Lunar Crater Giordano Bruno

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Abstract

There is growing evidence that a major lunar crater formed in recent historical time, A.D. 1178. The feature is now called crater Giordano Bruno, located just beyond the moon's upper right limb. The evidence includes eyewitness accounts, crater appearance, and lunar vibrations. This lunar impact conflicts with long-age assumptions and fits the recent creation view.

Introduction

Our moon has been described as a museum of the early solar system. Its geologic activity and cratering are often assumed to have completely ceased over three billion years ago. However there are occasional current observations of various transient lunar phenomena, or TLPs (Whitcomb and DeYoung, 1978). These events include volcanic activity in the form of luminous spots and also outgassing. TLPs are denied by those who assume the moon has long been inactive (Sheehan and Dobbins, 1999). Nevertheless, observed TLPs number in the hundreds. Related to this, there is a historical report of a large-scale cratering event on the moon. The result is crater Giordano Bruno (GB), located on the hidden side of the moon just beyond the northeast limb. This impact event and the host of TLPs challenge the assumption of an ancient, unchanging moon.

Historical Background

A very unusual event was recorded more than eight centuries ago by Gervase of Canterbury, in southern England. Gervase (A.D. 1141–1210) was a monk who compiled history for the royalty of early England. In his medieval chronicles, written in Latin, Gervase describes a dramatic lunar observation by fellow Catholic monks:

> In this year, on the Sunday before the Feast of St. John the Baptist, after sunset when the moon had first become visible a marvelous phenomenon was witnessed by some five or more men who were sitting there facing the moon. Now there was a bright new moon, and as usual in that phase its horns were tilted toward the east; and suddenly the upper horn split in two. From the midpoint of this division a flaming torch sprang up, spewing out, over a considerable distance, fire, hot coals, and sparks. Meanwhile the body of the moon which was below writhed, as it were, in anxiety, and, to put it in the words of those who reported it to me and saw it with their own eyes, the moon throbbed like a wounded snake. Afterwards it resumed its proper state. This phenomenon was repeated a dozen times or more, the flame assuming various twisting shapes at random and then returning to normal. Then after these transformations the moon from horn to horn, that is along its whole length, took on a blackish appearance. The present writer was given this report by men who saw it with their own eyes, and are prepared to stake their honor on an oath that they have made no addition or falsification in the above narrative (Stubbs, 1879).

This "fire on the moon" actually took place on June 18 or 19, A.D. 1178, Julian calendar. The moon was a thin waxing crescent, just 1.6 days past the new moon. The splitting of the upper horn of the waxing crescent moon apparently was caused by debris ejected from the lunar surface by an asteroid or comet collision. The observed flames and sparks were actually incandescent gases. A shimmering of the lunar image also would have resulted from the refraction of light through the produced gases. Great amounts of dust caused an overall darkening of the moon for some days or weeks. Figure 1 pictures the unusual lunar event.

The resulting crater was named in the 1970s, in honor of the Italian rationalist philosopher Giordano Bruno (1548–1600). He was not an astronomer like his contemporaries Copernicus and Galileo, though he championed their heliocentric ideas. Bruno was a brilliant Dominican priest who later became a pantheist and major opponent of the Catholic hierarchy. Condemned for heresy, immoral conduct, and blasphemy, Bruno was burned at the stake in

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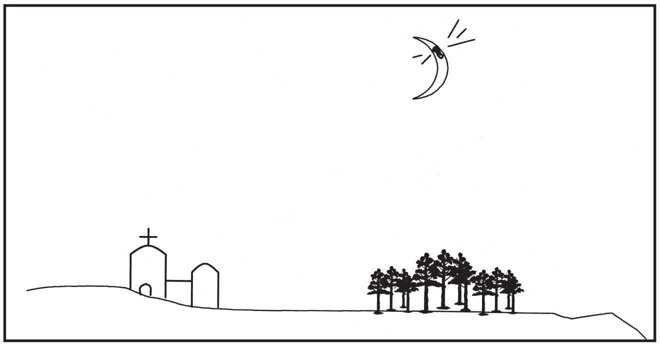

Figure 1. A sketch of what was seen when lunar Crater Giordano Bruno was formed in A.D. 1178.

