Sample Results Summary Sheet

Please return this form to the Curator for each allocated Sample

Sample ID: RA-QD02-0121

PI: Eizo Nakamura

Type and date of analysis performed: major element analysis (SEM-EDS, and EPMA-WDS), trace element (SIMS) [Jul 10-20, 2011], and oxygen-isotope analysis (HR-SIMS) [May 19, 2011]

Elements or phases identified: major phases: olivine, low-Ca pyroxene; minor phase: troilite, plagioclase, K-feldspar, glass

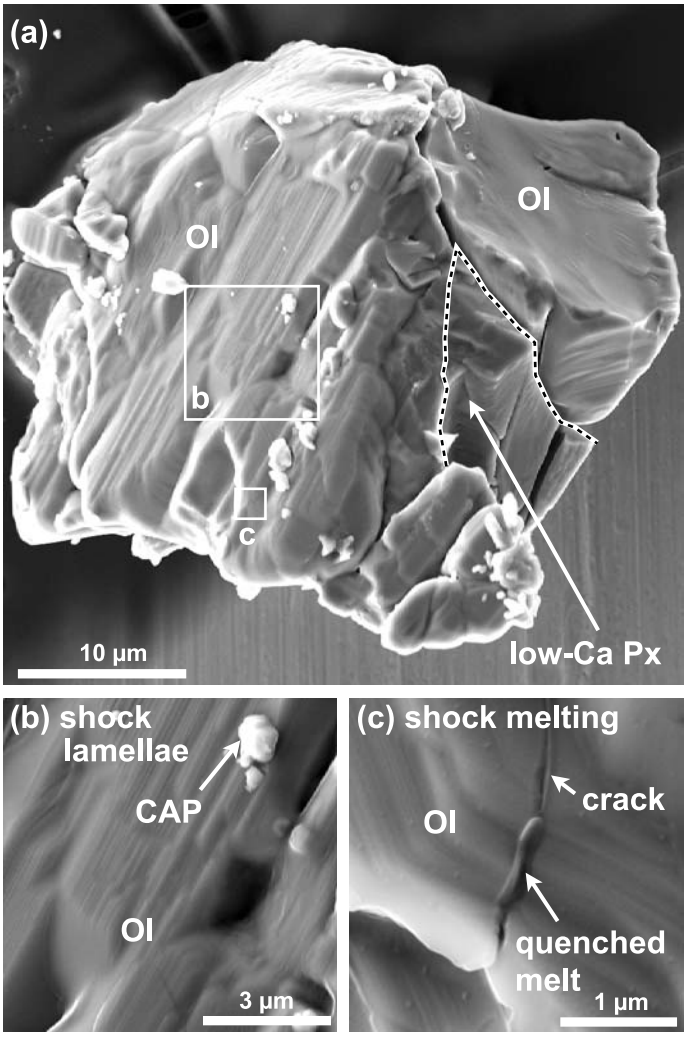
Contaminant phases identified: No

Sample handling: exposed in atmosphere, glued by glycol phthalate, coated C, sliced by FIB, and polished the FIB-sliced slab after acid-leaching, coated Au

