GEOLOGY

Section 5. Era of marine life - Paleozoic

Point I. The Cambrian period - the era of the trilobites
(59:1.1) From the dawn of this period of relative tranquility on the earth's surface, life was limited by the various inland seas and ocean coastline; no form of terrestrial organisms yet existed. Primitive marine animals acclimatized well and were ready for the next stage of evolution. Amoebae are typical survivors of this initial stage of development of animal life - they appeared towards the end of the previous transitional period.

Point A. 400,000,000 years ago
(59:1.2) 400,000,000 years ago both plant and animal marine life successfully spread throughout the world. The world's climate has become slightly warmer and more uniform. A general submergence was taking place on the sea-coasts of the various continents, especially North and South America. New oceans appeared and older bodies of water greatly expanded.

Point B. 380,000,000 years ago

Point 1. When the arctic waters joined the waters of the Gulf of Mexico.
(59:1.8) 380,000,000 years ago Asia began to rise, and the other continents rose briefly. But as this era progressed, the newly forming Atlantic Ocean made deep inroads into all adjacent coastlines. The North Atlantic or Arctic seas at that time joined the waters of the Gulf of Mexico. When this southern sea entered the Appalachian basin, its waves broke to the eastward on mountains as high as the Alps, but in general the continents were uniform immutables, entirely devoid of any picturesqueness.

Point 2. The Cambrian deposits.
(59:1.9) Sedimentary deposits from this period refer to four types:
(59:1.10) **1.** Conglomerates - material deposited around the shoreline.
(59:1.11) **2.** Sandstones - deposits in shallow water, but in such places where the waves could prevent the deposition of mud.
(59:1.12) **3.** Clay shale - deposits in the deeper and calmer waters.
(59:1.13) **4.** Limestone - including the deposits of trilobite shells in the deep places.

(59:1.14) There are both some basic similarities and distinct differences in the fossil trilobites of this period. The early animals that developed on the basis of the three initial implantations of life had characteristic differences - those that appeared in the Western Hemisphere were slightly different from those of the Eurasian, Australo-Asiatic or Australo-Antarctic groups.

Point C. 370,000,000 years ago

Point 1. North and South America along with Africa and Australia were submerged.
(59:1.15) 370,000,000 years ago there was an extensive and almost complete submergence of North and South America, after which Africa and Australia went under the water. Only some parts of North America remained above the level of these shallow Cambrian seas. After 5,000,000 years the seas gave way to the rising land. And all these processes of land subsidence and uplift were devoid of drama, slowly occurring over millions of years.

Point 2. Numerous geological changes of this epoch.
(59:1.16) The stratum bearing the fossil remains of trilobites belonging to this epoch came here and there to the surface of all the continents except Central Asia. Usually these rocks lie horizontally, but in the mountains they are inclined and deformed due to pressure and the formation of folds. In many places such shrinkage has changed the original character of these deposits. The sandstone became quartz, the shale into aspid shale, and the limestone into marble.

Point D. 360,000,000 years ago

Point 1. Rise of the continents, Greenland was a tropical paradise.
(59:1.17) 360,000,000 years ago the increase of land continued. North and South America rose to a considerable height. Western Europe and the British Isles surfaced, except for parts of Wales which were deep under water. During these epochs, large glaciers were absent. The supposed glacial deposits that occur in association with these strata in Europe, Africa, China, and Australia are explained by isolated mountain glaciers or by the displacement of

later glacial deposits. The world's climate was oceanic, not continental. The southern seas were warmer than now, extending north through North America to the polar regions. The Gulf Stream passed through central North America and drifted eastward, washing and warming the shores of Greenland and turning this now ice-covered continent into a veritable tropical paradise.

Point 2. Biological picture of Urantia during the Cambrian period.
(59:1.20) Such was the biological picture of Urantia at the close of that long period of world history, covering 50,000,000 years, called by your geologists the Cambrian.

Point II. Ordovician period - continental warming - era of invertebrate animals
(59:2.1) The periodic uplift and subsidence characteristic of the time were gradual and unspectacular, accompanied by little or no volcanic activity. During all these alternate uplifts and depressions of the land, the history of the original Asiatic continent did not in all respects coincide with the history of the other parts of the land. He repeatedly plunged, sinking now in one direction, now in another, which was characteristic of the initial stage. But here there are no uniform rock deposits such as can be found on other continents. In recent ages, Asia has been the most persistent of all land masses.

