Table II. Pollen Grains Collected using The Fly-Shield Rotobar Apparatus.

Experiment Number	Date	Elapsed Time in Hours	Number of Pollen Grains per 1.5 cm² of Tape
11	November, 1970	6	2
12	11-16-70 to 11-18-70	40	3
13	2-13-71 to 2-14-71	23.5	318

only five pollen grains total were collected in a period of 46 hours. It can be properly argued here that November in Southern California is a relatively pollen-free period. It was decided thereafter to sample during daylight hours and to add laboratory grease to the strips of sticky tape.

Using this modified sampling procedure (Experiment 13, Table II) 318 pollen grains appeared on both tapes after a 23.5-hour period in February. Thus the fly-shield rotobar data are similar to the gravity data in that both the cloudy, non-breezy days of Autumn (Experiments 11 and 12, Table II) and the non-breezy days of Summer (Experiments 1 - 3 and 6) showed very low numbers of pollen grains contaminating exposed slides. During breezy days, however (Table I, Experiments 4 and 5), as well as during the breezy days of Spring when oak trees were pollinating (Table 11, Experiment 13), larger numbers of pollen grains were collected.

Conclusions

The pollen grains of the Monterey pine in this present study were quite unlike those shown in Plate IV of Burdick's 1966 paper illustrating the spores found in Precambrian Hakatai shale. Thus whatever they may be, these later spores are certainly not due to contamination from modern pine plants. Although Burdick portrayed 31 different pollen grains in his two papers (1966 and 1972), Chadwick (1981, p. 10) matched only five of these with modern representative pollen grains.

In these experiments we do not deal with the possibility that the Hakatai shale rocks somehow became contaminated with modern pollen grains during the long time interval after the rocks formed (lithification) and before our samples were extracted. We will discuss that in a future paper.

The present results do not prove that all the grains found on recent slides (Howe *et al.*, 1986) or Burdick's slides (1966 and 1972) were deposited during the formation of Precambrian rock: but they do demonstrate that the chance of contamination by airborne pollen during the slide preparation stage and during periods of field work is extremely low. It would seem, as well, that Chadwick's overwhelming concern (1981) with contamination when preparing and examining slides is unjustified. Evidently whatever pollen might blow into a laboratory on a windy day quickly settles to a desk top or floor where it sticks. It would seem, as well, that reasonable care in cleaning the table, the slides, and the cover slips would make positive pressure and filtered air supplies an unnecessary precaution during the processing of the rocks and analysis of slides.

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COMETS AND CREATION

PAUL M. STEIDL*

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Abstract

It is well known that comets are fragile objects and cannot exist in the inner solar system for more than a few hundred revolutions around the sun. Naturalistic theories for their creation and maintenance are shown to be inadequate to explain their continued existence if the solar system were really old. Evidences for a young age for comets are presented.

Introduction

Comets have long been a weapon in the creationist arsenal. They are by nature short-lived objects; their lifetimes while in the inner solar system are measured in the thousands of years. Their continued existence, therefore, is evidence for the youth of the solar system. Of course, astronomers are aware of the problem and have devised a number of models of cometary origin in an effort to explain how we can continue to observe comets in a solar system which is supposed to be about

*Paul M. Steidl, M.S. receives his mail at 17126 11th Place, West, Alderwood Manor, WA 98037.

five billion years old. This paper is an examination of those theories to see if they are adequate to explain comets.

Astronomers have particular reasons for wanting to study comets. Comets spend most of their time away from the sun where there is not much to cause changes in their structure or composition over the years. Astronomers believe that most comets are in a cloud tens of thousands of astronomical units from the sun in a sort of cometary deep freeze. Because of this, scientists expect comets to be basically unchanged since their formation. They expect evidence from comets concerning how the solar system was formed, or more correctly, to confirm their theories about the evolutionary nature of the origin of the solar system. In fact, there are even some who say that comets may hold the key to the start of evolution of life on earth. Thus it is in their interest for comets to be as old as they believe the solar system to be. Most astronomers therefore, believe that comets were formed at the same time as the rest of the solar system billions of years ago (Donn and Rahe, 1982, p. 219).

