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Tides and the Creation Worldview

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Abstract

Lunar tides play a significant role in creation studies. Tides help our understanding of the fundamental law of gravity and also contribute to the biological health of the world's oceans. Canada's Bay of Fundy is one location where tides are especially evident, and an on-site description is included. The earth-moon tidal interaction results in a gradually receding moon and a slowing of the earth's rotation. These dynamical changes are highly dependent on earth-moon separation and are in conflict with the evolutionary timescale.

Introduction

The moon is our nearest neighbor in space. This natural satellite plays a key role in creation studies, including the topics of lunar origin, dust accumulation, orbital recession, transient phenomena, and the origin of life. The lunar tides interface with several of these topics. Ever since the fourth day of Creation, tides have washed the earth's coastlines. The history of tidal studies goes back many centuries with efforts to understand their cause. These efforts were largely unsuccessful until the gravity insights provided by Isaac Newton in 1687. Still today, questions remain concerning details of the tidal interactions between the earth and the moon, especially historical changes and frictional effects.

Tide History

There are excellent summaries of the development of tide clocks, maps, mechanical predicting machines, tide tables, and explanatory theories (Cartwright, 1999; Wylie, 1979). Galileo (1564–1642) proposed a unique cause for the earth's tides in his 1632 work, *Dialogue Concerning the Two Chief World Systems*. Figure 1 illustrates Galileo's approach, which does not involve the moon. The earth both rotates and revolves, and the large partial circle shows the earth's orbital path. The portion of earth at point F moves fastest through space since the rotation and revolving speeds add together in the forward direction. In contrast, the S position moves slowest since the forward revolving speed is somewhat counteracted by the back rotation. Galileo suggested that the ocean waters "piled up" at F as they were pushed ahead, and they likewise accumulated at S because of sluggish motion. The result was two high tides, roughly twelve hours apart, just as we observe. Galileo's explanation is interesting, but it is entirely wrong. One must remember that Galileo was searching for evidence of earth movement in his effort to challenge the geocentricism of his day, four centuries ago.

Fifty-five years after Galileo's publication, Isaac Newton showed in his classic *Principia* (1687), that the pull of the moon's invisible gravity is the key to understanding the tides. As Galileo had realized, the difference in relative earth motion at points F and S is not negligible. Orbital speed averages 66,000 miles per hour, and rotation speed is about 1,000 mph at the equator. However, the daily change of 66,000 ± 1,000 mph does not cause the seawater to "pile up" since the seas are a fixed component of Earth's rotation. Furthermore, the high tides do not line up with

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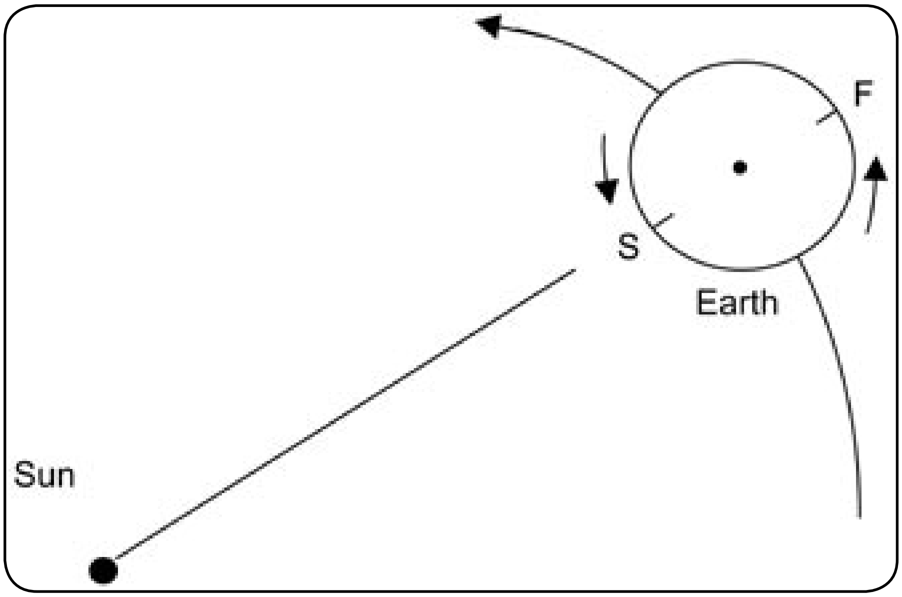

Figure 1. Galileo's model attributed high tides F (fast) and S (slow) to the earth's rotation (small circle) and revolution about the sun (large partial circle). Not drawn to scale.