Point A. 350,000,000 years ago - period of the first great submersions

Point 1. Three great floods are characteristic of this period.
(59:2.2) 350,000,000 years ago began the period of the great submergence of all continents except Central Asia. The landmasses repeatedly went under the water; only the coastal elevations remained above these shallow but vast and shifting inland seas. This period was characterized by three great floods, but before its end the continents rose again, and the total land surface exceeded by fifteen percent that which exists today. The Caribbean region rose to a great height. In Europe, this period left few traces, since the fluctuations of the land here were less significant, with great volcanic activity.

Point B. 340,000,000 to 330,000,000 years ago - period of the second submergence of land and subsequent uplift

Point 1. The Great Limestone Period.
(59:2.3) 340,000,000 years ago there was another extensive submergence of the land, which affected not only Asia and Australia. The waters of the oceans everywhere mingled. This was the great limestone period, in which much of this stone was deposited by the lime-secreting algae.
(59:2.4) A few million years later large parts of the American continents and Europe began to emerge from beneath the water. In the Western Hemisphere, only the arm of the Pacific Ocean above Mexico and the present-day Rocky Mountain regions remained, but towards the end of this era the Atlantic and Pacific coasts began to sink again.

Point 2. A period of relative stability, the eruption of a volcano in Kentucky.
(59:2.5) 330,000,000 years ago a period of relative stability began throughout the world, in which a considerable portion of the land lay above the surface of the water. The only disturbance of the earth's tranquility occurred with the eruption of the huge North American volcano in the eastern part of Kentucky - one of the most powerful manifestations of volcanic activity in the history of our world. This volcano covered an area of 1,300 square kilometers with a layer of ash 5 to 6 meters thick.

Point C. 320,000,000 to 310,000,000 years ago - period of the third submergence of land and subsequent uplift

Point 1. Third significant flood in this period.
(59:2.6) 320,000,000 years ago occurred the third great flood of this period. The water covered the entire surface of the land submerged during the previous flood, in many directions penetrating even further into the depths of America and Europe. The eastern parts of North America and western Europe were 3,000 to 4,500 meters underwater.

Point 2. The drought rose again and there was a calm period.
(59:2.7) 310,000,000 years ago, land again rose to a considerable height throughout the world, except in the southern parts of North America. Mexico floated away, resulting in the formation of the Gulf of Mexico, which has retained its current shape to this day.
(59:2.8) The life of this period continues its development. The planet once again became relatively calm and peaceful; the climate remained mild and even; land plants migrated farther and farther from seashores. Life forms thrived, although fossil plants from this period are rare.

Point III. Silurian Period - Second Great Submergence Period - Coral Period - Brachiopod Era

Point A. 300,000,000 to 290,000,000 years ago - first submergence and uplift of land in the Silurian Period

Point 1. The First Great Silurian Flood.
(59:3.1) 300,000,000 years ago another long period of land submergence began. The encroachment of the ancient Silurian seas in a southerly and northerly direction resulted in the absorption of most of Europe and North America. The land was not much above sea level, so there were not many coastal deposits. The seas abounded with creatures with calcareous shells, and the deposition of these shells on the sea floor gradually formed extensive deposits of limestone which covered practically all of Europe and North America, but only in some places appeared above the earth's surface. The thickness of this ancient rock layer reaches an average of three hundred meters, but many of these deposits were deformed over time due to tilting of layers, cataclysms and faulting, and others turned into quartz, schist and marble.
(59:3.2) Neither flint nor lava has been found in the strata of the rock of this period, except that which was ejected from the great volcanoes of southern Europe and the eastern regions of the State of Maine, and also from the lava flows of Quebec. Volcanic activity remained mostly in the past. It was a time of large-scale water deposition, mountain formation practically did not take place.

Point 2. Birth of the Caledonian Mountains.
(59:3.3) 290,000,000 years ago the sea had largely withdrawn from the continents, and the floors of the surrounding oceans were giving way. The massifs of the land remained unchanged until the next submersion. Early mountain-building movements began on all continents, and the most significant of these crustal uplifts were the Himalayas in Asia and the vast Caledonian Mountains, stretching from Ireland through Scotland and on to Spitsbergen.

Point 3. Deposits in this period.
(59:3.4) The deposits of this period are rich in gas, oil, zinc, and lead. Gas and oil are formed from the vast accumulations of plant and animal matter deposited in the course of the previous submergence of the land, while mineral deposits are the result of the formation of sediments in stagnant bodies of water. Many rock salt deposits belong to this period.

Point 4. Other characteristics of this period.
(59:3.5) The trilobites rapidly declined, their place being taken by larger molluscs or cephalopods. These animals, reaching 5 meters in length and 30 centimeters in diameter, became masters of the seas. This type of animals appeared suddenly and became the predominant form of marine life. The powerful volcanic activity of this period was in the European sector. The oceanic climate became mild.

