THE CAMBRIAN EXPLOSION pdf

1: Cambrian Explosion

The Cambrian explosion or Cambrian radiation was an event approximately in the Cambrian period when most major animal phyla appeared in the fossil record. It lasted for about 20 million years.

The Cambrian Explosion relates to an abrupt appearance of a wide range of organisms, mainly invertebrates, with hard fossilizable parts in Cambrian strata which mainstream scientists date from about million years ago. They were complex, well-developed organisms with many types of differentiated cells, and it is widely conceded that evolution of these organisms from unicellular precursors within such a short period of time is highly doubtful. Now, it can be granted that organisms without skeletons will leave few if any fossils, so it should not be too surprising if one evolving line were to appear suddenly in the fossil record. It is surprising, however -- at least within an evolutionary framework -- that such a wide variety of fossilizable forms should appear at more or less the same time. The number of radically different body plans which appear in such a very short period of geological time about 13 million years is greater than at any other. Accounting for the abrupt and sudden appearance of these organisms is one of the leading challenges in evolutionary biology. The Cambrian Explosion â€" Is it curtains for Darwinism? There are two principle options which are invoked in an effort to account for the sudden diversity: If they diverged at the beginning of the Cambrian then it does some way to explaining the absence of preceding fossils but then it remains inexplicable how the wide divergence of characteristics occurred so suddenly, i. If, on the other hand, they diverged considerably before the Cambrian era so as to allow for the divergence of various forms, then it is extraordinary that all the various lines should reach a fossilizable stage at much the same time. One example of a Cambrian-appearing organism is the sponge. There are four classes of sponges, all of which appear abruptly in the Cambrian. Despite a relatively unspecialized structure, the classes are distinct and difficult to relate to one another. There is no sign of intermediary fossils and there is certainly no consensus as to how they could potentially have evolved from a common ancestor. Despite their primitive form, the sponges are quite separate from the rest of the animal kingdom. Similarly, as far as the arthropods are concerned, the different subphyla of trilobites, horseshoe crabs and crustaceans arise in the Cambrian. Furthermore, the crustaceans are exceedingly diverse. All four major classes of the crustaceans and many lower taxa are found in the Cambrian; but, again, despite this multitude of fossils, no trace can be found of any transitional forms which would link the different groups to a common ancestor. One attempt to account for the Cambrian explosion involves the proposal that there was a substantial increase in oxygen about this time which stimulated rapid evolutionary progress -- but such a suggestion ignores the sheer improbability of biological macromolecules, whether oxygen is plentiful or not. The enigma is compounded because, not only do different phyla appear suddenly, but also -- within most of the phyla -- very distinct classes arise, again at more or less the same time. The Cambrian Explosion â€" Summary In summary, what is generally proposed, is the extraordinary coincidence that these diverse types of organism with their radically different skeletons all reached fossilizable stage within a relatively short period of time. The Cambrian explosion raises the kinds of questions that occur repeatedly regarding the fossil record. First is that major new types of organism appear suddenly and abruptly. Second, many different lines, exhibiting the same sort of significant development, arise about the same time. There exists such a radical diversity that it becomes implausible that they shared a recent common ancestor. It also seems unrealistic that the same sort of advance could have arisen independently in several lines, especially simultaneously.

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2: The Cambrian Explosion - Origin of Animals and the Cambrian Explosion - Science - The Burgess Shale

The Cambrian Explosion: For most of the nearly 4 billion years that life has existed on Earth, evolution produced little beyond bacteria, plankton, and multi-celled www.enganchecubano.com beginning about

