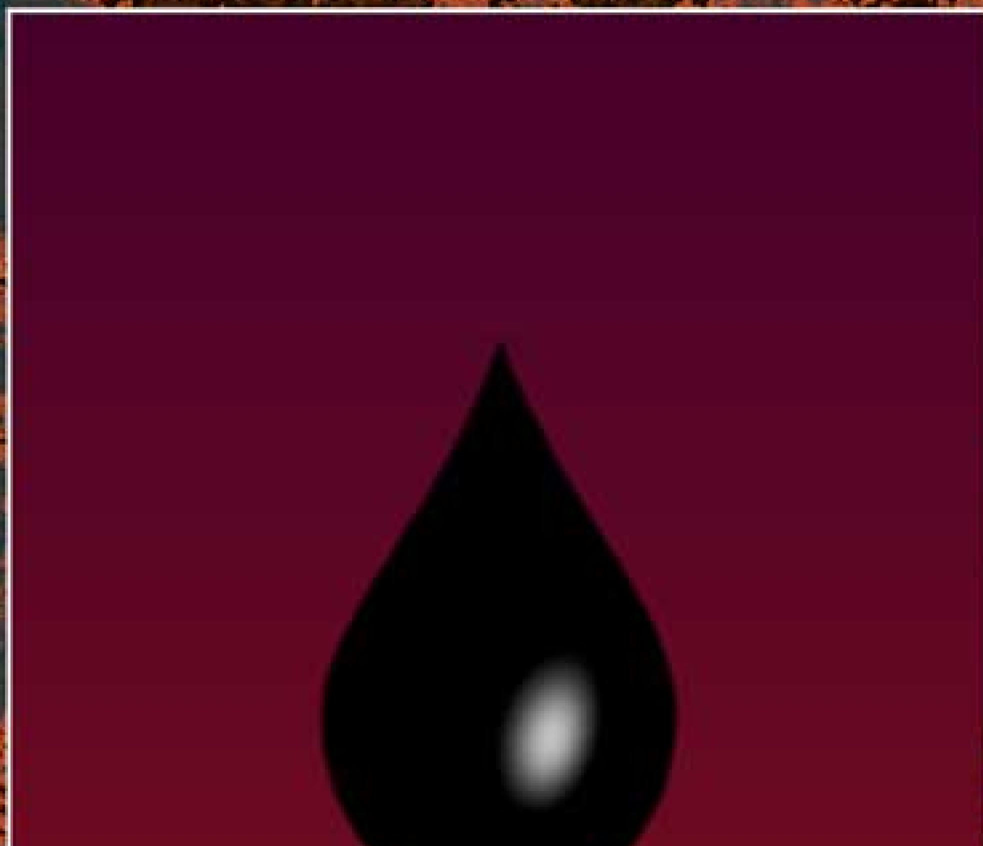
GENESIS AND THE

ORIGIN OF COAL & OIL



Trevor Major

GENESIS AND THE ORIGIN OF COAL AND OIL

by

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TABLE OF CONTENTS

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CHAPTER 1

INTRODUCTION

What is the origin of coal and oil? This is a hard question to avoid in our fuel-driven economies. In 1988, petroleum, natural gas, and coal accounted for almost ninety percent of U.S. total energy consumption. The so-called oil crisis of 1973 reminded us not to take our cherished private transportation for granted. New reserves, improved recovery techniques, and increased fuel efficiency have helped stave off the inevitable exhaustion of this finite resource.

Coal may take a distant second place to oil for many people, but it was an essential ingredient of the Industrial Revolution. Great railroads, rapid ocean transport, increased iron production, and factory modernization would not have been possible without copious supplies of coal. Today the demand for coal is greater then ever. It is cheaper to make electricity from coal than from natural gas or oil and, of course, coal (once converted to coke) remains a vital raw material in iron making.

Clearly, the science and technology of coal and oil discovery, extraction, and processing have reached dazzling levels of complexity. Huge multinational corporations expend billions of dollars merely to find and remove coal and oil in economic quantities. Petroleum geologists (the specialized scientists who work in this field) want to know everything about these precious substances. If they can discover their origins and history then maybe—just maybe—they can increase profitability and beat their competitors to new reserves.

ENTER THE BIBLE

The crisis for modern Bible believers is that the geologists' story of coal and oil formation does not mesh with a straightforward understanding of Scripture. If biblical chronologies and the Genesis accounts of Creation and the Flood are taken at face value, the world is very young. But as we will see, the standard textbook models assume that coal and oil take millions of years to form. Thick beds of coal and massive reservoirs of oil are supposed to represent the demise of plants, animals, algae, and other organisms over countless generations. Geological forces, working ever so slowly, buried these remains and transformed them into the fuels we hold so dear.

What, then, are we to do with coal and oil? One common response from Bible believers has been to reject their natural origins. After all, if coal and oil are not the end products of living things, then there were no extended cycles of life and death, and there is no problem with time. Coal and oil are in the ground, these people suggest, because God put them there for our use. Of course, this immediately raises a host of tricky questions. For a start, why did He not give us fuels that created less pollution? And what about the other bounties of creation? Did He create radioactive isotopes so we could make weapons? Did He give us lead so we could make white paint, and then create an industry to clean it away from our homes? This is not to say that the world was not created with humans in mind. That the Earth is well suited to intelligent life is a long-standing argument of theism. Yet it clearly is stretching the case to insist that every aspect of nature has a human-centered utility, or that humans always will use the provisions of creation in a God-ordained way.

Others have taken the argument in a slightly different direction. Coal and oil only look old, they suggest, because God wanted to confound the claims of the atheists. Any evidence for vast antiquity is a figment of the geologist's mind, nurtured by a desire to subvert the faith of God's people. This is reminiscent of times past when fossils were thought to be the work of the devil, or jokes, or freaks of nature, or failed experimental attempts of the Creator (Matthews, 1962, p. 146).