Comets Are Short-Lived Objects

Comets are short-lived objects for two reasons: 1) they lose much of their mass each time they approach the sun, and 2) their orbits are dynamically unstable. The following quote from a paper by two astronomers, Carusi and Valsecchi (1958, p. 261) summarizes the entire situation well:

> It is well known that the lifetime of comets in the inner solar system is limited to very much less than the age of the solar system itself both physically, because of progressive gas and dust loss from the nucleus, and dynamically, due to the instability of their motion against ejection on hyperbolic orbits; in fact, these arguments hold for all comets, no matter if of long or short period, and the conventional explanation for the mere fact that we do observe comets is that reservoirs sufficient for the replenishment of both cometary populations exist in the outer solar system.

Thus long- and short-period comets have lifetimes much less than the generally accepted age of the solar system.

Each time a comet passes perihelion, its closest point to the sun, it sacrifices some of its mass to form the sometimes spectacular coma and tail. There are various estimates of how long it would take a comet to disappear entirely, ranging from about 100 (Delsemme, 1985, p. 861) to about 1000 revolutions around the sun (Alfven and Arrhenius, 1976, p. 330; Woolfson, 1978, p. 213). The absolute maximum range is from 20 to 20,000 revolutions (Kresak, 1985, p. 285), but the latter is almost certainly too high. Some estimates of the actual amount of mass lost are 10^{11} kg in one revolution (Elmegreen, 1985, p. 6; Kresak, 1985, p. 281) and at closest approach up to 24,000 kg/sec (Moore and Mason, 1984, p. 26). This means that a typical comet might lose the top few meters from its surface (Delsemme, 1982, p. 87). But in any case the lifetime of a short-period comet (period less than 200 years) against destruction by the evaporation of its volatile materials is in the thousands to hundreds of thousands of years, far short of the expected billions of years.

Comets move through the solar system in highly elliptical orbits. A periodic comet may be in an orbit commensurate with a massive planet, i.e. an orbit whose period is a simple fraction of the period of the massive planet, enabling it to remain stable over long periods of time. But if it is not, it will certainly be perturbed by the planets' gravity and most such comets, will be ejected from the solar system on hyperbolic orbits (Everhart, 1982, p. 662). The most effective massive planet in changing comets' orbits is Jupiter.

No Evidence for Very Old Comets

So from the very start, scientists acknowledge that they have a problem explaining the existence of comets in a billion year old solar system. This is the reason astronomers have postulated a cometary reservoir as Carusi and Valsecchi said. However it is important to realize from the first that even astronomers acknowledge that there is no direct evidence that comets are billions of years old.

Comet expert Lubor Kresak (1982, p. 57) said:

> There is actually no direct evidence that the present flux of comets through the inner solar system is representative for longer time spans.

Brian Marsden (1977, p. 83) wrote:

> It is just possible, of course, that comets have been prevalent in the solar system (or at least in its inner part) for less than 0.1 percent of the lifetime of the solar system . . .

Armand H. Delsemme (1977, p. 453) says:

> In particular, the spherically random distribution of those comets coming from the Oort's cloud resembles that of globular clusters . . . However, the scaling down of the geometry, plus the residual uncertainty on its accurate shape coming from the small number of observed new comets, does not imply that it be much older than 10^7-10^8 years.

Later in the same paper Delsemme (p. 453) says:

> "no empirical evidence requests that the Oort cloud be older than a few million years."

The mention of the time "millions of years" in these quotes does not imply that there is evidence that comets have ages in the millions of years. The reason that this time span is mentioned is because the longest period comets have periods in the millions of years. Astronomers assume that they have their origin at the outer edge of the solar system, and hence would have taken a few million years to reach the inner solar system. But there is no evidence that they ever were actually at these large distances. There is no evidence contrary to a recent formation of comets in orbits which would take them millions of years to complete.

Delsemme (p. 453) goes on to explain that though there is no evidence that comets are older than a few million years, the problem is that no one can come up with a theory of how they could have formed so "recently." Therefore it is because of the assumption that the solar system formed billions of years ago together with the astronomers' inability to develop a naturalistic theory for recent cometary formation that most assume comets formed 4.5 billion years ago.