Fossils of the Burgess Shale Most major animal groups appear for the first time in the fossil record some million years ago on the geological time scale in a relatively short period of time known as the Cambrian explosion. Of great worry to Darwin , the explanation of this sudden, apparent explosion persists as a source of numerous major debates in paleobiology. While some scientists believe there was indeed an explosion of diversity the so-called punctuated equilibrium theory elaborated by Nils Eldredge the late Stephen J. Gould - Models In Paleobiology, , others believe that such rapid acceleration of evolution is not possible; they posit that there was an extended period of evolutionary progression of all the animal groups, the evidence for which is lost in the all but nonexistent precambrian fossil record. Early complex animals in the Paleozoic may have been nearly microscopic. Apparent fossil animals smaller than 0. Much of the early evolution could have simply been too small to see, much less preserve. Modern molecular technologies genomics and other omics , through comparing nucleic acid and amino acid sequences across living species, are enabling the identification of genetic components and patterns stingily conserved by evolution, from those in which times of evolutionary branching of the tree of life can be inferred. The theory of the Cambrian Explosion holds that, beginning some million years ago, an explosion of diversity led to the appearance over a relatively short period of 5 million to 10 million years of a huge number of complex, multi-celled organisms. Moreover, this burst of animal forms led to most of the major animal groups we know today, that is, every extant Phylum. It is also postulated that many forms that would rightfully deserve the rank of Phylum both appeared in the Cambrian only to rapidly disappear. Natural selection is generally believed to have favored larger size, and consequently the need for hard skeletons to provide structural support - hence, the Cambrian gave rise to the first shelled animals and animals with exoskeletons e. With the innovation of structural support, the early Cambrian period also saw the start of an explosion in the size of many animals. The Cambrian Explosion is the outcome of changes in environmental factors leading to changes in selective pressures, in turn leading to adaptive diversification on a vast scale. By the start of the Cambrian, the large supercontinent Gondwana, comprising all land on Earth, was breaking up into smaller land masses. This increased the area of continental shelf, produced shallow seas, thereby also expanding the diversity of environmental niches in which animals could specialize and speciate. The debate persists today about whether the evolutionary "explosion" of the Cambrian was as sudden and spontaneous as it appears in the fossil record. The discovery of new pre-Cambrian and Cambrian fossils help resolve the debate, as these transitional fossil forms support the hypothesis that diversification was well underway before the Cambrian began. More recently, the sequencing of the genomes of thousands of life forms is revealing just how many and what genes and the proteins they encode have been conserved from the Precambrian. The explosion of external form the phenotype in the fossil record is what we see now, but more gradual adaptation was taking place at the molecular level the genotype. These researchers estimated arthropods diverged from more primitive chordates more than million years ago, and Nematodes from that lineage almost million years ago. They furthermore estimated that the plant, animal and fungi Kingdoms might have split split from a common ancestors almost million years ago. Finally, they conjecture that the basal animal phyla Porifera , Cnidaria , Ctenophora diverged between about and million years ago. If their research is valid, at least six major metazoan phyla appeared deep in the Precambrian, hundreds of millions of years before the oldest fossils in the fossil record. Such estimates of ancient divergence times could contain substantial error caused by uncertainty of the molecular clock assumptions, confounding effects of horizontal gene transfer, and errors in estimating sequence homology i. Consequently, attempts to date evolutionary branchings with molecular clocks have resulted in widely different estimates among researchers. Despite disparities of estimates of divergence times, broad concensus exists that the developmental control henes such as HOX genes for metazoan body plans was well established prior to the Cambrian. If so, what is called the Cambrian Explosion was the consequence of selective pressures acting on this pre-existing "genomic toolkit".

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Only in recent years has science determined that developmental regulation proceeds through a sequential activation of series of regulatory switches that, in turn, activate networks of other genes. These regulatory genes produce proteins that bind to and affect the activity of other genes. The protein products of these genes then activate still other genes, and the cascade continues building an animal cell type by cell type in a distinct order. The best studied regulatory genes are the Hox genes that are so highly conserved as to predate the appearance of animals. A facinating aspect of the Cambrian Explosion is its apparent speed over some 10 million years. From this it is reasonable to infer that expanded genomic complexity occured much earlier, perhaps over a billion years, prior to the morphological phenotype diversity that appeared in the Lower Cambrian. In recent years, research has shown that genomic complexity "happens" in many ways, including duplication and deletion of genes, cascades of genes, and, in complex organisms, entire chromosomes can be affected. Interesting also, is that such geneomic scrambling is an important mechanism in the etiology of cancers in animals. Genomic diversity is, of course, the stuff a toolkit on which natural selection operates. The more numerous and complex enviroments and ecosystems provided the varying selective pressures to amplify benefitial mutation genotypes within populations, prune detrimental mutations, and otherwise fine-tuning genomes to enhance survival. Such fine-tuning would be different in different ecological niches. Less well known is that the American state of Utah where similar Cambrian creatures are found. If fact, some researchers believe a larger number of species are to be found in the Wheeler and Marjum Formations of Utah than in the Burgess Shale, though the fossils of soft-bodied animals in Utah are far less abundant and limited to relatively few horizons. It is important to remember that geological history contains numerous periods of slow evolution punctuated by periods of rapid evolution, which Steven J. Gould called Punctuated Equilibrium. The rates of evolution generally depend on rates of selection, which in turn depend on rates of environmental change. It also depends upon the existing genomic diversity on which selection acts. Mutation rates tend to be slow and steady, and in the absence of environmental change, slowly accumulate in a population. It is selective pressure that weeds out the mutations that are detrimental or neutral to survival, and retains and applifies the mutations that are beneficial within a population. For a population isolated in a new environment, rapid selection can lead to speciation, and in the Lower Cambrian, to radically new forms that we now group in the Phyla of modern times occured to an unprecedented extent that has never since been repeated. The years ahead should see furtherance of knowledge of how and the timeline along which the Tree of Life branched, especially when proteomes of its many branches are unraveled. In fact, the Tree of Life is a metaphore for what is actual a forest of trees. Still, major mysteries are likely to persist, given the amazing ability of nature to splice, dice, reassemble, swap, amplify, and silence or re-use nucleid acid sequences within the genome of living organisms.