Point B. 280,000,000 years ago - second flood and land uplift

Point 1. Uplift of land after the second Silurian flood.
(59:3.9) 280,000,000 years ago, much of the continents were uplifted after the second Silurian flood. The rock deposits associated with this submergence are known in North America as the "Niagara Limestone" because it is over this layer of rock that Niagara Falls currently flows. This layer of rock extends from the eastern mountains to the valleys of the Mississippi River, but continues westward only in the southern valley. Several layers cover the territory of Canada, part of South America, Australia and a large part of Europe; the average thickness of the Niagara strata is about 200 meters. Immediately above the Niagara deposits in many areas can be found accumulations of conglomerate, shale, and rock salt, which represent a collection of secondary ground deposits. The salt was deposited in huge lagoons, which sometimes opened and closed to the sea, sometimes they were isolated, so the evaporation deposited salt and also other substances contained in the solution. In some regions, such a salt bed reaches 20 meters in thickness.

Point 2. Climate and animal development.
(59:3.10) The climate was even and mild, and marine fossils were deposited in arctic regions. But towards the end of this era the seas became so salty that only a small fraction of their inhabitants survived.
(59:3.11) Towards the end of the closing Silurian submergence there was a great increase in the number of echinoderms - sea lilies - as evidenced by the deposition of crinoid limestone. The trilobites almost completely disappeared, and the molluscs continued to remain kings of the seas; significantly accelerated the formation of

coral reefs. In this era, in the most favorable places, primitive water scorpions first appeared. Soon after, and suddenly, the real scorpions appeared, the animals possessing their own atmospheric type of breathing.

Point IV. The Devonian period – era of the great uplift of land – period of plant life on earth – age of fishes
(59:4.1) In the centuries-old struggle between land and water, the sea was relatively more often and for a longer time victorious, but the time of the land was already approaching. Moreover, the process of continental drift was still far from complete, and at times practically all the land of the world was joined by the narrow isthmuses and barriers of narrow land.
(59:4.2) With the uplift of the land at the close of the Silurian flood, an important period in the development of the world and the evolution of animals closes. A new era has dawned on Earth. The bare and unattractive landscape of previous eras was covered with luxuriant greenery, and in the not too distant future the first magnificent forests were about to appear.

Point A. 270,000,000 to 260,000,000 years ago

Point 1. The Great Era of Land Rise.
(59:4.4) 270,000,000 years ago the continents were entirely above sea level. It was the first time in many millions of years that such an amount of land had been above water at the same time; it was one of the greatest eras of drought growth.
(59:4.5) 5,000,000 years later there was a brief flooding of the regions of North and South America, Europe, Africa, North Asia, and Australia, whereby in North America for a period of time the submergence was almost complete. The resulting layers of limestone ranged in thickness from 150 to 1,500 meters. These various Devonian seas extended first in one direction, then in another, with the result that the great inland arctic sea of North America found its outlet into the Pacific Ocean through northern California.

Point 2. First Devonian Flood - Coral Deposits in Kentucky.
(59:4.6) 260,000,000 years ago, toward the end of this great period of land depression, North America was partially covered by seas which simultaneously joined Pacific, Atlantic, and Arctic waters in the Gulf of Mexico. The deposits formed during these late stages of the first Devonian flood average three hundred meters in thickness. The coral reefs characteristic of this time indicate that the inland seas were transparent and shallow. Such coral deposits can be seen on the banks of the Ohio River not far from the city of Louisville in the state of Kentucky, they are about thirty meters thick and include over two hundred varieties. These coral formations extend across the territory of Canada and Northern Europe to the Arctic regions.
(59:4.7) After these submergences many banks rose to a considerable height, so that the older deposits were hidden under a layer of mud or shale. In addition, a layer of red sandstone, characteristic of one of the Devonian deposits, covers a significant part of the Earth's surface, occurring in North and South America, Europe, Russia, China, Africa and Australia. Such red deposits are characteristic of arid or semi-arid climates, but the climate of this era continued to remain warm and flat.
(59:4.8) During this whole period the land to the southeast of the island of Cincinnati remained at a considerable height above the level of the sea, but vast portions of western Europe, including the British Isles, were submerged. In Wales, Germany and elsewhere in Europe, Devonian rocks are approximately 6,000 meters thick.