Piazza Campo dei Fiori in Rome on February 19, 1600. Astronomer Jack Hartung, formerly with the State University of New York at Stony Brook, has been the chief promoter of the connection between crater GB and the chronicler Gervase (Hartung, 1976).

Here is a summary of the chronology of events related to crater Giordano Bruno:

1178 Lunar explosion is observed by monks and recorded by Gervase of Cantebury.
1600 Philosopher Giordano Bruno is executed.
1610 Galileo discovers lunar craters with his telescope.
1959 Backside of the moon is first photographed by the Soviet spacecraft, Luna 3.
1960s Consensus is reached that lunar craters have an impact origin.
1968 The Apollo 8 lunar mission photographs crater GB.
1970s Giordano Bruno crater is named. The Clementine spacecraft studies the lunar surface, including crater GB.
1976 Astonomer Jack Hartung relates crater GB to the 1178 observation.

The Result

What remains today from the A.D. 1178 impact event is a fresh crater, about 22km (13 miles) in diameter. It is located on the far side of the moon, just beyond Mare Crisium. As you look at the moon, GB is just behind the upper right edge, at a lunar latitude of 36° north and longitude of 102° east. Zero degree lunar longitude is measured from the center of the moon's nearside. The collision site is shown in Figure 2, taken in 1968 during the Apollo 8 lunar orbital mission. GB has a high reflectivity which implies a recent formation. The freshly excavated material is mixed with surrounding older soils (Pieters, et al. 1994). Most "recent" lunar craters have bright, radial rays of ejected material. Exposure to sunlight, radiation, and micrometeorites gradually darkens and smoothes the rays. In 1976 the Russian probe Luna 24 landed on a ray of Bruno in Mare Crisium, 1,200 km from the crater itself. Bruno has the longest rays for its size of any lunar crater. Luna 24 returned samples to earth, showing typical lunar soil rich in plagioclase feldspar (Al-Ca silicate).

During the 1969–72 Apollo space program, several laser reflectors were left on the lunar surface. For several decades these devices have allowed the precise monitoring of the earth-moon distance and also lunar vibrations. Such studies have revealed an unexplained, extra "ringing" oscillation in the lunar *libration*. Basic libration is a "rocking" motion of the moon such that we see slightly more than half the lunar surface, about 59 percent. This geometric effect is caused by the inclination of the moon's orbit and equator. Libration was first noted by Galileo three centuries ago. The tiny excess libration, of interest here, is based on more recent lunar laser ranging, and is consistent with an origin from the GB impact (Calame and Mulholland, 1978). The motion is measured as an extra longitude variation of about 14 meters, over a long period of about three years. That is, about 14 extra meters of surface can be seen at the lunar equator, or 1.8 arc seconds of longitude. This perturbation apparently was induced relatively recently and is consistent with the 1178 lunar collision. Thus, after eight centuries the moon still staggers from this particular impact event. The observed perturbation in lunar motion does not *prove* a recent lunar collision, but is supportive of it.

The space object which impacted GB is estimated to have been about 2–3km (1.2–1.8 miles) in diameter. Its

Figure 2. A photograph of crater Giordano Bruno taken during the 1968 Apollo 8 lunar mission (NASA photo). Available online at http:www.lpi.usra.edu/expmoon/ApoIlo8/A08_MP.Orbital5FS. gif

speed may have been about 16 miles/sec (26 km/sec), typical for space objects. The energy released, much of it initially in the form of kinetic energy, was equal to about 50 billion tons of high explosives. For comparison of relative energies, Table I lists several major energy events. A space object of this size would cause a similar crater on earth. On the moon, less gravity would cause a smaller free-fall speed, but the impacted matter could fly further. The two effects nearly cancel one another. There are many terrestrial craters of GB size and larger, but all are assumed to have formed in "deep" evolutionary time, millions or billions of years ago.

The Natural Science Reaction

Many astronomers doubt the recent formation of GB for two main reasons. *First*, an evolutionary time scale leads to a very small probability of anyone observing a major lunar impact. A crater of GB's size is estimated to occur only about once every million years (Wood, 2000a). This gives a 1-in-1000 chance that it happened during the last thousand years. The probability drops still lower that the impact would occur during night hours, on or near the lunar front side, and would be observed and reported by sky watchers. As further examples of the immense time assumption, the visible lunar craters Tycho and Copernicus are respectively dated at 100 million and 800 million years old. These craters are both about four times larger than GB.

