



Università degli Studi di Padova

Dipartimento di Geoscienze

A.A. 2014-2015

Laurea Triennale in Scienze Geologiche

Zolfo in clinopiroseni di Nakhli Marziane

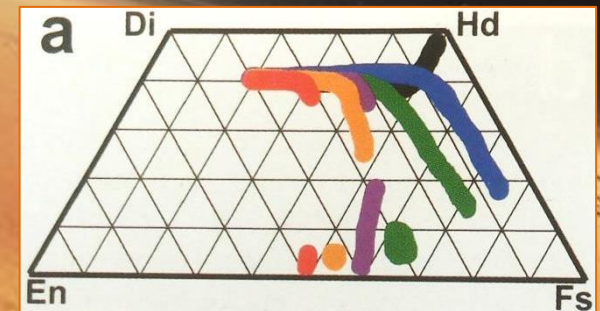
Gloria Tognon

Relatore: Andrea Marzoli

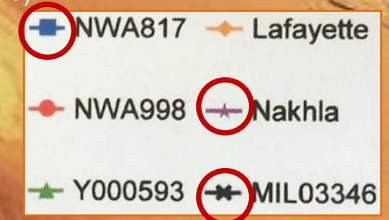
Co-relatori: Anna Maria Fioretti, Sara Callegaro

Nakhliti

- Meteoriti acondritiche marziane
- Roccia cumulitica derivata da magma basaltico
- Ricca in **cpx** augitico + **ol**; pasta di fondo con **plg** ± vetro
- Storia:
 - cristallizzazione ~ 1.3 Ga
 - alterazione ~ 620 Ma
 - spallazione da Marte ~ 11Ma
 - impatto sulla Terra ≤ 10 000 anni



a. Cristallo-chimica dei cpx delle nakhliti (Treiman, 2005)

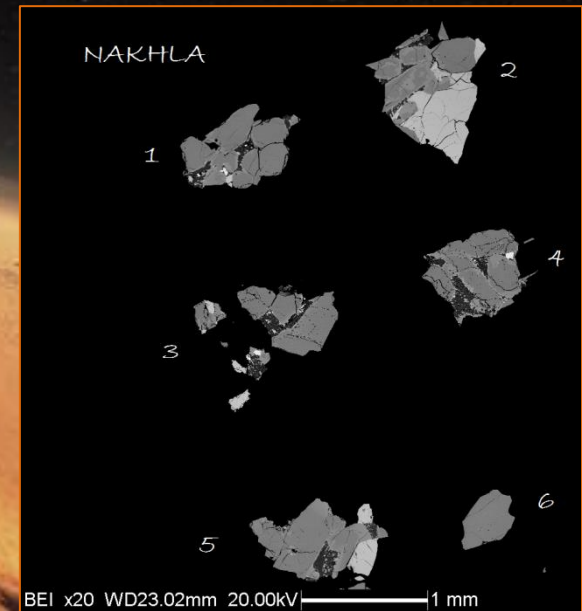


Campioni

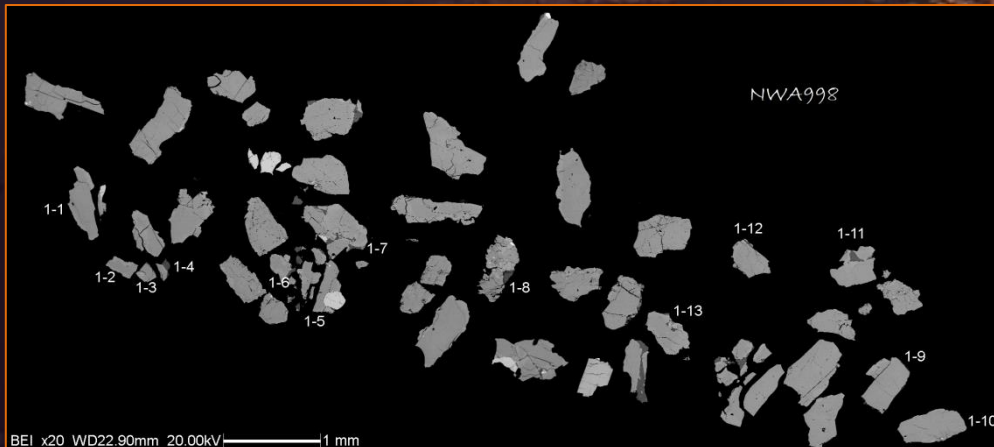
- MIL 03346: porzione superficiale; raffreddamento rapido



- Nakhla: situazione intermedia



- NWA 998: in profondità; raffreddamento lento



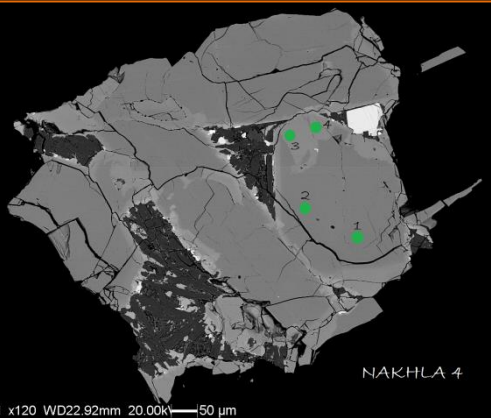
Obiettivo

Studiare il contenuto in zolfo dei pirosseni per ricavare la sua concentrazione finale nel magma essendo noto il coefficiente di ripartizione fra cpx e magma ($K_D = 0,03$; aumenta il contenuto in Fe dei px).

