# NWA1950

Lherzolitic Peridotite

~ 797 grams (2 stones)

*Figure 1. Photo of NWA1950 (courtsey of Bruno Fectay and Carine Bidaut). Scale is in cm. (nice clean fingers unknown).*

## Introduction

Two stones (414 and 383 grams) were found in the Atlas Mts. Morocco in 2001 (Russell et al. 2004; Gillet et al. 2005). They both have fusion crust (figures 1 and 4). Together, they are also known by their field name "Jules Verne". Perhaps more specimens will be found.

NWA1950 has not been dated, but a cosmic ray exposure age (~4 m.y.) has been determined.

## Petrography

The texture of NWA1950 is similar to that of ALH77005 (figure 2). Two lithologies are present; characterized as poikilitic and "non-poikilitic" (Gillet et al. 2005, Mikouchi 2005). The poikilitic lithology has large low-Ca pyroxene (up to 6 mm) surrounding large euhedral olivine and small chromite. The "non-poikilitic" lithology has intergrown augite, pigeonite and maskelynite as well as numerous accessory minerals including chromite, ilmenite, sulfide, phosphate, rare baddelyite and a K-rich phase (glass?). Magmatic melt inclusions are common in both olivine and pyroxene.

Fractures in NWA1950 contain calcite (from terrestrial weathering).

## Mineralogy

***Olivine:*** Olivine $Fo_{66-75}$ has FeO/MnO = 50 ± 10 (Gillet et al. 2005).

***Pyroxene:*** Both pigeonite ($En_{78}Fs_{19}Wo_2$-$En_{60}Fs_{26}Wo_{14}$.) and augite ($En_{53}Fs_{16}Wo_{31}$-$En_{45}Fs_{14}Wo_{41}$) are present in NWA1950 (figure 3).

***Plagioclase:*** All of the plagioclase in NWA1950 is shocked to maskelynite $An_{57-40}$ (Gillet et al. 2005, Mikouchi 2005).

**Mineralogical Mode of NWA1950**

| | Russell et al. 2004 | Gillet et al. 2005 |
|---|---|---|
| Olivine | 55 vol. % | 55 |
| Pyroxene | 35 | 35 |
| Maskelynite | 8 | 8 |

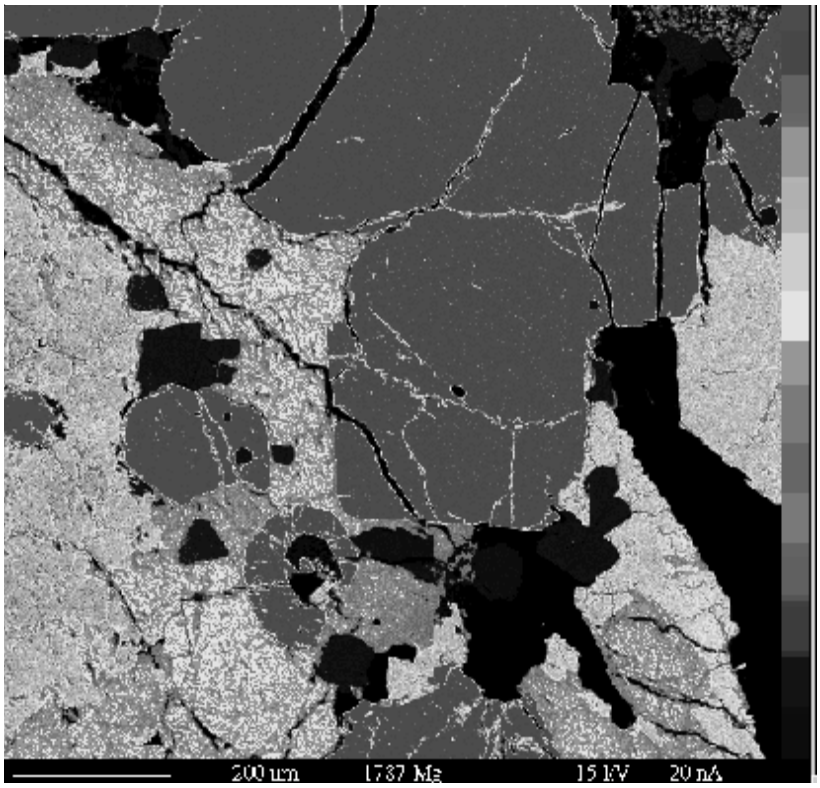


***Figure 2:*** *Texture of polished section of NWA1950 (courtesy J-A.Barrat and Marcel Bohn). Minerals generally lack chemical zonation. This striking photo is a map of Mg content of olivine (red), chromite and or ilmenite (blue), maskelynite (black), pigeonite (orange) and augite (green).*

***Chromite:*** Small (20-100 microns) euhedral chormite inclusion in olivine and pyroxene have compositions similar to those in ALH77005 (Gillet et al. 2005).

