AFRICAN METEORITE FINDS: TYPOLOGY, MASS DISTRIBUTION, POROSITY, AND WEATHERING VARIATION

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Introduction: Africa is a large continent with different types of geological and geographical landscapes and terrains so quite large numbers of meteorites can be estimated [1,2]. Indeed, the total number of meteorites from this continent represents 1/5 of all the samples recovered from the entire world. In this sense, the present work aims, firstly, to characterize the classification of the African meteorite finds by comparing them with Australian and Antarctic populations. Secondly, to study the variation of the weathering grades of this collection and its relationship with masses and porosities of the samples.

Methodology: The data for African meteorite finds were extracted from the «Meteoritical Bulletin database». Indeed, on January 1, 2017, we count 9660 samples. They are divided between 2399 samples (25%) classified under the names of the geographical location of the find and 7261 meteorites (75%) without filiation (6780 under the acronym "NWA", 476 baptized "Sahara" and 5 named "NEA").

Results:

- African meteorites population includes all types of meteorites known until now. Moreover, the African meteorite finds represent significant rates of rare meteorites worldwide: Martian meteorites (62%), Ureilites (51%), Rumuruti (59%), Lunar (47%), and HED (46%). This abundance of rare meteorite types could be related to the terrestrial timespan of the populations of meteorites sampled in semi-arid to arid regions of Morocco, Algeria, and Libya; and also to their ease of recognition in those environments compared with the rest of the world.
  In the other hand, throughout the last three decades, the African finds have a depletion in type's frequencies of the chondrites, especially the ordinary chondrites, contrary to the two populations of Australia and Antarctica that show an enrichment of these types. However, we note an important increase in the collection of achondrite meteorites in the African population and a decrease in the number of this type in Antarctica and a small increase for Australian achondrite.
- The mass distribution show that the most of the African meteorite finds (54%) have a masses between 0.1 and 1kg. Indeed, 15% of all finds have masses between 1 and 10kg and one quarter (28%) have a mass less than 0.1kg. The large abundance of the mass range [0.1-1kg] is due to the fact that searches are carried out on foot by nomads and meteorite hunters mainly in the North hot deserts of the continent. However, the mass distribution of African population peaks nearby 1kg, compared at about 0.1kg for Australian collection, and to about 0.01kg for Antarctic meteorites. Spatially, heavy meteorites are distributed in the Southern Hemisphere of the African continent and are mostly iron types, while the lightest samples are collected in the Northern Hemisphere and are frequently stony type.
- Concerning the alteration of African meteorite finds, 32% of samples have a weathering grade W1, 34% have W2
- and 32% of meteorites have a weathering grade between W3 and W6. Nevertheless, the African collection shows less pronounced weathering than the Australien population (peak = W3) but more altered than the Antarctic finds (peak = W1). However, we note that the weathering grade higher than W2 for African meteorites find decreases with increasing mass.The same result was found for Atacama collection (Chile) [3]. We conclude that the weathering grade is also correlated to the mass of the stones, indicating that small stones are preferentially more weathered than large one.
- Using shock stage as a proxy to the initial porosity,we observe that meteorites with higher initial porosity (S1 and S2, with porosity around 10%) are generally more weathered than meteorites with lower initial porosity (S3 and S4, with porosity 5%). Also, we can conclude that the initial porosity may be the main factor controlling chemical weathering of African meteorite finds.

Conclusion: Africa is a prolific place for meteorites recovery, with high meteorites concentrations estimated for instance to 0.32 10^{-3} per Km^2. Its includes rares types of achondrites than the Antarctic and Australian populations. However, the weathering grade of stony meteorites, collected mainly in North hot deserts, is less pronounced (dominance of W2). Besides the impact of the natural factors especially climate, the alteration of meteorites in Africa is controlled by the mass of the sample and its porosity.

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