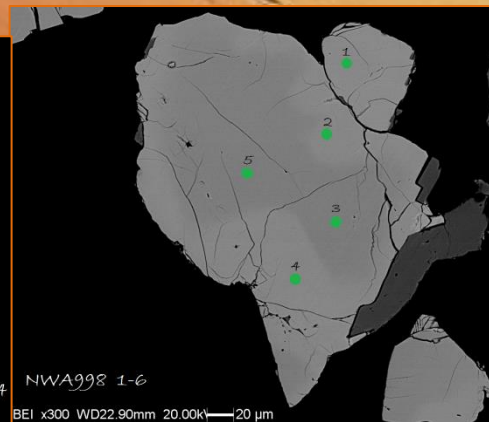
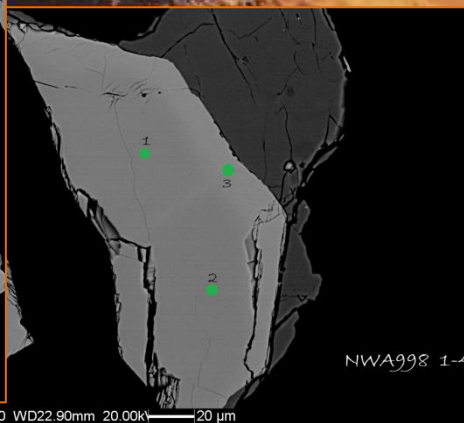
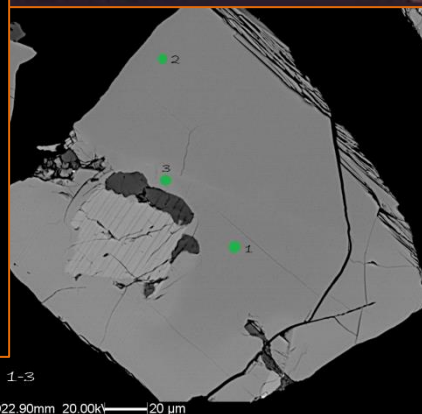
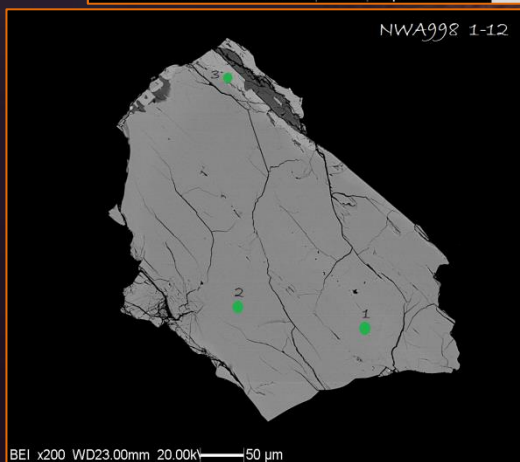
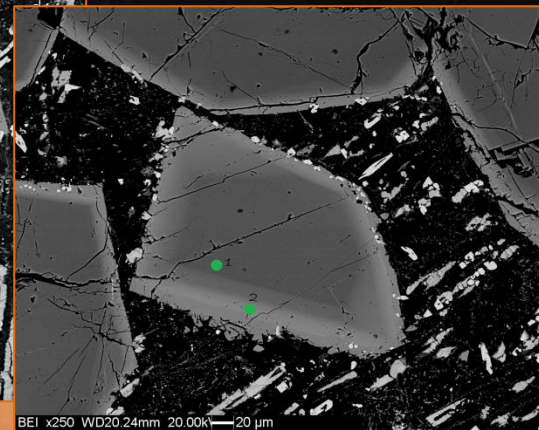
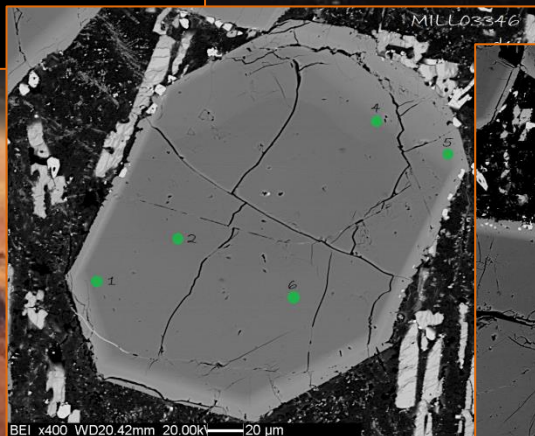
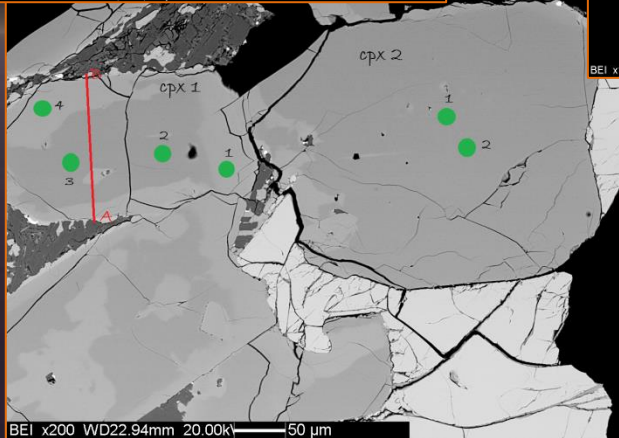
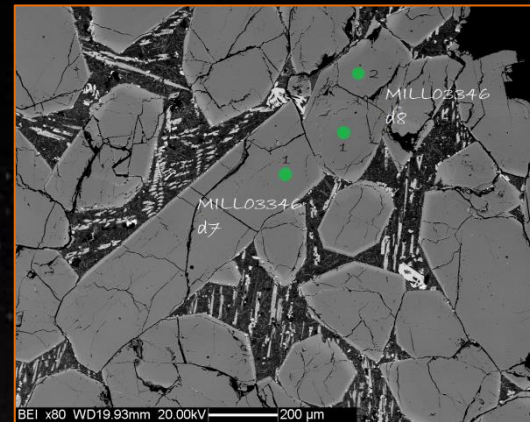
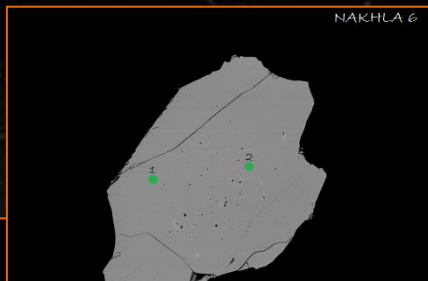
Procedimento