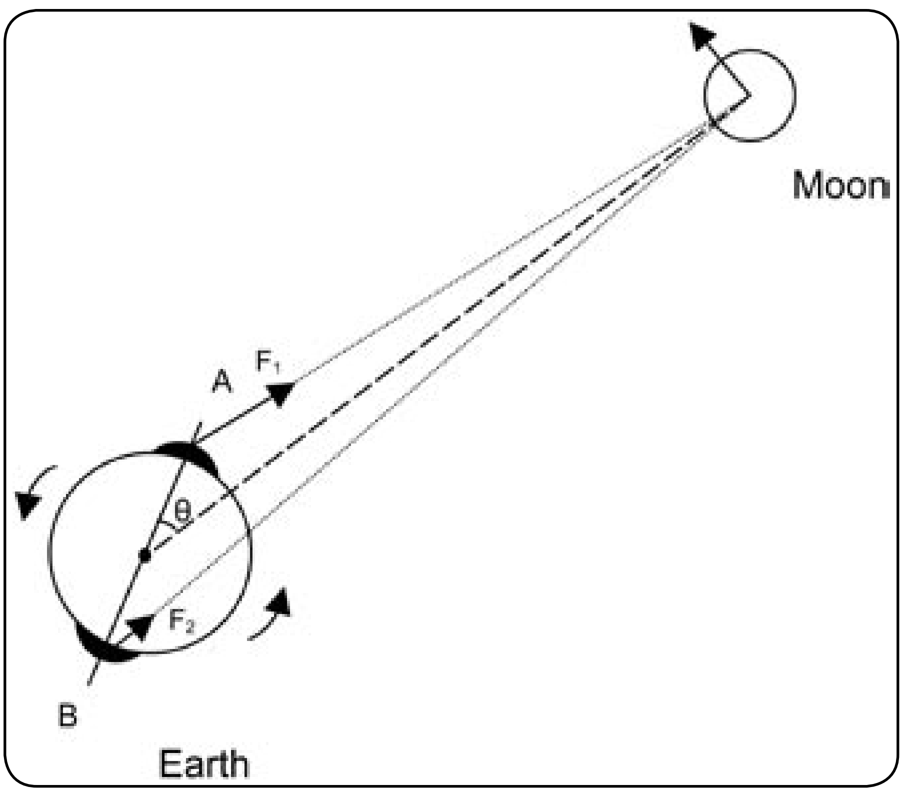

Figure 2. The earth and moon from above earth's North Pole, not drawn to scale. Friction causes the earth's tidal bulges to advance slightly ahead of the moon. The lag angle θ is two degrees or less. The forces F_1 and F_2 show the moon's gravity pull on the high tide bulges.

the sun as Figure 1 assumes. As Newton realized, it is the distant moon's gravity that controls the tides.

Tides and Gravity

It is readily noticed that the earth's high tides are separated by about 12 hours and 25 minutes. That is, if high tide occurs at a given location at twelve noon one day, then the next two high tides will occur at about 12:25 a.m. and 12:50 p.m. the next day. Since the moon rises about 50 minutes later each night, a lunar-tidal connection is apparent. We now know that the 50-minute increment is due to the combination of the rotating earth and revolving moon. In days gone by, however, this explanation was not obvious.

Figure 2 shows the earth with its two high-tide bulges, exaggerated in size. The bulges do not line up exactly with the moon's position, as explained in following sections. The bulge nearest the moon occurs since that portion of the earth experiences the greatest lunar gravitational acceleration. The bulge on earth's far side can be thought of as feeling the least acceleration, and therefore bulge B "lags behind" that of the center of mass of the earth. As the earth rotates, the two high tides act like permanent ripples on the moving crustal surface. Two low tides also occur every 24 hours 50 minutes, each about six hours after a high tide. Mathematical details of the tides are given in Appendix 1. Between the earth's near and far sides from the moon, the tidal force difference totals an astounding 1.32×10^{19} Newtons, or about 1500 trillion tons.

