

**Mineralogy and Organic Geochemistry of lunar meteorite
Gadamis-003**

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The current research investigates the lunar meteorite, Gadamis-003 discovered in the Ghadamis Basin, Libya in 2021. This certified meteorite, listed in the Meteoritical Bulletin Database is scarcely explored, therefore, a pilot study was conducted to examine the extraterrestrial sample using equipment and resources available within Pakistan, and making a modest contribution to the top emerging area of astrobiology. A detailed micrographic report was generated through microscopy and SEM/EDX analysis. Comprehensive petrography and elemental analysis revealed major minerals like anorthite (plagioclase), pyroxene, and olivine, alongside accessory minerals such as magnetite and ilmenites. A comparative study considering thin sections of the Apollo mission samples highlighted mineralogical similarity of Gadamis-003 with the Apollo 16 mission samples. It also revealed the possible locality of the sample, i.e., in proximity with lunar highlands, though its geochemical province is yet to be confirmed. The study also documented detailed sample-handling procedures that included trackable sub-sectioning used for the reconstruction of the recovered lunar meteorite sample for trailing the geochemical composition of the original site of the sample on the Moon. The powdered fragments of the lunar meteorite underwent biosignature investigation using gas chromatography-mass spectrometry, revealing traces of organic compounds classified as aldehydes and ketones. However, a thorough analysis of organic chemistry is necessary to characterize the detected compounds and verify their isotopic delta values. This work is fundamentally intended to serve as a groundwork for future studies aiming to spur the curiosity of local researchers.