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Transient lunar phenomena: a permanent problem for evolutionary models of Moon formation

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The Moon is often described as a dead, unchanging satellite of the Earth. It has been called the 'museum of the early solar system', preserving surface features from long ago. Lunar geologic activity is thought to have ceased completely about three billion years ago. This figure is based upon cosmological ideas of how the Sun, Moon and Earth formed, and radioisotope measurements of basalt samples (hardened lava) returned by the Apollo 12 lunar mission in 1969. A popular astronomy text states, 'There is no evidence that the interior of the Moon now contains significant heat … . The Moon is now a cold, dead, geologically inactive world'.[1]

However, there is a persistent problem with the assumption of an inert, ancient Moon. The problem is a growing list of lunar surface changes that have been observed with telescopes. These events are called 'transient lunar phenomena', or TLPs.[2] They do not include meteorite collisions but instead involve internal Moon activity.

TLPs have been described by observers as bright spots, colored glows, light streaks, and mists. They generally cover a small area of just several kilometers extent or less and last for only a few hours. By the time an observer can notify others about a TLP it may have ceased. This transitory nature of TLPs probably discourages the reporting of many sightings because of uncertainty or a fear of ridicule.

The current secular view of lunar origin involves an ancient collision between two solar system planetesimals—large asteroid-like objects. The impact eventually resulted in formation of both the Earth and Moon by the accretion of collision fragments. This collision idea is critiqued elsewhere.[3] In evolutionary thinking, the early Moon then was heavily bombarded by additional planetesimals. These collisions, together with radioactive decay, generated sufficient heat to melt the Moon's outer shell and perhaps the interior as well.[4] This heat gradually dissipated and now, after billions of years, it should be long gone.

Creationists do not accept the collision idea for lunar origin. Instead, the Moon was created instantaneously and supernaturally on the fourth day of Creation (Gen. 1:14–19). TLPs do not conflict with a young Moon within the Biblical timescale. However, TLPs certainly conflict with the idea that the Moon is billions of years old.

Figure 1. *The full Moon with 11 transient lunar phenomena hotspots indicated.*[10]

Examples of TLP

Over one thousand lunar transient events have been reported since the 1600s when telescopes were first developed. Astronomer William Herschel during 1783–1787 reported several apparent lunar volcanic emissions: 'I perceived in the dark part of the Moon a luminous spot. It had the appearance of a red star.' Four years later Herschel wrote, 'I perceive three volcanoes … The third shows signs of an actual eruption of fire, or luminous matter.'[5]

More recently, in 1971, the Apollo 15 lunar mission detected a high concentration of the isotope radon-222 in the vicinity of Aristarchus Crater. This radioactive gas has a half-life of only 3.8 days. It is obvious that the radon, a byproduct or radioactive decay, was a recent gaseous discharge from within the Moon.[6]

Lunar heat flow measurements made during the Apollo missions also were surprisingly high.[7] The values conflict with the idea of a billion-year-old Moon with an inert, cold crust.

In 1992, French astronomer Audouin Dollfus observed an unusual 'diffuse brightening' near the center of the lunar crater Langrenus. The haze resembled a gas cloud which was emitted from the crater's central peak.[8]

A 1968 summary from NASA tabulates 579 TLP reports covering four centuries.[9] Many of the lunar surface changes are concentrated at certain locations such as the craters Aristarchus and Alphonsus. Figure 1 indicates 11 lunar sites where TLP reports have been frequent.[10]

Conclusion

Why is it often assumed that the Moon is geologically inactive? Because, if the Moon is truly ancient, it should no longer contain significant heat. This follows from the Moon's small size, one-fourth the Earth's diameter and only 1.2% of the Earth's mass. There is indirect evidence for a small molten lunar core, only 2–3% of the lunar mass. In contrast, the Earth's molten interior accounts for 32% of our planet's mass. Since the Moon's magma core is hundreds of km underground, surface volcanic activity therefore is thought to be impossible. Actually, there are major uncertainties about the interiors of both the Earth and Moon. The lunar molten core may or may not be 1,500 km deep, as assumed. Regardless, TLPs indicate local pockets of magma close to the lunar surface.

Because of this long-age belief, TLPs are typically dismissed as resulting from poor observing techniques, Earth atmospheric effects, or perhaps the solar illumination of lunar features.[10] And perhaps many TLP sightings can be explained in these ways. However, this still leaves hundreds of observations of apparent short-term geologic activity. At minimum, the assumption of an ancient unchanging Moon is seriously challenged. Indeed, the source of the transient lunar events, near-surface heat, is consistent with a recently created Moon as the Bible records.

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The 'cool-tropics paradox' in palaeoclimatology

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In 1947, Harold Urey developed a method for estimating past ocean temperatures by measuring the oxygen isotope composition of seashells. Oxygen comes in three stable isotopes, two of which are used as a palaeothermometer. It is assumed that the ratio of these two oxygen isotopes is correlated to temperature, although other variables also affect the ratio. The more ^{18}O compared to ^{16}O incorporated into a shell, the cooler the water in which the shell formed. For decades the $^{18}O/^{16}O$ ratio has been measured in shells from deep-sea cores. The ratio has been used to infer cooling of the oceans during the Tertiary of the evolutionary/uniformitarian time scale. In the Creation/Flood model, the Tertiary cooling trend has been placed in a post-Flood context.[1,2] The ratio has also been used to deduce up to about 30 or more successive ice ages during the past several million years of geological time, which has been related to the Milankovitch mechanism.[3,4] Recent findings call into question some of the uniformitarian palaeoclimatic interpretations of oxygen isotopes from deep sea cores.

The paradox

According to oxygen isotope measurements, a paradox arose for the Cretaceous to Eocene tropical sea surface temperatures within the uniformitarian paradigm. The oxygen isotope ratios measured in the planktonic animal, foraminifera, from deep sea cores showed that the tropical surface temperatures were significantly cooler than today. Very special upwelling of cool bottom water to the surface was one hypothesis used to explain such an anomaly. The cooler tropical temperatures occurred at the same time the mid and high latitude oceans and continents were