On the construction of Martian interior model

T.V.Gudkova and V.N.Zharkov

Institute of Physics of the Earth, Russian Academy, gudkova@ifz.ru

We face the problem of construction of a model of the Martian interior every time the corresponding database is updated. Yoder et al. (2003) presented a value of the mean moment of inertia that was smaller than that previously applied and obtained the Love number k_2 from observations of the solar tide on Mars. These values of the Love number k_2 and the mean moment of inertia impose strong new constraints on the model of the planet. Since the mean moment of inertia is now known to be smaller, we have reconsidered the models of the Martian interior we constructed before (Gudkova and Zharkov, 2004). On the one hand, a model of the internal structure of Mars is interesting on its own. On the other hand, the question of how the Martian model can be used to confirm or to reject the fundamental concept of the chondritic composition of the terrestrial planets has been discussed for several years. If sulfur is the only admixture to iron in the core of the planet, the Fe/Si weight ratio is about 1.41 even for an implausibly high content of sulfur of 20 wt %. This ratio is much smaller than the chondritic value 1.7. If there are 50 mol % of hydrogen in the core, the Fe/Si ratio grows almost to the chondritic value, while this value is achieved for 70 mol % of hydrogen in the core. We should note the following tendency observed when the refined normalized moment of inertia I/MR^2 = 0.3634-0.3658 (Yoder et al., 2003) is used instead of the moment I/MR^2 = 0.3642-0.3678 applied in (Gudkova and Zharkov, 2004). We see that the application of the new data results in the following variation in the parameters of the Martian interior: the mantle ferric number Fe # decreases, both the Fe/Si weight ratio and the core radius increase. We can generally conclude that if the latest data are applied, the resulting internal structure of Mars is closer to the chondritic model. The models give a radius of Mars within 1600-1820 km; therefore, there must be more than 30 mol % of hydrogen in the core.