Point B. 250,000,000 to 230,000,000 years ago - fish, ferns, forests
(59:4.9) **Point 1.** 250,000,000 years ago the fish appeared, the vertebrates, which became one of the most important stages of evolution until the appearance of man.
(59:4.12) In the deposits formed toward the end of this period may be met with entire bone beds consisting of the teeth and skeletons of fishes, and rich fossil strata lying along the coast of California, for many sheltered bays of The Pacific Ocean cut into the land of this region.

(59:4.13) **Point 2.** The earth was rapidly being covered with new terrestrial vegetation. Until then, plants mainly grew near water; now suddenly appeared a prolific family of ferns, rapidly spreading over the surface of the rapidly rising land. Soon three species were formed, having a diameter of sixty centimeters and a height of twelve meters, later leaves appeared, but in these first varieties they were only in a rudimentary state. Many small plants existed, but their fossil remains were not preserved because they were usually destroyed by the earlier bacteria.
(59:4.14) As a result of the gradual uplift of the continents, North America was joined to Europe by land bridges that extended to Greenland. Even today, Greenland keeps under its ice remnants of armor from these ancient plants.

Point 3. Late Devonian flood.

(59:4.15) 240,000,000 years ago parts of the land in Europe, North and South America began to sink. This subsidence marked the beginning of the last and least extensive of the Devonian floods. The Arctic seas again moved southward, spreading over much of North America, the Atlantic flooded much of Europe and western Asia, while the southern waters of the Pacific Ocean covered much of India. This flood was slow to spread and also slow to recede. The Catskill Mountains along the west bank of the Hudson River represent one of the largest geologic monuments of this era on the surface of North America.

Point 4. Land invasion.
(59:4.16) 230,000,000 years ago the seas continued to recede. Vast areas of North America were above sea level, and there was powerful volcanic activity in the St. Lawrence River region. Mount Royal, near Montreal, is the eroded neck of one of these volcanoes. Deposits from this entire era are well visible in the Appalachian Mountains of North America, where the Susquehanna River cut through the valley, exposing these successive layers reaching a thickness of more than 4,000 meters.

Point V. Carboniferous Period-Periodical Shifting of Crust-Age of Frogs
(59:5.1) The appearance of fish in the previous age marked a peak in the evolution of marine life. From that time on, the evolution of terrestrial life became increasingly important. At the beginning of this period, almost ideal conditions existed for the appearance of the first land animals.

Point A. 220,000,000 to 210,000,000 Years Ago - Ferns and Frogs

Point 1. Age of ferns - rise of land and flowering of vegetation.
(59:5.2) 220,000,000 years ago many areas of the continental landmass, including much of North America, were above water level. The earth became covered with luxuriant vegetation; the age of ferns came. Carbon dioxide was still present in the atmosphere, but its amount was decreasing.

Point 2. Confluence of Atlantic and Pacific waters in the North American region.
(59:5.3) Soon after this the central part of North America was filled with water, and two vast inland seas were formed. The coastal uplands of both the Atlantic and Ocean coasts were located immediately behind the modern coastline. In no time these seas joined, mixing together the various forms of living things, and the amalgamation of the marine fauna marked the beginning of the rapid and world-wide decline of marine life and the opening of the succeeding period of terrestrial life.

Point 3. Sudden appearance of land animals.
(59:5.4) 210,000,000 years ago, warm arctic seas hid much of North America and Europe. Southern polar waters warmed South America and Australia, while both Africa and Asia were at a considerable height above sea level.
(59:5.5) When the water level reached its peak, a new evolutionary event suddenly occurred-the unexpected appearance of the first land animals. There were numerous species of such animals capable of living both on land and in water. These air-breathing amphibians evolved from arthropods whose swim bladders had evolved into lungs.

Point B. 200,000,000 to 180,000,000 years ago - Carboniferous Period

Point 1. Active Carboniferous Period - more than 25,000,000 years.
(59:5.13) 200,000,000 years ago the truly active stages of the Carboniferous period began to operate. The early coal deposits had formed during the twenty million years preceding this time, but coal formation was now occurring on a wider scale. The duration of the age of actual coal-formation was a little over twenty-five million years.
(59:5.14) The land periodically rose and subsided as the sea level fluctuated due to processes occurring at the bottom of the ocean. The restless condition of the crust - the sedimentation and uplift of the land, combined with the rich vegetation of the coastal marshes, helped to form large coal deposits, hence this period is known as the Carboniferous. Throughout the world, the mild climate was maintained.
(59:5.15) The coal beds alternated with shale, shale, and conglomerate. These coal seams in the central and eastern parts of the United States vary in thickness from twelve to fifteen meters. But many of these deposits were washed away during the subsequent uplift of the land. In some parts of North America and Europe, the thickness of the coal seam is 5,400 meters.