On earth, gravity is easily out-pulled by simply lifting a paperclip with a hand magnet. On the scale of moons and planets, however, the gravity force dominates space with impressive strength. The sun also causes earth tides. The solar tides are about one-half the magnitude of lunar tides, mostly due to the sun's greater distance from earth, 400 times further away from us than the moon.

Crustal and Atmospheric Tides

Tides are not limited to earth's seas, but also extend to the earth's solid crust and atmosphere. Solid or body tides of the earth are detected by small periodic gravity variations at fixed points on the earth. Such measurements were first made around 1900 with the construction of precise gravity meters. The earth's crust is somewhat flexible on the large scale, and its surface at high tide rises about 30 cm, or 12 inches (Peale, 2001). If a large stethoscope could somehow be placed upon the earth, one might hear the creaks of the stretching and contracting earth. One might also suggest this flexing of the earth's crust is an occasional trigger for earthquakes, but no such correlation has been found between tides and seismic events.

High tides in the atmosphere are due to a very slight outward lunar pull and expansion of the air. This leads to a measurable decrease in barometric pressure. A small, twelve-hour oscillation in pressure was detected with a mercury barometer in 1785 (Cartwright, 1999). It amounts to a pressure change of about 3 millibar, that is, 0.002 in or 0.005 cm of mercury. This is a 0.0066% change from normal air pressure. Solar heating of the atmosphere causes a far larger barometric effect. The thin upper atmosphere may expand and contract by several kilometers.

Bay of Fundy Tides

Around the world, high tide averages about 3 feet, or 1 meter above low tide. In places, however, tides reach impressive levels. One such location is the Bay of Fundy, located between the Canadian provinces of New Brunswick and Nova Scotia (Figure 3). The bay trends northeast with an Atlantic entrance width of about 60 miles (100 km) and a length of 180 mi (290 km). Toward the closed end, or head, of Fundy, the high tides reach 50–56 feet (15–17 meters) above low tide levels. This dramatic change is as high as a four-story building.

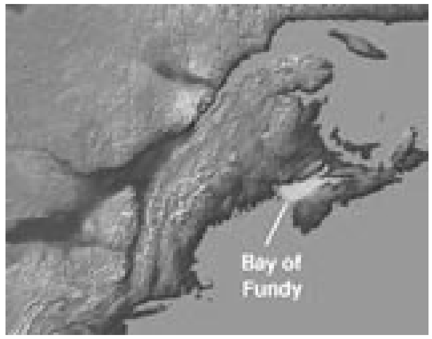

Figure 3. The Bay of Fundy lies between Canada's eastern provinces of New Brunswick and Nova Scotia. The bay covers an area of about 12,000 mi^2 or 31,000 km^2 of water.

There are two contributing reasons for the record tides in the Bay of Fundy. First, the length of the bay results in resonant water movement with the tides. The time for a wave to move from the mouth of the Bay to its head, and back again, is 12–13 hours. This is approximately the time between two high tides. As a result, the rocking motion of the water builds up and is amplified, an effect called *seiche*. The phenomenon is somewhat like a child sloshing water back and forth in a bathtub or small pool. A second reason for the impressive Fundy tides is the gradual narrowing of the bay along its length, funneling incoming water together. Two smaller horn-shaped bays at the head of Fundy further act like funnels within a larger funnel, concentrating the incoming water. It is in these inner bays where the highest tides are recorded.