***Sulfide:*** The sulfide phase is pyrrhotite with high Ni, some pentlandite, and trace Cu.

## Chemistry

The composition of NWA1950 has been determined by Gillet et al. (2005)(table 1). The rare earth elements (figure 5) are found to be between ALH77005 and NWA480.

## Radiogenic age dating

None

## Cosmogenic isotopes and exposure ages

Gillet et al. (2005) report cosmic ray exposure ages $^{3}$He = 5.3 ± 3.0 m.y., $^{21}$Ne = 3.5 ± 0.8 m.y., and $^{38}$Ar = 2.3 ± 1 m.y. Christen et al. (2005) determined a exposure ages of $^{3}$He = 4.1 ± 0.6 m.y., $^{21}$Ne = 5.3 ± 0.8 m.y., and $^{38}$Ar = 2.9 ± 0.4 m.y. (average is 4.1 ± 1.4 m.y.).

## Other isotopes

Oxygen isotopes are reported as delta$^{17}$O = 2.54 ‰, delta$^{18}$O = 4.28 ‰, and DELTA$^{17}$O = 0.31 ‰ by Gillet et al. (2005).

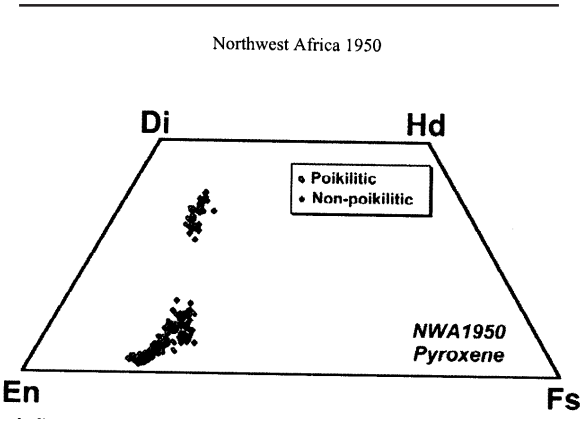


*Figure 3: Pyroxene compositions in NWA 1950 (Mikouchi 2005).*

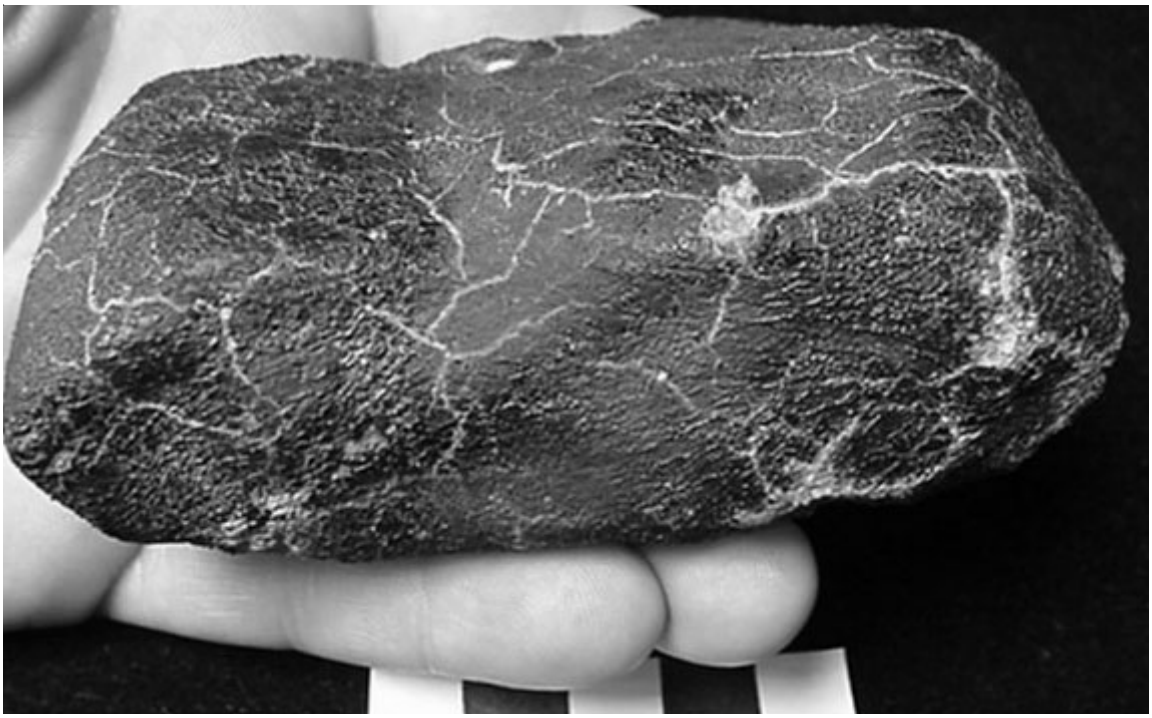

***Figure 4:*** *Jules Verne #2 (photo courtsey Bruno Fectay and Carine Bidaut). Scale is in cm.*

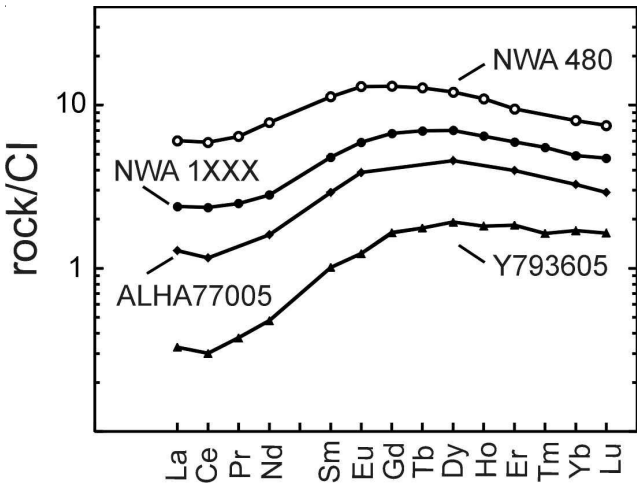


***Figure 5:*** *Rare-earth-element pattern for Jules Verne (NWA1950) (from Barret).*

## Table 1. Chemical composition of NWA1950.

| *reference* | Gillet 2005 | | |
|---|---|---|---|
| *weight* | | fusion crust | |
| SiO2 % | | 43.97 | (a) |
| TiO2 | 0.55 | 0.56 | (a) |