A *second* challenge to the recent formation of crater Bruno comes from the U.S. Navy's Clementine spacecraft. It has provided high-resolution images of lunar details, including crater GB. Figure 3 shows a 1994 Clementine photograph of the crater and rays. The very light semicircle in the center is the crater rim. Although not visible in this photograph, it appears that the edge of GB's floor has accumulated considerable weathering products (Pieters et al., 1994). This material results mainly from down-slope movement, or slump of the crater walls. However, such extensive weathering on a short timescale is completely unexpected. The standard conclusion is that GB is much older than 800 years, or else lunar weathering is far more rapid than thought. It has been suggested that the medieval monks who reported the collision event simply were mistaken. They may have actually seen a meteor entering the earth's atmosphere, along the line of sight between Canterbury and the moon. Of course, this counter-explanation is itself very unlikely.

Creationist Reaction

In contrast to conventional science, crater Giordano Bruno is seen as freshly formed, for at least five reasons:

Table 1. Relative energies of major events. A megaton is defined as 5 x 10^{15} joules of energy. "Energy expended" is in terms of high explosives.

Event	Energy Expended
Hiroshima bomb	20 kilotons
Barringer Arizona impact	10–20 megatons
Mount St. Helens eruption	10–20 megatons
Tunguska Siberia impact	90 megatons
Largest hydrogen weapon	100 megatons
Crater Bruno	50,000 megatons

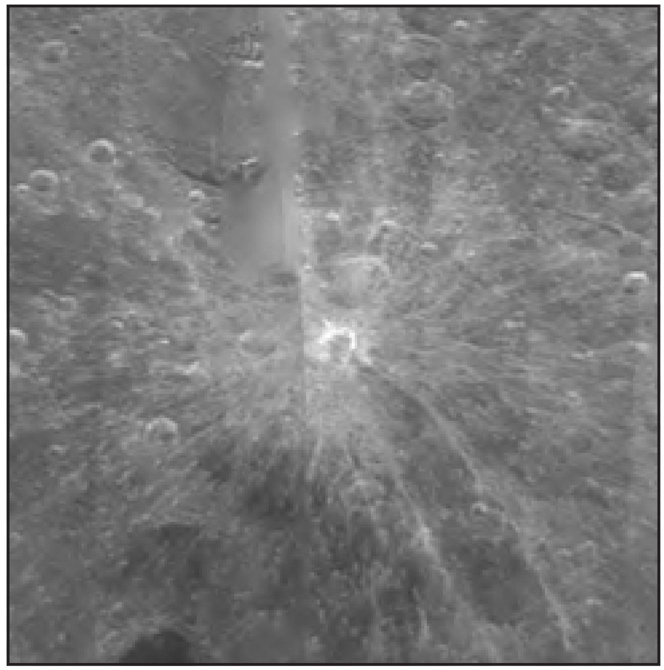

Figure 3. Crater Giordano Bruno photographed in 1994 by the Clementine lunar orbiting spacecraft. Available online at http://www.nrl.navy.mil/clementine/clib/multires.pl

- The event was observed and reported by multiple witnesses in 1178. In Gervase's words, the monks were "prepared to stake their honor on an oath that they have made no addition or falsification in the … narrative."
- The crater still looks very fresh, with ejected material overlying older sediment.
- The moon continues to vibrate or "ring like a gong" that was struck by a mighty blow, just a few centuries ago.
- The creation view is not constrained by the bias of required long ages and low probability of impact occurrence.
- Korean astronomical records indicate a major meteor shower on earth, 3.5 months after the GB impact. Calculations show that the earth may have caught up with lunar ejecta fragments at this time (Mims and James, 1982). Others have collected many worldwide reports of unusual sky phenomena eight centuries ago (Spedicato,

1996). This implies that the earth-moon system may have passed through a vast cloud of space debris.