A Personal Tour of Fundy

During Fall, 2007, my wife Sally and I traveled along the New Brunswick coast of Fundy Bay. The large-scale tides result in many wide tidal flats, streams and rivers that periodically reverse their flow, and coastal rock formations that are alternately submerged and exposed. The intertidal zone and inland waterways are a paradise for wildlife as the tides come and go. Of special note are Hopewell Rocks near the head of Fundy Bay (Figure 4). These are several sandstone/conglomerate sea stacks, 60–80 feet tall (18–24 m), which have been sculpted by the relentless tidal motion. At low tide, one can walk on the seafloor at the base of the mushroom-shaped rock formations. The ground is thick with gardens of seaweed and barnacles. Six hours later, at high tide, the tops of the stacks become small islands covered with spruce trees. Brochures at the Hopewell site claim that the rock formations formed during the ice age, 12,000 years ago. However, the Hopewell Rocks are actively eroding due to advancing and receding water. One team of geologists suggests, on the basis of old photographs, that the Hopewell Rock formations are only 100–250 years old (Trenhaile et al., 1998). This estimate fits the young-earth view of history, where earth changes are not on the scale of multiple thousands or millions of years. Readers may recall the 2003 loss of New Hampshire's "Old Man of the Mountain" and also the 2005 collapse of the "Apostle" sea stack on Australia's coast. The earth's surface is changing before our eyes.

At the entrance to Canada's Fundy National Park, the coastal village of Alma provides a dramatic view of the changing tides. As high tide diminishes, one can watch the shoreline widen at the rate of several feet per minute. Mudflat islands appear offshore and soon connect to the mainland. Docked fishing boats are left stranded and tilted on the wet ground until the tide returns to refloat them six hours later.

Moncton, New Brunswick, is famous for a tidal bore occurring periodically on the Petitcodiac River. Incoming water at high tide is funneled into the shallow, narrowing river. Friction on

Figure 4. Hopewell Rocks are scenic coastal formations near the head of the Bay of Fundy. These sea stacks are flooded and dried out twice every 24 hours.

the river bottom causes the rising water to slow and build up to a single wave that moves upstream against the normal river current. Similar tidal bores occur worldwide on coastal rivers where the local geography permits. River surfing is possible on the impressive Amazon tidal bore, but there are also dangers with the phenomenon. In 1843, the daughter and son-in-law of French writer Victor Hugo (1802–1885) were drowned on the Seine River when their sailboat was overtaken by a tidal bore. Also, in 1922, 130 lives were lost when a large bore wave capsized a steamer on the lower Colorado River in Mexico (Wylie, 1979).

Our visit to the Moncton tidal bore was on a November morning. There is a city park with bleachers placed along the riverside for viewing. However, building and bridge construction along the river have diminished the bore in recent years. When we asked residents about the tidal event for which their city is famous, some were not familiar with the heritage. There is a time clock in the park to indicate the arrival of the bore for observers, but it was not accurate. In past years, the Moncton bore wave reached five feet high. The wave we observed on a fall morning was less than one foot. Still, it was impressive to watch this leading-edge wave moving upstream at about walking pace, 3 miles/hour (4.4 feet/sec). The wave was accompanied by a line of white foam extending from shore to shore. The tidal bore made little sound, and unwary ducks were surprised and tossed into the air by its passing. The Moncton, New Brunswick, tidal bore continues twice every 24 hours, year around, little noticed except for tourist season, and greatly diminished from earlier years.

Tidal Energy

Energy extraction from the tides for electricity is an attractive option. Consider the Bay of Fundy, where 100 billion tons of water sweep in and out, twice each day. This is about twice the total discharge of all the world's rivers combined. Tidal energy produces no smoke or thermal pollution, and no radioactive waste. There is an estimated worldwide tidal power production potential of about 200 billion watts, equivalent to 200 fossil fuel or nuclear plants. This is a small component of the current total since there are more than 50,000 power plants worldwide, large and small. Still, at full potential, harnessed tidal energy could replace the consumption of 3–4 billion barrels of oil annually. Reality, however, complicates the picture. Tidal electric generating plants are limited to coastline areas where the tides are high, and where the water can be channeled through turbines. Also, the building of major dams to channel seawater is not economical, and a host of environmental concerns arise with coastal construction.

The best-known tidal power plant is located on the English Channel estuary of the Rance River in France. Since 1966, this facility has been generating 240 million watts of power, about one-quarter that of a large power plant. U.S. states considering similar tidal plants include Alaska and Maine. Countries with plans to tap tidal energy include Australia, Brazil, Canada, China, India, Korea, and Russia. Rising oil prices may yet make tidal generating plants a growth industry worldwide.