The Origin of Current Theories

Modern theories of cometary formation begin with Jan Oort who in 1950 did an analysis of the orbits of known long-period comets (defined as comets with periods of more than 200 years). He noticed that most long-period comets had aphelia (farthest distances from the sun) in the tens of thousands of astronomical units (AU). There seemed in particular to be a concentration near 50,000 AU. He postulated the existence of a cloud of 10^{11} comets around the sun and reaching halfway to the nearest stars. The passage of nearby stars would so perturb some of the comets in the cloud that they would be sent into the inner solar system to be converted into short-period comets. Later perturbations by the Jovian planets should convert the long-period comets into short-period comets (Weismann, 1982, p. 637). Thus as the short-period comets become burned out, there is always a new supply from those which enter the solar system as long-period comets. All mainline comet theories are variations on this theme.

Scientists assume that this comet cloud is perhaps 50,000 to 100,000 astronomical units from the sun, and contains as many as two trillion of them. This would be about 30 times the mass of the earth in comets alone (Delsemme, 1977, p. 453). It is called the “Oort cloud” of comets, named after the astronomer who suggested its existence. These comets would be in orbits which never bring them near enough to the sun for their volatiles to begin to evaporate. This way they could exist indefinitely. Occasionally a passing star will disturb the orbit of some of them, sending them plunging into the inner solar system to appear as new comets.

However, there is no direct observational evidence for the Oort cloud. It remains an assumption. Something like the Oort cloud is necessary to allow comets to exist for billions of years and so most scientists take its existence for granted. As one astronomer says, “Although there are various difficulties with populating the cloud and its subsequent evolution it is the basis for nearly all current studies on the origin and evolution of comets.” (Donn, 1976, p. 663). Thus, though there are difficulties with this theory as we shall see shortly, astronomers are forced to accept it. There are, however, a few astronomers who doubt the Oort cloud even exists (Everhart 1984, p. 215; Witkowski, 1972, p.419).

As we get into the details of the source of long-period comets, it becomes apparent that there are as many theories and variations of theories as there are astronomers. Most still hold to the existence of an Oort cloud. But some, realizing the problems involved with such a cloud, postulate different sources for comets. Each one is more than willing to point out the fatal difficulties of the others’ theories, but somehow has trouble seeing them in his own. In fact, at each major step in dealing with the origins of comets, there is at least one optimistic astronomer who considers himself to have solved it. So if at each step one accepts the statements of the most optimistic writer, it would appear that all problems have been solved. This, however, is far from the truth.

It will be useful to describe further the two categories into which comets have been divided, long-period and short-period comets. The periods vary widely, from about three years to nearly infinite. But at a somewhat arbitrary point of 200 years they are separated into long- and short-period comets. This point is not totally arbitrary, however, for the properties of long- and short-period comets differ. Short-period comets are the more familiar ones for they come back again and again, like Halley’s. Most short-period comets have prograde orbits, meaning that they revolve around the sun in the same direction as the planets. They also tend to lie close to the ecliptic plane, the plane containing the orbit of the earth. Long-period comets, on the other hand, are oriented randomly. They are not confined to the ecliptic but may have any orientation. Long-period comets are seen only once because the time between their apparitions is so long or because they have never entered the inner solar system before.

The long-period comets can again be divided into two categories, those which are “new” and those which are not. What is a new comet and how can astronomers tell if a comet is new or not when all of them are seen only once? The new comets have something in common; when their orbits are computed they all have large aphelia, or maximum distances from the sun. These vary from a few tens of thousands of astronomical units to about 100,000 AU.

This, scientists feel, implies that all long-period comets started at the same distance, that of the new comets. Some have entered the inner solar system before and when they did, the gravity of the planets disturbed their orbits enough so that their aphelia were no longer the same. Thus after a single passage through the solar system a “new” comet becomes a non-new but still long-period comet (Van Flandern, 1978, p. 89). But the “new” comets have never entered the inner solar system previously. Consequently when they are seen for the first time they all appear to have similar orbits. The fact that “new” comets have similar aphelia is used as evidence supporting the existence of the Oort cloud at 50,000 A.U. This, of course, is circular reasoning since the new comets were defined as those having aphelia of about this distance.

The Formation of the Oort Cloud

A natural question to ask about the Oort cloud is from where did the cloud come? Oort himself considered this question and decided that there are only two possibilities. Either the comets in the distant cloud formed there at great distances from the sun, or they formed in the inner solar system, among the planets, and were later ejected (Vanysek, 1976, p. 44). Astronomers have not agreed on the answer and it is still a wide open question (Donn and Rahe, 1982, p. 219) because there are problems with all possibilities.

