**MEAN ATOMIC WEIGHT AND GRAIN DENSITY OF INTERIOR AND FUSION CRUST OF ALESSANDRIA CHONDRITE.** M. A. Szurgot, Lodz University of Technology, Center of Mathematics and Physics, Al. Politechniki 11, 90 924 Lodz, Poland (mszurgot@p.lodz.pl).

**Introduction:** Mean atomic weight, bulk and grain densities, porosity, and magnetic susceptibility are physical properties important to characterize minerals, rocks, planets, moons and asteroids, and are important to classify meteorites. Recently interrelationships between mean atomic weight *(Amean)*, grain density *(dgr)*, and iron to silicon ratio for planetary materials were revealed and applied for predicting and verifying mean atomic weight, *Fe/Si* atomic ratio, and grain density of ordinary and enstatite chondrites, Earth, Venus, Mars, Mercury, Moon, and Vesta [1-7]. The aim of the paper was to determine mean atomic weight, and grain density of interior and fusion crust of Alessandria ordinary chondrite. Alessandria meteorite fell on February 2, 1860, in Alessandria in Italy, and has been classified as a H5 chondrite [ 8-10].

Literature data on chemical composition of interior [8] and fusion crust [10] of Alessandria meteorite were used to calculate *Amean(Bulk composition)*, and *Amean(Fe/Si)* relationships were used to verify mean atomic weight. Grain density was predicted using relationship: *dgr(Fe/Si)*. Grain density of interior of Alessandria chondrite has been already measured by Macke [9].

**Results and discussion:** Iron to silicon atomic ratio for the interior of Alessandria meteorite is equal to *Fe/Si* = 0.873, and for fusion crust *Fe/Si* = 0.525. The following values of mean atomic weight of Alessandria chondrite were obtained: *Amean (Bulk composition)* = $\sum wi/\sum(wi)/Ai)$ = 25.27 for interior, and *Amean (Bulk composition)* = 22.99 for fusion crust. Here, *wi/(wt%)* represent mass of *i*-th constituent, *Ai* is the mean atomic weight of *i*-th constituent of the meteorite.

Two new relationships *Amean(Fe/Si)* were derived and applied to verfy *Amean(Bulk composition)* values of interior and fusion crust values. For interior regions of ten ordinary chondrites the following equation is valid:

$$Amean(Fe/Si, Interior) = 5.37(Fe/Si) + 20.59, \quad (1)$$

for which $R^2$ = 0.98, and RMSE = 0.14,
whereas for fusion crust regions of nine ordinary chondrites somewhat different *Amean(Fe/Si)* dependence is valid:

$$Amean(Fe/Si, Fusion\ Crust) = 4.29(Fe/Si) + 20.78, \quad (2)$$

for which $R^2$ = 0.98, and RMSE = 0.08.

Equations (1) and (2) lead to the *Amean(Fe/Si)* values: *mean(Fe/Si, Interior)* = 25.28 for interior, and *Amean(Fe/Si, Fusion Crust)* = 23.04 for fusion crust of Alessandria chondrite. It is seen that *Amean(Fe/Si)* values are nearly identical as *Amean (Bulk composition)* values.

Grain density of interior and fusion crust of Alessandria chondrite were determined using *dgr(Fe/Si)* relationship established for extraterrestrial matter [1]:

$$dgr(Fe/Si, g/cm^3) = 0.765(Fe/Si) + 3.11, \quad (3)$$

valid also for ordinary chondrites, for which RMSE = 0.07 $g/cm^3$.
Equation (3) predicts two *dgr(Fe/Si)* values:
*dgr(Fe/Si, Interior)* = 3.78 $g/cm^3$ for interior, and *dgr(Fe/Si, Fusion Crust)* = 3.51 $g/cm^3$ for fusion crust of Alessandria chondrite. Value of *dgr(Fe/Si, Interior)* is very close to *dgr(experimental)* = 3.77 ± 0.03 $g/cm^3$ that was measured by Macke [9].

**Conclusions:** Mean atomic weight, and grain density of interior of Alessandria chondrie are within the range of H chondrites falls. Interior of the meteorite exhibits higher atomic weight, higher grain density, and higher *Fe/Si* ratio than fusion crust. Grain density and mean atomic weight of ordinary chondrites can be predicted by *Fe/Si* atomic ratio. *Amean(Fe/Si)* dependence for fusion crust is somewhat different than for interior of ordinary chondrites.

**References:** [1] Szurgot M. (2015) *LPSC 46*, Abstract #1536. [2] Szurgot M. (2015) *Comparative Tectonics* and Geodynamics, Abstract #5001. [3] Szurgot M. (2016) *Annual Meeting of the Meteoritical Society 79*, Abstract #6005. [4] Szurgot M. (2019) *Acta Societatis Metheoriticae Polonorum* 10:140-159. [5] Szurgot M. (2019) *LPSC 50*, Abstract #1165. [6] Szurgot M. et al. (2020) *LPSC 51*, Abstract #1287. [7] Szurgot M. A. (2021) *LPSC 52*, Abstract #1029. [8] Levi-Donati G. R., Sighinolfi G. P. (1977) *Meteoritics*, 12, 291-292. [9] Macke R. J. (2010) *PhD Thesis*, Univ. Central Florida, Orlando. [10] Genge M. J. and Grady M.M. (1999) *Meteoritics & Planet. Sci., 3*, 341-356.