Creationists see the moon as a young, dynamic satellite. Certainly, most large craters were formed in earlier history, many perhaps connected with the Flood catastrophe (Froede and DeYoung, 1996). However, the frequency of large lunar crater formation may still be 1,000 times greater than usually assumed, leading to a major event every millennium or so. If true, a creationist prediction is that the moon is due for another major impact anytime within the next few centuries. There is ongoing discussion of lunar impact history by both creationists and naturalists (Faulkner, 1999; Ryder, 2000).

Future Research

Crater Giordano Bruno may not be the only large lunar crater that has formed recently. A number of lunar craters do not appear on early hand-drawn maps. The crater Linné located in Mare Serenitatis, is one such example waiting for study (Wood, 1999). Lalande A is another crater with a very fresh appearance (Wood, 2000b). Additional lunar vibrations from recent impacts may be extractable from collected libration data.

Efforts have been made to link the GB impact with fragments from the annual beta-Taurid meteor shower, occurring in late June (Hartung, 1993). These fragments may originate from comet Encke. The resulting meteor shower may be responsible for GB, the June 1908 Tunguska event, and a major meteoroid shower noticed on the moon in June 1975. Further correlations also might be possible between other lunar blemishes and earth observations.

A 20 km diameter crater is assumed to occur just once every one million years on either the moon or the earth. Continued creationist study is needed of both lunar and terrestial craters, to evaluate their possible recent ages.

Much lunar data is available online to anyone interested, including evidence for rapid weathering processes. In particular, the Clementine lunar orbiter has accumulated vast numbers of photographs. Such data awaits detailed creationist evaluation.

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Birds and Dinosaurs

The theory linking dinosaurs to birds is a pleasant fantasy that some scientists like because it provides a direct entry into a past that we otherwise can only guess about. But unless more convincing evidence is uncovered, we must reject it and move forward to the next better idea.

Larry D. Martin, professor of systematics and ecology at the University of Kansas and head of the vertebrate palentology division in the university's museum of natural history. *Sunday World-Herald*, Omaha, NB. January 19, 1992, p.17B.

Notes from the Panorama of Science

Origin of Closed Canyon, Trans-Pecos Texas: A Comparison to the Black Canyon of the Gunnison River, Colorado

Emmett L. Williams*

Along the beautifully scenic, but mostly desolate highway 170 in southwest Texas, is found an interesting notch canyon cut into massively-welded Santana Tuff (Figures 1 and 2). Closed Canyon is about 0.7 mile in length with sheer walls extending approximately 160 feet high (Figures 3 and 4). This canyon in the Colorado Mesa is an arroyo today, but it is obvious that greater amounts of water flowed through the narrow slot in the past.

Discussing the history of the region as well as the origin of Closed Canyon, Alloway (1995, p. 25) stated:

> At one time, the valley the River Road (Texas highway 170) goes through was much more filled in and the ancestral Rio Grande was at a higher elevation than now. The stream that chiseled Closed Canyon also started its flow to the ancestral Rio Grande at a much higher elevation. As the river cut downward, the tributary followed suit, slicing through Colorado Mesa and forming Closed Canyon (parentheses mine).

Henry (in press) discussed the origin of the canyon within the regional setting:

> Several arroyos are superimposed; that is, their courses were determined at higher elevations in different rocks from what they traverse now. Closed Canyon, a steep, narrow canyon cut through Santana Tuff in Colorado Mesa, is the most notable example of a superimposed stream... Closed Canyon arroyo must have drained across Colorado Mesa to the Rio Grande when soft, basin-fill sedimentary rocks completely covered the mesa. As the Rio Grande and the Closed Canyon arroyo cut downward, they cut into the buried mesa. Downcutting was sufficiently fast that the arroyo cut through the mesa instead of being diverted around it.

Young Earth-Flood Model Concepts

Consider a model for the origin and development of Closed Canyon using Flood postulates. As Floodwater receded from the Trans-Pecos region of Texas, one of the directions taken by retreating water was generally along the present path of the Rio Grande (see Williams and Howe, 1996). Flood currents generated considerable erosion in the locality of Closed Canyon. As water with suspended debris drained from the adjacent highlands, it eroded through any recently deposited soft sedimentary material and continued to cut downward into the welded Santana Tuff as it flowed toward the "ancestral Rio Grande" (a Flood retreat channel).