Among those who believe comets were formed in the solar system, the most popular place is the region of the outer planets from Jupiter to Neptune. They have to be formed at least that distance from the sun in order for ices like methane, ammonia and carbon monoxide to form. In this case they must be ejected to the Oort cloud by the outer planets. But Jupiter is too inefficient. Only one percent of the comets ejected by Jupiter would enter the Oort cloud; the rest would be ejected from the the solar system altogether. Uranus and Neptune would take too much time to form— the time scale would be 100 billion years. The efficiency of the ejection process, taking all the giant planets into account, is only a few tenths of a percent. This means that to have the estimated two trillion comets in the Oort cloud, the initial mass of comets must have been about one-tenth of a solar mass (Donn and Rahe, 1982, p. 219). Mendis and Alfven (1976, p. 643) say: "this seems to require an embarrassingly large number of comets within the solar system at some time ($>10^{16}$)." In fact, Alfven and Arrhenius (1976, p. 328) say:

> Oort has suggested that the long-period comets were produced in the inner regions of the planetary system and ejected by Jupiter. Detailed orbital evolution calculations show that this mechanism is impossible. The result is also fatal to Whipple's theory of an origin in the Uranus-Neptune region. One is forced to conclude that the comets were formed by some process in the transplanetary region.

Then what about the theory that comets were formed where they are? The usual objection to this is that the solar nebula from which the solar system is supposed to have formed is much smaller than the distance to the Oort cloud. There would have been no material at that distance for comets to form (Vanysek, 1976, p. 44; Whipple, 1976, pp. 44, 628-9; Fernandez, 1985, p. 45). And there are scientists who still say that there would not have been enough material available for comets to form (Greenberg, 1985, p. 3).

More recently it has been suggested that comets formed at intermediate distances from the sun, in somewhat massive fragments of the solar nebula which became disconnected from the portion which became the inner solar system. Or perhaps, if stars form in clusters, there may have been massive fragments of material floating around from which comets could form (Dorm and Rahe, 1982, pp. 220-2). These are just *ad hoc* assumptions and there is no reason to think this would happen. Safronov (1977, p. 483) said that this theory is not supported by the facts. It is apparent from reading the papers of those astronomers who propose such things that they are grasping at straws because they can think of no other way to form the Oort cloud at large distances from the sun. All these ideas are clearly just guesses and there is no evidence for any of them.

Alternative Theories of Oort Cloud Formation

Some astronomers have realized that the evidence simply makes the formation of the Oort cloud impossible and seek other ways to explain comets. For instance, some say that comets were not formed as part of our solar system at all, but are captured from giant molecular clouds in interstellar space through which it passed (Yabushita, 1985, p. 11). But this suffers from problems also. First is the lack of observations of comets with hyperbolic orbits, meaning comets which were not originally bound gravitationally to the sun. Second, Jupiter could not capture such comets into elliptic orbits. Third, any comets which were captured this way would tend to have low inclinations, that is, they would tend to have orbits close to the ecliptic. This is not the case (Fernandez, 1985, p.45). And fourth, chemical abundances of comets seem to be the same as solar abundances, which would not be expected if they were formed somewhere else (Delsemme, 1977, p. 45.3).

Astronomers who postulate this are forced to make a number of assumptions, including a high density of comets in these interstellar clouds, and even that the giant molecular clouds are formed from the comets rather than vice versa. Some astronomers try to get around the objection of low capture probability by assuming special conditions within the molecular clouds from which the comets would come. But they admit that the processes are unknown (Clube, 1985, p. 19). Fernandez has calculated that their mechanism would be inadequate to create a sizable comet cloud (Fernandez, 1985, p. 45). The evolutionists' first uncrossable hurdle: there is no way to form the comet cloud.

Preserving the Oort Cloud

Assuming that somehow a large number of comets came to be in a distant cloud around the sun, we find further difficulties. The life of such a cloud over 4.5 billion years is not entirely quiescent. Destructive mechanisms are at work making the persistence of the cloud impossible.

The solar system is moving through the Galaxy, the Milky Way, in which it resides. In fact it is in orbit about the center of the Galaxy at a distance of 10 kiloparsecs (2×10^{17} miles). It is moving at a speed of 25 km/sec relative to the spiral arm nearest the sun. The spiral arms of the galaxy are where the molecular clouds are densest. Therefore during the 4.5 billion years during which the sun is supposed to have been doing this, it should have passed through about 15 massive clouds. In 1979 Napier (p. 455) concluded, "Clearly the outer part of the Oort cloud, from which long-period comets are supposed to derive, would be very efficiently cleared . . ."

