TIGLIT: AUBRITE METEORITE FALL IN MOROCCO ON DECEMBER 2021.

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Introduction: Every year, one or more meteorite falls are detected in Morocco [1]. On 2021, there was at least four detections, among these meteors, Tiglit fall that occurred on December 9th in the Moroccan Sahara close to Guelmim.

Fireball and field work report: In the evening of this date, around 8:30 pm, many people from southern Morocco reported an important fireball east of Guelmim and northeast of Laayoune moving in a northwest to southeast direction. Two field missions to the fall area were conducted a few days after the fall. Pieces of the fall were found close to Tiglit village and Oued Tiglit. Several eyewitnesses were interviewed. A blue colored fireball followed by a greenish light moving from northwest toward southeast was reported. A few seconds after a large explosion was heard in the valley and the mountains followed by two or three more explosions after the first one. The last explosion was a high-pitched sound like a bang in a tin bucket or high pitched like hitting a metal object. He thought it was an earthquake. Mr. Lbaz Brahim is a third eyewitness living in Oum Laouitgat village. The trajectory reported was coming from Aouinat Ait Oussa in the northeast heading southwest toward Tiglit. The day after the fireball report, hundreds of hunters and people from the area went searching for the fall. All hunters reported a strong odor of sulfur in the entire valley. The first pieces were found in the same day near the junction of Oued Tiglit and Guelta Moukiyoud which flow towards Oued Draa. The region is steep with significant relief. Some pieces were found on a small relief called "Assafaou" which is part of the starting point of "Jbel Bani" the most important mountain of the Moroccan Anti-Atlas chain.

Physical description: Six large pieces plus many small fragments were recovered. The main mass is a complete stone of 736 g. So far total known mass is less than 3 kg. Exterior is covered with multi-colored (green-orange-brown) fusion crust. Physical aspect is close to Norton County. Broken surfaces reveal a mild breccia of mm- to cm-sized fractured bright white pyroxene grains, elongate to stubby, permeated and bounded by shock-darken domains. Large pyroxenes include black material as needles or grain inclusions. Samples are fragile and easily broken. Magnetic susceptibility logχ varies from 2.7 to 3.6 x 10−9 m^3/kg.

Petrography: Backscatter electron image maps show that enstatite makes up ~90-95% of this meteorite. Scattered diopside and olivine grains were observed, and only a single albite grain was detected in the microprobe mount. A few aluminous silica polymorph grains were also found. Ubiquitous shock melt pockets and veinlets are present throughout, most of which are silica-rich or albitic, although some are diopsidic in composition, and some have minor amounts of sulfur. Detected sulfides include: troilite, Ti-troilite, Cr-troilite, Mn-troilite, ferroan alabandite, ferromagnesian alabandite, daubreélite, and oldhamite. Metals include kamacite and taenite; Si was below detection limits in both metals. Rare schreibersite was observed. Vesicular enstatitic fusion crust was observed by BSE, apparent thickness is ~100-300 um.

Geochemistry: Enstatite is $Fs_{0.08\pm0.06}Wo_{0.9\pm0.3}$, n=12; diopside is $Fs_{0.02\pm0.01}Wo_{44.7\pm1.7}$, n=5; olivine is $Fa_{0.04\pm0.04}$, n=5; albite $Ab_{95.5\pm0.6}Or_{3.5\pm0.2}$, n=2; troilite Fe=60.8±0.6, Ti=0.55±0.23, Cr=1.04±0.51, S=36.0±0.4 (wt%), n=20; Ti-troilite Ti=4.6±2.3 (wt%), n=3; Cr-troilite Cr=3.6 (wt%); Mn-troilite Mn=4.1 (wt%); ferroan alabandite Mn=43.2±4.2, Fe=16.2±2.8, Mg=1.3±1.1, S=36.8±0.6 (wt%), n=9; ferromagnesian alabandite Fe=14.3±2.6, Mg=8.7±0.6 (wt%), n=2; daubreélite Cr=34.0±1.0, Fe=17.0±0.7, Mn=1.8±0.6, S=43.2±0.4 (wt%) n=12; oldhamite Ca=51.6±2.3, Mn=0.9±0.3, S=42.6±0.2 (wt%), n=7; kamacite Fe=96.3±1.6, Ni=4,7±1.4, Co=0.3±0.2 (wt%), n=10; taenite Fe=50.0±11.0, Ni=47.5±10 (wt%) n=4; fusion crust SiO2=58.0±0.1, Al2O3=0.7±0.1, MgO=37.0±0.4, FeO=1.7±0.2, MnO=0.21±0.01, CaO=1.0±0.2, Na2O=0.26±0.04 (wt%), n=4.

Classification: Based on the physical caracteristics, petrography and geochemisty, Tiglit is classified as Aubrite, fragmental monomict breccia [2,3]. It is the tenth aubrite fall known, the latest was Mayo Belwa that fell in Nigeria on 1974. This group of meteorites is named after the Aubres fall on 1836 in France. Tiglit gives an interesting opportunity to work on a fresh aubrite fall to look further on the history of the origin of aubrites and enstatite chondrites.

References: [1] Chennaoui Aoudjehane H. (2016). *Meteoritics & Planetary Science* 51:S1 abstract 6119, [2] Keil K. (1989) Enstatite meteorites and their parent bodies. Meteoritics 24, 195–208. [3] Meteoritical bulletin 111 in preparation, Metbull database.

Acknowledgement: authors thanks A. Aaranson for the field work help and samples.