely nourished by the inorganic matter, being "the last multicelled animals" that could thus be nourished. It is unclear whether the UB statement is the result of a misreading of Schuchert or of an intentional disagreement with him. If the latter, the UB's claim runs counter to an axiom in biology, which Schuchert states as follows: "Plant cells have the power of organizing inorganic matter into living plasm; animal cells subsist on organic materials alone."

59:2.9: all animals except certain of the more primitive ones are directly or indirectly dependent on plant life for their existence

Here the UB writer upholds the claim made in 59:1.19 (see above), this time in defiance of Chamberlin & Schuchert's restatement of the axiom: "The existence of plants in the Cambrian period would perhaps be doubted were it not known that all animals depend on them, directly or indirectly, for food."

59:2.10: the trilobites utterly perished during the beginning of the next period

The UB writer apparently interpreted Chamberlin & Salisbury's comment—"In the next period the numbers fell off a full half, and this decline continued until the tribe became extinct"—to mean that the extinction occurred at the beginning of the next period (the Silurian). However, Chamberlin & Salisbury track the trilobites' continued existence through the succeeding periods (the Silurian, Devonian, and Carboniferous). In 59:3.5, 59:3.11, and 59:5.8 the UB writer also tracks the trilobites' continued existence in the succeeding periods, contradicting its statement that "the trilobites utterly perished during the beginning of the next period."

59:2.12: bivalve gastropods ... embrace muscles, clams, oysters, and scallops

Muscles (mussels), clams, oysters and scallops are not bivalve gastropods; they are not gastropods at all. They are, as Schuchert writes, pelecypods or bivalves. The UB sentence, as the chart shows, joins clauses drawn from Chamberlin & Salisbury and from Schuchert. The former describes gastropods, the latter pelecypods (bivalves); but the UB sentence turns the subject into "bivalve gastropods" and erroneously ascribes muscles, clams, oysters, and scallops to that class.

59:3.1 changed to quartz, shale, and marble

Quartz schist and marble are metamorphic, shale is not. Chamberlin & Salisbury write that shale was changed to slate and schist. It is unclear whether the UB's misstatement is the result of a misreading of Chamberlin & Salisbury or of a typo or other transcription mistake.