More recently it has been shown that the only way a comet cloud could survive repeated passages through such molecular clouds is for it to be much more concentrated close to the sun than was previously thought (Bailey, 1984, p. 65). Therefore some have proposed that there are really two comet clouds (Fernandez, 1985, p. 45; Clube, 1985, p. 19), one relatively nearby which cannot be swept away by the passages through the molecular clouds and which can replenish the outer one and the second, traditional Oort cloud at large distances. But replenishing the outer cloud from the inner is an inefficient process. To put hundreds of billions of comets into the outer cloud from the inner means that the inner cloud must have 10^{15} to 10^{16} comets (Napier, 1985, p. 31). This is almost the mass of the sun itself. A mass of comets this large would be in conflict with other aspects of solar system formation (Clube, 1985, p. 19). And there is no way that the less massive outer planets could put this large a mass into longer period orbits (Napier, 1985, p. 31). I would also question whether this process could move two trillion comets from an inner cloud to an outer one in the time between passages through the molecular clouds. Further, Napier says that the half-life of such an inner cloud would be only one billion years and is therefore ruled out (Napier, 1985, p. 31). This is the second hurdle: the Oort cloud cannot survive for 4.5 billion years.

Bringing the Comets Back

Oort was indeed able to show that a passing star could change a comet's orbit enough to send it into the solar system as a new comet. But this is a long-period comet. The astronomers'dilemma is to account for the short-period comets. It is the short-period comets which spend so much time near the sun that their lifetimes are unacceptably short. Some way must be found to change the long-period comets into short-period comets.

The theory that long-period comets are changed into short-period comets by gravitational interaction with Jupiter is almost two centuries old, originating with Laplace. But it was shown in 1891 by H. A. Newton that a single close encounter with Jupiter or any planet cannot change a long-period comet into a short-period one. The probability is extremely small that it could happen, and even for those whose orbits are changed sufficiently, the characteristics do not match those of real comets (Mendis and Alfven, 1976, pp. 649-50). Everhart (1969 p. 735) who has done extensive computer modeling of cometary orbits, says;

> Every calculated distribution is in serious conflict with the corresponding distribution for the known short-period comets. These cannot be the immediate or unmodified result of capture by Jupiter.

More recently Everhart has shown that greater success in reproducing the orbits of short-period comets from long-period ones can be obtained after several hundred encounters with Jupiter by the same comet (Alfven and Arrhenius, 1976, p. 234). Unfortunately there are so many short-period comets that this process would produce them 1,000 (Bailey, 1984, p. 65) to 10,000 times too slowly (Alfven and Arrehnius, 1976, p. 330). Transitions from long-period to short-period comets cannot be made at a fast enough rate to account for the observed number of short-period comets.

Here is the third hurdle: comets from the Oort cloud cannot account for short-period comets. We have encountered three uncrossable hurdles for the Oort cloud theory: there is no way to create the Oort cloud, the Oort cloud could not survive for the supposed age of the solar system, and the comets cannot be returned from the Oort cloud at a fast enough rate.

The Age of Comets

The conclusion is already obvious— some form of Oort cloud is necessary to preserve intrinsically short-lived comets for billions of years. No way has been found either to create or maintain such a cloud, therefore comets are young. But there are other indications of a young age as well.

Lubor Kresak has analyzed the dynamics of long- and short-period comets. He concludes that the long- and short-period comets differ substantially in their dynamical history. In fact he says, ". . . the end fates of long- and short-period comets and, hence their structure and physical evolutions are different." (1985, pp. 296-298). This means that the short-period comets did not come from long-period comets. So here is another break in the chain linking the Oort cloud with short-period comets.

But there is something more significant in his analysis than he realizes. His conclusion that long- and short-period comets are intrinsically different is partially based upon observations comparing the orbits of asteroids and comets. There is a theory that once a comet has outgassed until most or all of its volatiles are gone, it looks very much like an asteroid. Some of the objects which we have identified as asteroids may in fact be burned out comets. Short-period comets which return to the sun every few years or decades would be expected to lose their volatiles in a relatively short period of time and turn into asteroid-like objects. And in fact there are some asteroids whose orbits resemble short-period comets.

