

ASU-NWA-210 (K521)

Fabien Kuntz

TKW 360.9g

History: Fabien Kuntz purchased 4 fragments weighing a total of 360.9g from a meteorite dealer in Guelmim, Morocco in 2020.

Physical characteristics: Samples are irregular shaped and have a dark yellowish-brown oxidized exterior. A cut face shows the sample has a brecciated texture and a high abundance of sulfides.



Figs. 1&2 Overview photo (F. Kuntz) showing irregular-shaped, oxidized individuals (left); cut face (F. Kuntz) showing brecciated sulfide-rich texture.

Petrography: Description and classification (A. Love, App) Sample is a breccia composed of (vol%): cm-sized angular-rounded lithic fragments and isolated mineral grains (61) set within a matrix of FeNi metal (17) and anastomosing troilite (22). Lithic fragments are allotriomorphic, coarse-grained (1.5-2mm) eucrites and impact melt breccias with intergranular textures composed of (vol%): anhedral to subhedral olivine (11); zoned and exsolved, sieve-textured Opx (40), Cpx with ragged grain boundaries; and plag (25) mineral fragments in a melt matrix. Pyroxene mineral grains in contact with FeNi + FeS show reaction coronas composed of an assemblage of Si+Cpx+plag+FeS+Na-poor merr. Olivine lacks reaction coronas. Large metal nodules are absent in these specimens. Silicates and metal set within large regions of optically continuous sulfides (with strong birefringence). Additional minerals are chromite, troilite, taenite, kamacite, merrillite, a Si-polymorph, and ilmenite.

Shock: Silicates are cross cut by irregular fractures and show undulatory extinction. Oxide veins crosscut silicates possibly through pre-existing fractures. Some silicates show fine blebs of FeS

