Northwest Africa 4884

Anorthosite-bearing basaltic (polymict) regolith breccia

42 g

Figure 1: Interior surface of NWA 4884 with fingers for scale (photo by G. Hupe).

Introduction

Northwest Africa 4884 was found in 2007 in northwest Africa. It is comprised of a single stone (42 g) partially covered by black fusion crust; interior slices show it to be a breccia composed of white, beige and light gray clasts in a dark gray matrix (Fig. 1).

Petrography and Mineralogy

Preliminary reports (Connolly et al., 2008) describe it as a "regolithic breccia composed of abundant angular mineral and lithic clasts in a sparse vesicular, glassy matrix. Mineral fragments include calcic plagioclase ($An_{92.4-95.3}Or_{0.5-0.1}$), pigeonite ($Fs_{52.3}Wo_{10.5}$; FeO/MnO = 65.2), augite, Ti-chromite, ilmenite (one with a tiny baddeleyite inclusion) and silica polymorph. Lithic clasts include several types of mare basalt (a coarse-grained example is composed of olivine + zoned pigeonite + calcic plagioclase + ilmenite + troilite), granophyric intergrowths of Fe-rich augite+fayalitic olivine+silica polymorph, a coarse grained dunitic or troctolitic rock containing a large metal grain (associated with rutile and secondary ilmenite), and a large “breccia-within-breccia” clast. Mare basalt clasts and debris are predominant over highlands lithologies." Olivine clasts ($Fa_{37.0-37.7}$; FeO/MnO = 94-98) are very different from olivine in a basalt clast ($Fa_{87.9}$; FeO/MnO = 89), and augite lamella ($Fs_{31.9}Wo_{31.9}$; FeO/MnO = 60.3), pigeonite clast ($Fs_{60.1}Wo_{7.0}$, FeO/MnO = 71.1), and augite clasts ($Fs_{17.2}Wo_{36.9}$, FeO/MnO = 53.3) are slightly different in composition from those in the basaltic clasts.

Chemistry

The intermediate FeO content and high Sm are consistent with this sample being a mixture of anorthositic and basaltic materials in a regolith breccia (Table 1). Moreover, the composition of NWA 4884, combined with its petrography and mineralogy, have led some to propose that it could be launch paired with the Yamato 981031 and QUE 94281 polymict lunar meteorites (Korotev et al., 2009a,b). The overlapping trace element characteristics (Fig. 2) and major element composition (Korotev et al., 2009b) illustrate this well.

