RELATIONSHIP BETWEEN MEAN ATOMIC WEIGHT AND IRON TO SILICON RATIO FOR LUNAR MATERIALS.

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Introduction: Mean atomic weight is important to characterize minerals, rocks, planets, moons and asteroids, and is important to classify meteorites. Recenty interrelationships between mean atomic weight *(Amean),* grain density *(dgrain),* and iron to silicon ratio *(Fe/Si)* for planetary materials have been 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, Vesta, and Moon [1-6]. It has been shown that lunar surface materials have their own *dgrain(Amean)* and *dgrain(Fe/Si)* relationships which can be applied for predicting and verifying grain density of lunar meteorites and Apollo samples [6]. For ordinary chondrites relationship between mean atomic weight and *Fe/Si* atomic ratio has been discovered by Szurgot in 2015 [2].

The aim of the paper was to reveal relationship between mean atomic weight and iron to silicon ratio for lunar surface materials and to predict and verify *Amean* values for lunar meteorites and Apollo samples.

Literature data on chemical composition of lunar meteorites and Apollo samples [7-13] were used to calculate *Amean* and *Fe/Si* values and to establish new *Amean(Fe/Si)* relationship. Various lunar meteorites and Apollo samples representing various groups of lunar crust materials were analyzed.

Results and discussion: Collected data indicate that a new empirical *Amean(Fe/Si) d*ependence describing lunar surface materials can be expressed by the equation:

$$Amean(Fe/Si) = 4.96 \cdot Fe/Si + 21.20, \quad (1)$$

for which $R^2 = 0.98$, and RMSE = 0.16. Equation (1) predicts mean values: for highland crust: *Amean(Fe/Si)* = 21.59 *(Fe/Si* = 0.078), for intermediate crust: *Amean(Fe/Si)* = 22.20 *(Fe/Si* = 0.202), and for mare crust: *Amean(Fe/Si)* = 23.09 *(Fe/Si* = 0.382), and for mean global Moon's crust: *Amean(Fe/Si)* = 21.79 *(Fe/Si* = 0.119 [14]). Bulk composition data [9] indicate average values of mean atomic weight: for highland crust: *Amean* = 21.62, for intermediate crust: *Amean* = 22.13, for mare crust: *Amean* = 23.15, and for global Moon's crust: *Amean* = 21.7 [1,6]. Ranges of *Fe/Si,* and [*Amean(Fe/Si)*] values have been established: for anarthositic group of rocks: 0.01-0.15 [21.2-21.9], for intermediate, basaltic-anarthositic group: 0.15-0.25 [21.9-22.4], for basaltic group: 0.31-0.49 [22.7-23.6], and for global Moon's crust: 0.01-0.49 [21.2-23.6].

For individual lunar meteorites the following *Fe/Si* ratios, and values of *Amean* are predicted by eq. (1): Dhofar 733: *Fe/Si* = 0.057, *Amean(Fe/Si)* = 21.48 *(*21.46), Dar al Gani 400: *Fe/Si* = 0.068, *Amean(Fe/Si)* = 21.54 *(*21.63), Allan Hills A81005: *Fe/Si* = 0.099, *Amean(Fe/Si)* = 21.69 (21.65), Yamato 791197: *Fe/Si* = 0.116, *Amean(Fe/Si)* = 21.78 (21.74), Northwest Africa 4932: *Fe/Si* = 0.155, *Amean(Fe/Si)* = 21.97 (21.83), Calcalong Creek: *Fe/Si* = 0.193, *Amean(Fe/Si)* = 22.16 (22.25), Northwest Africa 773: *Fe/Si* = 0.352, *Amean(Fe/Si)* = 22.95 (22.57), Northwest Africa 4898: *Fe/Si* = 0.314, *Amean(Fe/Si)* = 22.76 (22.82), LaPaz Icefield 02205: *Fe/Si* = 0.362, *Amean(Fe/Si)* = 23.00 (23.18), Northwest Africa 4734: *Fe/Si* = 0.484, *Amean(Fe/Si)* = 23.60 (23.23), Yamato 793169: *Fe/Si* = 0.422, *Amean(Fe/Si)* = 23.29 (23.40), Asuka 881757: *Fe/Si* = 0.422, *Amean(Fe/Si)* = 23.29 (23.41). *Amean* values of lunar materials shown in parentheses were determined by bulk composition [6].

For Apollo returned samples the following values of *Fe/Si* ratio, *Amean(Fe/Si),* and (*Amean)* are predicted: 60025: *Fe/Si* = 0.0094, *Amean(Fe/Si)* = 21.25 (21.41), 15418: *Fe/Si* = 0.116, *Amean(Fe/Si)* = 21.78 (21.77), 14303 (matrix): *Fe/Si* = 0.188, *Amean(Fe/Si)* = 22.13 (21.99), 14321(matrix): *Fe/Si* = 0.199, *Amean(Fe/Si)* = 22.19 (22.14), 15545: *Fe/Si* = 0.417, *Amean(Fe/Si)* = 23.27 (23.01), 12009: *Fe/Si* = 0.392, *Amean(Fe/Si)* = 23.14 (23.10), 15555: *Fe/Si* = 0.423, *Amean(Fe/Si)* = 23.30 (23.23), 12051: *Fe/Si* = 0.373, *Amean(Fe/Si)* = 23.05 (23.25), 12063: *Fe/Si* = 0.408, *Amean(Fe/Si)* = 23.22 (23.33), and 70215: *Fe/Si* = 0.429, *Amean(Fe/Si)* = 23.33 (23.69).

Conclusion: *Amean(Fe/Si)* relationship was revealed for lunar surface materials which can be applied for predicting and verifying mean atomic weight of lunar meteorites and Apollo samples.

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