3: Cambrian Explosion | Definition of Cambrian Explosion by Merriam-Webster

The Cambrian Explosion and the Origin of Modern Marine Ecosystems. The rapid appearance of a wide variety of animals - particularly bilaterians - led to the development of radical new ecological interactions such as predation.

Compared to conventional fossil deposits, in which only the remains of more durable body parts are typically preserved, Burgess Shale-type deposits provide a much more complete picture of a normal Cambrian marine community. In modern marine settings, animals with mineralized body parts shells, carapaces, etc. This is also the case in most Burgess Shale-type deposits where the shelly assemblage usually represents a small percentage of specimens collected. Thus, without the fossilized remains of soft-bodied organisms, especially from the Burgess Shale, our knowledge of Cambrian ecosystems would be extremely limited. Similarities among various Burgess Shale-type deposits around the world suggest the deep marine ecosystem was geographically uniform and evolutionarily conservative from the Lower to at least the Middle Cambrian i. The characteristic assemblage of organisms is often referred as the Burgess Shale-type biota. Back to top Explaining the Explosion Why did the Cambrian explosion happen when it did, and why was it such a unique event? While there is no current consensus among scientists, most researchers agree the explosion cannot be ascribed to a single, simple causal mechanism. The potential triggers can be classified in three main categories: Deciphering the impact of each of these factors remains one of the most important challenges faced by palaeontologists today. Back to top Was there an Explosion at all? Very few organisms ever enter the fossil record; after death, their remains are usually completely destroyed and recycled. Animals with hard body coverings, such as trilobites, are much more likely to be preserved than those with only soft body parts. So the evolutionary development of mineralized shelly parts by different groups would be marked in the rock record by a sudden jump in fossil numbers. Thus, preservation bias alone could create the appearance of an "explosion" of new life forms at the beginning of the Cambrian. When he published On the Origin of Species in , Charles Darwin puzzled over the apparently sudden appearance of complicated organisms in the fossil record at the beginning of the Cambrian Period. He noted this could be used as an argument against his controversial new theory, which predicted a more gradual appearance of simpler organisms. At the time, Darwin pointed to the imperfection of the fossil record as his only defence, arguing complex animal life must have lived long before the Cambrian, but traces of that life had not yet been found. The presence of large, soft-bodied, putative animals problematic as they may be in Ediacaran seas does indeed make the "explosion" appear less abrupt. But the fact remains that the Early Cambrian was a time of major change in marine animal communities and environments, with the rapid and unprecedented advent of disparate new body plans and novel ecological niches. By the end of the period, every major animal phylum was firmly established, and life after the Cambrian was radically different from what had gone before. So it is safe to call this event an "explosion" - it was crucial to the evolution of life on Earth as we know it. Triggers of the Cambrian Explosion Environmental Explanations Before complex animals could evolve on Earth, there had to be an environment favourable for their survival. Researchers have examined a number of environmental factors that might have been instrumental in the evolution of new body plans, but the two strongest contenders are a rise in oxygen levels and the end of extreme glacial conditions. Oxygen Multicellular animals use oxygen to fuel their metabolism. Photosynthesis could have caused a rise in the amount of oxygen in the seas and atmosphere near the beginning of the Cambrian, allowing the evolution of larger, more complex animals with respiratory and circulatory systems. However, there does not seem to be much variation in oxygen levels across the Ediacaran-Cambrian boundary. Earlier increases might have triggered the evolution of large Ediacaran metazoans prior to the explosion, and a subsequent post-explosion rise in oxygen levels may have allowed animals to adopt more active, energy-intensive lifestyles such as swimming and hunting. Glaciation Another possible environmental explanation for why the explosion occurred when it did involves glaciers. Some researchers have suggested the entire Earth was covered with ice before the Cambrian explosion. This is known as the "Snowball Earth" hypothesis. The ice would have limited the number of evolutionary niches for life in the sea, and blocked most of the sunlight on which cyanobacterial mats and algae depend. But once the