Now some of the longer period comets should also have made enough passages to the sun to lose their volatiles and turn into asteroid-like objects. It would take them longer than for short-period comets, since they return to the sun less often, but there has been plenty of time if the solar system is 4.5 billion years old. Despite the fact that solar system objects with aphelia beyond Saturn should be especially easy to spot, *not one* asteroid in a comet-like orbit has been found in this region (Kresak, 1985, pp. 296-8). Kresak is puzzled by this. The only way he can explain it is that short- and long-period comets are physically different, the short-period comets being able to turn into asteroids and the long-period comets being unable to turn into asteroids. But he notes ". . . that there are no observable systematic differences in their radiation mechanism." (1985, pp. 296-8). What he is saying is that long- and short-period comets are the same in every way except that apparently, one produces asteroids and the other does not.

What does this mean? Some short-period comets may have turned into asteroids, but no long-period comets have done so. The conclusion is clearly that while there has been enough time for some short-period comets to turn into asteroids, there has not been enough time for any long-period comets to do so. This is a clear indication that comets are far younger than the supposed age of the solar system. The exact lifetimes of comets are unknown, but we can make some estimates. A comet with an aphelion at Saturn's distance would have a period of about 15 to 30 years. If it lasts a maximum of 1,000 orbits, its lifetime would be 15,000 to 30,000 years. It seems that none have lasted that long.

There is still a great deal of dispute about whether or not comets really do turn into asteroids. But whether they do or not, evolutionists still have trouble. If comets do turn into asteroids, then the lack of asteroids in long-period comet orbits demonstrate the youth of comets. If they do not turn into asteroids, then, as Kresak said, there must be two independent populations of comets, with no transitions from long-period to short-period comets, and therefore no way to repopulate the short-period comets from the long-period comets.

There is further evidence that the long-period comets have not been around very long. Recall that new comets are long-period comets which are entering the inner solar system for the first time. Once they have entered they should continue to return to the sun again and again as long-period comets which are not new. However most long-period comets are new (Vanysek, 1976, p. 44). Only about one fourth as many non-new comets as expected are really observed (Everhart, 1979, p. 23). If this has been happening for billions of years and comets can survive for hundreds of orbits, there should be many times more "old" comets than new ones. There simply has not been enough time for many old ones to come back for a second trip.

The usual answer to this is that there are selection effects in the observation of comets. If comets diminish in brightness in the course of time, we are more likely to observe new comets than dimmer, old ones (Shtejns, 1972, p. 347). Kresak (1977, p. 93), however, disagrees. He states that the lack of old comets can only be explained if almost all new comets vanish after one perihelion passage or dim appreciably after a single passage.

Even deep space is not empty. One resident of space is the cosmic rays. Over billions of years a large number of cosmic rays would pass through a comet. The effect would be to polymerize the simple compounds and ices that make up the comet. This means that the small molecules would be made into larger and less volatile compounds, molecules which would not evaporate from the surface as easily when the comet at last reached the inner solar system. Cosmic rays would penetrate the outer layer of a comet from one to a few meters deep (Donn, 1976, p. 617). Schulman (1972, p. 265) has calculated that during a time interval of 2×10^7 to 2×10^8 years every molecule in the surface layer will be struck by cosmic rays and take part in these chemical reactions. This is in sharp contrast to what is actually observed. New comets are very bright, meaning that they are losing large amounts of gas and dust. Thus there is no indication that comets have spent a large amount of time in space.

There are some who say that the effect of cosmic rays would actually be to increase the activity of new comets (Whipple, 1981, p.1). But experiments may indicate otherwise. Methane gas, when exposed to radiation is transformed into a viscous oil (Shulman, 1972, p. 265). Another experiment exposed low temperature ices to ultraviolet radiation, not cosmic rays, and produced something they called "yellow stuff" which did not evaporate even when heated. This would happen in space in only 10 million years (Greenburg, 1982, p. 131).