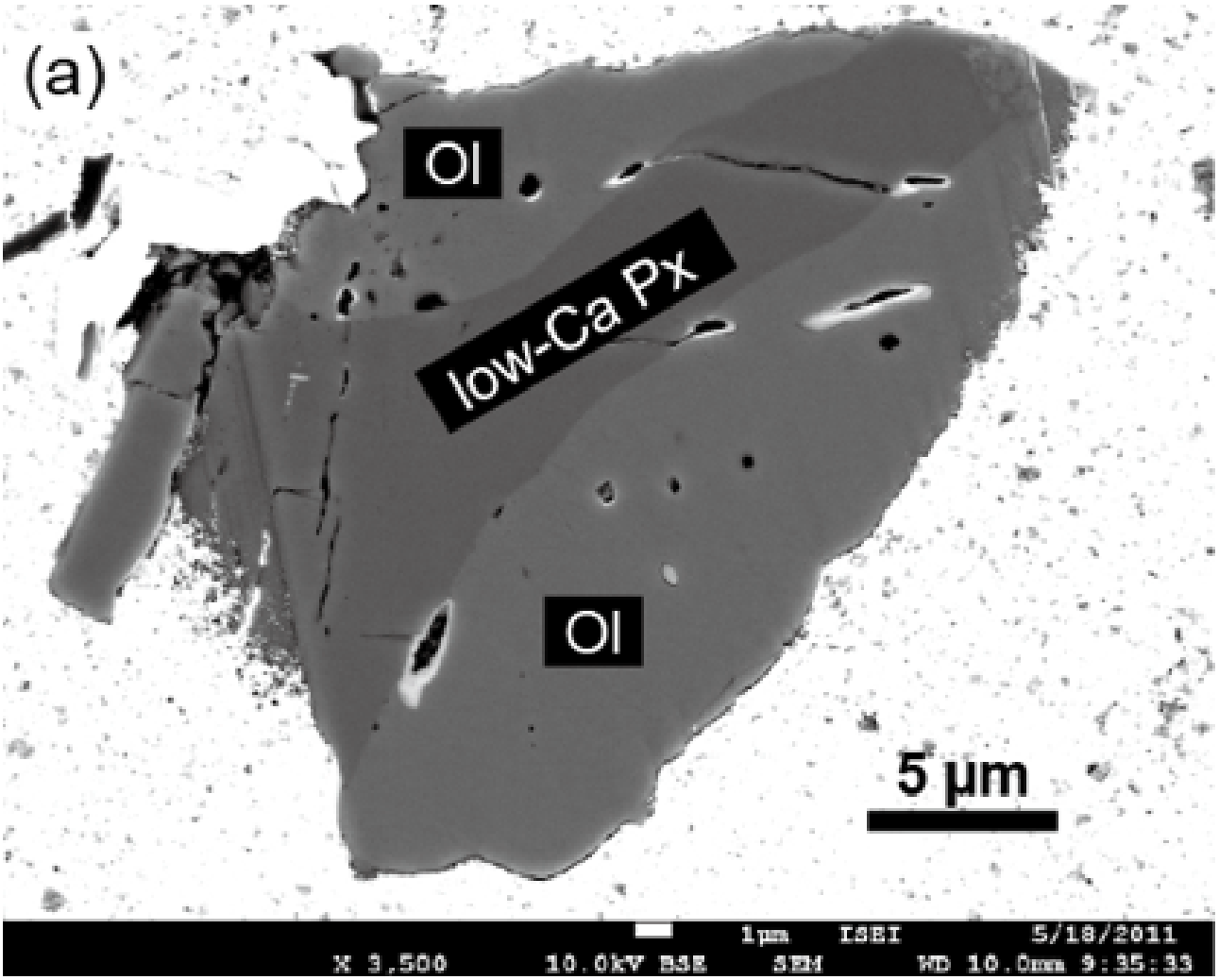
State of sample pre-analysis: atmosphere, glued, C-coated, FIB-sliced, In-mounted, polished section, Au coted

