A PLAUSSIBLE BULK MINERAL COMPOSITION FOR THE MARTIAN MANTLE. P. Futó¹ and A. Gucsi² ¹University of Debrecen, Cosmochemistry Research Group, Department of Mineralogy and Geology, Debrecen, Egyetem tér 1. H-4032, Hungary (division@citromail.hu) ²Eszterházy Károly Catholic University, Faculty of Natural Sciences, Institute of Chemistry and Physics, Department of Physics, H-3300, Eger, Leányka utca 6-8. (sopronianglicus@gmail.com)

Introduction: We can conclude on the composition of martian crust based on the compositional examination of martian meteorites. The instruments of Mars rovers can provide substantial information for in situ petrologic characteristics of martian rocks [1]. The chemical characteristics and the mineralogy of bulk silicate Mars (BSM) have a substantial role in the formation of complex pattern of the surface mineralogy and the geological properties of the planet. Venus, having an interior structure resemble to that of Earth, has an iron-nickel core. The mantle of the planet is composed of magnesium – rich silicates and basaltic crust [2]. The martian crust is also basaltic [3], however the mantle is more oxidized compared to that of Earth and the bulk Mg/Si ratio of BSM is lower than the corresponding terrestrial and venusian values.

InSight seismic data have been used to constrain the core radius of Mars (1830 ± 40 km) [4]. In terms of the model of Yoshizaki and McDonough, the sulphur content in the core is thought to be lower than 10 wt %, the calculated value is 6.6 wt% [5]. Interestingly, the occurence of ringwoodite at the core - mantle boundary might have contributed to the partitioning of O and H into the Martian core [5].

The main purpose of this study is to constitute an approximate structural and compositional model for the Martian interior. However, the surface and subsurface mineralogy have not been investigated in this model.

Modeling the bulk mineral composition of the mantle: The modeled mineral composition is based on the bulk Mg/Si value of the bulk silicate Mars (Mg/Si = 1.01), which have been taken from the study of Yoshizaki T., McDonough et al. (2020).

A plausible model composition for martian mantle: The surface gravity is almost three times lower than on Earth: gs = 3.72 m s-2 (0.38 g Earth).

The calculations show that the pressure in the lowermost mantle zone is too low to the rwd – bdg transition therefore a bdg – layer is not present at the core mantle boundary (CMB) of Mars leading to the absence of a bridgmanite – dominated lower mantle.

Figure 1. The schematic interior model of Mars. (UTZ = upper transition zone, LTZ = lower transition zone, ol = olivine, wdl = wadsleyite, rwd = ringwoodite, mj = majorite, sk = skiagite, py = pyrope, px = pyroxenes).

An upper mantle with upper and lower transition zone had been developed by the differentiation during the early evolution of the planetary body. The martian mantle can structurally be similar to the terrestrial UM and transition zone. However, the mineral chemistry of the mantle is different from that of the Earth due to the predicted lower bulk Mg/Si values and the higher Fe abundance of the BSM.

The ol(olivine) – wdl (wadsleyite) -transition occurs at the depth of 1078.86 km. The wdl- rwd (ringwoodite) phase transformation in olivine occurs at the depth of 1368.3 km (Fig.1).

The mineralogy in the martian UM is characterized by the olivine - garnet – (majorite – skiagite and pyrope) – diopside – jadeite multicomponent system (Fig.2). The Fe content is the one of the most important factor for the mj composition and the assemblage of accessory minerals in the martian mantle, which is rich in iron oxides. This factor sug-
gests that there can be a substantial role of the skia-
gitic component \((\text{Fe}^{3+}\text{Fe}^{2+}\text{Si}_3\text{O}_{12})\) in garnets in
the mantle. The iron endmember skiaigite of garnets
is important for the geochemistry of the Earth’s up-
per mantle and transition zone [6].
The physico-chemical interactions between the
core and the mantle can yields a multicomponent
lower-mantle mineral system in the LM – layer
above the core. The model indicates that Mars may
have a garnet – rich zone at the bottom of the man-
tle.

**Figure 2.** A plausible bulk mineral composition for
the martian mantle.

Significant differences manifest in geodynamical
activity and geology between Earth and Mars. The
small planetary mass, the different mantle structure
and composition affect the rheological properties
of the mantle, resulting in stagnant – lid mode of
convection on Mars.

**Summary:** We conclude that a relatively great di-
versity of mineral assemblages can be present in
the martian mantle. It is implies that the mineral di-
versity of the rocky exoplanetary crusts and man-
tles with lower bulk Mg/Si values than that of
Earth can be significantly higher than previously
thought.

ce. 373. 443 – 448. [5] Yoshizaki T., Mc-