INTERNAL CONSTITUTION OF THE MOON IN THE LIGHT OF THE DYNAMIC EARTH MODEL

by

L. EGYED

(Geophysical Institute of Lorand Eötvös University)

(Received: 31. VIII. 1965)

SUMMARY

The author deals with the consequence of his Earth model concerning the structure and evolution of the Moon and states that:

1. The evolution of the internal structure of the Moon, just like that of the Earth, was governed by expansion.

2. In the Moon too, the low-velocity channel discovered on the Earth must exist, but it must be thicker and lie deeper than in the Earth.

3. The formation of the lunar craters is considered to be due to the volcanic activity of an originally highly gaseous magma, and only to an insignificant degree to meteorites.

4. The mechanism of evolution of the lunar maria must have been the same as that of the terrestrial oceans.

5. In the initial stage, the Moon must have possessed a significant atmosphere too, under which processes of erosion and sedimentation could have taken place.

6. The above statements are all corollaries of the Dirac-equation concerning the decrease of the gravity coefficient with time.

Since 1953, the author has developed a new, dynamical model of the Earth, based on his studies concerning the Earth's internal structure and dynamism. The essentials of this dynamical Earth model are as follows (1):

Disregarding the differentiated matter, 100 to 300 kilometres thick, of the upper mantle, the Earth consists of three modifications of a chemically uniform silicatic substance. The first modification corresponds to the inner core, the second one to the outer core, while the mantle consists of the third modification as suggested also by R a m s e y (2). Now the first modification is in steady transition into the second one, and the second into the third one. The transition is irreversible and results in a steady decrease of the mean density of the Earth. Therefore the volume of the Earth undergoes a steady increase. The rate of expansion connected with this decrease of bulk density can be derived from geological, geophysical and astronomical data, all of which yield an annual radius increase of 0,5 to 1,0 millimetre (3).

The basic physical phenomenon which brings about the transitions between the modifications and thus the expansion of the Earth is the decrease of the gravity coefficient according to the Dirac-equation, $f = \varkappa/t$ (4).

The Dirac-equation provides an insight into the process of formation of the solar system; it is to be concluded (5) that the latter was not due to a concentration of a large number of meteorites. The Moon is no satellite of the Earth, but its twin, i.e. Earth and Moon constitute a double planet.

The application of the Dirac-equation and of the results of the dynamical Earth model to the Moon has the consequence that the volume of the Moon must also have increased steadily with time and that the rate of radius increase of the Earth is different from that of the Moon. Initially, the pressure in the interior of the Moon was high enough so that the high-pressure phases found in the present Earth could subsist and consequently, the Moon also possessed a high-density core. At that time the lunar continents came to exist on the surface of the Moon, forming a uniform and contiguous surface shell. This first lunar shell was much thicker than the first terrestrial mantle. Indeed we have proved (6) that the first mantle of the Earth was exceedingly rich in volatiles, some part of which, escaping, formed the terrestrial atmosphere and hydrosphere. The same process took place on the Moon too; however, as the lunar mantle was much thicker owing to the Dirac-relation, the mass of the escaping gases was much greater too, so that the uppermost differentiated acidic magma formed an exceedingly volatile-rich melt similar to rising dough, which was soon solidified, and then repeatedly blown up by the excess gases; it was in this way that the characteristic lunar craters came to exist. This process of formation is in agreement with Baldwin's diagram, who compared the lunar craters with bomb and explosion craters. The explosion of the bubbles of the rising dough made possible the formation of giant craters.

The lunar maria were brought forth by the expansion of the Moon, which has torn apart the superficial layer and let the volatile-poor deeper magma mount to the surface. That is why the craters of the maria, being formed in a latter stage of the degassing process, are so small. Hence only an insignificant part of the lunar craters are due to the impact of meteorites.

In the interior of the Earth, Gutenberg has demonstrated the presence of a low-velocity channel. The existence of this channel was confirmed by later investigations, and the dynamical Earth model has provided a satisfactory explanation of its origin, considering it as the result of a first process of differentiation taking place in the mantle. Now the same process took place in the Moon, too, and consequently a low-velocity layer must exist there also, only at a much deeper level than in the Earth. Beneath this deeper-lying part, the lunar mantle must contain even to-day significant amount of volatiles which may surge eventually to the lunar surface along deep fissures of the lunar mantle caused by moonquakes (on the analogy of earthquakes).

From the Dirac-equation and from the idea of the Moon's expansion it also follows that, immediately after the first differentiation, the Moon must have possessed an atmosphere and a hydrosphere, too, which brought about some phenomena of weathering on the primordial lunar surface. In this stage of development, sediments must have formed, some traces of which must be still there (7), because the subsequent escape of the atmosphere and hydro-

sphere as a result of the decrease of the gravity field stopped the processes of weathering and transport.

In all, the application of the basic assumptions of the dynamic Earth model to the Moon gives some quite matter-of-fact explanations for the origin and development of the lunar surface too.

REFERENCES

1. Egyed L.: A new theory of the internal constitution of the Earth and its geological-geophysical consequences. *Földtani Közlöny,* **85.** 277 – 318 (1955 *in Hungarian with English summary)* and *Acta Geol. Acad. Sci. Hung.* **4.** 43 – 83. (1956 *in English).*
2. Ramsey W. H.: On the nature of the Earth core. *Monthly Notices. R.A.S. Geoph. Suppl.* **5.** 409 – 426 (1949).
3. Egyed L.: Determination of changes in the dimensions of the Earth from palaeogeographical data. *Nature.* **173.** 534 (1956).
4. Dirac, P. A. M.: A new basis for cosmology, *Proc. Roy. Soc.* **A. 165.** 199 – 208 (1938).
5. Egyed, L.: Dirac's cosmology and the origin of the solar system. *Nature.* **186.** 621 – 622 (1960).
6. Egyed, L.: On the origin and constitution of the upper part of the Earth's mantle. *Geol. Rundschau.* **50.** 225 – 234.
7. Gold, T.: Dust on the Moon. *Vistas in Astronautics.* **2.** 261 – 266 (1959).