glaciers receded, huge expanses would suddenly be opened for life: Unfortunately for the hypothesis, the last worldwide glaciation seems to have ended around million years ago - nearly 90 million years before the first signs of the Cambrian explosion in the fossil record which was followed by another major regional glaciation around million years ago. Even if there is no direct triggering link between Precambrian glaciations and the Cambrian explosion, the post-glacial period was a crucial time in evolution. The appearance of the first large and complex multicellular organisms shortly after the return to a warmer global climate suggests that environmental conditions had become ripe for them to evolve. Developmental Explanations Some scientists have argued there was nothing in the environment during the Precambrian-Cambrian transition that was particularly unique. For these researchers, the answer to the question "why did the Cambrian explosion take place when it did? According to this approach, life first had to evolve the ability to develop new and diverse body plans. Developmental genes in animals regulate how and when other genes operate to "build" the organism through its earliest life stages. Many important developmental genes are shared between widely-divergent animal groups. They are so closely shared that control genes from a lab mouse work perfectly well in a fruit fly. This conservation means those control genes must also have been present in the last common ancestor to both the fruit fly and the mouse. Very small changes in developmental genes can have a surprisingly large impact on the resulting organism. For instance, changes to the so-called hox genes in fruit flies can cause a fly to sprout an extra set of wings, or to grow legs where the antennae should be. From this, it could be argued that the fuse setting off the Cambrian explosion may have been ignited when the genome in the ancestor of all modern animals reached a level of complexity including the evolution of hox-like developmental genes sufficient to create radically new body plans. This would have provided more raw material for natural selection to act upon. Such genomic changes might have been in the making long before the Cambrian, perhaps giving rise to the Ediacarans through a novel developmental pathway that was never repeated after their extinction. Following the Cambrian explosion and the evolution of the body plans that we know today, large-scale developmental change seems to have been "locked" into place, and no new body plans have appeared since. Ecological Explanations The explanation of the Cambrian explosion may lie not in the wider environment, or in the controlling genes, but in the complex ecological interactions between animals. The explosion may be a result of co-evolution, with different inhabitants of the Cambrian ecosystem being "pushed" to evolve by changes within that ecosystem. For example, the emergence of predators might have stimulated the evolution of skeletalization including mineralized plates for protection, or swimming as a means of escape. Before predation became widespread, early "experiments" in different body plans could have briefly thrived because species interactions were probably more limited. Moving into previously-unexploited environments would allow even a poorly-adapted animal to survive, perhaps with one of the "exotic" body plans seen in the Cambrian. New ecological niches - particular spaces in the ecosystem occupied by species - would have been created by organisms interacting with the environment. Examples might include the evolution of zooplankton making organic material available for bottom dwellers, or the evolution of burrowing making new interactions with the sediment possible.

THE CAMBRIAN EXPLOSION pdf

4: Cambrian Explosion Disproves Evolution | Learn The Bible

The Cambrian Explosion was a dramatic burst of evolutionary changes in life on Earth. During the Cambrian Period, which began about million years, trilobites were the dominant species.

The new fossils appear in an interval of 20 million years or less. On evolutionary time scales, 20 million years is a rapid burst that appears to be inconsistent with the gradual pace of evolutionary change. However, rapid changes like this appear at other times in the fossil record, often following times of major extinction. The Cambrian Explosion does present a number of interesting and important research questions. It does not, however, challenge the fundamental correctness of the central thesis of evolution. This time is known as the Early Cambrian, and began around million years ago. This time interval is recorded by some spectacular fossil deposits that include superbly preserved fossils of these early animals. However, although different in certain ways, there are other times of very rapid evolutionary change recorded in the fossil recordâ€”often following times of major extinction. The Cambrian Explosion does present a number of challenging and important questions because it represents the time during which the main branches of the animal tree of life became established. It does not create a challenge to the fundamental correctness of the central thesis of evolution, the descent of all living species from a common ancestor. This important period in the history of life extended over millions of years, plenty of time for the evolution of these new body plans phyla to occur. Furthermore, the fossil record provides numerous examples of organisms that appear transitional between living phyla and their common ancestors. The ongoing research about the Cambrian period is an exciting opportunity to advance our understanding of how evolutionary processes work, and the environmental factors shaping them. The major animal body plans that appeared in the Cambrian Explosion did not include the appearance of modern animal groups such as: These animal groups all appeared at various times much later in the fossil record. However, they did include the basic features that define the major branches of the tree of life to which later life forms belong. For example, vertebrates are part of the Chordata group. The chordates are characterized by a nerve cord, gill pouches and a support rod called the notochord. In the Cambrian fauna, we first see fossils of soft-bodied creatures with these characteristics. However, the living groups of vertebrates appeared much later. It is also important to realize that many of the Cambrian organisms, although likely near the base of major branches of the tree of life, did not possess all of the defining characteristics of modern animal body plans. These defining characteristics appeared progressively over a much longer period of time. The fossil record is notoriously incomplete, particularly for small and soft-bodied forms. Some researchers argue that the apparent rapid diversification of body plans is an artifact of an increase in the rate of fossilization, due in part to the evolution of skeletons, which fossilize more effectively. In many cases these, often very tiny, mineralized structures are all that are found as fossils. There were major changes in marine environments and chemistry from the late Precambrian into the Cambrian, and these also may have impacted the rise of mineralized skeletons among previously soft-bodied organisms. For example, scientists are now gaining a better understanding of what existed before the Cambrian Explosion as a result of new fossil discoveries. Recent discoveries are filling in the fossil record for the Precambrian fauna with soft-bodied organisms like those in the Ediacaran Assemblages found around the world. Some of the new fossil discoveries, in fact, appear to be more primitive precursors of the later Cambrian body plans. The discovery of such precursors shows that the Cambrian organisms did not appear from thin air. Although the genetic divergence of organisms would have preceded the recognition of new body plans in the fossil record, accumulating genomic data is broadly consistent with the fossil record. Unanswered Questions The sudden change of the Cambrian Era was, in relative terms, not too sudden for the process of evolution. The changes during the Cambrian Era did not occur over decades, centuries, or even thousands of years; they occurred over millions of yearsâ€”plenty of time for evolutionary change. However, for millions of years beforehand, body plans of animals had remained relatively constant. Not until this time period did a significant change occur. The remaining questions are: What triggered the Cambrian Explosion? And why did so much change occur at this time? Several different theories address the origin of the Cambrian Explosion, proposing that dramatic