The problem with these denials is that they miss a very important point: the world as we know it is not the same as the world God created. The Earth has experienced tremendous cataclysms related indirectly to the actions of humankind. Specifically, the Genesis Flood represents a divine judgment by catastrophic inundation of water upon the world (Genesis 6:17). In all probability, any large-scale geological effects, such as deposits of coal and oil, would have to be explained by the Flood. Indeed, it is my contention that certain features of these deposits are explained better by the Flood than by the standard geological models.

WHAT DO WE HOPE TO ACHIEVE?

My purpose here is not to present a robust Flood model of coal and oil origins; such a model does not exist. Steven Austin has gone some way toward proposing a coal-formation model consistent with a worldwide Flood. New and improved ideas surely will emerge in the future. My intention is to show that the standard models are not without their problems, and that the Christian is not compelled to accept their conclusions.

Also, this book is not strictly a technical treatise. I wish to answer common questions about the origins of coal and oil in a way that the average person can understand. Some references are provided for those readers who want to pursue these subjects in more detail. Given those limitations, I have striven for accuracy, but I invite you, the reader, to point out factual errors.

THE CLASH OF WORLD VIEWS

Some critics of the biblical view of origins would dearly love believers to provide an alternative theory of Earth history. If a Flood model is better at explaining the data, and helps geologists find and extract coal and oil in a more rational, efficient way, then it would seem that this approach should replace the standard models.

However, most critics would reject this alternative theory for one crucial reason: it relies on the supernatural for its causation. No ordinary, natural process is sufficient to cause a recent, worldwide Flood. If such an extraordinary event is necessary to explain coal and oil deposits, then most modern geologists will reject it out-of-hand. Of course, if the Flood can explain these deposits, then we would have to apply it in almost every other aspect of historical geology. Further, if the alternative model is consistent with the biblical text, then the Christian claims for the divine inspiration and authority of Scripture may seem to be substantiated. The implications of accepting the Flood model are far-reaching indeed.

From the Christian perspective, even a seemingly great theory for the origin of coal and oil may become the target of ridicule and summary rejection. The misguided responses I noted earlier are typical reactions to this disheartening outlook. If Christians cannot advance a rational explanation, then why bother? An anti-science or anti-intellectual sentiment emerges among some believers who feel that scientists have "marginalized" their social status. The believers' input on almost any subject is trivial because it is based on invalid or meaningless claims (i.e., that there are supernatural causes). Science, they perceive, has become the exclusive playground of the naturalist who sets the following rules: the material Universe is all there is, and any claim must be verified by the five senses.

The ancient struggle between theists and naturalists is a struggle between world views. Each side has its own way of viewing reality and making sense of their life experiences. Scientists driven by a naturalistic world view simply are not disposed to accepting a supernatural component to any explanation of coal and oil. They are not satisfied by the claims of Christians (or theists in general) that there exists a God Who is able to involve Himself in human affairs.

HOW DID WE GET HERE?

The decision to remove the supernatural had an interesting effect on the science of geology in its early days. At one time, people were willing to allow several divinely caused catastrophic events in world history. But two hundred years ago, James Hutton suggested that the "present is the key to the past." He believed that the geological features we see on Earth today must be accounted for by the geological processes we see working today. If these processes worked as slow in the past as they seem to work in the present, he reasoned, then the geological record of the rocks must have taken millions of years to form. Not only were the laws of nature uniform in space and time, but they never could be interrupted by the action of a supernatural agent. This view came to be known as uniformitarianism. With God out of the picture, geologists could practice their science in the context of a naturalistic world view. Within fifty years, and largely due to the work of Charles Lyell, uniformitarianism came to dominate geology (for a summary, see Gould, 1987, pp. 119ff.).

This basic outlook has not changed. Certainly, modern geologists are more willing than their predecessors to allow regional or even global catastrophes. Who would have thought, twenty years ago, that scientists would propose a unique global cataclysm to explain mass extinctions and the demise of the dinosaurs? However, these are special cases. In their normal work, as they wander across the land with geological hammers in hand, most geologists still think in terms of uniform processes acting at uniform rates over vast ages.

So, there remains a broad gulf between the two sides. Geologists who operate by uniformitarian assumptions will tend to interpret the data accordingly. Those of us who subscribe to the Genesis flood believe that this unique event provides a far-reaching interpretive framework for geology. It is under that framework that I now would like to discuss the origins of coal and oil.

CHAPTER 2

ORIGIN OF COAL

The standard, uniformitarian process of coal formation begins in a swamp (Figure 1). In this water-saturated environment, dead mosses, leaves, twigs, and other parts of trees do not decompose completely. Instead, this plant matter becomes a layer of peat. At various intervals, the swamp may be covered by sand and mud when a river floods or when ocean levels rise. Under the weight of these sediments, the peat may lose some of its water and gases, eventually turning into a soft brown coal called lignite. With increasing pressures or temperatures, more water and gases are driven off, forming the common bituminous family of coals. Finally, high temperatures and pressures may cause bituminous coal to turn into a hard black coal called anthracite. As Figure 2 (next page) shows, an increase in rank represents an increase in the proportion of carbon within the coal.

Hypothetical evolution of peat from a Carboniferous swamp environment into coal: (a) Partially decomposed plant material accumulates slowly in a swamp. (b) More fragile plant tissues are destroyed, while woody material is preserved. (c) If the peat is buried under a thick layer of sediment, increasing pressures and temperatures will reduce water content and cause chemical and physical transformation of peat into coal.

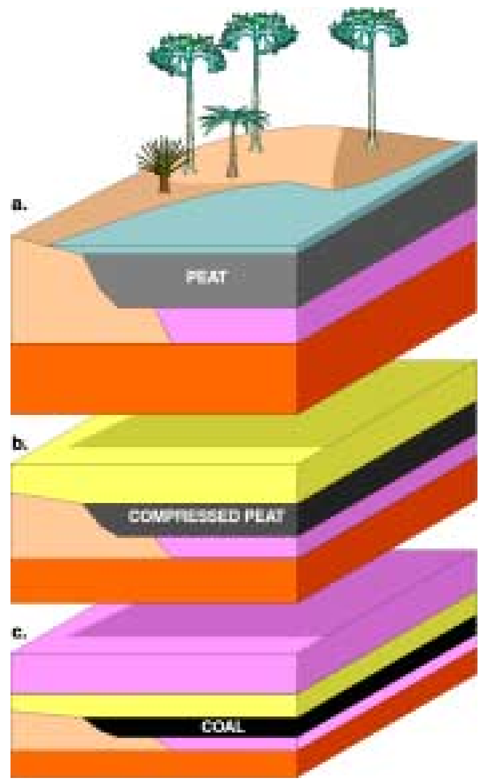


Figure 1

The type or rank of coal is thought to depend more on depth of burial than time. For example, it is possible to find lignite and bituminous coals that seem to have formed at the same time, but in different places. In other words, rank is not a good predictor of age.

