# MEAN ATOMIC WEIGHT OF L'AIGLE CHONDRITE.

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**Introduction:** L'Aigle meteorite is a typical L6 chondrite, moderately shocked (S4) which fell in 1803 in France. Mean atomic weight is important to characterize minerals, rocks, planets, moons and asteroids, and is important to classify meteorites. The aim of the paper was to determine mean atomic weight and mean atomic number of the L'Aigle meteorite, and to predict grain density of silicates, metal, and the whole rock of the meteorite.

**Results and discussion:** Bulk elemental composition of the meteorite [1,2] has been used to calculate mean atomic weight *Amean* and mean atomic number *Zmean* using following formulas:

$$Amean = \sum wi / \sum (wi/Ai), \quad (1)$$

$$Zmean = \sum wi / \sum (wi/Zi), \quad (2)$$

where *wi*(wt%) is the mass fraction of i*th* element and i*th* oxide, *Ai* is atomic weight of i*th* element and i*th* oxide, and *Zi* is atomic number of i*th* element and i*th* oxide. Apart from the bulk composition data, also *Fe/Si* ratio, grain density *dgrain*, and magnetic susceptibility $\chi$ were used to predict *Amean* values using *Amean(Fe/Si)*, *Amean(dgrain)*, and *Amean(logχ)* relationships, recently established by Szurgot (e.g. [3-7]):

$$Amean(Fe/Si) = 5.72 \cdot Fe/Si + 20.25, \quad (3)$$

$$Amean(dgrain) = 7.51 \cdot dgrain - 2.74, \quad (4)$$

$$Amean(log\chi) = 1.49 \cdot log\chi + 16.6, \quad (5)$$

$$A(Fe/Si, dgrain, \chi) = (Amean(Fe/Si) + Amean(dgrain) + Amean(log\chi))/3. \quad (6)$$

Grain density was calculated using two relationships, discovered by the author [3,4,8]:

$$dgrain(Amean) = 0.133 \cdot Amean + 0.37, \quad (7)$$

$$dgrain(Fe/Si) = 0.765 \cdot Fe/Si + 3.11. \quad (8)$$

Table 1 compiles values of *Amean*, *Zmean* and *Amean/Zmean* ratios calculated for L'Aigle meteorite, and average values for L6 chondrites. Data concern falls, and composition of meteorites does not include $H_2O$.

**Table 1.** Mean atomic weight *Amean*, mean atomic number *Zmean*, *Amean/Zmean* ratio, and *Fe/Si* atomic ratio of L'Aigle, and mean for L6 chondrites.*****L6's data were established by Szurgot [3].

| Meteorite | *Amean (Bulk composition)* | *Zmean* | *Amean/Zmean* | *Fe/Si atomic ratio* |
|---|---|---|---|---|
| **L'Aigle L6** | **24.21** | **11.87** | **2.040** | **0.626** |
| L6 Average[#] | 24.06 ± 0.16***** | 11.89 | 2.023 ± 0.002 | 0.60 ± 0.04***** |
| *L6 Range* | *23.6 - 24.4* | *11.7-12.1* | *2.021 - 2.027* | *0.53 - 0.65****** |

**Table 2** *Amean* values of L'Aigle determined by bulk composition (eq.(1)), and by relationships (eqs (3) - (6)).

| *Amean (Bulk composition)* | *Amean(Fe/Si)* | *Amean(dgrain)* | *Amean(logχ)* | *A (Fe/Si, dgrain, χ)* |
|---|---|---|---|---|
| **24.21** | **23.83** | **24.52*** | **23.86*** | **24.07 ± 0.39** |

*L'Aigle *Fe/Si* = 0.626, *dgrain* = 3.63 g/cm$^3$ [9], and *logχ* = 4.87 [9]. [#] Average for ten L6 chondrites

Tables 1 and 2 show that L'Aigle *Amean* = 24.21 is close to the mean atomic weight of L6 chondrite falls (average: 24.06 ± 0.16, range: 23.6-24.4), and is also close to H/L intermediate group: avg 24.32±0.07 **[5].** L'Aigle *Fe/Si* atomic ratio (0.626) is close to the average for L6 falls: 0.60 ± 0.04, and is within the L6 range: 0.53 - 0.65 [3]. In addition, L'Aigle *Amean/Zmean* ratio (2.040) is close to the average *Amean/Zmean* L6's ratio: 2.023. L'Aigle silicates and metal show *Amean* values: 21.81, and 56.24, and *dgrain(Amean)* relationship (eq.(7)) shows grain density values: 3.59, 3.27, and 7.85 g/cm$^3$, for the whole rock, silicate fraction, and Fe,Ni metal, respectively. *dgrain(Fe/Si)* relationship (eq.(8)) reveals grain densities: 3.59 g/cm$^3$ for the whole rock, and 3.33 g/cm$^3$ for silicates.

**Conclusions:** Mean atomic weight, mean atomic number, *Amean/Zmean* ratio, and *Fe/Si* ratio indicate that L'Aigle belongs to L6 chondrites, as previously established. *Fe/Si* atomic ratio, grain density, and magnetic susceptibility satisfactorily predict *Amean* values, and *Amean* and *Fe/Si* ratio predict grain density of L'Aigle meteorite.

**References:** [1] Dodd R.T. and Jarosewich E. (1981) *Meteoritics* 16:93-111. [2] Jarosewich E. (1990) *Meteoritics* 35:323-337. [3] Szurgot M. (2015) *Acta Societatis Metheoriticae Polonorum* 6:107-128. [4] Szurgot M. (2015) *LPSC XLVI*, Abstract #1536. [5] Szurgot M. (2016) *LPSC XLVII*, Abstract #2180. [6] Szurgot M. (2017) *LPS XLVIII*, Abstract #1130. [7] Szurgot M. (2018) *LPSC XLIX*, Abstract #1039. [8] Szurgot M. 2017. *Meteoritics & Planet. Sci.*, 52(S1), #6008.pdf. [9] Macke R. J. (2010) *PhD Thesis*, Univ. Central Florida, Orlando.