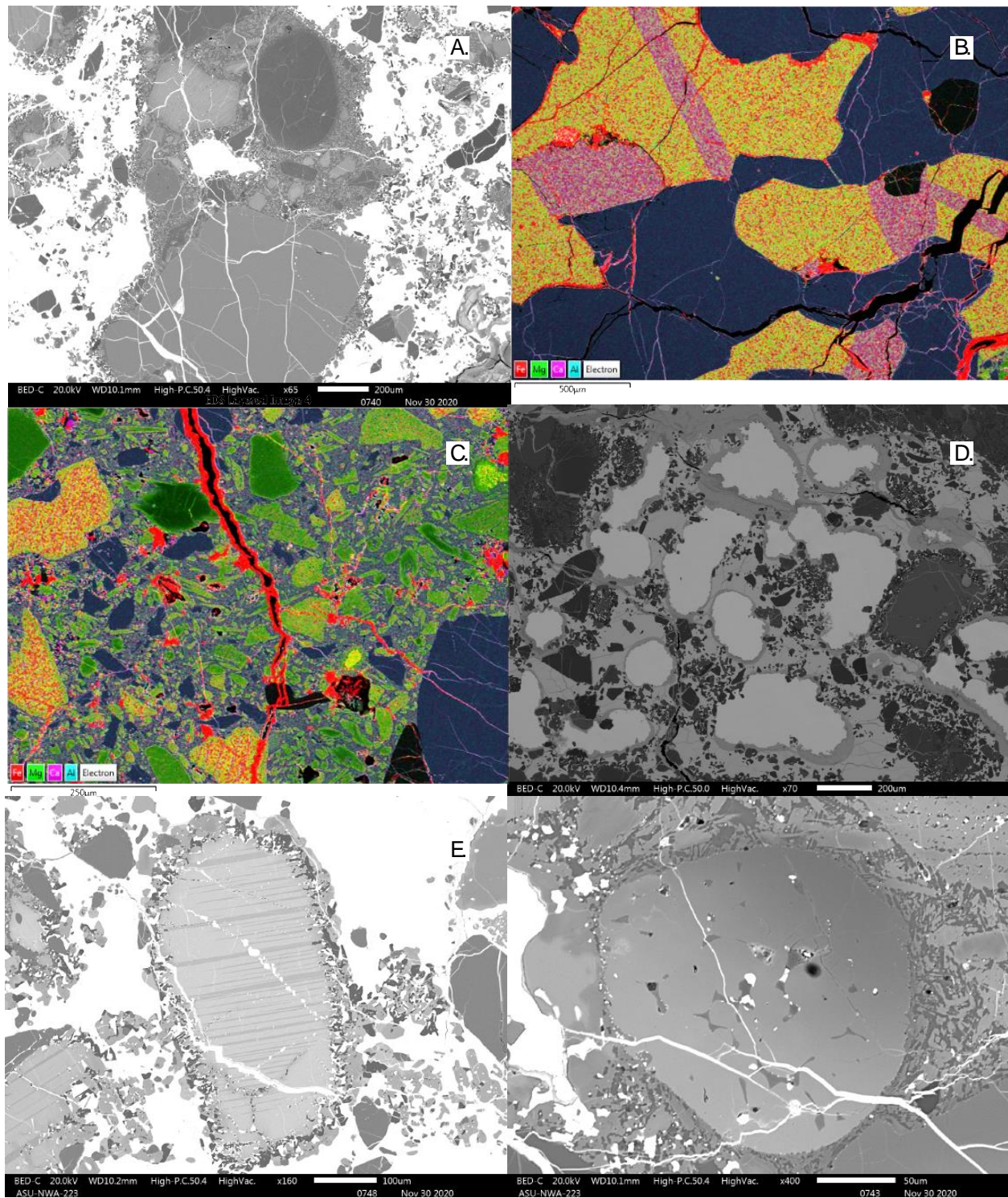


Fig. 3 A-F: A. BSE image of impact melt clast, notice anhedral crystal shapes; B. False color X-ray map showing allotriomorphic granular textured euclite clast (yellow and pink grains-exsolved Opx with Cpx lamellae, blue-plagioclase, black Si polymorph); C. FC-Xray map showing IM clast with anhedral pyx (w/ ragged grain boundaries) and plag grains; D. BSE image showing FeNi metal (white) showing oxidized rims (medium gray) surrounded by troilite (light gray) and

Fig. 3D-F cont. silicates (darker hues); BSE images showing exsolved pyx /inclusion rxn. rim; F rounded, zoned olivine within impact melt clast.

Weathering: Many FeNi grains are surrounded by rims of oxidized metal. FeOH veinlets crosscut the sample.

Magnetic Susceptibility: Mass magnetic susceptibility was measured using a ZH Instruments SM-30 pocket MS meter. Quadruplicate measurements of the sample produced $\log \chi \times 10^{-9} \text{ m}^3/\text{kg} = 5.36$. This value falls in the lower end of the range defined for mesosiderites (Rochette et al., 2009).

Geochemistry: (A. Love, App) Geochemistry of both samples was measured using the JEOL ITS300 SEM with Oxford XMax EDS in the Dewel Microscopy Lab at Appalachian State University. An accelerating voltage of 20kV was used to analyze 3 spots per grain.

Olivine ($\text{Fa}12.9 \pm 5.8$, $\text{Fe}/\text{Mn} = 36.1 \pm 1.4$, $n=7$), low-Ca pyroxene ($\text{Fs}36.2 \pm 15.3$ $\text{Wo}2.9 \pm 0.9$, $\text{Fe}/\text{Mn} = 28.9 \pm 1.3$, $n=12$); pigeonite ($\text{Fs}53.0 \pm 5.7$ $\text{Wo}7.0 \pm 1.2$, $\text{Fe}/\text{Mn} = 28.5 \pm 2.4$ $n=8$); high-Ca pyroxene ($\text{Fs}30.0 \pm 2.3$ $\text{Wo}39.9 \pm 1.9$, $\text{Fe}/\text{Mn} = 30.3 \pm 1.6$, $n=11$). plagioclase ($\text{An}94.7 \pm 1.3$ $\text{Or}0.0 \pm 0.1$, $n=8$).