CHALLENGES TO THE UNIFORMITARIAN MODEL

Evidences against the uniformitarian model of coal formation, and evidences for a catastrophic interpretation, are as follows: (1) the lack of gradation from one coal rank into another; (2) the great quantity and extent of coal deposits; (3) the type of fossils and plants associated with many coal deposits; (4) the evidence for the rapid and recent formation of coal in nature; and, (5) the evidence for the rapid and recent formation of coal in the laboratory. A final section will outline an alternative model from the creationist perspective.

Van Krevelen diagram shows the main groups of organic matter plotted as a ratio of hydrogen-to-carbon versus oxygen-to-carbon.

Vitrinite is the main component of most common coals, and is derived from lignin—the durable substance that provides physical strength for woody plants.

Increasing levels of heat and pressure change the physical and chemical properties of lignin. This produces the different ranks of coals shown on the diagram. Note that an increase in rank from lignite to anthracite represents a rise in carbon content relative to hydrogen and oxygen.

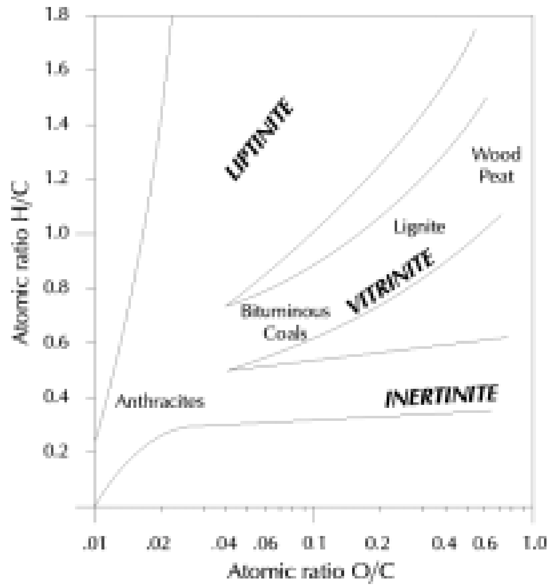


Figure 2

Coal Formation

If coal has formed from the gradual build-up and burial of organic matter in a swamp, we would expect to find some gradation in rank from the top of a coal deposit to the bottom. Theoretically, material in the lower sections has had more time to change, and has been under greater heat and pressure, than the material at the top. Carl Hilt noticed just such a change in European coal deposits, and in 1873 offered the following "rule" or "law": In a vertical sequence, at any one locality in a coalfield, the rank of the coal seams rises with increasing depth.

For example, in the Pie Rough borehole, which penetrated forty-two coals in 3,500 feet of strata, researchers found increases in carbon content and calorific (heating) value, and decreases in moisture and volatile content (Williamson, 1967, pp. 241-242). These four trends are consistent with an increase of rank with depth. Yet the change over this great distance spans only two adjacent subgroups—from low volatile bituminous coal at the top to semi-anthracite coal at the bottom.

Greater variations may occur laterally in a coalfield, with ranks changing gradually over several miles. The presumed cause of such variation is regional tectonic activity, such as faulting, folding, volcanism, and intrusions. These large-scale disturbances may bring extra heat or depth to one part of the coalfield, and cause an increase in rank in the affected area.

However, nowhere do we find a swamp in which peat is changing into coal. In the Waikato Valley of New Zealand, peat swamps lie over rocks containing sub-bituminous coal seams, but there is no subtle gradation between the two. By uniformitarian estimates, the coal preceded the peat by fifty million years (Schofield, 1978, 2:449), and the two deposits are related by nothing more than geography.

The making of coal, it appears, is a "threshold" process. That is, all the right conditions have to be in place before organic matter is turned into coal. Limited variations do exist, but they are within the system of coal ranks. Coal deposits appear in geological strata already formed, and do not show evidence of the presumed evolutionary pathway leading from a peat swamp. Certainly, a transformation from plant material to coal has occurred, but not in the way suggested by the uniformitarian swamp model.

Quantity of Coal Deposits

There is a problem with the proportions of coal deposits found on the Earth today. Theoretically, it takes 10 feet of plant matter to form one foot of peat, and 12 feet of peat to form one foot of coal (see Morton, 1984, p. 215). Williamson notes that the lower parts of modern peat deposits show considerable compaction, and that perhaps only five feet of peat are needed to form one foot of coal (1967, p. 221). Based on these figures, a coal seam 10-feet-thick would require 500-1,200 feet of plant matter, and a 200-feet-thick seam would require 10,000-24,000 feet of plant matter. A geologist holding to the conventional model would respond that this peat accumulated over long periods of time, given a suitable climate, a productive ecosystem, and a continually subsiding sedimentary basin. Still, hundreds of feet of plant matter or peat are **not** collecting in swamps today. Thus, we cannot explain coal formation if we maintain that the "present is the key to the past." W.G. Woolnough stated: "Again, nowhere in the world, at present, can accumulations of vegetable matter be found which are **quantitatively** commensurate with any of the major coal deposits of past geological time" (1971, p. 6). For example, a single seam belonging to the Pennsylvanian coals of the central and eastern parts of the United States covers an area of one hundred thousand square miles (Nevins, 1976, p. ii). There is no modern analogy if this was supposed to be an extensive freshwater peat swamp. Conditions favoring the production of thick sequences of plant matter that would, in turn, produce thick seams of coal, do not exist today.