- Analisi in microsonda elettronica e in micro-XRF in luce di sincrotrone
- Fitting dei dati con Pymca

Punti analizzati



NAKHLA 2

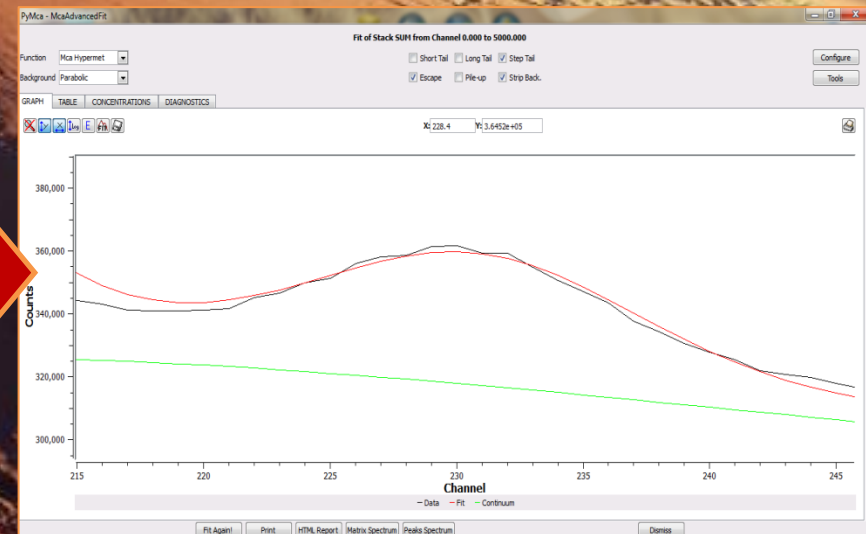
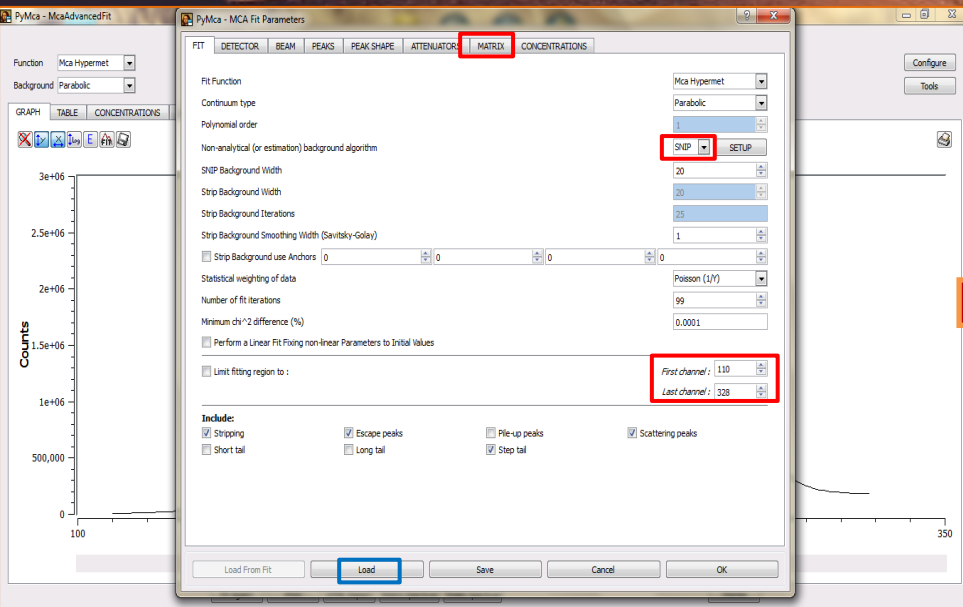
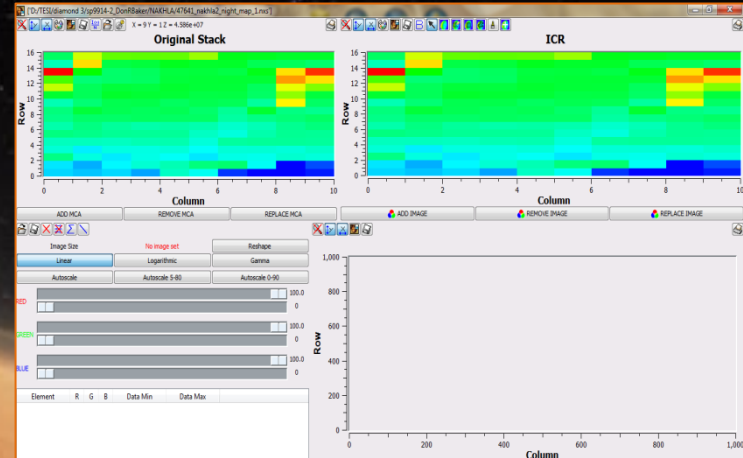
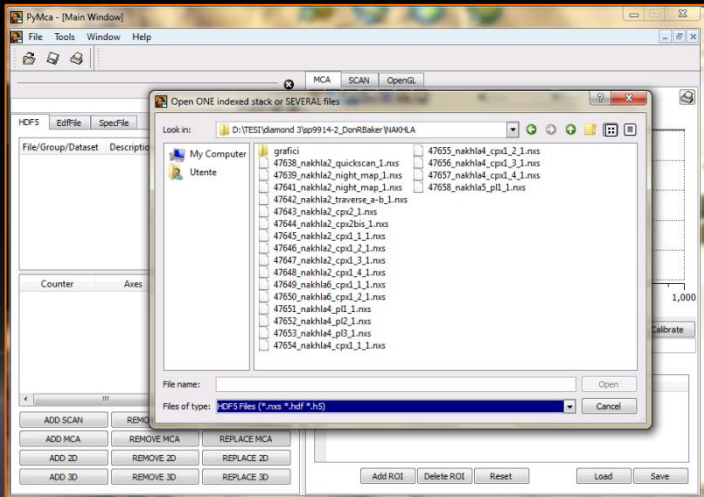