environmental changes must have opened up new niches for natural selection to operate upon. These proposals include the runaway glaciation theory,11 which proposes that glaciers briefly covered much of the earth, and the resultant loss of habitat created bottlenecks where evolution could act more rapidly. Another theory suggests that a change in atmospheric oxygen led to this sudden burst in evolutionary changes. These fossils provide valuable insight, particularly for envisioning the common ancestors of diverse groups. For instance, both vertebrates fish and echinoderms sea urchins, starfish are part of the group called deuterostomes. Without fossil evidence, it is hard to envision what a common ancestor would look like for these very different creatures. The Cambrian fossils are filling in the picture.

THE CAMBRIAN EXPLOSION pdf

5: Cambrian explosion - Wiktionary

The Cambrian Explosion - Summary In summary, what is generally proposed, is the extraordinary coincidence that these diverse types of organism with their radically different skeletons all reached fossilizable stage within a relatively short period of time.

See Article History Cambrian explosion, the unparalleled emergence of organisms between million and approximately million years ago at the beginning of the Cambrian Period. The event was characterized by the appearance of many of the major phyla between 20 and 35 that make up modern animal life. Many other phyla also evolved during this time, the great majority of which became extinct during the following 50 to million years. Ironically, many of the most successful modern phyla including the chordates , which encompass all vertebrates are rare elements in Cambrian assemblages; phyla that include the arthropods and sponges contained the most numerically dominant taxa taxonomic groups during the Cambrian, and those were the taxa that became extinct. The first life-forms were small and simple. Later forms were more complicated and diverse. The beginning of the Cambrian Period is marked by the evolution of hard body parts such as calcium carbonate shells. These body parts fossilize more easily than soft tissues, and thus the fossil record becomes much more complete after their appearance. Many lineages of animals independently evolved hard parts at about the same time. The reasons for this are still debated, but a leading theory is that the amount of oxygen in the atmosphere had finally reached levels that allowed large, complex animals to exist. Oxygen levels may also have facilitated the metabolic processes that produce collagen , a protein building block that is the basis for hard structures in the body. Other major changes that occurred in the Early Cambrian to million years ago include the development of animal species that burrowed into the sediments of the seafloor, rather than lying on top of it, and the evolution of the first carbonate reefs, which were built by spongelike animals called archaeocyathids. Life in the shallow regions of the seafloor, however, was already well diversified. This early aquatic ecosystem included the relatively large carnivore Anomalocaris, the deposit-feeding trilobites early arthropods and mollusks , the suspension-feeding sponges, various scavenging arthropods, and possibly even parasites such as the onychophoran Aysheaia. Thus, it seems likely that a well-developed aquatic ecosystem was already in operation in the ocean shallows by this time. Sketch of Anomalocaris canadensis. Members of the genus Anomalocaris were the largest marine predators of the Cambrian Period. Following the Cambrian Period, the biosphere continued to expand relatively rapidly. In the Ordovician Period Many marine species died off near the end of the Ordovician because of environmental changes. The Silurian Period As a result, pelagic predators such as nautiloids became abundant. Gnathostome fishes , the oldest craniates, became common near the end of Silurian times.

THE CAMBRIAN EXPLOSION pdf

6: The Cambrian Explosion

The Cambrian Explosion is the outcome of changes in environmental factors leading to changes in selective pressures, in turn leading to adaptive diversification on a vast scale. By the start of the Cambrian, the large supercontinent Gondwana, comprising all land on Earth, was breaking up into smaller land masses.

