**ON THE Mg/Fe RATIO IN SILICATE MINERALS IN THE CIRCUMSTELLAR ENVIROMENTS I. THE Mg/Fe RATIO IN SILICATE MINERAL CONSTITUENTS OF THE KABA METEORITE.** P. Futó[1], [1]University of Debrecen, Hungary, Department of Mineralogy and Geology, Debrecen, Egyetem tér 1. H-4032, Hungary (dvision@citromail.hu)

**Introduction:** Some important elements such as O, Mg, Si and Fe are the cosmically most important mineral-forming elements, which may be the dominant planet-building elements for terrestrial planets. The cosmic silicate mineral grains can be categorized into two main groups: the olivines (Ol) ($Mg_{2x}Fe_{2x-2x}SiO_4$ where x is between 0 and 1) (forsterite-$Mg_2SiO_4$, fayalite-$Fe_2SiO_4$) and the pyroxenes (Px) ($Mg_xFe_{1-x}SiO_3$ where x is between 0 and 1) (enstatite-$MgSiO_3$, ferrosilite-$FeSiO_3$). In the interstellar medium (ISM) and in the protoplanetary disks the silicate minerals may be present in amorphous and/or in crystalline forms (that can be classified into two cristallographic systems: rhombic -Ol, Px; and monoclinic structure-Px) [1].

The detailed compositions and origins of crystalline or amorphous ferromagnesiosilicates are poorly understood, up to date. Nevertheless, they are likely derived from supernovae (SN)-nucleosynthesis and the atmosphere of metal-rich asymptotic giant stars (AGB). It is known that the composition of Earth's crust and mantle are dominated by Mg-rich silicates with a relatively low Fe-content. The interstellar silicates are Mg-rich minerals [2], which are being caused by the cosmochemically higher abundance of Mg as opposed to that of Fe. Interestingly, Mg-rich (X=0.01±0.001 at a formulation of $Mg_{(2-2x)}$ $Fe_{2x}SiO_4$) crystalline olivine grains are being found in the disk of β Pictoris [3]. At the same time, Fe-rich crystalline olivine grains (Fe/[Mg + Fe] ~0.2) are also known in several debris disk [4] and iron-rich olivine has also been found by analyzing the mineral chemistry of Itokawa dust particles [5].

The Mg/Fe ratio in silicates may be an important factor for the material properties in terrestrial planetary mantles. The examination of Mg/Fe ratio in the meteoritic materials of Solar-System may provide useful information, which from we may conclude on the plausible compositional properties of planet-building silicates in other planetary systems. According to a likely scenario, the terrestrial-like exoplanets are thought to have been accreted from undifferentiated protoplanetary disc (PPD) materials similarly to the chondritic meteorites.

Therefore, I presents calculated values for Mg/Fe ratio based on a composition of a carbonaceous chondrite using the measured concerning data by Gucsik et al. (2013) [6].

**The model composition for the examined sample of Kaba meteorite:** The major components of a typical carbonaceous chondrite are the chondrules, the fine-grained matrix of minerals, Ca/Al-rich inclusions (CAIs) and it may even contain amobeoid olivine aggregates (AOA) and isolated grains in the matrix.

The examined sample is the Kaba meteorite, which is a less metamorphosed CV3 type carbonaceous chondrite with a relative large-sized chondrules and it had been undergone on a low-grade thermal metamorphosis.

The purpose of this study is to support that the silicates in the ISM and PPDs are mostly Mg-rich minerals. The measure results for given mineral compounds are being analyzed based on the examination of Kaba meteorite. The chondritic composition of terrestrial-type planets in the Galaxy have been assumed.

The quantitative analyses (Gucsik et al. 2013) for the minor and major elements of olivine were performed by wavelength-dispersive spectrometry (WDS) linked to a JEOL JXA-8900R SEM (scanning electron microscope).

*The selected target minerals for the estimation:* The one of the examined minerals is forsterite (Fo1-1) that can be found in a ~1.3 mm sized porphyritic olivine chondrule on the analyzed area of A1. Two forsterite mineral components (Fo7-1 and Fo7-2) have been intentified in an area of amobeoid olivine aggregates. Chondrule is also known, which contains Fe-rich mineral phases in the analyzed area of A5. The mineral texture in the area of complex aggregates contains fayalitic olivine (Fa9-2) and enstatite (En9-4).

The simple applied method for calculating the Mg/Fe ratio in the mineral constituents of target areas is the comparison for the molar masses of the compound elements in the oxides (FeO, MgO).

**Results:** The smallest Mg/Fe ratio is calculated in case the sample of A7-Fo7-2, the highest value has been found for the sample A5-FeO, which composed almost entirely of iron-oxide.

The Mg/Fe ratio in the most of the examined target mineral constituents is moderately high, which corrob-

oratory data also shows that the silicates in the Solar enviroment are Mg-rich minerals. This statement may extend to the composition of silicate minerals of the ISM by assuming the chondritic-like compositions in the most of the interstellar and circumstellar enviroments in the Galaxy.

| Target area | FeO (wt%) | MgO (wt%) | Mg/Fe |
|---|---|---|---|
| A1-Fo1-1 | 0.3 | 55 | $Mg_{0.993}Fe_{0.007}$ |
| A5-FeO | 97.63 | 0.28 | $Mg_{0.002225}Fe_{0.99775}$ |
| A7-Fo7-1 | 0.41 | 55.03 | $Mg_{0.9904}Fe_{0.0096}$ |
| A7-Fo7-2 | 2.71 | 52.58 | $Mg_{0.93356}Fe_{0.0664}$ |
| A9-Fa9-2 | 68.05 | 0.26 | $Mg_{0.9962}Fe_{0.0038}$ |
| A9-En9-4 | 1.21 | 36.3 | $Mg_{0.957}Fe_{0.043}$ |

**Table 1.** The ratio of FeO and MgO compounds (wt%) in the given target areas. The Mg/Fe ratios are also calculated. The utilized concerning data of the elements Fe, Mg and O are taken from www.ptable.com.

**Results:** The smallest Mg/Fe ratio is calculated in case the sample of A7-Fo7-2, the highest value has been found for the sample A5-FeO, which composed almost entirely of iron-oxide.
The Mg/Fe ratio in the most of the examined target mineral constituents is moderately high, which corroboratory data also shows that the silicates in the Solar enviroment are Mg-rich minerals (Table 1.) This statement may extend to the composition of silicate minerals of the ISM by assuming the chondritic-like compositions in the most of the interstellar and circumstellar enviroments in the Galaxy.

**Summary:** The moderately high ratio of Mg in the silicates of the Solar enviroment indicates that Mg-rich silicates might be frequent in the interstellar and the circumstellar enviroments for the case of chondritic composition.

**References:**

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