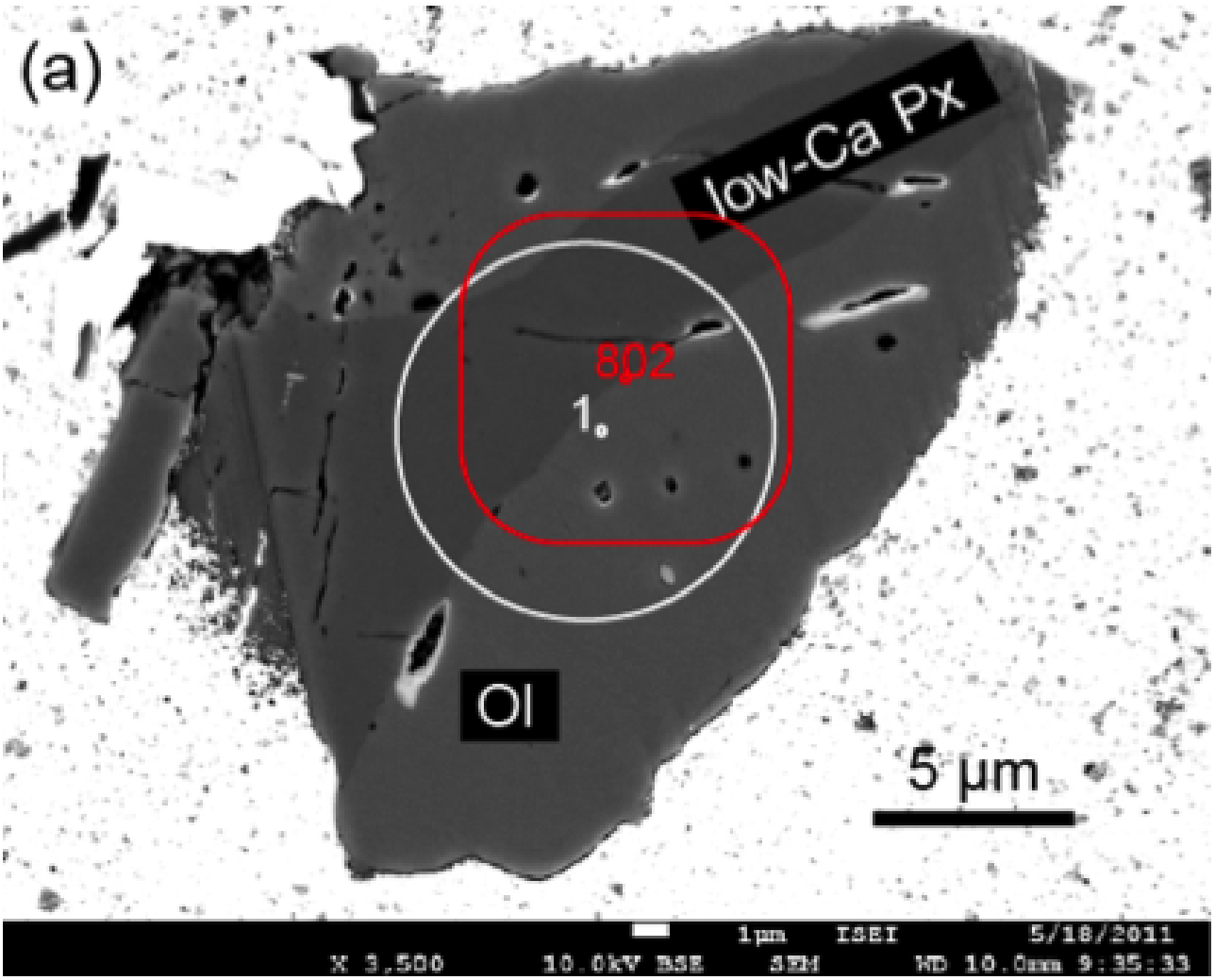
State of sample post-analysis: atmosphere, glued, C-coated, FIB-sliced, In-mounted, polished section, Au coted**,** sputtered by (spotted by) Cs- and O-beams

Analysis data Notes: This sample (original size: 40×30 μm) consists of olivine and low-Ca pyroxene, with the olivine showing sets of sharply defined lamellae with widths at the sub-μm scale. These lamellae could reflect high strain rates and high shear stresses associated with shock compression. An object with a ropey fabric, observed on and along a crack cross-cutting the lamellae, appears to have originated from melt. Ratios of Fe/Mg and Mn/Fe in olivine and low-Ca pyroxene fall within the range for LL-ordinary chondrites. See details in Nakamura et al. (2012)'s "grain A".


(a)
Ol
Ol
b
c
10 µm
low-Ca Px
(b) shock lamellae
CAP
Ol
3 µm
(c) shock melting
crack
Ol
quenched melt
1 µm

Target Phase	Grain A			
	$Ol_{n=2}$		low-Ca $Px_{n=2}$	
SiO_2	39.61	(1.59)	53.85	(1.06)
TiO_2	-		0.18	(0.01)
Al_2O_3	-		0.41	(0.32)
Cr_2O_3	-		-	
FeO	24.57	(1.13)	15.38	(0.19)
NiO	-		-	
MnO	0.49	(0.03)	0.49	(0.02)
MgO	35.97	(1.03)	28.42	(0.73)
CaO	-		0.61	(0.12)
Na_2O	-		-	
K_2O	-		-	
total	101.4		99.3	
Formula	fo_{72}		wo_1en_{75}	
Mg#	72	(0.4)	76	(0.2)
$(Fe/Mg)_{atom}$	0.38		0.3	
$(Fe/Mn)_{atom}$	49		31	


(a)
Ol
low-Ca Px
Ol
5 μm
1μm ISEI 5/18/2011
X 3,500 10.0kV BSE SEM WD 10.0mm 9:35:33


(a)
low-Ca Px
802
1
Ol
5 μm
1μm ISEI 5/18/2011
X 3,500 10.0kV BSE SEM WD 10.0mm 9:35:33

