Reference List

NWA 4797 – 15 grams
Highly-shocked ultra-mafic Shergottite

Figure 1 a, b: *Photos of whole and end cut of NWA4797 (by Ali Hmani). Cube is 1 cm.*

Introduction

Irving et al. (2008) reported on a small ultramafic shergottite with dramatic shock features (figure 1). It was found in Morocco in 2001 (Connolly et al. 2007). It has a fusion crust on one side, and is cut by several veins of glass, produced by shock (figure 2). It appears to be a new kind of rock from Mars. The thick glass vein may from a preexisting shock event on Mars.

Mineralogic Mode for NWA4797

	Walton et al. 2009
Olivine	40.3
Opx	22.1
Cpx	11.8
Plagioclase gl.	9.1
Chromite	3.5

Petrography

Irving et al. referred to NWA4797 as a "wehrlite", which has special significance in petrology. NWA4797 is primarily olivine and clinopyroxene. Large oikocrysts of zoned clinopyroxene enclose mm-sized chadocrysts of olivine (figure 2). Interstitial regions have been to shocked to vesicular glass, with very small birefringent microlites of plagioclase. Accessory phases include Ti-chromite, Mg-ilmenite, merrillite and pyrrhotite.

Walton et al. (2009, 2011) found the olivine and pyroxene in NWA4797 was highly shocked with strong mosaicism, pervasive fracturing and partial melting at grain boundaries. Plagioclase in the interstitial regions has been completely melted and vesiculated (*it is a plagioclase glass rather than maskelynite).* Walton et al. conclude the shock pressure was at least 60 GPa; Irving et al. place it near 80 GPa. However, high pressure mineral phases are not described.

Mineral chemistry is given by Irving et al. (2008). The composition of pyroxene and olivine is plotted in figure 3.

Chemistry

A preliminary chemical composition of NWA4797 has been reported by Korotev in Irving et al. (2008) (table 1). However, it is of a melt phase, because the sample was so coarse-grained. The REE pattern is low and flat (figure 4). The overall composition has been calculated from the mode by Walton et al. (2009).

Exposure Age

Huber et al. (2012) reported an ^{38}Ar exposure age of 5.2 m.y. for NWA4797, but they prefer an age of 3.7 m.y. from ^{21}Ne. Walton et al. (2011) had reported an age of 2.2 ± 0.4 m.y. by laser probe Ar measurements.