Pymca

➤ Caricare file .nxs

➤ Caricare file di configurazione

➤ Impostazione parametri (matrix, background, 1st e last channel)



Valori medi nuclei cpx

Concentrazione S:

MIL 03346 > Nakhla > NWA 998

27 ppm

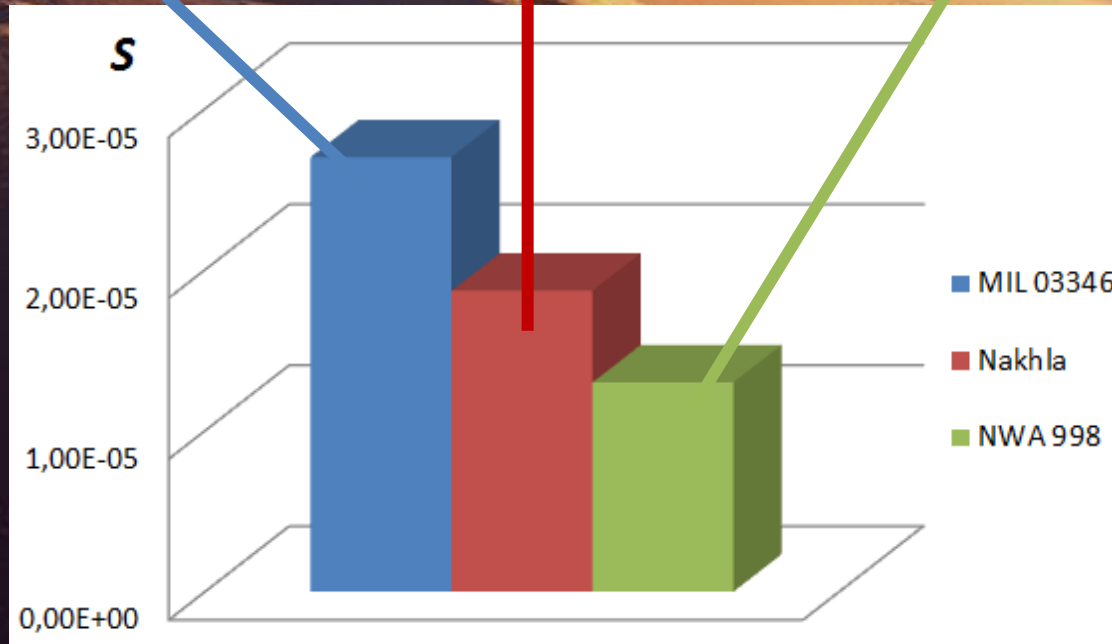
(in equilibrio con un valore del melt max 2800 ppm)

17 ppm

(in equilibrio con un valore del melt di ~ 650 ppm)