Great deposits of coal seem to require the rapid, deep burial of immense quantities of vegetation. As we will see, this may be consistent with a turbulent worldwide Flood, which would have uprooted plants and buried them under a thick layer of sediments.

One objection voiced by Glenn Morton (1984) is that the quantity of carbon in the Earth's crust represented by coal and oil is hundreds of times greater than that which the pre-Flood biosphere could support. In other words, it seems that vast oil fields and extensive coal seams represent long periods of accumulation, not the sudden burial of all organisms that happened to be living on the Earth at any given time. Such huge accumulations would appear to be a problem for catastrophists, not uniformitarianists. Morton suggests, by way of a solution, that commercial deposits of coal and oil may have formed from, or at least been augmented by, the leakage of methane from the Earth's crust. More will be said on this theory in the following discussion on oil.

In a response directed specifically at these claims, John Woodmorappe (1986) criticized Morton's assumptions, and found his inorganic theory unnecessary. First, Woodmorappe points out that Morton estimated the quantity of carbon based on the mass of plants contained within a given area of tropical forest. However, tropical rain forests are not the most dense or productive ecosystems. For instance, almost twice the concentrations of plant matter are found in forests of the Pacific Northwest. Second, Woodmorappe points out that Morton neglected the contribution of peat deposits in the pre-Flood world. These may have contributed a significant proportion of organically derived carbon. It is possible that deposits of peat more than sixty feet deep could have accumulated in the sixteen hundred years between the creation and the flood, based on modern estimates of peat accumulation.

From this information, Woodmorappe concludes that all the world's coal (using Morton's figures) could be derived from peat covering just 1.27% of the Earth's surface—an area somewhat smaller than the island continent of Australia. Hence, there is no need to insist on millions of years of accumulation.

Composition of Coal

There is a problem with the type of plants and fossils found within coal deposits. If most coal formed from peat collecting in a swamp, then it should be dominated by the remnants of swamp-dwelling organisms. However, while some coal-forming plants may have tolerated wet ground conditions, many others required dry land (see Morton, 1984, p. 216). Further, many coal deposits contain the fossils of animals that lived in the sea. It then is suggested that these swamps were close to the ocean, and occasionally were inundated by tides and a rise in sea level. Again, most coal-forming plants were adapted neither to marine nor swamp environments (Nevins, 1976, p. i).

Rapid Formation of Coal in Nature

There are several indications that the process of making coal did not take millions of years. First, vertical tree trunks within coal deposits suggest that they must have been buried fairly quickly; otherwise, the exposed portion of the trunk would rot before preservation could take place (for examples, see references in Morris, 1974, p. 108).

Second, Robert Gentry's work on coalified wood from uranium-rich rocks of the Colorado Plateau and the Chattanooga Shale may show that the coal formed rapidly, and in relatively recent times. These rocks contain radiohalos—microscopic, spherical sites of alteration that are thought to be caused by the decay of radioactive particles deposited by water flowing through the wood before it was transformed into coal. One unusual group of halos created by the breakdown of uranium appears too young for the age assigned by uniformitarian geology. Analyses of the halos suggest that they are several thousand years old, not several million years old (Gentry, et al., 1976).

Another group of radiohalos has an elliptical shape (see Figure 3 below). It seems that these halos—formed by the breakdown of polonium over a period of six months to a year—were originally circular (a). Then, while the coalified wood was still reasonably plastic, they were squashed by the pressure of overlying sediments (b,c). Some of these halos are very unusual, however, in that they are superimposed by a second, circular halo (d). Apparently, about 20 years after the wood was compressed, the breakdown of an unstable variety of lead caused another halo to form in the same place. In Gentry's model, this means that the period of compression began, and ended, within a few decades after burial under many feet of sediment.

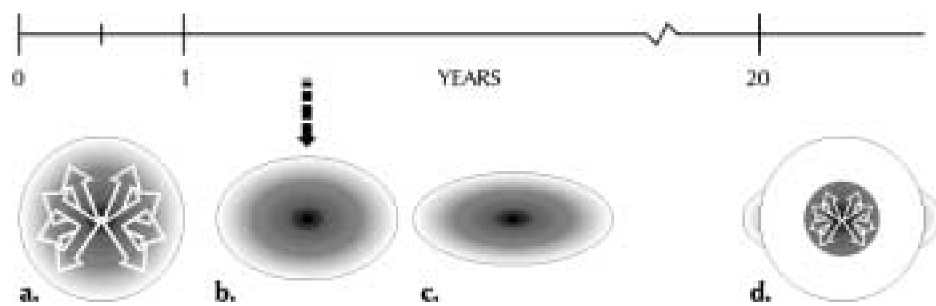


Figure 3. Gentry's Model of dual elliptical/circular halo formation in coalified wood (see text for description)

Further, the very existence of these polonium halos may suggest a rapid process of transforming wood into coal. This concept can be illustrated by considering a "kitchen bench" experiment. Make two bowls of jelly: one set, and the other one unset. Place a firecracker in the unset jelly and explode it. Apart from a sticky mess, you will see paper, unburnt gunpowder, and so on. After the jelly sets, you will probably see only the indirect effects of the explosion, that is, the remnants of a firecracker. Then explode a firecracker within the set jelly. Again, you will see the debris from the firecracker, but the crevices and holes within the jelly will be preserved. Now, leap from the kitchen to nuclear physics. If a radioactive particle disintegrates before soft wood can coalify, the effects of that disintegration will not be seen. Like the unset jelly, the soft wood will turn into coal without preserving a halo. However, if the wood turns into coal within a few days (or few weeks at most), then the evidence of polonium breakdown will be preserved.

Thus, Gentry has provided evidence which seems to show that this wood, and the sediments in which it lies, were: (a) buried quickly and in relatively recent times; and (b) transformed into coal and rock quite rapidly. Also, because these radiohalos are found in coalified wood from several different locations, and appear to have formed at the same time, then a single, widespread, catastrophic event seems to be responsible. As Gentry concluded: "This is exactly what would be expected on the basis of a near simultaneous deposition of all the wood at the time of the flood" (1986, p. 58).