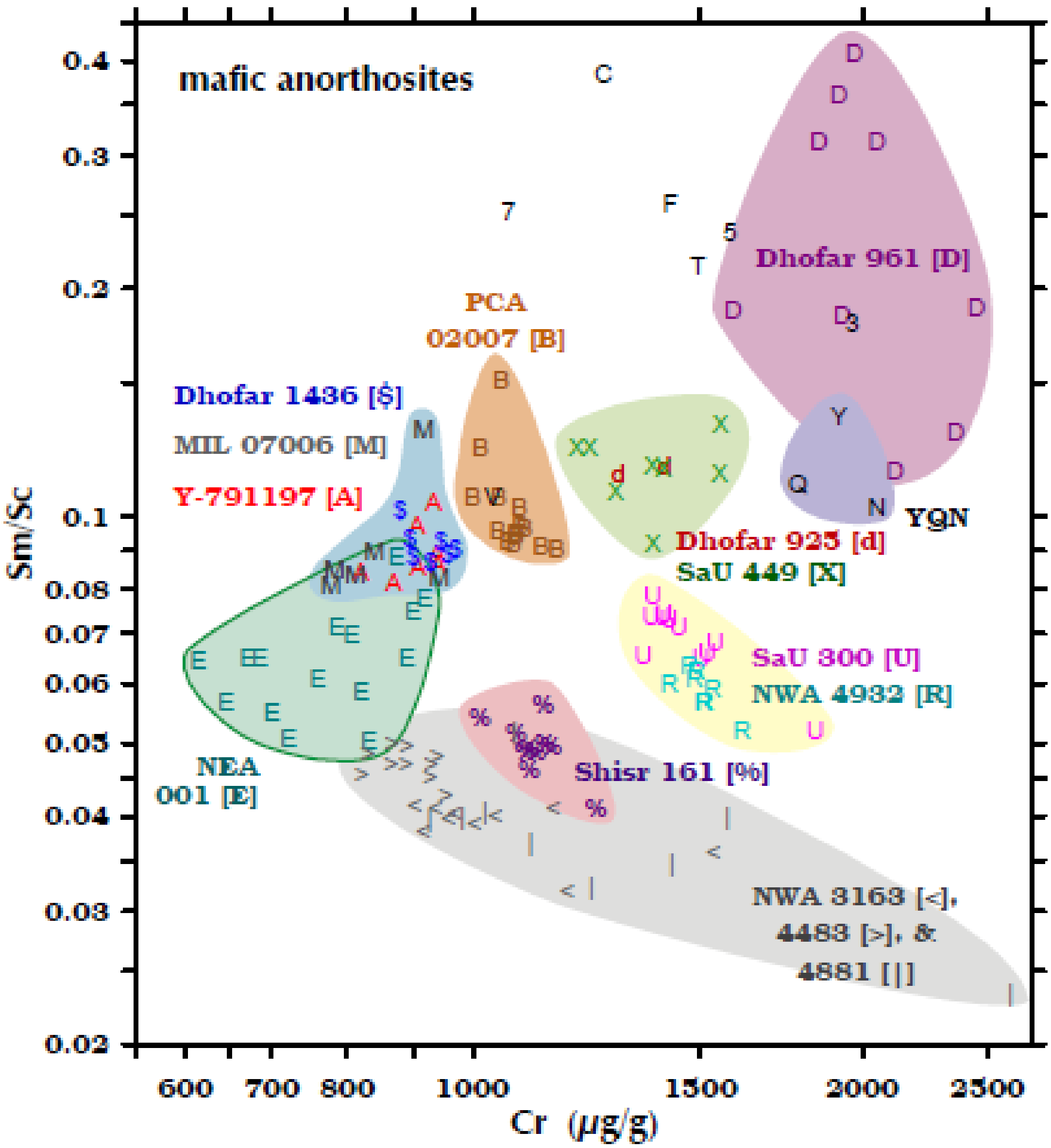

Figure 2: Sm/Sc versus Cr for a wide range of lunar meteorites, but illustrating the narrow compositional range of the YQN (Yamato 981031, QUE 94281, and NWA 4884) samples (from Korotev et al., 2009a).

Table 1a:Chemical composition of NWA 4884

reference	1	1
weight	20-60	266
technique	a	c
SiO_2 %	46.2	
TiO_2	0.63	
Al_2O_3	17	
FeO	13.7	13.72
MnO	0.18	
MgO	8.85	
CaO	12.4	13.9
Na_2O	0.37	0.366
K_2O	0.07	<0.3
P_2O_5	0.06	
S %		
sum	99.8	
Sc ppm		29.9
V		
Cr		2050
Co		43.8
Ni		153
Cu		
Zn		
Ga		
Ge		
As		<0.8
Se		0.1
Rb		<8
Sr		115
Y		
Zr		88
Nb		
Mo		
Ru		
Rh		
Pd ppb		
Ag ppb		
Cd ppb		
In ppb		
Sn ppb		
Sb ppb		
Te ppb		
Cs ppm		0.09
Ba		88
La		6.29
Ce		16.4
Pr		
Nd		10.1
Sm		3.07
Eu		0.786
Gd		
Tb		0.638
Dy		
Ho		
Er		
Tm		
Yb		2.35
Lu		0.33
Hf		2.25
Ta		0.26
W ppb		
Re ppb		
Os ppb		
Ir ppb		3.2
Pt ppb		
Au ppb		1.2
Th ppm		0.93
U ppm		0.26

technique (a) EMPA, (b) ICP-MS, (c) INAA (d) XRF

Radiogenic age dating

Cosmogenic isotopes and exposure ages

None yet reported.

Table 1b. Light and/or volatile elements for NWA 4884

Li ppm	
Be	
C	
S	
F ppm	
Cl	
Br	0.1
I	
Pb ppm	
Hg ppb	
Tl	
Bi	

References: 1) Korotev et al. (2009b)