Tidal energy currently is lost to water turbulence, friction between water and the sea bottom, land erosion, etc. The tidal energy dissipation across the entire earth is enormous. The tidal power loss is estimated at 1.5–2 x 10^{12} watts (Stacey, 1969, p. 34). This is the approximate electric power production of the entire world. The large-scale frictional energy loss resulting from the moving seas is the subject of the next two sections.

Lunar Recession

George Howard Darwin (1845–1912) was the fifth of Charles and Emma Darwin's ten children. George is called the "father of geophysics" for his dynamical studies of the earth and solar system. In 1878, he proposed that our moon originated by fission from the earth. He believed that the earth once rotated about ten times faster than at present. The moon was flung outward from the Pacific Ocean basin, much like mud from a spinning bicycle wheel. Lunar fission is a failed theory and has been followed by a parade of alternate lunar origin theories, none of them scientifically adequate or convincing (DeYoung and Whitcomb, 2003). Nevertheless, George Darwin's fission theory led him to consider the gradual outward movement of the moon from the earth. He wrote five major technical papers during 1879–1880 that included both lunar recession and earth retardation.

Figure 2 shows that the earth's two tidal bulges do not line up exactly with the moon. The lag angle is not well known, and it varies. One estimate of the high tides offset is 2.2° (MacDonald, 1965, p. 285). High tide occurs eastward or ahead of the moon because of friction and inertia of the earth's tidal waters. The near-moon bulge continually pulls the moon forward, resulting in a slow outward-spiraling lunar orbit. The increasing distance to the moon is precisely measured by earth-based lasers. Beams are reflected back from retroreflector devices placed on the moon during the 1969–1972 Apollo missions. The current lunar recession rate, after orbital motions and oscillations are subtracted, is 3.82 ± 0.07 cm/yr, or 1.5 in/yr (Cartwright, 1999, p. 250).

George Darwin realized that lunar recession was nonlinear, and was considerably greater in the past when the moon was closer and the tides were stronger. Based on theory, Darwin's estimate for the time when the moon fissioned from the earth was on the order of 54 million years ago (Cartwright, 1999, p. 150). Appendix 2 gives a calculation for the extreme nonlinearity of lunar recession. This analysis gives a maximum lunar age of less than 1.55 billion years. By no means is the moon necessarily this old. Instead, this number is an upper limit on lunar age, and it also is a major challenge to the evolutionary view of lunar history. If one "regresses" the lunar distance into the distant past, the moon comes uncomfortably close to the earth in less than two billion years. If such an event actually occurred, the resulting tides would be hundreds of feet high and would sweep far inland. Furthermore, tides from a nearby moon could heat the oceans to the boiling point and extinguish life on earth. Worldwide earthquakes and volcanoes would result from distortion of the earth's crust. If the moon were ever closer to the earth than the Roche (rōsh) limit, it would be destroyed. This limit extends outward from earth's center about 2.9 radii, or 18,500 km. If the moon were ever at this near-earth position, the earth's gravity would overcome the self-gravity of the moon. As a result the moon would shatter into fragments and spread out into a Saturn-like ring around the earth.

The preceding limit on lunar age, less than two billion years, cannot be tolerated by the natural science community. The moon is firmly assumed to be 4.6 billion years, the same age as the earth and the rest of the solar system. What is the response to the serious conflict between the 4.6 billion year age assumption and the moon's recessional age limit? Some creation critics simply reject a nonlinear, increasing recession rate in the past. If the recession has always been just 3.82 cm/yr or less, then an ancient lunar age is compatible. However, the lack of understanding of such critics needs no further rebuttal.

Another suggestion is that the current value of lunar recession, 3.82 cm/yr, must be anomalously high. That is, in contrast to the physics model of Appendix 2, the recession rate is said to be getting larger over time rather than smaller. In this view, for a long period of history, lunar recession was very small. Then, at some point, the moon underwent a sudden speedup in its outward motion. This unexplained increase in lunar recession rate (and earth rotational slowdown) is described as an inflection or phase-change of the earth-moon dynamics (Lathe, 2006; Thompson, 2000). There is no mechanism for such a change, which appears to be a desperate attempt to preserve the assumed 4.6 billion year age for the moon.