Rapid Formation of Coal in the Laboratory

Various laboratory experiments have tried to generate coal in an artificial environment. For example, researchers at the Argonne National Laboratory conducted several experiments heating a selection of organic products at different temperatures and in a variety of conditions (Hayatsu, et al., 1984). By far the most successful tests subjected lignin to a heat of 150°C in the presence of clay over a period ranging from two to eight months in the absence of oxygen. After two months, the products had a chemical composition resembling lignite, and after eight months, the products had a chemical composition resembling bituminous coals (Figure 4).

Results of artificial coalification experiments represented on a van Krevelen diagram. Lignin, in the presence of clay, is heated at 150°C for 2, 4, 6, and 8 months (points 1-4, respectively). Comparison with Figure 2 shows a good match with the predicted transformation of plant matter in the coal series (after Hayatsu, et al., 1984, Figure 1).

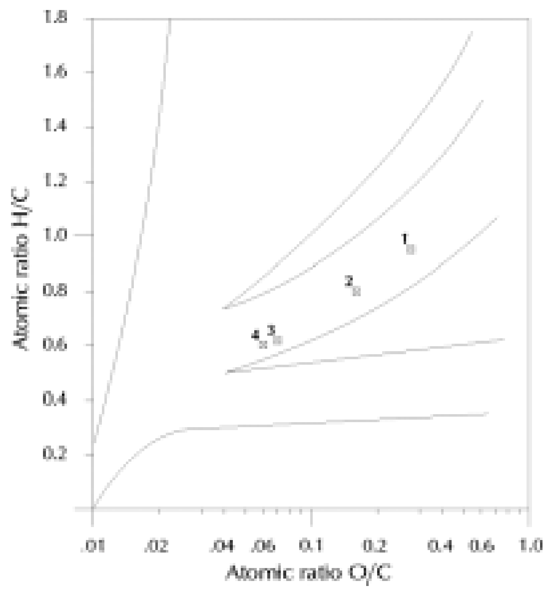


Figure 4

These experiments came very close to simulating natural conditions. First, lignin is an important component of wood fiber and is the primary component of coal. Second, clay is a significant inorganic constituent of coal, and coal seams often are associated with clay layers. As we will see in the next section, the association of clay with coal may support our alternative model. And third, a temperature of 150°C corresponds to a depth of burial we might expect for bituminous coals.*

A FLOOD MODEL

In his research on a Kentucky coal bed, Austin (1979) found evidence to indicate that many coal deposits did not form from the gradual accumulation of peat in freshwater swamps—for many of the reasons given in the previous sections. In an alternative model, he suggests that a raft of plant debris floating on top of a sea or lake could sink, be buried, and then be transformed into coal. Thus, the raw materials of coal did not collect in place, but were transported to the site of deposition. This would explain the occurrence of marine fossils and sediments in coal, and the size and composition of many coal deposits. Further, the "log raft" model is consistent with a catastrophic flood.

Possible support for this model came in 1980 with the eruption of Mount St. Helens. Within a few minutes, a blast 500 times as powerful as the Hiroshima bomb blew 1,500 feet off the side of the mountain, flattening trees for 15 miles around, and sending ash more than 60,000 feet up into the stratosphere

* Worldwide average geothermal gradients range from 24°C/km to 41°C/km (Miles, 1989, p. 65). A temperature of 150°C corresponds to a depth of 6.25 to 3.66 km (20,506 to 12,008 feet). R.P. Suggate has estimated that higher-grade bituminous coals form at these depths (see Williamson, 1967, Figure 19.5).

and around the Earth (*Science News*, 1980a, 1980b). Millions of trees were deposited in nearby Spirit Lake, forming a dense log mat over much of the surface. Many logs with an attached root system were found floating in an upright position, and an estimated 15,000 logs were partially buried in the lake sediments. Hence, it is possible that upright tree stumps found in many coal beds represent, not the remains of trees growing in a peat swamp, but the effects of a flood or similar disaster.

Further, bark and branches from these logs fell to the bottom of the lake forming a layer of peat. Accordingly,

> The Spirit Lake peat resembles, both compositionally and texturally, certain coal beds of the eastern United States which also are dominated by tree bark and appear to have accumulated beneath floating log mats.... All that is needed is burial and slight heating to transform the Spirit Lake peat into coal (Austin, 1986, p. 9).

Andrew Snelling and John Mackay (1984) have compared the findings at Mount St. Helens with two coal deposits in eastern Australia (the Pilot Coal Seams at Newcastle, New South Wales, and the Walloon Coal Measures at Oakleigh, Queensland). They report the following: remains of pine forests that could not have grown over peat swamps; layers of coal and volcanic material arranged in a similar fashion to the Spirit Lake deposit, including trees in apparent "growth position"; and possible evidence for the rapid transformation of wood into coal.

Compared to the Flood of Genesis 6-8, the Mount St. Helens eruption was but a minor disaster. Imagine, then, what might be achieved by the violence of the waters and "fountains of the deep" that wreaked havoc across the Earth in the days of Noah. Indeed, the evidence from many existing coal deposits, the modern analogy from Spirit Lake, and the "log raft" model all provide a way to explain coal in terms of a young Earth and the Genesis Flood.

CHAPTER 3

ORIGIN OF OIL AND NATURAL GAS

Oil has no equivalent to the relatively straightforward “swamp model” of coal formation. Indeed, scientists still are debating whether oil has a biological or a non-biological origin. Most petroleum geologists believe that oil is derived ultimately from living organisms, and scientists are having some success in finding such a connection (e.g., Moldowan, et al., 1990). Unfortunately, the destructive effects of heat and chemical reactions deep in the Earth make it difficult to confirm this theory. Distinguished astrophysicist Thomas Gold is one man who thinks oil has a non-biological origin. He suggests that oil and gas formed from methane in the early part of Earth’s history. However, his greatest hope—a 21,000 feet deep, $40 million hole in Sweden—has turned up dry (Kerr, 1990).