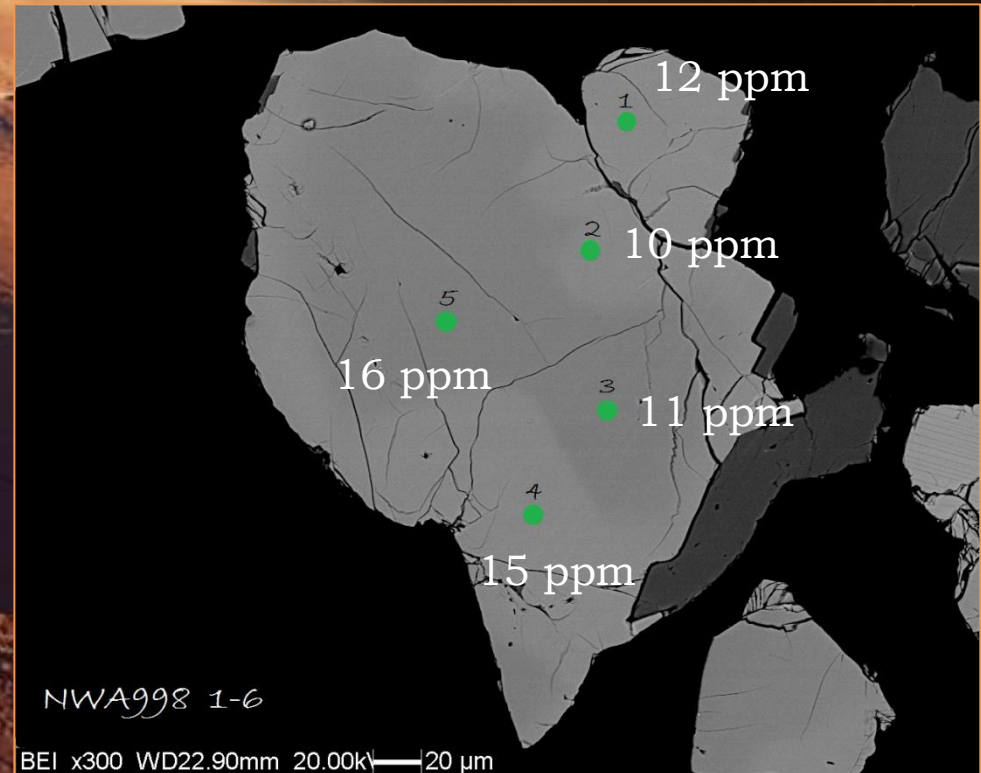
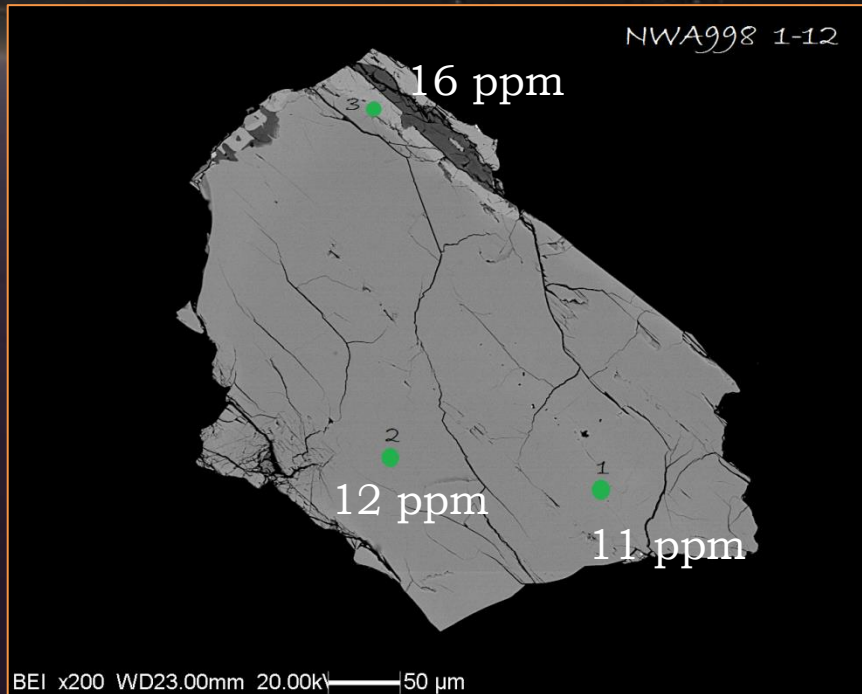
12 ppm

(in equilibrio con un valore del melt di ~ 400 ppm)