Point 2. Coking process.
(59:5.16) The presence of the roots of trees which grew in the layer of clay underlying the coal beds of today indicates that the coal was formed in the very places where it is now found. Coal is the water-preserved and

pressure-altered remains of a luxuriant vegetation existing at that remote epoch in the swamps of the submerged coasts. Coal seams often contain both gas and oil. Peat layers - remains of ancient vegetation, would turn into one of the types of coal if they were subjected to the necessary pressure and high temperature. Anthracite underwent greater pressure and heating than other types of coal.

Point 3. The amount of coal seams is from 10 to 85.
(59:5.17) In North America the amount of coal beds in the different strata, signifying the number of uplifts and subsidences of the earth, varies from ten in Illinois, twenty in Pennsylvania, and thirty-five in Alabama, to eighty-five in Canada. Fossil remains of freshwater and marine life are found in these coal seams.

Point 4. Coal deposition continues.
(59:5.19) 190,000,000 years ago there began a westerly expansion of the sea existing in the Carboniferous period in the territory of North America; this sea submerged the present-day Rocky Mountain region and formed an outlet to the Pacific Ocean through northern California. Layer by layer, coal continued to be deposited throughout the Americas and Europe as the coastal land rose and subsided in this age of coastal fluctuation.

Point 5. The Carboniferous period ends
(59:5.20) 180,000,000 years ago the coal period ended, during which coal was formed all over the world-in Europe, India, China, North Africa, and the Americas. At the end of this period of coal formation, a portion of North America was uplifted east of the Mississippi Valley, and much of this region has remained above sea level ever since. This period of land uplift marked the beginning of formation of the modern North American mountains, both in the Appalachian region and in the west. Active volcanoes existed in Alaska and California, and also in the mountain-forming regions of Europe and Asia. Eastern America and Western Europe were joining the Greenland continent.

Point 6. Climate Change
(59:5.21) The uplift of the land began to effect a modification of the maritime climate of the preceding ages, which began gradually to be replaced by a less mild and more contrasting continental climate.

Point VI. The Permian period - a transitional climatic period - the period of seed plants - an era of biological upheaval
(59:6.1) This period marks the end of the main evolutionary development of marine life and the beginning of the transition period leading to the subsequent ages of land animals.

Point A. 170,000,000 years ago - climatic changes

Point 1. Land uplift, mountain formation, glaciations and droughts.
(59:6.4) 170,000,000 years ago, evolutionary changes and adaptations covered the entire surface of the Earth. All over the world the land was rising and the ocean floor was sinking. Isolated mountain ridges appeared. Eastern North America was high above sea level; slowly rose the western regions. The continents were covered with large and small salt lakes and numerous inland seas that joined the oceans by narrow straits. Strata from this period are 300 to 2,000 meters thick.
(59:6.5) In the course of these uplifts of land, extensive folding took place in the earth's crust. This was the time of the appearance of the continents, 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.
(59:6.6) Inland lakes and seas gradually dried up all over the world. Separate mountain and regional glaciers began to appear, especially in the southern hemisphere, and in many areas ice deposits resulting from these local ice formations can even be met with among some surface and later coal deposits. Two new climate factors emerged: glaciation and aridity. Many uplands became dry and barren.

Point 2. Changes in the plant and animal world.
(59:6.7) Throughout this period of climatic transformations tremendous changes also took place among the land plants. Seed plants first appeared, thanks to which the nutrition of land animals improved, the number of which subsequently increased. Radical changes took place among insects. Diapauses occurred, representing periods of reduced activity in winter and during droughts.

Point B. 160,000,000 years ago - End of the Permian Period of the Paleozoic Era
(59:6.12) The vast ocean cradle of Urantia life has fulfilled its purpose. In the course of long ages, when the earth was not adapted to the support of life-until the atmosphere became sufficiently saturated with oxygen to sustain the

life of the higher developed land animals-the sea cared for and nourished the ancient life of this world. From this point on, the biological importance of the sea gradually declined, until the second stage of evolution began to unfold on land.

(60:0.1) For the era of exclusively marine life. The uplift of the land, the cooling of the crust and oceans, the contraction and subsequent deepening of the seas together with the significant increase of the land in the northern latitudes - all this had a huge impact on the change of the global climate in all regions far from the equator.

(60:0.2) The last epochs of the previous era were indeed the epochs of the frogs, but these ancestors of the terrestrial vertebrates were no longer the dominant group, and the number of the surviving population was sharply reduced. Only a small number of types survived the cruel trials of the preceding period of biological disasters. Even the spore plants practically died.