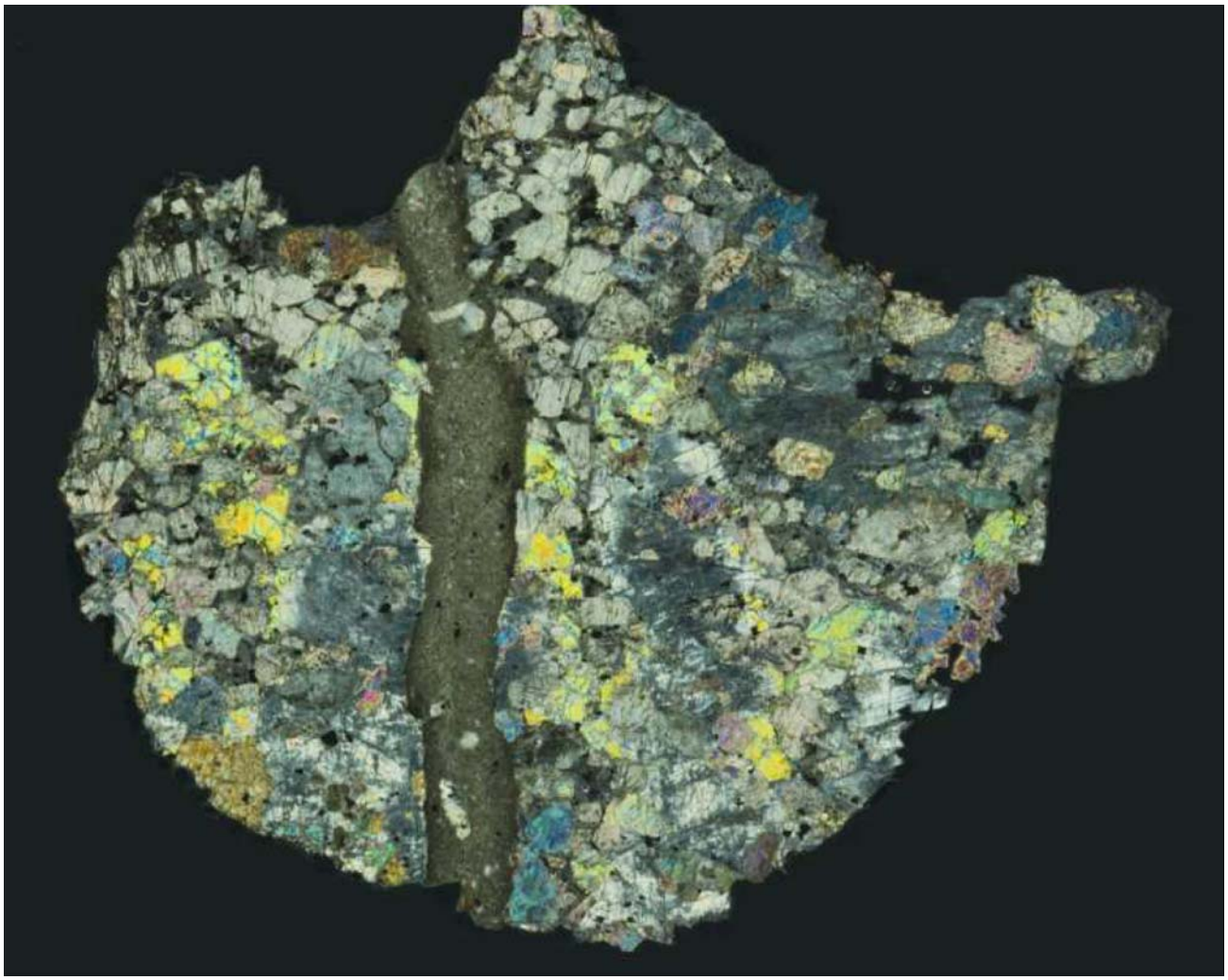

Figure 2: *Photomicrograph of thin section of NWA4797 (in crossed-polarized light), showing mm wide glass vein and abundant mafic minerals (from Irving et al. 2008).*

Other

Oxygen isotopes were reported by Rumble and Irving (2009). Delta ^{17}O = 0.27 ‰.

Processing

Where is the rest of the sample?

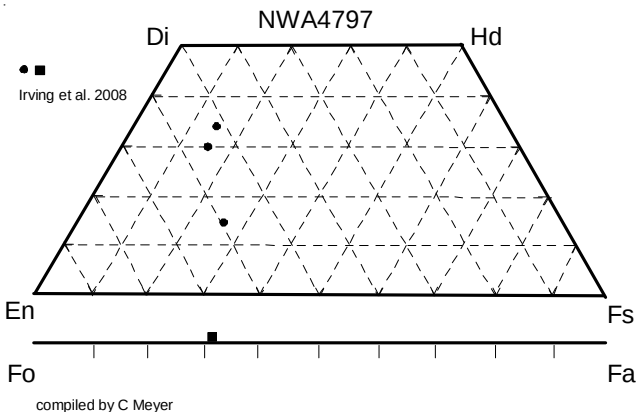

Figure 3: *Olivine and pyroxene composition for NWA4797 (from Irving et al. 2008).*

References for NWA4797

Table 1. Chemical composition of NWA 4797.

reference	Irving 2008		Walton09		Connolly08	
weight					shock vein	
SiO2 %			41.6	(b)	58.7	(c)
TiO2			0.4	(b)	1.4	(c)
Al2O3			3.7	(b)	14.3	(c)
FeO	19.6	(a)	19.9	(b)	6.5	(c)
MnO			0.5	(b)	0.22	(c)
MgO			25.6	(b)	2.1	(c)
CaO			4.7	(b)	11.8	(c)
Na2O	0.4	(a)	0.7	(b)	2.7	(c)
K2O			0.1	(b)	0.12	(c)
P2O5			0.4	(b)	1.8	(c)
S %						
sum						
Sc ppm	26.3	(a)				
V						
Cr	6620	(a)	13700	(b)		
Co						
Ni	330	(a)				
Cu						
Zn						
Ga						
Ge ppb						
As						
Se						
Rb						
Sr						
Y						
Zr						
Nb						
Mo						
Ru						
Rh						
Pd ppb						
Ag ppb						
Cd ppb						
In ppb						
Sn ppb						
Sb ppb						
Te ppb						
Cs ppm						
Ba						
La	0.69	(a)				
Ce						
Pr						
Nd						
Sm	0.52	(a)				
Eu	0.18	(a)				
Gd						
Tb	0.19	(a)				
Dy						
Ho						
Er						
Tm						
Yb	0.57	(a)				
Lu	0.08	(a)				
Hf	0.55	(a)				
Ta						
W ppb						
Re ppb						
Os ppb						
Ir ppb						
Pt ppb						
Au ppb						
Th ppm	0.1	(a)				
U ppm						

technique: (a) INAA, (b) calculated from mode, (c) elc. Probe

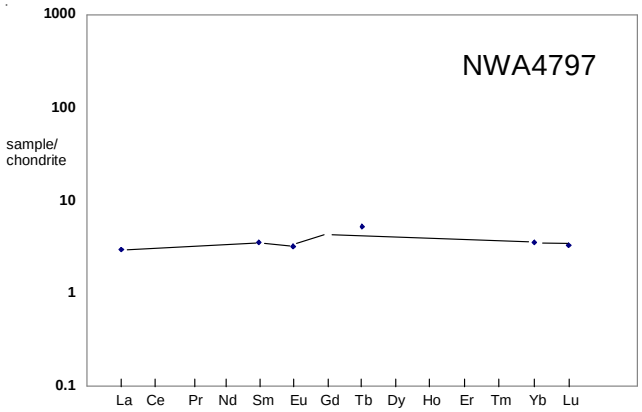

Figure 4: *Normalized rare-earth-element diagram for NWA4797 (data from table 1).*