

TIRHERT - JULY 2014 - EUCRITE FALL IN MOROCCO.

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Introduction: During 2014 there were two eyewitnessed and recovered falls in Morocco, named Tirhert and Tinajdad [1].

History: Around 9:30 pm on Wednesday 9th July, residents of the villages of Foug El Hisn, Douar Imougadir, and Tirhert witnessed the spectacular event that preceeded the fall of the Tirhert meteorite. The fall occurred close to Foug El Hisn and the first piece was recovered the following morning after the fall. The fireball was seen for hundreds of kilometers around the fall area. Eyewitnesses reported a bright yellow bolide lasting about four seconds, and shortly followed by multiple sonic booms. The day after the fall, hundreds of hunters came from all over southern Morocco to search for pieces of the meteorite. We prepared and conducted a field mission a few days after the fall, which occurred during the summer in the desert during the fasting month of Ramadan. The temperatures during the day was around 52°C. The aim of the fieldwork was to verify the fall, collect the testimonials, collect samples, and map the strewnfield.

Strewnfield: About 8 to 10 kg of meteorites was recovered, as complete stones and pieces from 1 to 1300 g. These pieces defined a strewnfield of about 3 x 6 km, with a direction NW to SE, consistent with the eyewitness descriptions.

Physical description: Most pieces are covered by black glossy fusion crust. The interior shows mm-sized white plagioclase and honey brown pyroxene, and scattered opaques.

Petrography: Microprobe examination shows texturally equilibrated pyroxene and plagioclase, granoblastic to poikilitic with triple junctions. Pyroxenes show exsolution lamellae. Plagioclase and pyroxene grain size to 2 mm. Silica, ilmenite, chromite, troilite, and Fe-metal (low Ni) present. Fusion crust ~50-100 um thick, vesicles up to 20 um present, glassy with compositional gradients and swirls.

Geochemistry: EPMA (UNM) Low-Ca pyroxene $Fe_{53.6\pm 4.8}Wo_{9.3\pm 5.9}$, $Fe/Mn=32\pm 1$, $n=29$; augite $Fe_{30.3\pm 1.3}Wo_{39.2\pm 1.0}$, $Fe/Mn=33\pm 2$, $n=15$; plagioclase $An_{89.9\pm 0.9}Ab_{9.6\pm 0.9}Or_{0.4\pm 0.1}$, $n=7$. Fusion crust, proxy for bulk composition (20 um beam) $SiO_2=48.3\pm 1.0$, $TiO_2=0.5\pm 0.2$, $Al_2O_3=12.2\pm 3.5$, $Cr_2O_3=0.2\pm 0.04$, $FeO=19.3\pm 2.8$, $MnO=0.6\pm 0.1$, $MgO=7.7\pm 1.2$, $CaO=10.1\pm 1.1$, $Na_2O=0.4\pm 0.1$ (all wt%), $Mg\#=41.6\pm 0.5$, $n=23$. Tirhert is an equilibrated, unbrecciated, gabbroic eucrite, showing clear compositional separation of the low- and high-Ca pyroxenes consistent with metamorphic type 6 [2]. Oxygen isotopes (laser fluorination, UNM) of acid-washed bulk subsamples gave (mean of 6), respectively, $\delta^{17}O = 1.36$, $\delta^{18}O = 3.06$, $\Delta^{17}O = -0.254$ ‰.

Short lived cosmogenic data: The presence of ²²Na, ⁵¹Cr, ⁷Be, ⁵⁴Mn, and ⁴⁶Sc indicates a fall within two weeks from the reputed fall date (2σ).

References: [1] Meteoritical Bulletin 103, in preparation [2] H. Takeda and A. L. Graham, 1991 Meteoritics 26, 129-134.