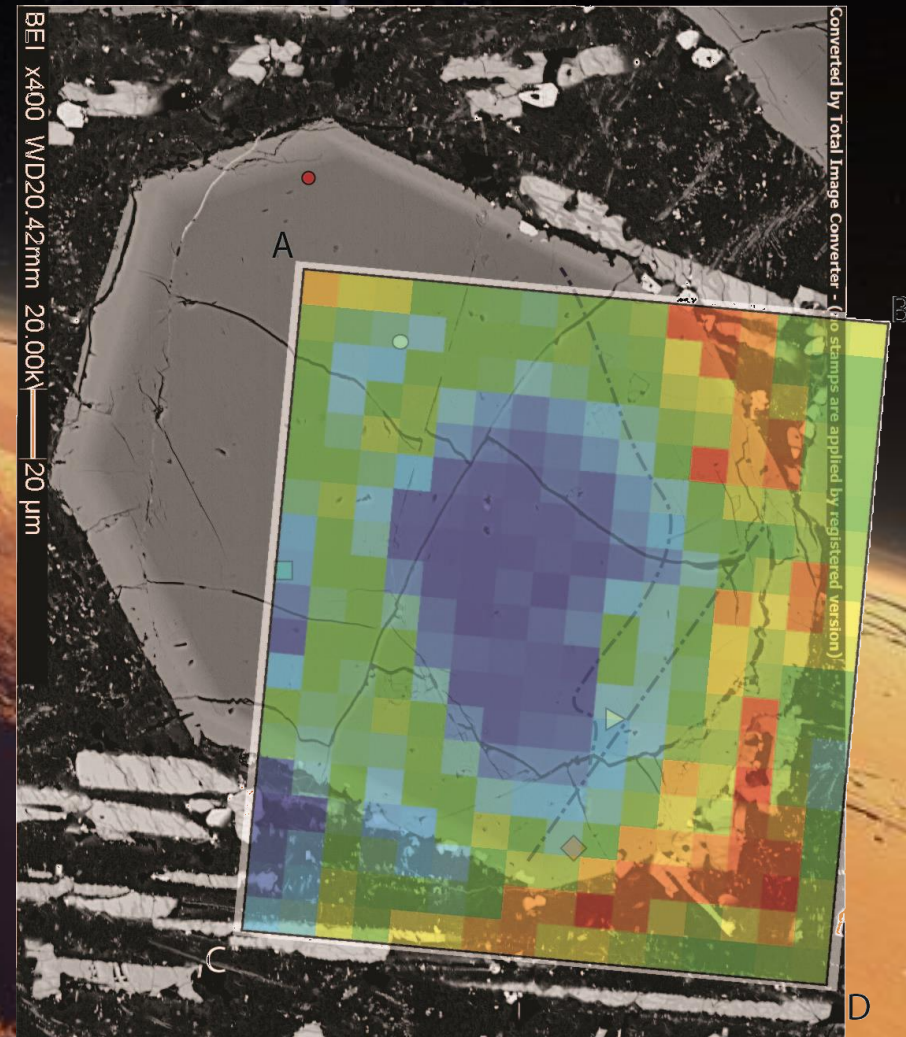
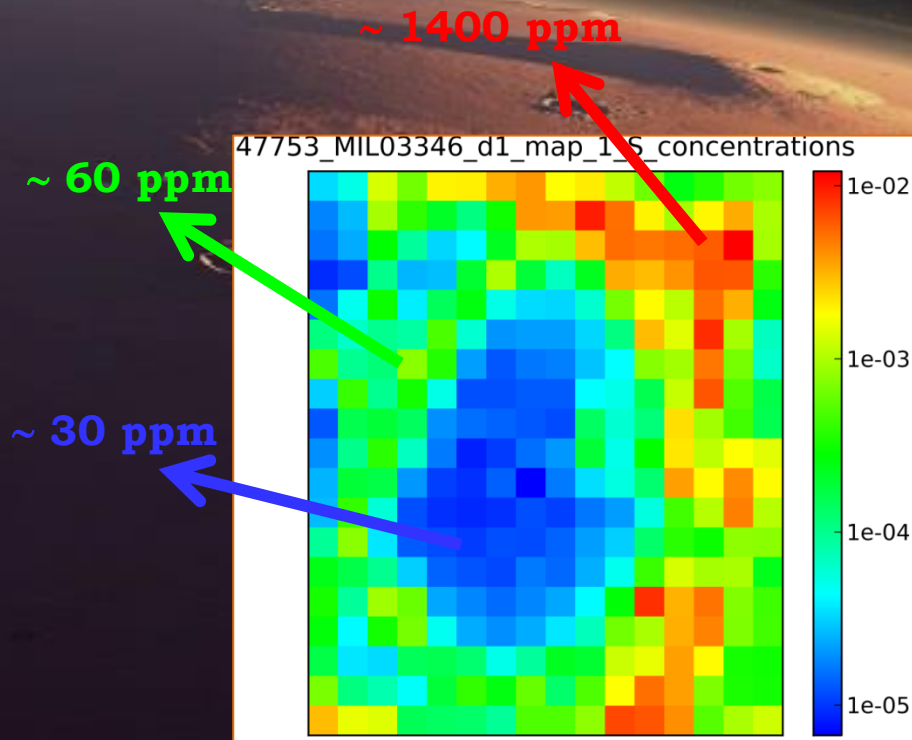
Risultati