Figure 1. Closed Canyon in southwest Texas along highway 170 is somewhat funnel-shaped (broad at the top and a narrow slot at the base) indicating that greater amounts of water flowed through it in the past.

Figure 2. A view of the slot in highly-welded Santana Tuff that forms the narrow base of Closed Canyon (Photograph by Carl R. Froede, Jr.).

Black Canyon and Closed Canyon

A similar mechanism was offered for the formation of the Black Canyon of the Gunnison River (Williams, 1998). Sediment-laden Floodwater moving in regional

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currents sliced through any existing softer overburden into the metamorphic and igneous rock that now forms the side walls of the Black Canyon. As the water level dropped, the flowing abrasive particulate-laden water continued to cut downward into the crystalline material. In both cases (Black Canyon and Closed Canyon), downcutting must have been sufficiently rapid so that the moving water sliced through hard rock rather than being diverted around it.

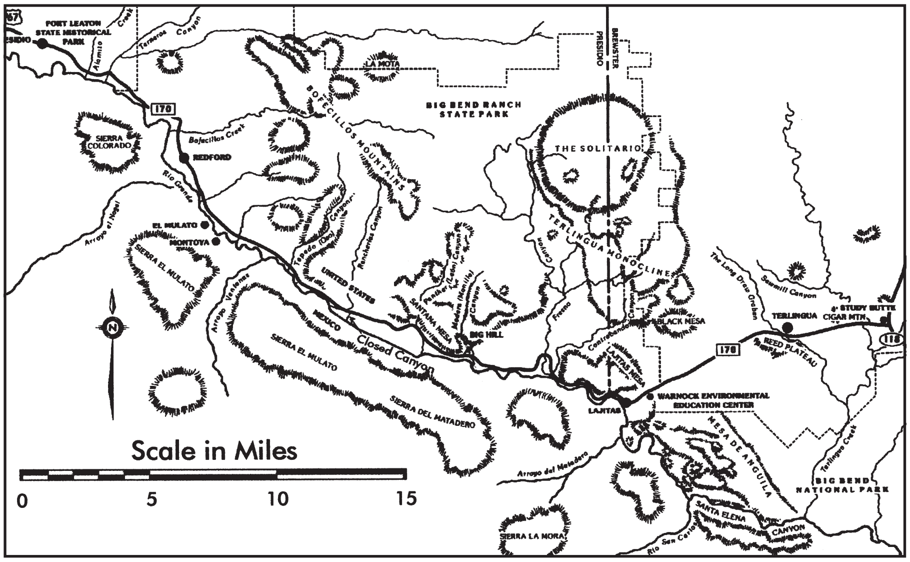

Figure 3.The location of Closed Canyon along highway 170 in southwest Texas near Big Bend National Park. The canyon is between highway 170 and the Rio Grande directly south of the Bofecillos Mountains. After Alloway, 1995, pp. 26, 27.

Appendix: Origin and Lithology of Santana Tuff

Santana Tuff varies lithologically from a nonwelded to thoroughly-welded vitric-crystal material depending upon location. The tuff contains a high percentage of glassy luster sanidine crystals (Barnes, 1979). Santana Tuffs erupted from Santana calderas in Chihuahua, Mexico (Figure 5). The Santana Tuff flowed into the Bofecillos Mountains from the south and pinches out southwest of Fresno Canyon, where it is entirely nonwelded. The Santana Tuff is petrographically distinct, lacking quartz phenocrysts and the large scoriaceous pumice (Henry and Davis, 1996, p. 100).