Some fossil corals and banded iron formations appear to show tidal growth lines from the distant past. This data has been searched for evidence of a dramatic, historic, inflationary change in tide magnitude, but without success. Whether or not fossil coral bands actually show evidence of paleotides is a separate, doubtful issue (DeYoung, 1979). On a timescale of just 6000 years, with little change in the 3.82 cm/yr recession rate, the moon has moved outward since Creation a negligible distance of about 230 meters.

Earth Retardation

As the moon's orbit slowly spirals outward, the earth's rotation slows. Eclipse records give supporting evidence: Around 1695, Edmund Halley noticed that Arab solar eclipse records from A.D. 900 were in conflict with the calculations of his day by 1–2 hours. Research continues on eclipse records found on Babylonian clay tablets. In 1754, Immanuel Kant first suggested that the length of day was increasing due to tidal braking. George Darwin's 1879–80 technical papers clarified the idea of "earth retardation," or rotational slowing.

It is currently estimated that earth's daily rotation is decreasing by about 0.002 sec/century. This value is highly nonlinear, just as Appendix 2 shows for the lunar recession rate. The historic rate of earth's rotational slowdown is somewhat uncertain due to unknown frictional effects, continental drift, fluid core motion of the earth, ice distribution, and solar activity. Considering evolutionary time, and linearity for simplicity, one billion years ago the length of each day would be 5.6 hrs shorter than today, or 18.4 hours long. In contrast, on a creation timescale, the length of a day 6,000 years ago was just 0.12 seconds longer than at present.

Tides and Life

Tidal cycling has been suggested as a driving force for the spontaneous origin of life on earth (Lathe, 2004). The periodic coastal flooding and drying is thought to be helpful for the spontaneous formation of replicating prebiotic polymers, or precursors to life. Multiple uncertainties in this origin-of-life scenario include the presumed faster tidal cycling in the ancient past, sea salinity, available chemicals, and continental drift. Varga et al. (2006) point out further problems with this desperate attempt to begin life on the earth using the moon's tides as a catalyst.

Apart from life's origin, the moon is indeed essential to present-day life. The moon is responsible for the regularity of earth's seasons by its stabilization of the earth's rotation axis (Ward and Brownlee, 2000, p. 222). Without the moon, on a long timescale, the earth's axis would wobble randomly. As a result, much of the earth might become locked into a permanent deep freeze, or else heated to dangerous levels.

Aside from the seasons, the moon also is indirectly responsible for about half of the oxygen in our atmosphere. The seas are filled with microorganisms—algae, bacteria, and phytoplankton—that perform the near magic of photosynthesis. These organisms have been called the grasses of the seas, with total biomass that exceeds all the land plants and trees. Likewise, coastal areas support vast amounts of aquatic vegetation, including submerged kelp forests. The total oxygen production of the sea closely matches that provided by all the land vegetation (Travis, 2003). It is tidal movements that help keep the seas healthy by neutralizing chemicals entering from the land. The rivers of the world pour an unhealthy mix of chemicals into the oceans, both natural and man-made, especially agricultural runoff. Continual dilution, dispersion, and disintegration of pollutants take place, and as a result, the seas remain suitable for the essential oxygen-producing plant life.

A further vital connection between life and the tides are the biorhythms that govern sea and shoreline creatures. The spawning of grunion, the hatching of sea turtles, and the feeding of seabirds all depend on the regularity of the tides.

Some have suggested that the moon and its tides influence people. After all, tides act on water, and the human body is composed of about 65% water. Attempts have been made to connect the birth rate, crime rate, and stock market performance with the moon and its tides and phases. However, studies fail to show a convincing statistical correlation. Appendix 1 shows that lunar tides do not apply to people. Tides act on the earth because of the 7,910-mile (12,730 km) diameter distance between its near and far sides from the moon. However, the distance difference between a person's head and feet gives a negligible tidal acceleration. There may be unknown lunar connections between the earth and moon, especially in agriculture, but "human tides" do not occur.

