AL-KHADHAF: A CAMERA-OBSERVED H5-6 FALL FROM OMAN.

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Introduction: Four sky observation cameras were installed in the desert of Oman in 2022 as a part of the Global Fireball Observatory (GFO) [1] in collaboration with Swiss scientists and the Omani Ministry of Heritage and Tourism. Such fireball camera systems provide insight into the frequency of meteors and enable the calculation of delivery orbits of meteoroids. They also allow for the modelling of the landing area of meteorites, thus facilitating the retrieval of fresh falls. The terrain in Oman is ideal for meteorite searching [2,3,4,5,6] and presents good conditions for the retrieval of freshly fallen meteorites even at low masses. The camera system in Oman is thus projected to supplement the sparse record of small meteorite falls. Here we report the recovery of Al-Khadhaf, the first camera-observed meteorite fall of the Oman Meteorites Monitoring project.

Fireball observation and meteorite recovery: A promising fireball occurred on 8 March 2022 at 20:15 UTC. The fireball was observed by two cameras, both with considerable distance to the trajectory (> 200 km). The observable fireball trajectory started at an altitude of 68 km, lasted for 3.2 seconds, and ended at 30 km above ground. An estimated 50 g survived atmospheric entry. The modelled target area was searched during a field campaign in early 2023. On 7 February 2023, two fresh-looking meteorite pieces were recovered. The two specimens weigh 13.85 g and 8.21 g, respectively, resulting in a total mass of 22.06 g.

Link between fireball and meteorite: The temporal link between camera observations and the recovered meteorites was established by gamma spectrometry using the GeMSE facility [7]. The detected activities of the short-lived cosmogenic nuclides ^{54}Mn (t1/2 = 312 d) and ^{22}Na (t1/2 = 2.6 a) confirm the young terrestrial age of both recovered samples (~1 a at the time of find). The low ^{26}Al activity of Al-Khadhaf (18.4 ± 0.2 dpm/kg) can be attributed to its small estimated pre-atmospheric radius of only ~3.5 cm.

Classification: Mineral compositions, chondrule size and magnetic susceptibility of Al-Khadhaf are consistent with a H-type ordinary chondrite. Due to the presence of H6 clasts in a H5 matrix with the same mineral composition, the meteorite was classified as H5-6 breccia. With undulous extinction present and planar fractures absent, we attribute a shock degree of S2. The sulfide and metal grains of Al-Khadhaf exhibit some rust due to the retrieval ~1 year after the fall, implying a low weathering degree of W1.

Orbit: With a semi-major axis of 1.72 AU and an eccentricity of 0.45, the delivery orbit of Al-Khadhaf is within the range of other H-type ordinary chondrite falls [8 and references therein]. The modelled orbital parameters correspond to an origin in the main asteroid belt.

Discussion: The recovery of a meteorite after an observation time of one year by four cameras is a promising result for this project. Al-Khadhaf adds a very ordinary chondrite to the meteorite fall record and contributes to our understanding of the frequency and properties of meteorite falls. We will discuss the details of our study of Al-Khadhaf and general aspects of the camera system and present more recent findings.

References: [1] Devillepoix H. A. R. et al. (2020) *Planetary and Space Science* 191. [2] Al-Kathiri A. et al. (2005) *Meteoritics & Planetary Science* 40:1215-1239. [3] Zurfluh F. J. et al. (2016) *Meteoritics & Planetary Science* 51:1685-1700. [4] Hofmann B. A. et al. (2018) *Meteoritics & Planetary Science* 53:2372-2394. [5] Rosén Å. V. et al. (2020) *Meteoritics & Planetary Science* 55:149-163. [6] Sliz M. U. et al. (2022) *Meteoritics & Planetary Science* 57:2170-2191. [7] Von Sivers M. et al. (2016) *Journal of Instrumentation* 11. [8] Andrade M. et al. (2023) *Monthly Notices of the Royal Astronomical Society* 518: 3850–3876.