**A NEW PLANET-CLASS: CARBON-SILICATE PLANETS.** P. Futó \(^1\) \(^2\) Department of Physical Geography, University of West Hungary, Szombathely, Károlyi Gáspár tér, H-9700, Hungary (division@citromail.hu)

**Introduction:** For the case of significant amount of solid C/O, it may present as a planet building material. If the C/O ratio is below 0.8, Si is in a mineral as SiO\(_4\) or SiO\(_2\). At the same time, if the C/O ratio is a higher value than 1, carbon-based minerals are the dominated mantle-consisting compounds. Carbon-silicate planets are thought to have formed in protoplanetary disks with a C/O ratio 0.8-1. The adequately large carbon-silicate planets must have metallic cores which are distinct to a solid inner core and an outer core in melted state. Their upper mantle built up from carbides and silicates. The crust may contain silicates, silicon- and aluminium-oxides, carbides and a diamond layer in the deeper zones (sub-crust).

The diagenetic silicates may exist various state in the interior of rocky planets. Thus, carbon substitution for oxygen could occur in complex silicates [1] in case of the carbon-rich environments at adequate pressure and high temperature. It is possible that the silicon oxycarbides (which expressed by the formula of SiO\(_2\)C\(_{x}\)) can be found in the lower crust and mantle of carbon-silicate planets.

It is also probably that carbon is the most abundant light element would be a good candidate in the core of the carbon-silicate planets. Carbon is in plausible forms of iron carbides as example Fe\(_3\)C, Fe\(_7\)C\(_3\) [2] and Fe\(_{17}\)C\(_2\) [3] have been predicted to be stable carbide phase at around the central pressure of the Earth.

**Modeled carbon-silicate planet with Earth-like structure:** My model is built upon the hypothesis for the existence of the carbon planets, constituted by Kuchner and Seager [4]. Here I present a composition of a theoretical low-mass exoplanet has formed in a protoplanetary disc with a C/O ratio is between 0.8 and 1.0, calculating C/O =0.9 ratio. The internal structure of this planet is modeled as being Earth-like with a greater C-enrichment in its chemical composition. Additionally, this refers to a terrestrial planet composed of Fe/Mg silicates and Fe/Ni core, containing relatively high amounts of carbon-based compounds. The carbon-silicate planet is proposed to be a new type of terrestrial planets with carbon-rich composition.

The modeled planetary core mostly composed of iron alloyed with 17 wt % nickel and 3 wt % carbon in different forms of iron carbides (Fe\(_{6.9}\)Ni\(_{0.17}\)C\(_{0.03}\)) covered by the lower mantle composed of silicon-carbide, silicate-perovskite MgSiO\(_3\) and in the zone of lowermost mantle:post-perovskite, SiC, TiC, olivine [(Mg,Fe)\(_2\)SiO\(_4\)]. Wadsleyite and ringwoodite are used to model the mineral composition of the upper mantle. It is necessary to take account of other consisting materials in the lower-crust and the mantle such as silicon oxycarbides. Vinet equations of state [5,6] have been used for the structural modeling.

**Results:** The carbon-silicate planet is calculated to have 1.028 R\(_{\oplus}\) total radius and 0.554 R\(_{\oplus}\) core radius as illustrated in Figure 1. The carbon-based minerals and silicon oxycarbides show lower density than the normal silicates yielding a slightly larger total radius for this planet-type as opposed to a silicate planet with the same mass and internal structure ratios. In its atmosphere and its surface/subsurface zones the methane content is relatively high because at C/O>0.8, methane becomes more abundant than water [7].

Taking into account that the detailed composition in the spherical shells is not known, 1-3 % uncertainties appear in all interior structure models. For the case of analog models with complex composition such as this carbon-silicate planet, the estimated uncertainties can be higher value: 2-5 %.

**Figure 1.** A model is shown to represent the composition for the carbon-silicate planet with radius parameters of its interior structure in units of Earth-radius.

**Summary:** In this study, I propose a new planet-class called carbon-silicate planets for carbon-rich terrestrial-type planetary bodies which have masses between 0-10 M\(_{\oplus}\). According to our hope, the precise instruments will be capable to identify low-mass carbon-rich exoplanets in the future.