Evolutionary Future of the Moon

Secular science does not have an optimistic view of the distant future (Stacey, 1969, p. 39). Some of the predictions include: If lunar recession continues unchecked, then in about four billion more years the moon will reach a maximum distance from earth of 350,000 miles, about 50% farther than its present location. By then, earth rotation will have slowed to 55 of our present days. There will then be only 6–7 days in an entire earth year. The moon orbit time will also be slowed to 55 days, so it will appear to be suspended motionless in the sky on one side of the earth. Lunar tides will no longer be significant or change because of the greater earth-moon distance and the earth-moon synchronism. Any existing life on earth will be endangered by the reduced tides and lack of ocean mixing. Lunar recession will now reverse its outward motion and begin to approach the earth, due to the sun's extended atmosphere (Powell, 2007).

An earlier section of this paper describes the breakup and loss of the moon as it approaches earth's Roche limit. With the moon now reduced to a ring of debris, solar tides will dominate and gradually slow the earth's rotation further. Eventually, the length of the day will equal or surpass the length of the year. One side of the earth will become a permanent scorching desert while the dark side is covered with miles of ice. Before this happens, however, the sun will reach its red giant stage. That is, the sun will expand greatly and burn the earth's surface, if not vaporize it completely.

There are a variety of eschatological views among creationists. However, each view has a more optimistic and positive view of the distant future. We are assured that the times are in the Creator's hand (Ps. 31:15).

Conclusion

We have discussed several aspects of the earth's tides, yet mysteries remain. One unknown is the actual mechanism of tidal friction, on both the sea and land. Also, we know that tides are caused by the moon's gravity, but what is this invisible force that gives stability to the universe? General Relativity shows that curvature of space is responsible, yet the source of the curvature is itself a mystery. Meanwhile the tides continue to wash the world's shorelines daily, as they have done since the week of Creation.

Appendix 1: Earth Tides

Figure 2 shows the earth-moon system, including earth's two high-tide bulges. The high-tide offset from alignment with the moon is discussed in Appendix 2. The earth's near side feels the greatest lunar gravity attraction, resulting in bulge A. The earth's far side feels a minimum lunar gravity force, leading to bulge B. Consider the total gravity force F between the earth and moon,

$$F = Gm_e m_m/r^2$$

where G = the universal gravity constant, m_e = earth mass, m_m = moon mass, and r = the earth-moon separation. Let us find the difference dF in lunar gravity attraction between bulges A and B, where dr is earth's diameter, by taking the differential of F.

$$dF = F_1 - F_2$$

$$= -2Gm_e m_m dr/r^3$$

$$= -F2dr/r$$

Substituting $F = 1.98 \times 10^{20}$ N, $dr = 1.28 \times 10^7$ m, and $r = 3.84 \times 10^8$ m,

$$|dF| = 1.32 \times 10^{19}\ \text{N}$$

This difference between the lunar forces at bulges A and B is nearly 1.5×10^{15} tons. That is, lunar gravity pull is about 7% stronger at bulge A than at bulge B,

$$dF/F = 0.0667$$

Appendix 2: Lunar Recession

Figure 2 shows the earth-moon system, including earth's tidal bulges, not to scale. These high points result from the unequal lunar gravity forces F_1 and F_2, where $F_1 > F_2$. Notice that F_1 and F_2 result in a twisting effect, or torque (T) about the earth's rotation axis, tending to slow the earth's rotation. Note that this tidal torque is distinct from the more familiar torque responsible for the earth's precessional motion. This latter torque is also due to the moon but results from earth's equatorial bulge, not the tides.

From Appendix 1, the height or size of the tidal bulges is proportional to $1/r^3$, where r is the earth-moon separation. That is, the height of the tides increases strongly as the earth-moon separation decreases. Furthermore, the forces F_1 and F_2 themselves increase proportional to $1/r^3$. Said another way, one can think of this as positive feedback: As r decreases, earth's tidal bulges will grow as $1/r^3$ and F_1, F_2 will also increase as $1/r^3$. As a result, the braking torque on the earth's rotation varies sharply as $1/r^6$. See (Peale, 2001) for a full discussion of this torque.

Conservation of angular momentum requires that the amount lost by the earth's decreasing rotation is taken up by the moon's orbital angular momentum (l_m). From Newton's second law, the earth braking torque is

$$T = dl_m/dt \qquad (1)$$

and

$$l_m = m_m r^2 \omega$$

$$= m_m rv$$

where m_m, ω, and v are the moon's mass, orbital angular velocity, and orbital velocity.