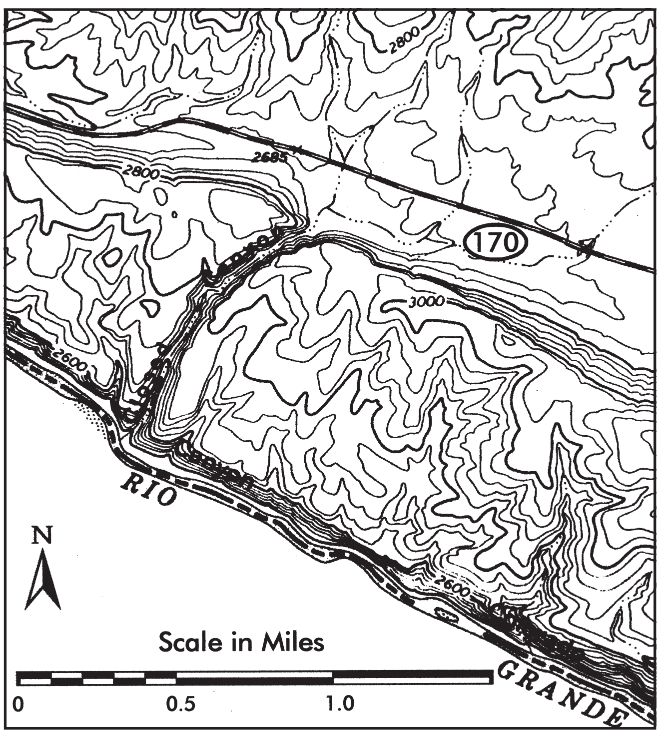

Figure 4. Closed Canyon, from the USGS Redford SE Texas-Presidio County quadrangle, 1971.

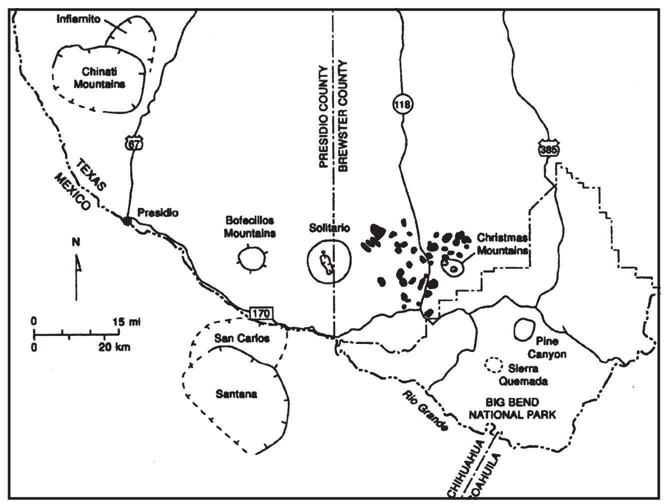

Figure 5. Several calderas and other volcanic centers in southwest Texas and adjacent Chihuahua, Mexico are shown. The black areas are intrusives around the Christmas Mountains. Santana Tuffs erupted from the Santana calderas in Mexico. After Henry and Davis, 1996, p. 82.

Acknowledgments

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Do the Microcontinents Between Greenland and the British Isles Fit With Plate Tectonic Theory?

Jim Honeyman*

What happens to a theory if physical facts logically predicted by it are not found? For example, a basic assumption of Plate Tectonic Theory states that if North and South America separated from Europe and Africa, the North Atlantic Ocean would have been generated between them as the continents moved apart. The problem with this model are the multiple continental islands and ridges which lie between Greenland and the British Isles.

Problems Along Continental Margins

Talwani and Eldholm (1974, p. 361) stated: "The margins have been complicated by the interpreted splitting off of the continental fragment comprising the Jan Mayan Ridge..." They proposed that this ridge split off of Greenland and "rotated" to its present location north of Iceland, and about 300 km east of Greenland. No force was suggested which might cause this movement.

According to Roberts, (1974, p. 343) "Farther to the west, the Faeroe Islands and Rockall Plateau *microcontinents* are separated from the margin..." (emphasis added). Also (1974, p. 343) "The Rockall Plateau is the only major microcontinent in the North Atlantic Ocean…" These structures are not considered to be thin, basaltic ocean floor.

There are large differences between continents and ocean floor. "These surveys showed that the undersea crust in both the Atlantic and the Pacific is only 4 to 6 kilometers thick, compared with the 25 to 40 kilometer thickness of the crust beneath the continents." (Ericson and Wollin, 1967, p. 246). Also, "...the crust is differentiated into two separate general rock types with different densities... Sialic rock is sometimes termed continental or granitic... continental masses have a density of about 2.7, whereas the density of the oceanic crust is 2.9. (Davis, 1977, pp. 20–21). The rock of the ocean floor is basaltic, and the density and chemistry are similar to the mantle rock which underlies both ocean and continent. The great depth of lower density continental rock penetrates deep into the higher density mantle and obtains buoyancy which supports the continental surface above sea level. The principle is exactly the same as a ship which sinks into and displaces water in order to float.