- NWA 998: povera in zolfo; omogenea



Risultati

- MIL 03346: ricca in zolfo; eterogenea



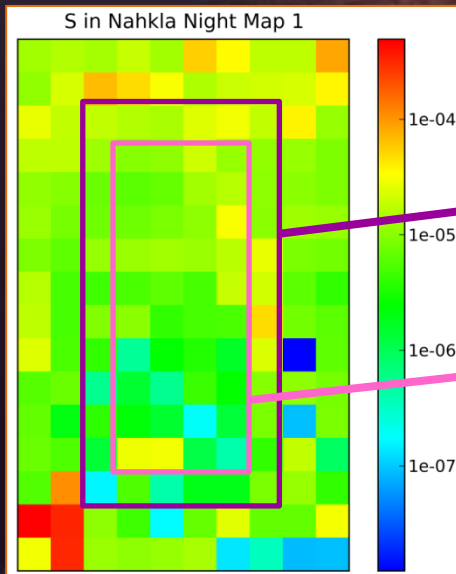
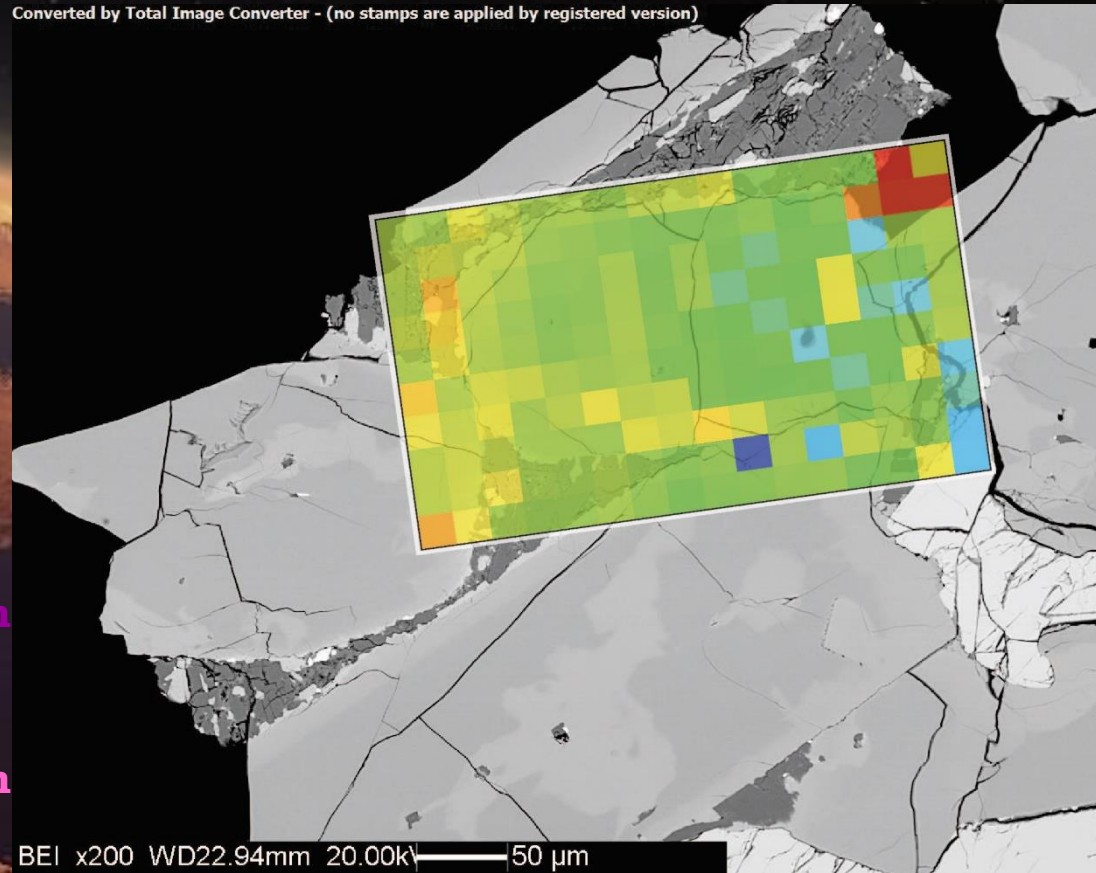
NB: Le mappe hanno scale diverse

Risultati

- Nakhla: contenuto in zolfo intermedio; omogenea

1,21E-05	7,31E-06	1,72E-05	1,28E-05			2,41E-05	2,05E-05	4,04E-04	
4,67E-05	1,14E-05	7,83E-06	4,48E-05	2,17E-05	7,11E-06	9,67E-06	2,26E-05	5,69E-04	6,25E-04
5,40E-06			1,13E-05	1,64E-06	7,47E-06	4,48E-06	5,00E-06	5,92E-05	2,35E-06
	1,13E-04	1,20E-05	7,58E-06	1,35E-05	4,26E-05	4,76E-05	9,32E-07	6,70E-06	2,18E-06
5,03E-05	6,90E-05	2,32E-05	7,13E-06	1,20E-05	7,79E-06	9,28E-06	4,71E-06	1,29E-05	1,44E-05
1,25E-05	2,87E-05	1,99E-05	2,88E-06	1,71E-05	1,47E-05	8,01E-06	5,40E-06	3,33E-06	2,92E-05
1,46E-05		3,69E-05		1,02E-05	1,04E-05	9,05E-06	5,99E-06	6,32E-06	3,78E-05
8,02E-06	1,35E-05	7,98E-05	1,46E-05	9,96E-06	1,19E-05	2,38E-05	2,54E-05	1,64E-05	2,07E-05
7,04E-06	1,04E-05	3,30E-05	3,20E-05	4,05E-06	7,62E-06	6,11E-06	5,41E-06	6,00E-06	3,50E-06
5,65E-06	7,61E-06	2,71E-05	2,40E-05	2,68E-06	8,16E-06	8,74E-06	5,33E-06	7,11E-06	7,32E-07
4,81E-06	9,53E-06	2,71E-05	4,18E-05	7,95E-06	8,03E-06	1,03E-05	4,83E-06	1,12E-05	5,16E-06
7,77E-06	5,22E-06	7,46E-06	1,98E-05	1,06E-05	5,34E-06	6,75E-06	8,81E-06	7,31E-06	9,98E-06
4,99E-06	6,48E-06	4,94E-06	1,30E-05	2,84E-05	4,96E-06	8,39E-06	5,02E-06	1,81E-05	1,70E-05
1,33E-05	8,12E-05	1,87E-05	3,94E-05	2,81E-05	9,00E-06	1,01E-05	2,25E-05	1,88E-05	3,43E-05
3,65E-05	1,88E-05	3,72E-05	1,83E-05	1,65E-05	5,80E-05	1,02E-04	8,12E-05	1,95E-05	8,73E-06
8,15E-05	2,85E-06	6,29E-06		7,62E-05		1,18E-05	8,88E-06	8,76E-06	7,29E-06