Part of the problem in explaining the origin of oil is its diversity. Oil has been found in many different geological situations, and its chemistry varies from place to place. Yet there is this one common factor: oil always is found in or near sedimentary rocks of marine origin (Brownlow, 1979). For this reason, it usually is thought that oil comes from the remains of countless dead plants and animals that collected on an ancient seafloor. This organic matter was then buried under thousands of feet of sediment and converted by heat and chemical reactions into various kinds of hydrocarbons (compounds of hydrogen and carbon)—collectively known as crude oil or petroleum (Figure 5). With increasing burial and heat, the heavyweight parts were broken down into methane and light hydrocarbons—collectively known as natural gas.

Van Krevelen diagram showing the path of three different organic sources (kerogen types I-III) as they are subjected to increasing pressures and temperatures. Oil forms primarily during catagenesis, while natural gas forms primarily during later catagenesis and metagenesis.

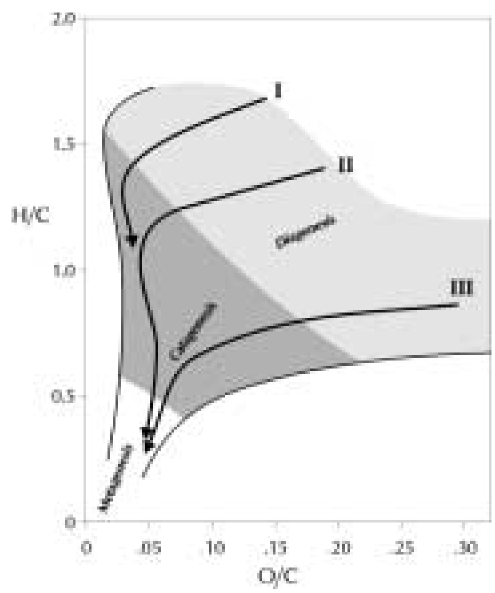
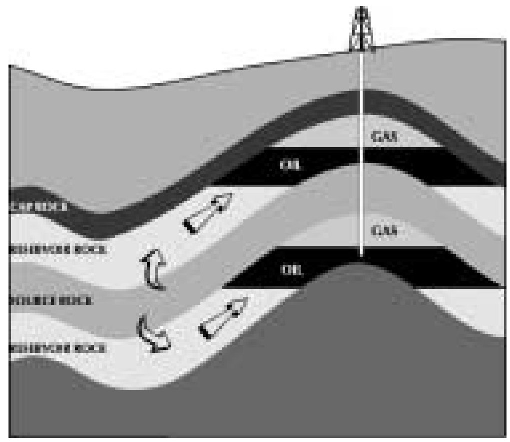


Figure 5

Two other steps are necessary to explain the huge oil fields found in certain parts of the world. First, oil and gas must migrate out of the original source rock into a reservoir rock that can hold the oil in its pores and crevices. Second, there has to be some barrier, such as an impervious rock, which will stop oil from leaking to the surface and keep it under pressure. [The dribble of oil from Jed Clampett’s musket shot into a swamp may get him to the local lube bay, but not Beverly Hills.] In their unending search for oil, exploration geologists try to find special formations that would favor the accumulation of oil. One such formation, called an anticline, is often a good place to look because oil and gas can pool in the uppermost part of the arch-shaped fold (Figure 6).



Migration and accumulation of hydrocarbons in an anticlinal formation (i.e., where folds in rock strata allow oil and gas to accumulate)

Figure 6

Clearly, in the uniformitarian scheme of things, oil takes millions of years to form. First, time is needed for sufficient quantities of organic matter to collect in the sediments of the seafloor. Second, time is needed to bury these sediments under a sufficient thickness of rocks to produce the pressure, and thus the heat, needed for the transformation of biological substances into petroleum. Third, time is needed for this transformation to work. And fourth, time is needed for oil and gas to migrate and collect in suitable reservoirs. The first two stages, at least, are assumed to take place over a period of several million years. Dating of source rocks by conventional geological methods is supposed to reinforce the idea of an ancient origin for most oil deposits.

ALTERNATIVES TO THE UNIFORMITARIAN MODEL

Thus far, little work has been done by creationists to explain the origin of oil and gas within a general interpretive framework (i.e., a framework similar to the theory of coal formation proposed by Austin). However, various creation scientists have addressed certain aspects of petroleum geology from the perspective of a young Earth and a global Flood.

Inorganic Origin

Some scientists see the quantity of oil as a real problem for the young-Earth model. In this regard, creationist Glenn R. Morton (1984) argues that the total amount of carbon found in the world's petroleum deposits is significantly greater than the amount of carbon contained in all the plants and animals that lived before the Flood. In other words, there is not enough organic matter to make all the world's known oil reserves in a single, short-lived, catastrophic Flood.

To overcome this perceived difficulty, Morton proposes an inorganic origin for oil. Unfortunately, while his arguments are interesting, his model is based on Thomas Gold's methane out-gassing idea. As we have seen already, Gold's model is now suffering from a severe lack of credibility. This is not to say that an inorganic origin, or an inorganic means of enhancing oil production, should be eliminated out-of-hand. Nonetheless, most of the evidence points toward a primarily organic origin.

Once again, John Woodmorappe (1986) responds that existing quantities of oil can be explained in terms of the Genesis Flood. While Morton estimates that there are approximately 2×10^{20} grams of petroleum carbon in the Earth's crust, Woodmorappe shows that this is only one hundredth of the estimated 2×10^{22} grams of organic carbon in the sediments of the modern seafloor. He concludes: "If any combination of the carbon in the antediluvian oceans and that mobilized during the flood totaled only 1% of the present oceanic amount, the high value [of Morton] for global oil would be immediately satisfied" (1986, p. 206). In other words, there is no problem in finding enough organic matter in the pre-Flood world to make huge quantities of oil.

Note the similarity between (a) Chlorophyll and (b) porphyrin—a suggested breakdown product. During diagenesis (see Figure 5), a metal such as iron or magnesium in the nucleus of the molecule is replaced by nickel or vanadium.