If continents are 25–40 km in depth, then as they moved apart, a deep chasm would open between them. Since the Atlantic ocean crust is only about 5 km thick, hot, plastic mantle rock would have to rise this distance to form new ocean floor. Therefore, all of the ocean floor between Europe and North America should be thin, basaltic rock. The facts already presented, however, show that between Greenland and Ireland there are substantial structures identified as continental by geologists.

Problems with Iceland

Iceland presents an interesting problem. The water depth between Iceland and Greenland is less than one km. If it is continental, then it may be joined to Greenland by a great depth of granite. However, on the National Geographic map of the Arctic Ocean floor, (1989) Greenland is shown to be a part of the North American continent. It is firmly attached to Canada in the north by continental rock under the Nares Strait and in the south by rock under the Davis

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Strait. Between these straits is Baffin Bay, where the water is so deep that it may have a true, basaltic ocean floor. The question arises, if Greenland is part of North America and Iceland is attached to it, is Iceland also part of the North American continent?

The answer, according to the National Geographic map of the North Atlantic ocean floor, (1988) is that there are continuous continental structures from Greenland to the British Isles. These include Iceland, the Faroe-Iceland Ridge and the Faroe Islands, and the Faroes appear to be attached to the continental shelf of Europe which underlies the North Sea. South of Iceland are the Reykjanes and Garder Ridges, and south of the Faroes, the Wyville-Thomson Ridge and Rockall Plateau. North of Iceland are the Kolbiensey and Jan Mayan Ridges. All of these are located where according to the theory, only thin, basaltic ocean floor should be found.

One kind of evidence illustrates the difference between Iceland and true ocean floor. South of Iceland there are thousands of kilometers of mid-ocean rift, which ends at the south end of Reykjanes Ridge. Scheidegger (1982, p. 19) refers to the rifts: "These are huge 'mountain' ranges rising above the abyssal plains, sometimes (in the form of islands) reaching to the surface of the sea." After the rift opened, the floor on both sides was elevated. This elevation, however, increased the diameter of the earth at that location, increasing the circumference along the central rift. The force elevating the ocean floor was so powerful that it opened fractures perpendicular to the central rift which permitted the increase in circumference. These fractures are prominent on every map of the ocean floors.

However, the force which opened the mid-ocean rift also forced a fracture or earthquake fault from the south end of Reykjanes, through Iceland and past the north end of Jan Mayan, a distance of about 2200 km. In all this distance, there are no perpendicular fractures. The implication is that the fracture passed through continental granite which was there before the fault was generated. As though to certify the difference from thin, basaltic ocean floor, the rift continues north into the deep Norwegian Sea where the floor was elevated with perpendicular rifts. Evidently following the path of least resistance, the rift turns left through the Spitsbergen Fracture Zone, which again must be deep granite because it is not elevated. Emerging into the Arctic Ocean, the rift turns right about 70°, elevates the thin ocean floor and dies out at the Siberian coast.

Evolutionists assume that millions of years were available to introduce continental fragments between Greenland and Europe. That assumption has this limitation: Iceland was in its present location before the mid-ocean rifts were elevated and the perpendicular fractures generated.

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Book Reviews

Molecular Biology of the Cell, Third Edition

by Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, and James D. Watson

Garland Publishing, New York. 1999, 1291 pages, $75.95

Lest the reader think that only general public textbook authors use outdated or misrepresented facts, I would like to draw your attention to this new textbook, with James Watson (of Watson and Crick DNA helix fame) as the senior author. As a surgeon now 21 years out of medical school, I enjoyed Wayne Friar's article, Embryology and Evolution (1999). I remember learning Ernst Haeckel's "biogenetic law" and his illustrations in medical school in 1975. It surprised me to learn from Dr. Friar that these were known to be fraudulent 85 years ago. It surprised me even more to see the exact same illustrations displayed again on page 33 of this book, which one would expect to be up to date. Statements in the Preface to the First Edition include, "The broad coverage expresses our conviction that cell bi-