| Al2O3 | 4.02 | 4.02 | (a) |
| FeO | 21.65 | 21.77 | (a) |
| MnO | 0.46 | 0.52 | (a) |
| MgO | 25.06 | 20.87 | (a) |
| CaO | 4.09 | 5.13 | (a) |
| Na2O | 0.81 | 0.82 | (a) |
| K2O | 0.1 | 0.02 | (a) |
| P2O5 | 0.65 | 0.7 | (a) |
| S % | | | |
| *sum* | | | |
| | | | |
| Sc ppm | | | |
| V | | | |
| Cr | 6400 | | (a) |
| Co | 71 | | (b) |
| Ni | 306 | | (b) |
| Cu | 7.6 | | (b) |
| Zn | 48.8 | | (b) |
| Ga | 9.3 | | (b) |
| Ge ppb | | | |
| As | | | |
| Se | | | |
| Rb | 0.78 | | (b) |
| Sr | 21.5 | | (b) |
| Y | 9.61 | | (b) |
| Zr | 26 | | (b) |
| Nb | 1.12 | | (b) |
| Mo | | | |
| Ru | | | |
| Rh | | | |
| Pd ppb | | | |
| Ag ppb | | | |
| Cd ppb | | | |
| In ppb | | | |
| Sn ppb | | | |
| Sb ppb | | | |
| Te ppb | | | |
| Cs ppm | 0.041 | | (b) |
| Ba | 9.94 | | (b) |
| La | 0.586 | | (b) |
| Ce | 1.51 | | (b) |
| Pr | 0.24 | | (b) |
| Nd | 1.34 | | (b) |
| Sm | 0.739 | | (b) |
| Eu | 0.343 | | (b) |
| Gd | 1.37 | | (b) |
| Tb | 0.261 | | (b) |
| Dy | 1.77 | | (b) |
| Ho | 0.367 | | (b) |
| Er | 0.984 | | (b) |
| Tm | 0.141 | | (b) |
| Yb | 0.81 | | (b) |
| Lu | 0.12 | | (b) |
| Hf | 0.82 | | (b) |
| Ta | 0.064 | | (b) |
| W ppb | 119 | | (b) |
| Re ppb | | | |
| Os ppb | | | |
| Ir ppb | | | |
| Pt ppb | | | |
| Au ppb | | | |
| Th ppm | 0.083 | | (b) |
| U ppm | 0.019 | | (b) |

*technique: (a) ICP-AES, (b) ICP-MS*