Target	Spot	Phase	$\delta(^{18}O/^{16}O)$	$\delta(^{17}O/^{16}O)$	$\Delta(^{17}O/^{16}O)$
Grain A	802	$Ol_{0.5}$ low-Ca $Px_{0.5}$	6.9	4.1	0.5
Grain B	694	$Ol_{0.95}$ $Pl_{0.05}$	5.2	5.2	2.5
	720	$Ol_{0.8}$ $Pl_{0.2}$	2.4	2.5	1.3
	721	$Ol_{0.8}$ $Pl_{0.2}$	4.0	4.6	2.5
	723	$Ol_{0.6}$ $Pl_{0.4}$	5.1	5.0	2.3
Grain C	755	Di	7.2	5.5	1.8
	756	Di	8.0	4.2	0.1
	765	Pl*	8.8	5.8	1.2
Grain D	782	low-Ca Px	2.9	2.6	1.1
	783	low-Ca Px	1.7	1.7	0.8

Supplemental Table 7 | Chemical compositions of the Itokawa grains determined using the Cameca ims-5f ion microprobe. Abundances are expressed in a unit of $\mu g \cdot g^{-1}$ except for SiO_2. In-run uncertainty ($1\sigma_{mean}$) is provided in parentheses. Note that SiO_2 concentration (wt.%) is obtained by electron microprobe analyses (Supplemental Table 1). For analyses sampling two phases, proportions of the two phases are indicated, and SiO_2 concentration[§] was calculated using these proportions. Dashes and dots indicate "not available" and "not analyzed", respectively. . † and ‡ were obtained in "LIGHT" and "RARE-EARTH" sessions, respectively.

Target	Grain A		Grain B		Grain B		Grain B		Grain B		Grain B	
Spot	1		2		3		4		5		6	
Phase	$Ol_{0.5}$ low-Ca $Px_{0.5}$		Ol		$Ol_{0.9}Pl_{0.1}$		Pl		$Pl_{0.3}Ol_{0.7}$		$Pl_{0.6}Ol_{0.4}$	
SiO_2	*39.61*	§	*38.93*		*38.93*	§	*65.40*		*65.40*	§	*65.40*	§
TiO_2	1,300	(44)	-	(19)	• • •		360	(70)	• • •		• • •	
Al_2O_3	1,500	(21)	430	(10)	• • •		15,000	(840)	• • •		• • •	
Cr_2O_3	660	(9)	-		• • •		1,700	(390)	• • •		• • •	
FeO	• • •		• • •		• • •		• • •		• • •		• • •	
NiO	-		-		• • •		-		• • •		• • •	
MnO	4,600	(26)	7,100	(50)	• • •		1,200	(23)	• • •		• • •	
MgO	• • •		• • •		• • •		• • •		• • •		• • •	
CaO	4,500	(170)	110	(50)	• • •		15,000	(540)	• • •		• • •	
Na_2O	39	(1)	120	(2)	• • •		40,000	(380)	• • •		• • •	
K_2O	-		19	(1)	• • •		6,100	(83)	• • •		• • •	
P_2O_5	-		720	(10)	• • •		2,100	(210)	• • •		• • •	
H_2O	580	(7)	690	(15)	• • •		350	(9)	• • •		• • •	
Li†	-		7.9	(0.1)	• • •		3.0	(0.1)	• • •		• • •	
Li‡	0.51	(0.03)	2.7	(0.1)	2.5	(0.2)	• • •		1.3	(0.1)	3.0	(0.5)
B	-		-		• • •		-		• • •		• • •	
F	25	(2)	4.3	(0.3)	• • •		36	(1)	• • •		• • •	
Cl	5.6	(0.3)	-		• • •		11	(1)	• • •		• • •	
Sr	0.11	0.0	5.2	(0.4)	17	(4)	• • •		64	(7)	83	(15)
Y	0.27	(0.02)	0.26	(0.13)	0.16	(0.07)	• • •		1.1	(0.1)	54	(9)
Zr	0.78	(0.05)	0.44	(0.09)	1.3	(0.1)	• • •		2.8	(0.6)	3.2	(0.5)
Nb	2.3	(0.2)	0.74	(0.27)	1.9	(1.4)	• • •		15	(2)	45	(8)
Ba	-		-		-		• • •		-		-	
La	-		-		-		• • •		-		-	
Ce	-		-		-		• • •		-		-	
Pr	-		-		-		• • •		-		-	
Nd	-		-		-		• • •		0.52	(0.002)	8.2	(1.4)
Sm	-		-		-		• • •		-		-	
Eu	-		-		-		• • •		-		-	
Gd	-		-		-		• • •		-		-	
Dy	-		-		-		• • •		-		-	
Er	-		-		-		• • •		-		-	
Yb	-		-		-		• • •		-		-	
Lu	-		-		-		• • •		-		-	
Hf	-		-		-		• • •		-		-	