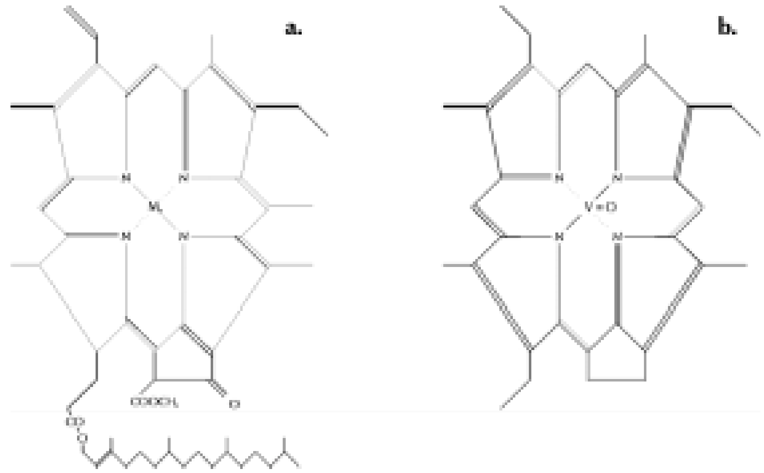


Figure 7

Organic Origin

David McQueen (1986) shares with most creationists the belief that oil was formed by the sudden burial of plants and animals in the violent waters of the Flood. As noted earlier, direct evidence for this biological origin is difficult to obtain. Most of the evidence rests on the possibility that various organic substances can be transformed into the sort of compounds found in crude oils. For example, chlorophyll *a*, which occurs in nearly all photosynthetic cells, is structurally similar to porphyrin, a common ingredient of sedimentary rocks and crude oil (Figure 7). For this reason, scientists conclude that porphyrin represents a “chemical fossil” of chlorophyll *a*. Porphyrin also is associated with heme (Russell, 1960, p. 25), a component of hemoglobin found in the red blood cells of all vertebrates and many invertebrates.

One feature of organic compounds is that they are broken down quickly in aerobic (oxygen-containing) conditions. This occurs because: (a) they react with oxygen; and (b) many organisms effective in the decomposition of organic matter live aerobically. As a result, geologists favor the sort of oxygen-poor conditions found in quiet areas of the seafloor with little circulation to accumulate organic remains (see, also, the introductory remarks on oil formation). The premature decay of porphyrin can be avoided, therefore, if it builds up slowly in an anaerobic (oxygen-free) environment.

However, slow accumulation is not the only way to avoid the effects of oxygen. If sediments can accumulate rapidly, then organic matter is isolated immediately from aerobic conditions. This alternative approach is taken by McQueen. He suggests:

> If a “high sedimentation rate” will preserve organic material, a catastrophic sedimentation rate, such as we envision for the worldwide Flood, would uproot, kill, and bury organic material so rapidly as to cut the porphyrins off from oxidizing agents which would destroy them in the ocean water (1986, p. iii).

As evidence for his argument, McQueen then points to the wide distribution of porphyrins in sediments and crude oils, and experiments which show that porphyrins can be produced from chlorophylls in a matter of hours. This catastrophic alternative shows that chemistry of oil does not have to be explained from a uniformitarian point of view.

Rapid Formation of Oil in Nature

Scientists have discovered what would be considered very young oil forming in the Guaymas Basin (Didyk and Simoneit, 1989). This 6,500-feet-deep trench in the Gulf of California is covered by a 1,500-feet-thick blanket of olive green ooze [yes, that is the technical name for these deposits] formed from the remains of billions of tiny planktonic organisms. It appears that hot, geothermal waters percolating through the ooze are converting this organic material into oil and gas. Radiocarbon dating shows that the oil is less than 5,000 years old, and may be only a few years old.

The Guaymas discovery bears strongly on the Flood model for at least two reasons. First, it shows that oil can form naturally in a short period of time, rather than over millions of years. Correspondingly, the Flood model proposes a short-lived, catastrophic, geological event within relatively recent history. Second, it shows that heated water can generate oil at a greater rate than the heat provided by mere burial. Correspondingly, flood geology often includes the suggestion that the biblical "fountains of the deep" were equivalent to volcanic and geothermal emissions. However, rapid burial of organic matter and accumulation of sediments still would be required to preserve the vast deposits of oil and gas we see today.

This find should not be embraced uncritically. It is necessary to establish that the percolation of hot waters through organic-rich sediments can provide a significant mechanism for the formation of the world's oil reserves. Unfortunately, hydrothermal activity usually is associated with igneous rocks (e.g., granites, basalts, etc.), yet these rarely are found in close proximity to oil-bearing strata. As noted earlier, oil has a consistent association with sedimentary rocks of marine origin, which seems discouraging if such a mechanism is to be incorporated into a Flood model. However, one suggestion might be to speculate that the opening of the fountains of the deep was a general, widespread release of the Earth's inner energy onto its surface, and was not always confined to geysers, volcanoes, hot water springs, and other discrete emissions. Indeed, John Baumgardner's model of global crustal movements during the Flood involves the rapid addition of new, hot, ocean crust (1990, 2:36). This heat could drive the conversion of organic matter into hydrocarbons.

Another potential problem in making our analogy lies in compositional differences. Simoneit points out that the chemical range of hydrocarbons from the Guaymas Basin does not coincide exactly with those of typical crude oils (1993, pp. 400-408). However, the Guaymas deposits derive primarily from one organic type (i.e., the remains of planktonic bacteria and algae), whereas in most sedimentary basins, or even in a chaotic flood, we would expect organic matter to come from a variety of sources. Further, these oils are extremely young and were formed at very shallow depths, and so have not experienced the same pattern of migration and accumulation that we infer from most oil deposits (see, for example, Figure 6). Still, with minor exceptions, "the bulk of this oil is compositionally the same as conventional crude oil" (Simoneit, 1993, p. 400).

Despite some reservations, this writer agrees with Andrew Snelling, who concluded: "...[T]his model for hydrothermal generation of petroleum is more than a feasible process for the generation of today's oil and gas deposits in the time-scale subsequent to Noah's flood as suggested by creation scientists" (1990, p. 34).