Converted by Total Image Converter - (no stamps are applied by registered version)

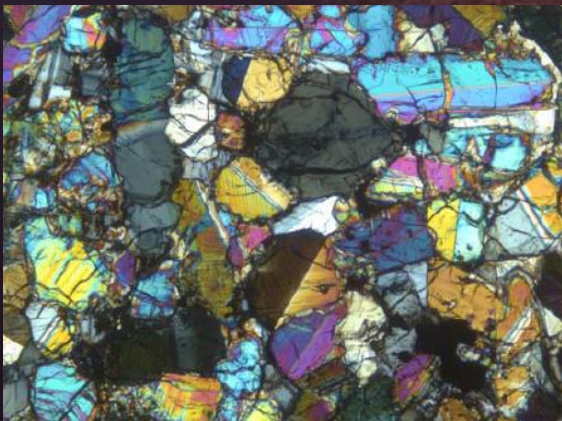


NB: Le mappe hanno scale diverse

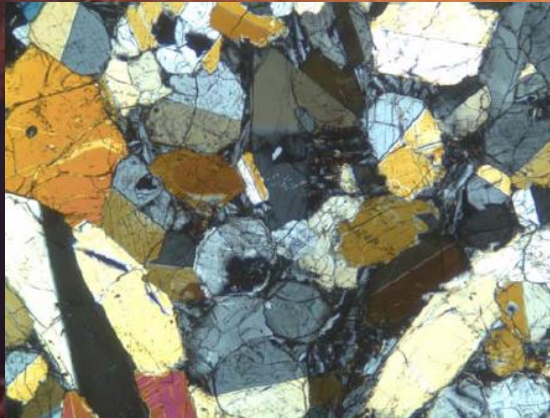
Interpretazione

- Differenza per processi di diffusione e/o degassing dei cpx
- Evidente in NWA 998 e Nakhla; mancata diffusione in MIL 03346

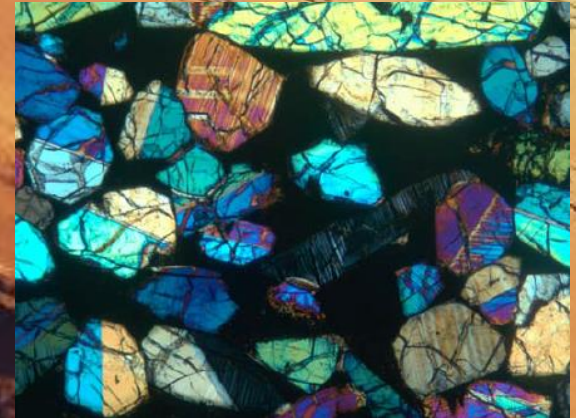
NWA 998



Nakhla



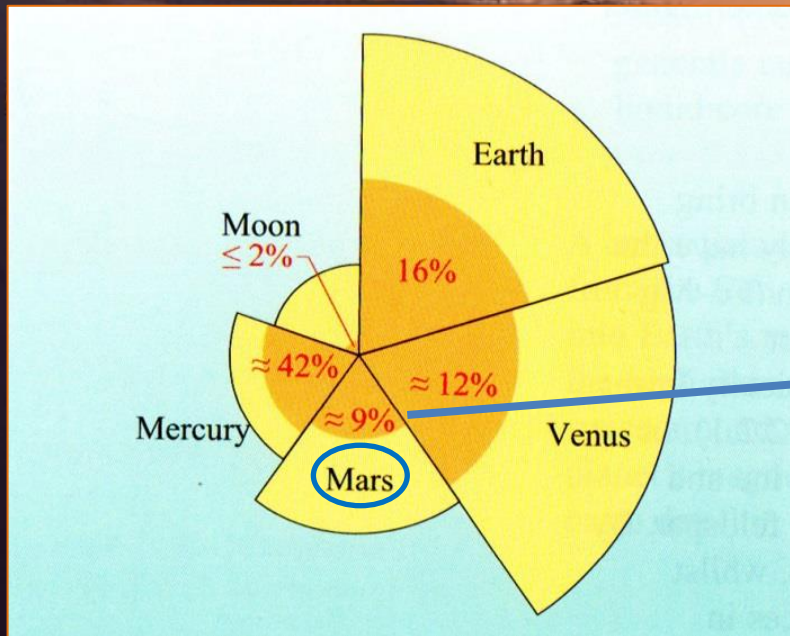
MIL 03346



(Da Treiman, 2005)

Conclusioni

- Dati MIL 03346 indicativi per la composizione del magma marziano
- Compatibile con ipotesi di nucleo di dimensioni ridotte



Percentuale del volume occupato dal nucleo rispetto al volume totale del corpo

(Da Rothery, McBride, Gilmour, 2011)

Bibliografia

- Meteoritical Bulletin Database: <http://www.lpi.usra.edu/meteor/>
- Treiman A.H., The Nakhlite meteorites: Augite-rich igneous rocks from Mars, Chemie der Erde, 2005.
- Ding e al., New bulk sulfur measurements of martian meteorites and modeling the fate of sulfur during melting and cristallization – Implications for sulfur transfer from martian mantle to crust-atmosphere system, EPSL, 2015.