Applying this discussion to (1) and absorbing m_m and the torque proportion into a constant k^{ll},

$$1/r^6 = k^{ll} d(rv)/dt$$

we can substitute v from Kepler's third law, where G is the gravitational constant and M is earth mass,

$$v = (GM/r)^{1/2}$$

then, with a new constant k^l,

$$1/r^6 = k^l d(r^{1/2})/dt$$

the differential becomes

$$d(r^{1/2}) = 1/2r^{-1/2}dr$$

Therefore, with a modified constant k,

$$dr/dt = k/r^{11/2} \qquad (2)$$

Now integrate, with the lower limit t =0 when r =0. That is, with the moon's origin by either fission or collision, it begins at the earth's location at time zero.

The result is

$$t = 2/13(r^{13/2}/k) \qquad (3)$$

This is the same result achieved by MacDonald (1966, p. 181), and Brown (2008), with alternate derivations. For a graph of equation (3), see DeYoung (1990).

Looked at another way, one can solve equation (3) for k, and substitute k into (2). The result is

$$dr/dt = 2r/13t$$

Applying this equation to the present, r = 384 thousand km, dr/dt = 3.82 cm/year, t gives the historical time at which the moon would be positioned at the earth's location. The result is t = 1.55 billion years. This number should be looked at as an approximate, extreme limit on the moon's age. The range of alternate derivations is 1.4–2 billion years, one-third to one-half of the moon's assumed age.

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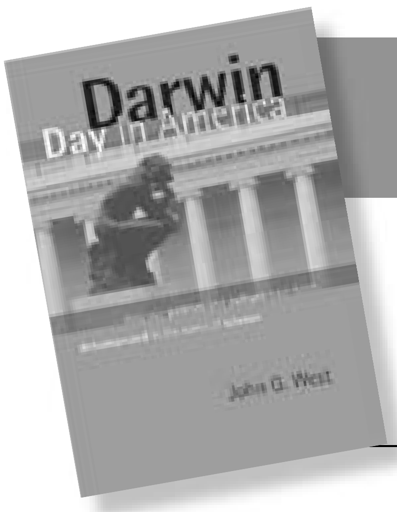

Book Review

Darwin Day in America

by John G. West

Intercollegiate Studies Institute, Wilmington, DL, 2007, 370 pages, $20.00.

It has often been said that ideas have consequences. This truth comes forth in this work by John G. West. West is Senior Fellow at the Discovery Institute in Seattle. He earned his Ph.D. from the Claremont Graduate University in government and has published a number of works dealing with Darwin and related issues.

Darwin Day shows how the ideas put on the table by Charles Darwin in the nineteenth century have affected how we view life, not only in America but also across the globe. It may be fair to say that the man on the street, if asked, would say that Darwin and his ideas are only of biologic interest. Not so, says West. He brings attention to the ways in which Darwinian thought is not only about biology but also about economics, poverty, wealth, education, sex, life, and death. Darwin has provided an all-encompassing view of reality and has infected us on how we deal with each other. Calling Darwinian thought "scientific materialism," West contrasts this view with the more traditional view that life is more than the sum total of things material.

West takes a journey into modern thoughts about crime and punishment. Under Darwinian thought, crime is a mental illness and punishment is turned into treatment (chapters 3-5). Especially eye opening is the discussion on eugenics, a movement that is making advances in our day. Life becomes cheaper under Darwin. West shows how poor science has led to poor decisions in American life.

Much of the book might be viewed as "nothing new" in the sense that those who have followed the impact of Darwin for years know the disturbing implications. Nevertheless, there will be others for whom the book can be a wakeup call, inviting them to investigate more fully the things they thought to be true, as presented in countless books, films, TV programs, magazines, and college courses. It can safely be said that many in the creation science movement are not on the same page as our friends at the Discovery Institute, the leading "think tank" for intelligent design. There are differences between us, but we are in the same fight, one directed to bring integrity and honesty back to the table. To that extent, we can join forces with West.

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