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Chemometric analysis as a tool for confirmation of join meteorites fall- case study

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Ten specimens of ordinary chondrites from two different campaigns were investigated. An analysis was carried out using a unique gamma spectrometry system to obtain the optimal measurement conditions for the quantitative identification of the radioactive isotopes. Short-lived radionuclide concentrations can be considered, as a specific fingerprint of the chondrite terrestrial age, to confirm whether meteorites originate from a single fall.

Chondrite radiometric studies enabled a detailed analysis of the activities of radioactive isotopes—the short-lived ^{22}Na, ^{54}Mn, ^{60}Co, and long-lived ^{26}Al, ^{40}K. The HaH 346 group of chondrites was classified in February 2021. The data sets have been analyzed based on multivariate chemometric techniques, including K-means, PCA, and clustering analysis, to derive essential information and confirm similarities or significant differences between the studied specimens. In this study, low-background gamma spectrometry was used to confirm the identity of a set of ordinary chondrites found in 2018 and 2019, by different expeditions, in a part of the Al-Hamada al-Hamra desert, in the region of Al-Dzabal al-Gharbi, in Libya.

Short-lived radionuclides are sensitive tools to estimate the terrestrial age of chondrites, even if the fall took place in a relatively short time interval. ^{54}Mn is the most representative for a comparison of specimens originating from different falls. Radioactivity levels of ^{54}Mn in HaH 346-163 and HaH 346-198, is on average, twice lower than in the case of other specimens and are equal to 13.3 and 22.5 Bq/kg, while the average value for other specimens is equal to 35.9 ± 7.2 Bq/kg.