Backgrounder The Cambrian Explosion: For most of the nearly 4 billion years that life has existed on Earth, evolution produced little beyond bacteria , plankton , and multi-celled algae. But beginning about million years ago in the Precambrian, the fossil record speaks of more rapid change. First, there was the rise and fall of mysterious creatures of the Ediacaran fauna, named for the fossil site in Australia where they were first discovered. Then, between about and million years ago, another burst of diversification occurred, with the eventual appearance of the lineages of almost all animals living today. This stunning and unique evolutionary flowering is termed the "Cambrian explosion," taking the name of the geological age in whose early part it occurred. But it was not as rapid as an explosion: In order to be available to us, the remains of ancient plants and animals have to be preserved first, and this means that they need to have fossilizable parts and to be buried in an environment that will not destroy them. It has long been suspected that the sparseness of the pre-Cambrian fossil record reflects these two problems. First, organisms may not have sequestered and secreted much in the way of fossilizable hard parts; and second, the environments in which they lived may have characteristically dissolved those hard parts after death and recycled them. An exception was the mysterious "small shelly fauna" -- minute shelled animals that are hard to categorize -- that left abundant fossils in the early Cambrian. Recently, minute fossil embryos dating to million years ago have also been discovered. Life was flourishing long before the Cambrian "explosion". Laid down in the middle-Cambrian, when the "explosion" had already been underway for several million years, this formation contains the first appearance in the fossil record of brachiopods , with clamlike shells, as well as trilobites , mollusks , echinoderms , and many odd animals that probably belong to extinct lineages. They include Opabinia, with five eyes and a nose like a fire hose, and Wiwaxia, an armored slug with two rows of upright scales. The question of how so many immense changes occurred in such a short time is one that stirs scientists. Why did many fundamentally different body plans evolve so early and in such profusion? Some point to the increase in oxygen that began around million years ago, providing fuel for movement and the evolution of more complex body structures. Others propose that an extinction of life just before the Cambrian opened up ecological roles, or "adaptive space," that the new forms exploited. External, ecological factors like these were undoubtedly important in creating the opportunity for the Cambrian explosion to occur. Internal, genetic factors were also crucial. Recent research suggests that the period prior to the Cambrian explosion saw the gradual evolution of a "genetic tool kit" of genes that govern developmental processes. Once assembled, this genetic tool kit enabled an unprecedented period of evolutionary experimentation -- and competition. Many forms seen in the fossil record of the Cambrian disappeared without trace. Once the body plans that proved most successful came to dominate the biosphere, evolution never had such a free hand again, and evolutionary change was limited to relatively minor tinkering with the body plans that already existed. Gould emphasizes the role of chance. He argues that if one could "rerun the tape" of that evolutionary event, a completely different path might have developed and would likely not have included a humanlike creature. Morris, on the other hand, contends that the environment of our planet would have created selection pressures that would likely have produced similar forms of life to those around us -- including humans.

THE CAMBRIAN EXPLOSION pdf

7: The Cambrian Period

The "Cambrian Explosion" refers to the appearance in the fossil record of most major animal body plans about million years ago. The new fossils appear in an interval of 20 million years or less. On evolutionary time scales, 20 million years is a rapid burst that appears to be inconsistent.

Although molecular clock analysis has been invoked to propose that the Cambrian explosion is an artifact of the fossil record whereas the actual divergence occurred much earlier, the reliability of these estimates appears to be questionable. In an already familiar pattern, the relationship between the animal phyla remains controversial and elusive. It is evident at many different scales, from the obvious generation of morphologically distinctive groups to diversity in anatomical details. For instance, one might expect that complexity and sophistication of eyes improved through the Phanerozoic, but the recent discovery of exquisitely preserved eyes from arthropods in the early Cambrian Emu Bay Shale in Australia illustrates that highly advanced, compound eyes with more than 3, ommatidial lenses had evolved very early in the history of the clade. The Construction of Animal Biodiversity, , p. Despite half a billion years of evolutionary exploration generated in Cambrian time, no new phylum level designs have appeared since then. The Burgess Shale and the Nature of History, , pp. The Cambrian period thought to have started million years ago is a huge evolutionary enigma. Scientists at one time postulated that evolution of phyla took more than 75 million years. Even that period of time was vastly insufficient for this major evolutionary step. Now Darwinists believe that this happened in a few million years. Supposedly nothing but blue-green algae and bacteria lived for billions of years and then in a geologic instant all of the major types of animals sprung into existence! This has been called the Big Bang of Biology. The introduction of abundant organisms in the record would not be so surprising if they were simple. Why should such complex organic forms be in rocks about six hundred million years old and be absent or unrecognized in the records of the preceding two billion years? At the start of the Cambrian, about million years ago, animals burst forth in a rash of evolutionary activity never since equaled. Ocean creatures acquired the ability to grow hard shells, and a broad range of new body plans emerged within the geologically short span of 10 million years. Paleontologists have proposed many theories to explain this revolution but have agreed on none. The problem has led to what geneticist John F. Very big gaps, too. For example the Cambrian strata of rocks, vintage about million years, are the oldest ones in which we find most of the major invertebrate groups. And we find many of them already in an advanced state of evolution, the very first time they appear. It is as though they were just planted there, without any evolutionary history. Needless to say, this appearance of sudden planting has delighted creationists. Indeed the missing Pre-Cambrian record cannot properly be described as a link for it is in reality, about nine-tenths of the chain of life: Paul Chien is chairman of the biology department at the University of San Francisco. He has extensively explored the mysteries of the marvelous Cambrian fossils in Chengjiang, China. That means [there are] more phyla in the very, very beginning, where we found the first fossils [of animal life], than exist now. Gould, [a Harvard University evolutionary biologist], has referred to this as the reverse cone of diversity. The theory of evolution implies that things get more and more complex and get more and more diverse from one single origin. But the whole thing turns out to be reversed. We have more diverse groups in the very beginning, and in fact more and more of them die off over time, and we have less and less now. First, what evolutionary processes produced the gaps between the morphologies of major clades? Second, why have the morphological boundaries of these body plans remained relatively stable over the past half a billion years? Some modern Darwinists have suggested that the absence of primitive lifeforms below the Cambrian is not a problem for evolution. However, this difficulty was fully appreciated by Darwin and it has only become more acute since his days. Facts and Fallacies, , p.