Rapid Formation of Oil in the Laboratory

Various attempts have been made to produce oil under laboratory conditions. This has been done to investigate the origin of oil, and to explore the possibility of making synthetic oil when current reserves are depleted.

Many experiments have produced petroleum compounds, crude oil, and oil-like substances in relatively short periods of time. This, at first, would seem to provide good evidence for the rapid production of oil. However, there is always a question concerning the difference between experimental conditions, and the "true" geological setting and time required to generate oil. In other words, how can a few pounds of organic matter, subjected to heat and pressure in a sealed capsule for a few hours or days, match the conditions expected in nature?

Researchers Saxby and Riley (1984) tried to circumvent this problem by conducting their experiments over a period of six years. They placed oil shales and brown coals, both of which are source rocks associated with the production of oil and gas in nature, into two sets of six stainless steel pressure cooker-like devices. Beginning at 100°C, they raised the temperature by one degree per week over a period of 50, 100, 150, 200, 250, and 300 weeks, analyzing the contents of the ovens at 150°C, 200°C, 250°C, 300°C, 350°C, and 400°C, respectively. This was intended to simulate the burial of source rocks under hundreds of feet of sediment per week.* After 200 weeks, that is, in less than four years, the shale produced a substance "indistinguishable from a paraffinic crude oil," while the brown coal produced a "wet natural gas."

This experiment confirms the origins of crude oil and natural gas "by showing that slow chemical processes, under the right conditions, can generate hydrocarbons like those found naturally" (*Science News*, 1984). However, a uniformitarian interpretation is confirmed only given the assumption that a rise of one degree is equivalent to the deposition of sediments over hundreds of thousands of years. If it is assumed that a thick sequence of sediments could accumulate in a matter of months, as the Flood model proposes, then the experiment still would work. Indeed, the virtual lack of dependency on "geological time" is confirmed by those involved in the project:

> In many geological situations much longer time intervals are available but evidently the molecular mechanism of the decomposition is little changed by the additional time. Thus, within sedimentary basins, heating times of several years are sufficient for the generation of oil and gas from suitable precursors (Saxby, et al. 1986, 9[2]:80).

Similar experiments by Lewan (1993) reached peak oil production after 72 hours at temperatures between 330°C and 350°C. The composition of oils expelled from the organic-rich rock samples fell well within the expected range of natural crude oils. The simulated oils differed mainly in having a relatively high proportion of non-hydrocarbons, such as nitrogen, sulfur, and oxygen. This also characterized the Guaymas Basin oils. In both cases there has been rapid, intense heating, and a lack of migration and accumulation. Indeed, it is possible that the proportion of non-hydrocarbons would diminish in natural conditions after the oil had moved through, and collected in, rock layers. So, despite the limitations of these experiments, it is clear that oil can form within a relatively short period of time.

SUMMARY

While much detail needs to be added to the Flood model of oil and gas formation, an initial study of the problem finds much hope for a reasonable solution. Observations in both nature and the laboratory suggest that oil can be formed fairly rapidly, and does not have to be millions of years old. Further studies are needed to relate unique deposits (i.e., those in the Guaymas Basin) and experimental procedures to hydrocarbon deposits throughout the world, with special attention to their geological contexts.

Ultimately, it is only within an assumption of uniformitarianism that a thick sequence of suitable sediments must accumulate over vast geological ages. In the Flood model, we would expect sediments to build up very quickly, producing the minimal temperatures and pressures needed to begin oil formation. We would expect that these sediments would contain rich concentrations of organic matter from the catastrophic death of plants, animals, and other organisms. In these conditions, as opposed to the uniformitarian model, there would be little opportunity for oxygen and scavengers to break down organic matter, which would prevent oil formation in the first place. Finally, we would expect higher temperature regimes from massive tectonic movements, which would further accelerate the rapid transformation of organic matter into oil.

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* Flood geologists have no problem with the rapid accumulation of sediments represented by an increase of 1°C per week. However, under uniformitarian assumptions the 200-week duration of the experiment would translate into a period of 5 million to 240 million years.

CHAPTER 4

POSTSCRIPT

One reaction to the uniformitarian challenge is to capitulate to the naturalism of Hutton and Lyell, and thereby compromise or abandon a conservative interpretation of Scripture (e.g., Young, 1982). Another approach, while having good intentions, also fails to consider the proper relationship of science and Divine Revelation. Specifically, people have suggested to this writer that fossils, coal, and other geological features look old because God made them that way. These efforts to invoke God indiscriminately wherever there is a gap in our understanding about nature are bound to cheapen both God's creation and His Word.

Yes, it is true: that God created the world in a mature state—with apparent age, as it were (see Major, 1989); that the trees were fully formed and bearing fruit (Genesis 1:12); and, that man and the animals were able to go forth and multiply as God commanded them (Genesis 1:22,28). So it is possible that God could have created coal and oil in the rocks of the world for the benefit of mankind, and He certainly had the power for this feat. However, it also is true that God sent forth a great Flood to destroy all life on Earth "wherein is the breath of life" (Genesis 6:17). And it is true, as we have just observed, that there is much evidence to indicate that plants, animals, and other organisms became the source for much of the world's coal and oil. Therefore, to say "God just did it" brings us close to suggesting that God may be deceiving man into thinking that coal and oil were formed from a catastrophic burial, when they really weren't. Further, to say "God just did it" is to deny that coal and oil deposits offer remarkable evidence for His watery judgment of sinful man (Genesis 6:5-7).

Perhaps we can learn this lesson by looking at Nicolaus Steno—a naturalist of the seventeenth century with a special interest in geology. Steno often is acclaimed as a man who rationally applied the scientific method, despite the supposed ignorance of those pre-modern times (cf. Gould, 1987, pp. 51ff.). Yet, a hundred years before James Hutton took God out of geology, Steno happily interpreted the rocks of Tuscany in terms of a recent creation and the Flood of Noah. As far as Steno was concerned, "nature supplements Scripture, or neither provides an answer, but in no instance does nature suggest one thing and Scripture another" (as quoted in Lindberg and Numbers, 1986, p. 146).

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