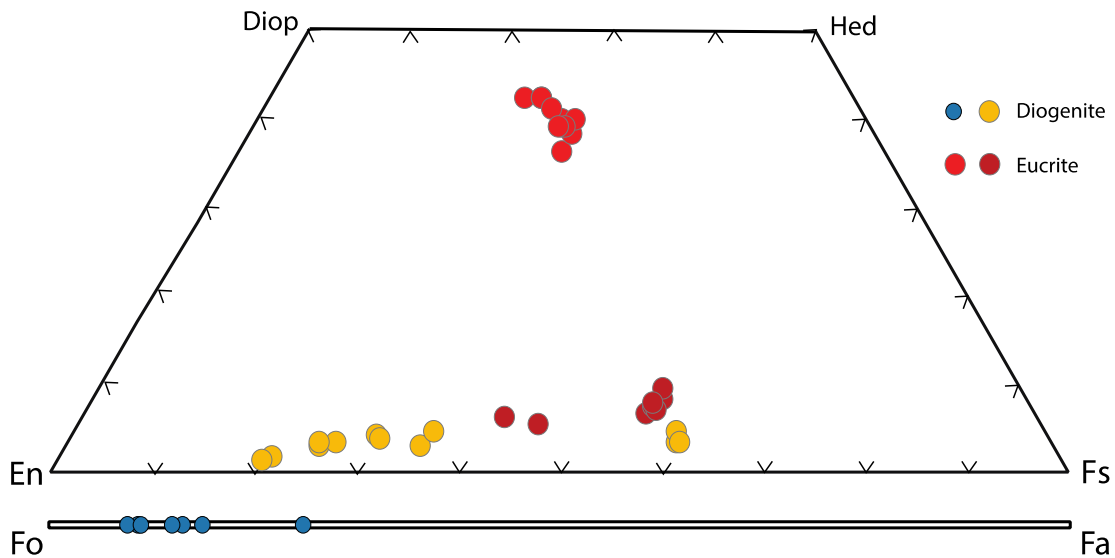


Fig. 4 Pyroxene and olivine compositions within the sample.

Classification: Mesosiderite (estimated class A4). Based on abundance of FeNi metal, modal mineralogy and mineral compositions this is a type A mesosiderite. Based on textures of clasts, this is an impact melt (type 4).

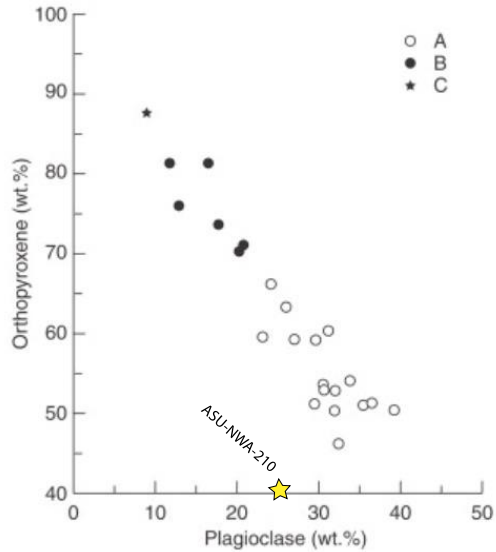


Fig. 5 Modal abundances of plagioclase and orthopyroxenes estimated from image thresholding. Abundances of plagioclase and orthopyroxene fall closest the type A mesosiderites (modified from Krot et al, 2007).

Samples: Fabien Kuntz holds the main masses. An endcut weighing 28.73g and a polished mount are on deposit at App.

References: Krot, A.N., Keil, K., Scott, E.R.D., Goodrich, C.A., Weisberg, M.K., 2007. Classification of Meteorites *in* Holland, H.D., and Turekian, K.K., 2007. Treatise on Geochemistry Vol. 1, p. 34.

Rochette, P., Gattacceca, J., Bourot-Denise, M., Consolmagno, G., Folco, L. Kohout, T., Pesonen, L., Sagnotti, L., 2009. Magnetic classification of stony meteorites: 3. Achondrites. MAPS 44, N.3, pp. 405-427.