Cosmic rays can have another effect. Cosmic rays are primarily composed of protons (nuclei of hydrogen atoms) moving at speeds close to that of light. They have extremely high energies and are capable of inducing nuclear reactions. One type of reaction that can be induced by cosmic rays is called spallation. A spallation reaction is one in which a high energy proton strikes the nucleus of a of relatively heavy atom and breaks it into smaller fragments, each of which is then the nucleus of a different kind of atom (Harwit, 1973, p. 35). Carbon, nitrogen and oxygen are among the more common heavier elements which are likely to be targets of the energetic protons (Harwit, 1973, p. 421). They exist in such compounds as methane, ammonia and water. These compounds exist in comets. Over a long period of time the spallation reactions should result in a relatively large amount of the element lithium as a spallation product (Harwit, 1973, p. 35). The longer the exposure to cosmic rays, the greater should be the amount of lithium in comets. However, when spectra of comets are examined, no lithium is present (Donn, 1976, p. 620). Again we see that comets cannot have been exposed to cosmic rays for very long.

Non-Oort Cloud Theories

What we have just seen is that there is no way to explain how comets can exist for a period of billions of years. Comets are much younger than this. Some astronomers, realizing this, have abandoned the Oort cloud type of explanation and have tried to explain how comets might have been created recently.

Some astronomers who reject the Oort cloud give as one of their reasons the so-called distribution of perihelia. If the comets were truly oriented randomly in space, these perihelion points would appear to come from all directions with equal probability (Weismann, 1985, p. 87). In fact though, they do not. There are about five directions from which comets prefer to come and one direction in particular. This is not consistent with an old Oort cloud whose comets are perturbed by passing stars since comets should be coming from all directions with equal probability. Furthermore, all long-period comets, both old and new, have their perihelia clustered in the same directions (Yabushita, 1985, p. 11). Now the old long-period comets are supposed to have been through the solar system before and had their orbits severely changed by the gravity of the planets. But if the old and new comets all have the same distribution, it is clear that neither has ever been influenced by the planets while traveling through the solar system before. Thus we do not have to assume that comets are even as old as one period of the old, long-period comets.

Again, this observation is often attributed to selection effects in observation. Witkowski cites several studies whose purpose was to eliminate these selection effects from the data in order to show that the true distribution is random. Contrary to the expectations of the investigators, the non-random distribution is real. And in fact their motion is similar to the motions of stars in the solar neighborhood (Witkowski, 1972, p. 419).

Another observation indicating that comets did not come from a uniform Oort cloud is the distribution of the orbits of some comets. Major solar system objects fall in the plane of the ecliptic. Comets have orbits of all orientations. But of course there are some comets whose planes are perpendicular to the ecliptic. Of those there are 54 percent more in the retrograde than in the prograde direction. This is too large to come from primordial or galactic effects; it would be dissipated by orbital diffusion in 20-30 million years, hence these comets must be younger (Delsemme, 1985a, p. 19; Delsemme, 1985b, p. 896).

One even less orthodox theory for the origins of comets is a revamping of an old theory proposed by the two astronomers Ovenden and Van Flandern. They observed that the comets tend to come from certain directions more than others in the sky. This suggested to them that there was once a planet in orbit between Mars and Jupiter where the asteroid belt is now. It exploded and its fragments are the asteroids and comets. They say the planet was about 90 times the mass of the earth and it exploded about six million years ago (Van Flandern, 1977, p. 475; Ovenden, 1973, p.319; Van Flandern, 1978, p. 89). This actually answers some problems that other theories do not. It is one of the few which can explain the preferred direction of cometary perihelia. And it is the only one, in my opinion, which has any explanation of why most new comets seem to have about the same aphelion distance. The answer is simple: if the explosion took place six million years ago, only those comets given a period of six million years by the original explosion would be seen coming back now for the first time. If it did not have one unsurmountable flaw, it might be tempting to try to find a way to fit this into a creationist time scale. The problem is that no known process could cause a giant planet to explode. (Perhaps, though, a collision could account for it.)

A rather strange theory says that comets are continually forming even now in the solar system. Alfven and Arrhenius have developed an entire theory for the formation of the solar system based upon what they call jet streams. They say that instead of spreading out, dust in the solar system tends to concentrate into dense rings they call jet streams. The dust thus concentrated is able to accrete into larger bodies. They contend that for instance, all the dust in the orbits of comets is not really spreading out along the orbit, as most believe, but is in fact accreting into the comet, making it larger. Thus comets are continually forming from loose dust in the solar system (Alfven and Arrhenius, 1976, p. 330). This is against all reason as well as against the second law of thermodynamics. Most astronomers dismiss the process as impossible.

