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Formation and evolution of the Earth and the Moon: evidence from petrological data

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At present, the main concepts of the formation and internal evolution of solid terrestrial planets are based on diverse physical and geochemical calculations and theoretical models. It is implicitly accepted that there is no real relevant material in nature, and the problem is the subject of diverse speculation. All of these hypotheses are speculative and completely ignore the available geological and petrological data on the tectonomagmatic evolution of these bodies. However, these data provide the main information on the internal evolution of planetary bodies. Comparative study of the Earth and Moon revealed a significant similarity in the evolution of lunar magmatism and terrestrial Paleoproterozoic magmatism. There are no analogues of the terrestrial Archean (granite–greenstone terranes) and subduction-related Phanerozoic activity on the Moon.

The major feature of irreversible evolution of the Earth and the Moon is existence of sharp turning point in development of tectonomagmatic processes at the middle stages of their existence (2.3-2.0 Ga on the Earth and 3.9-3.8 Ga on the Moon). Instead of depleted high-Mg magmas of the first phases of their evolution, related to ascending of mantle superplumes of the 1^{st} generation, at the second phases geochemical-enriched magmas with high contents of Fe and Ti, close to the terrestrial Phanerozoic within-plate magmatism, became common; they were related to ascending of mantle superplumes of the 2^{nd} generation (thermochemical). On the Earth this type of superplume activity survived till now. According to current data to the Earth's geodynamics, thermochemical superplumes start from the boundary of liquid metallic cores and silicate mantle.

Such order of events (from depleted to geochemical-enriched magma sources) conflicts with popular idea of homogenous accretion of the planet bodies. Obviously, such a situation could be explained only in case, that (1) accretion of the both planetary bodies was heterogenic (with primordial metallic cores and silicate mantle), and (2) their heating occurred downwards, from the surfaces to cores and accompanied by cooling of their outer shells. Such centripetal energetic (warming-up) wave could be appeared after completion of their formation in the making of modern stationary regime of the planets rotation around their axis as it should be from experimental data in revolved bodies. This process was completed when metallic cores of the planets bodies became fully melt. It is coincided with mass appearance of Fe-Ti basalts at the both bodies (2.3-2.2 and 3.9 Ga accordingly). Material of such superplumes was enriched in volatile components, and they could reach more shallow levels. Extension of their heads have to lead to active interaction with ancient rigid planets' crusts caused appearance of plate tectonics on the Earth and maria on the Moon. By now, the Earth's core partly solidified, and the Moon's – completely. Probably, the Mars and the Venus were developed on the same scenario.

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