

ANOMALOUS ACAPULCOITE STONES FOUND IN CLOSE PROXIMITY TO THE ERG ATOUILA 001 ACHONDRITE PROVIDE EVIDENCE FOR A HETEROGENEOUS SODIUM-RICH METEOROID DERIVED FROM THE ACAPULCOITE-LODRANITE PARENT BODY.

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Introduction: Five stones were found in Mali in August 2021 in close proximity to the first specimen of the Erg Atouila 001 ungrouped albite-rich achondrite [1, 2], specifically at distances of 40 to 900 meters. The five stones (with weights of 52.6 to 1152 grams: total 1442 grams) are all visually similar, but different from the more pale colored Erg Atouila 001 material. Exterior surfaces lack obvious fusion crust and are light brown in color with black patches, whereas broken interior surfaces are more beige in color and polycrystalline with a vitreous luster.

Petrography: Electron microprobe analyses were conducted on polished pieces of each of the five stones. All have triple grain junction metamorphic texture (mean grain size ~250 μm) – see Figure 1. All are composed predominantly of albite (~50 vol.%, $\text{Ab}_{90.4-91.7}\text{An}_{4.1-3.2}\text{Or}_{4.7-5.8}$) with subordinate low-Ca pyroxene ($\text{Fs}_{20.2-22.7}\text{Wo}_{1.4-1.8}$, FeO/MnO = 14-15), olivine ($\text{Fa}_{23.6-27.3}$, FeO/MnO = 22-25) and diopside ($\text{Fs}_{7.1-8.2}\text{Wo}_{45.6-44.1}$, FeO/MnO = 9-12), plus accessory ilmenite (containing rare baddeleyite inclusions), chromite (with variable Ti content), merrillite, apatite (halogen-bearing), troilite, rare kamacite and taenite. Most apatite contains only F, whereas some contains minor Cl as well.

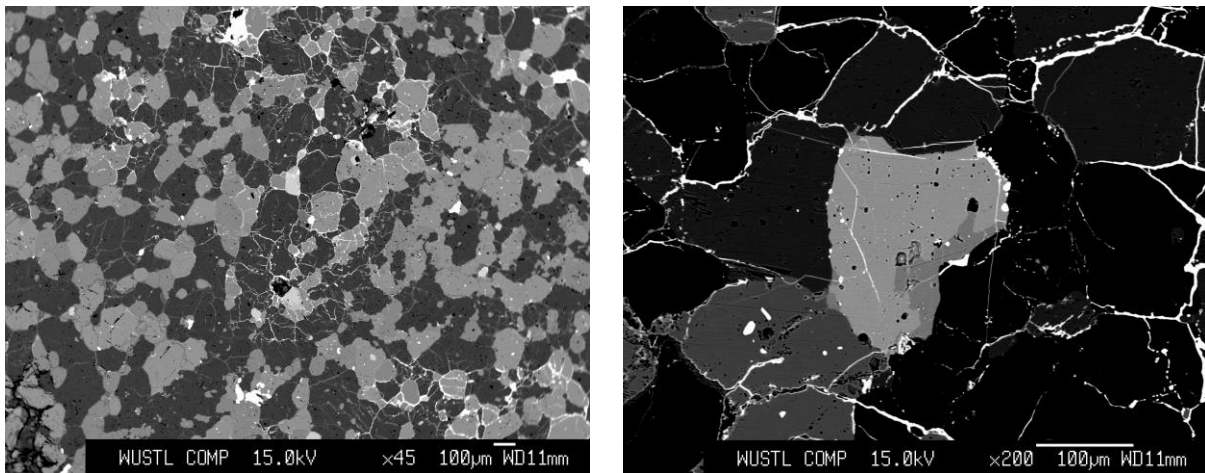


Figure 1. Back-scattered electron images. **A** (left). Overview showing albite (darkest gray), low-Ca pyroxene (medium gray), olivine and diopside (lighter gray), oxides (lightest gray) and metal+sulfide (bright). **B** (right). Detail of composite phosphate grain composed of fluorapatite with subordinate merrillite (darker gray).

Discussion: This material is more feldspar-rich and more metal-poor than other known acapulcoites, and contains mafic silicates that are significantly more ferroan. Plagioclase as sodic as $\text{Ab}_{87.7}$ is present in a few acapulcoites (e.g., NWA 6557), but albite *sensu stricto* has not been previously reported. Although found in close proximity to the Erg Atouila 001 stones and possessing some similarities to them, this material differs significantly in terms of its texture and mineralogy. The mineral assemblage has about half as much albite plagioclase as in Erg Atouila 001 [1, 2], and includes low-Ca pyroxene and some more Ni-rich metal, both of which have not been reported in Erg Atouila 001. The mafic mineral compositions are also somewhat more magnesian than those in Erg Atouila 001 (e.g., olivine is more magnesian by up to 6 mole% Fa).

We propose that these anomalous acapulcoite stones plus the ungrouped albite-rich achondrite stones found nearby comprised a single heterogeneous sodium-rich meteoroid ejected from the acapulcoite-lodranite parent body, which broke into diverse components before and/or during an ancient impact in the Malian Sahara.

References: [1] *Meteorit. Bull.* **110** [2] Irving A. *et. al.* (2022) *Lunar Planet. Sci.* **LIII**, #2059.

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