And the most bizarre of all is that supported by a number of Soviet astronomers who say that comets were erupted from volcanoes of all the planets. This is supposed to be going on still, with Jupiter's volcanoes as the major source, but in the past it has occurred on all planets, even the very hot Mercury and Venus (Vsekhsvyatskij, 1972, p. 413). It is rather obvious that of the two solar system bodies known to have active volcanoes, the earth and Jupiter's moon Io, neither one is spouting comets. Jupiter does not seem capable of having volcanoes, and if it did, it is not likely that anything coming out of them would be able to escape its tremendous gravity. It is just another feeble guess.

Conclusion

It is clear that evolutionary theories are totally incapable of accounting for comets in an old solar system. They cannot explain the formation, maintenance or return of comets. The chemical composition, behavior, and orbits of comets are not consistent with large ages and naturalistic formation. Comets are young objects. And since there is no natural mechanism which can account for a recent formation of comets, they must have been created recently in a recently created solar system.

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MISSISSIPPIAN AND CAMBRIAN STRATA INTERBEDDING: 200 MILLION YEARS HIATUS IN QUESTION

WILLIAM WAISGERBER*, GEORGE F. HOWE**, AND EMMETT L. WILLIAMS***

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Abstract

Two field trips were made to study the supposed unconformity between Mississippian Redwall Limestone and Cambrian Muav Limestone along the North Kaibab Trail, Grand Canyon. Characteristics indicative of unconformable stratigraphic relationships are described. Such characteristics were not observed along the Redwall-Muav contact line. Field evidence supports the belief that continuous deposition of sedimentary strata occurred, one formation on another. Thus there need not be any 200 million year depositional hiatus between the two formations.

Introduction

Geologists believe that there exists a 200 million year hiatus between the top of the Cambrian Muav Limestone and the base of the Mississippian Redwall Limestone-Collier (1980, p. 10). This belief is contradicted by Burdick (1974) who reported that elements of the Redwall Limestone and Muav Limestone were intertonguing with each other to form repeating sequences:

> Now we come to the Cambrian Period, and walking down the trail, we see where the Mississippian will come down to a certain level and then we find a layer of Muav limestone. Still lower we find a layer of Mississippian and again another layer of Cambrian. It is strange that they can jump back and forth, these alternations of rocks over 100 million years. This is called recurrent formation or faunas. Mississippian life is supposed to have ended at the end of that period and an entirely different type of rock should be in the Cambrian. In the Cambrian, the oldest rock, are trilobite fossils and other shell fish, distinctive of that type of rock. When you progress to the Mississippian, you are supposed to be leaving that type of life and coming to another. Instead, we find another layer of Cambrian. Something is wrong. Evolutionists say you cant put evolution in reverse: it is always forward. So here is another puzzle, recurrent faunas. p. 61

If it can be shown that there is no hiatus between the Redwall Limestone and the underlying Muav Limestone, then this conclusion would 1) discredit geologic time as promoted by some geologists and 2) do great damage to the macroevolution model of origins.

Observations

The CRS Research Committee authorized two trips into Grand Canyon in 1986 to study stratigraphic relationships within that area publicized by Burdick (1974). Key exposures exist along the southerly trending, principally southerly descending, sinuous North Kaibab Trail, in the Grand Canyon. Burdick's stratigraphic section is situated just southerly of a National Park Service information sign. The sign identifies to the reader the base of Redwall Limestone lying on top of Muav Limestone. The stratigraphic section can be reached from North Rim, Grand Canyon, commencing at the trailhead for North Kaibab Trail. Merely walk down North Kaibab Trail for a horizontal distance of about 4 miles, dropping vertically about 2000 feet to reach the study site.

*William Waisgerber, M.S., consulting geologist and lecturer on creationist geoscience is owner of William Waisgerber and Associates, Consulting Geologists and receives his mail at P.O. Box 2068, Sepulveda, CA 91344.
**George F. Howe, Ph.D., Director of the CRS Grand Canyon Experiment Station and Professor and Chairman, Division of Natural Sciences and Mathematics, The Master's College (formerly Los Angeles Baptist College). He receives his mail at 24635 Apple Street, Newhall, CA 91321.
***Emmett L. Williams, Ph.D., Editor of the CRS Quarterly receives his mail at 5093 Williamsport Drive, Norcross, GA 30092.