8: Cambrian explosion | Define Cambrian explosion at www.enganchecubano.com

Cambrian explosion, the unparalleled emergence of organisms between million and approximately million years ago at the beginning of the Cambrian www.enganchecubano.com event was characterized by the appearance of many of the major phyla (between 20 and 35) that make up modern animal life.

Precambrian paleobiology is thrivingthe vast majority of all scientists who have ever investigated the early fossil record are alive and working today; new discoveries are being made at an ever quickening clip William Schopf The Cambrian explosion refers to the quality of the fossil record during the first 30 million years of the Cambrian Period roughly to million years ago. There were sponges, bryozoans, hydrozoans, brachiopods, and a few species of stalked echinoderms. The oldest fossilized bacteria date from about 3. Two billion years later algaeâ€"organisms with cells, a nucleus, and chromosomesâ€"appeared. Marine invertebrates with hard shells and skeletons of chitin or lime are more conducive to fossil preservation than soft-bodied creatures. Perhaps adding to the conditions that were conducive to preserving fossils during the Cambrian Period was the fact that most landmasses on the planet at that time were in the Tropics or the southern hemisphere. Before the Cambrian Period, life on earth had emerged but large animals had not evolved. One explanation for this is that respiration was not possible as there was not much oxygen content in the atmosphere and the oceans until the Cambrian. Another explanation is that the earth was a frozen snowball until about the Cambrian Period and that sudden melting brought about a "climate shock" that triggered the evolution of multi-cellular animals. There are other proposed explanations, as well. As Jerry Coyne notes: The staggered appearance of groups that become very different over the next million years gives no support to the notion of instantaneously created species that thereafter remain largely unchanged. If this record does reflect the exertions of an intelligent designer, he was apparently dissatisfied with nearly all of his creations, repeatedly destroying them and creating a new set of species that just happened to resemble descendants of those that he had destroyed. The fact is, the fossil record is imperfect. As Richard Dawkins notes: Eldredge and Gould proposed the theory of punctuated equilibrium on the belief that some of the gaps in the fossil record represent what actually happened: But even Eldredge and Gould recognized that some gaps many be due to imperfections in the record. Creationists love to quote Gould and Dawkins out of context. Christie Syftestad of Roseville writes that "Stephen Jay Gould himself admitted that fossil evidence completely contradicts natural selection" letter to the editor, Sacramento Bee, Dec. In his final published work, The Structure of Evolutionary Theory , Gould wrote that an important reason for writing the book was to present a tight brief for substantial reformulation in the structure of evolutionary theory, with all threads of revision conceptually united into an argument of different thrust and form, but still sufficiently continuous with its original Darwinian base to remain within the same intellectual lineage and logic Furthermore, unlike creationists and ID advocates, Gould was a scientist. The lack of fossil evidence from pre-Cambrian times did not mean it was time to give up science and bring in a god or some other magical being to wave his wand and create species individually just as it says in the Bible! No, Gould notes proudly that paleontologists have been scouring the appropriate sediments on earth for whatever evidence they might find of pre-Cambrian life: These large creatures up to a meter in length in one case, though most specimens occupy the range of centimeters to decimeters tend to be highly flattened in form, composed of numerous sections that seem to be "quilted" together certainly not segmented in any metameric way , and appear to possess no body openings. Although some researchers have sought the origin of a few bilaterian phyla within this fauna, the comparisons seem farfetched and many paleontologists regard the Ediacaran animals as an early expression of pre-bilaterian possibilities of diploblast design with modern cindarians and a few other groups surviving as a remnant of this fuller diversity , while other experts have regarded them as an entirely separate and failed experiment in multicellular life or even as a group of marine lichen! The creationists and ID advocates are anti-scientific propagandists. They assume that no amount of scientific investigation will ever produce more data of relevance to understanding the processes of evolution that have taken place over the past several billion years on this planet. Some of these pious frauds go so far as to claim that evolution is false and not scientific. Frank believes that a true scientist believes in the Bible and

appeals to a magical invisible being to do his science for him. If either Sherwin sibling actually read anything by Dawkins or Gould or an other evolutionary scientist they would have to lie their way to heaven if they tried to maintain that evolutionists are the ones who claim to have all the answers. This is the talk of a propagandist, not a scientist. What you gonna believe? It is the talk of a man who has no true interest in the magnificent and magical universe around him. It is the talk of a man who has an imaginary friend that allows him to stop thinking and dogmatically declare that he has all the answers so there is no need to investigate this wonderful world of living things any further.

9: Cambrian "explosion" - The Skeptic's Dictionary - www.enganchecubano.com

The Cambrian explosion From about to million years ago, an evolutionary burst of life forms occurred, often referred to as the "Cambrian Explosion." This marks an important point in the history of life on earth, as most of the major lineages of animals got their starts during the Cambrian Period and have been evolving ever since.

Many reputable and highly accomplished scientists at major accredited universities worldwide say it is an insurmountable challenge. Moreover, I believe it is proof that evolution is merely a widely held myth of popular culture. The Cambrian age in the geologic time scale is dated by scientists as being about million years old. What is really interesting is not just what is found in this layer, but what is found in the layers above it, and what is not found in layers under it. The Cambrian layer has virtually every phyla known to man. No evolutionary sequence here, they are all coexistent simultaneously. Layers Above and Below Remarkably the layers below the Cambrian have practically nothing with regard to fossilized specimens. The few creatures that are found in pre-Cambrian strata are all soft-bodied organisms like worms. So essentially you have nothing along the lines of organic complexity and diversity pre-Cambrian, and then suddenly everything. But wait, it gets even more interesting. To compound this huge problem the number of species fossilized in the layers above the Cambrian period gradually decrease with each successive layer. This is where that saying came fromâ€”hard scientific fact. A reasonable and honest person must conclude from the evidence that the fossil record is diametrically opposite what would be predicted by evolutionary theory. It is noteworthy that these conclusions are derived from a geologic time framework that is put forth by scientists own interpretation of geologic evidence. In fact, the belief that the strata represent different geologic ages is just that, a belief. Nevertheless, it is a belief held among scientists world-wide. Darwin Knew Darwin and his contemporaries were aware of this problem with the fossil record some years ago, but they believed that the fossil record had been insufficiently sampled up to that time. Exactly the opposite happened. After a century and half of excavating fossils from the strata we have found the problem to be worse, not better. Contrary to the tree of life depicted in the school books, the fossil record depicts exactly the opposite story. The tree of life is an inverted cone, and not a tree at all. No Correlation Remember, evolutionary theory states that everything evolved from a common ancestor that climbed out of the primordial soup. This ancient ancestor gradually evolved. Its evolutionary progress branched out into different paths and these different paths led to the creation of increasingly complex and divergent organic forms. The paths continued to branch out resulting in the great diversity of life we have today. Now, if this is true, what would you expect to see in the fossil record? Of course you would expect to see simple organisms in the lowest layers and a gradual increase in diversity and complexity of life as you progress to more recent layers in the geologic time scale. But what do we really find in the fossil record? We find the exact opposite. Not something ambiguous like everything found in each layer. No, you find the exact opposite of what is predicted by evolution. From a correlation perspective you do not find a factor of 1, meaning perfect correlation, or a 0, meaning no correlation, you find a -1, meaning perfectly uncorrelated to the prediction. This begs the question, how much proof do evolutionary scientists need anyway? How could they speak about this theory with such surety with such strong evidence to the contrary? They believe the theory in spite of the evidence. That is why many leading creation scientists keep referring to evolution as a philosophy of science or even a religion. This belief is so strong in academic circles that scientists are chided if they even question evolution publicly. Why are they ridiculed? They are ridiculed because the only alternative to evolution is creation. Some like to pretend there are a variety of options in explaining origins. This is simply not so. The options often presented are merely shades of the two primary options, and scientists know this. Conclusion If evolution did not take place, if the natural forces at work today did not create the diversity of life we see on our little blue world, then something supernatural must be responsible. True science seeks to understand, no matter what the philosophical or metaphysical ramifications may be. That is why evolution is not science, but rather a philosophy, for it seeks to explain things within only one possible framework, whether or not this framework is true. The significance of this great body of evidence against evolutionary theory in the fossil record cannot be stressed enough. It is utterly devastating to

evolutionary theory completely by itself. But in the final analysis, it is but one of a plethora of scientific facts that refute the 19th century fable that is evolution. In closing I would like to share with you some of my favorite quotes on the subject by leading evolutionary scientists, and even Darwin himself. By their own words they admit this very important piece of the evolutionary puzzle does not fit, and never will. I allude to the manner in which species belonging to several of the main divisions of the animal kingdom suddenly appear in the lowest known fossiliferous rocks. If numerous species, belonging to the same genera or families, have really started into life at once, the fact would be fatal to the theory of evolution through natural selection. Within just a few million years, nearly every major kind of animal anatomy appears in the fossil record for the first time The Precambrian record is now sufficiently good that the old rationale about undiscovered sequences of smoothly transitional forms will no longer wash. It is as though they were just planted there, without any evolutionary history. Needless to say, this appearance of sudden planting has delighted creationists. Why are the ancient body plans so stable? Will Hoyt Login or register to post comments Type.

THE CAMBRIAN EXPLOSION pdf

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