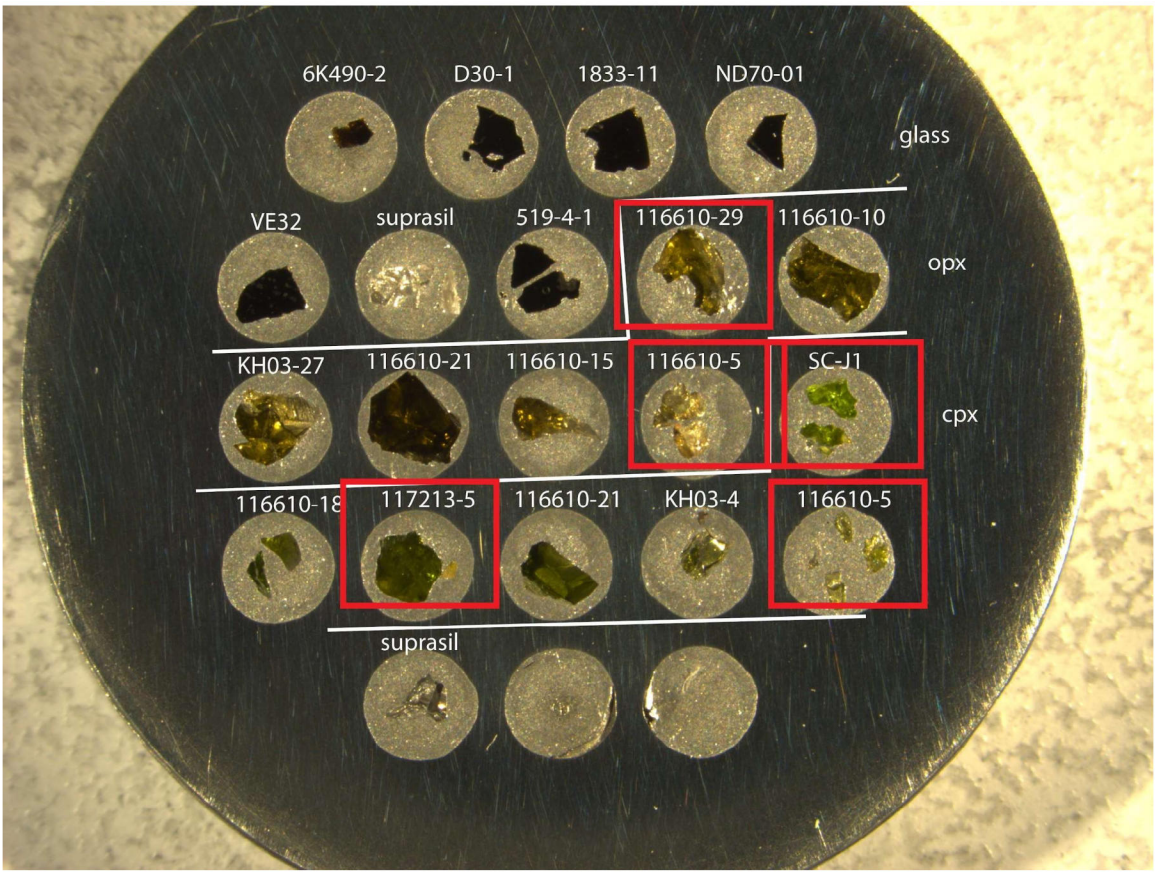
Version 6 of SM3 Documentation

Kumamoto Standard Mount 3 (SM3)

NMNH Catalog Number 118331

Kumamoto, K. M., J. M. Warren, and E. H. Hauri (2017), New SIMS reference materials for measuring water in upper mantle minerals, *American Mineralogist*, *102*, 537–547.



Mount History

- Standard mount created and polished in June 2018 by Katie Kumamoto.
- Mount was gold coated at WUSTL on 9 July 2018 by Clive Jones.
- Mount was analyzed on 14 July 2018 using WUSTL 7f SIMS by Warren/Lynn/Prigent.
- Mount transferred from University of Delaware to the Smithsonian National Museum of Natural History in October 2018 (accession #2084887, catalog #118331).
- Versions v5 onwards include correction to a previous error in this document: A value was incorrectly provided for 116610-5Cpx and no value for 116610-5Opx. For updates in 2019 to create v5, value for 116610-5Cpx was removed (see further notes below) and value for 116610-5Opx included.
- Version v6 includes data from the 2018 WUSTL analytical session, which provides confirmation of SM3 mineral H2O abundances.

Notes

- Mount contains specific grains that were analyzed in Kumamoto et al. (2017) and new grains (red boxes) that were measured during the July 2018 WUSTL session.
- Data for 116610-5Cpx from the grain on this mount and two other mounts, all measured in July 2018, indicate that this sample has previously unrecognized heterogeneity.
- 116610-5Cpx should be excluded from the working curve. For the grain in this mount, three analyses give OH/Si ratios of 0.0546, 0.0567, 0.0716, with only the highest ratio plotting on the working curve (see end of document). This suggests intragrain heterogeneity and this grain should not be used for calibration (or further analyses should be performed to constrain the heterogeneity).

Recommended working curve values for SM3:

Orthopyroxene

116610-29 (BCN-203)	62 ± 5 ppm
116610-10 (SLP-114)	128 ± 12 ppm
118317-2 (KH03-27)	182 ± 19 ppm
116610-21 (DGO-166)	215 ± 21 ppm
116610-15 (SLP-402)	234 ± 22 ppm
116610-5 (SLP-142)	309 ± 27 ppm

Clinopyroxene

118318 (SC-J1)	62 ± 9 ppm
116610-18 (DGO-160)	199 ± 27 ppm
117213-5 (SLP-108)	315 ± 40 ppm
116610-21 (DGO-166)	354 ± 50 ppm
118316-1 (KH03-4)	427 ± 59 ppm
116610-5 (SLP-142)	TBD ± TBD ppm

Glasses

Suprasil	0 ppm (Use this grain to measure background water)
ALV-519-4-1	1700 ± 43 ppm (Le Voyer et al., 2017)
6K-490-2	?
GL07 D30-1	1.54 wt% (Erik Hauri, Pers. Comm., 2017)
ALV-1833-11	11700 ± 585 ppm (Kumamoto et al., 2017)
ND70-01	1.0 wt% (Erik Hauri, Pers. Comm., 2017)
WASVNTR-032GL (VE32)	0.287 wt% (Erik Hauri, Pers. Comm., 2017)

Grain-specific values (for informational purposes, not for working curves):
The following values are the H2O abundances of specific grains included in this mount. Data are from supplementary table 2 of Kumamoto et al. (2017). Use the sample average values above for working curves, not use these values.

Orthopyroxene

116610-10: #2 from M7 → 123 ± 9 ppm
KH03-27: #2 from M9 → 127 ± 6 ppm
116610-21: #2 from M7 → 211 ± 11 ppm
116610-15: #1 from M9 → 141 ± 7 ppm

Clinopyroxene

116610-18: #2 and 3 from M9 → 119 and 198 ppm, 8 and 4 ppm stdv
116610-21: #2 from M8 → 338 ± 7 ppm stdv
KH03-4: didn't write down number, but it's from M9 → 78 ± 5 ppm or 84 ± 6 ppm

Analysis of SM3 in 2018 to confirm suitability of reference materials:
The volatile composition of grains in SM3 was checked by 7f SIMS during a session in July 2018 at Washington University in St. Louis (WUSTL). Data collected by J.M. Warren, K.J. Lynn, and C. Prigent. Data reduction completed by C. Prigent in 2020:

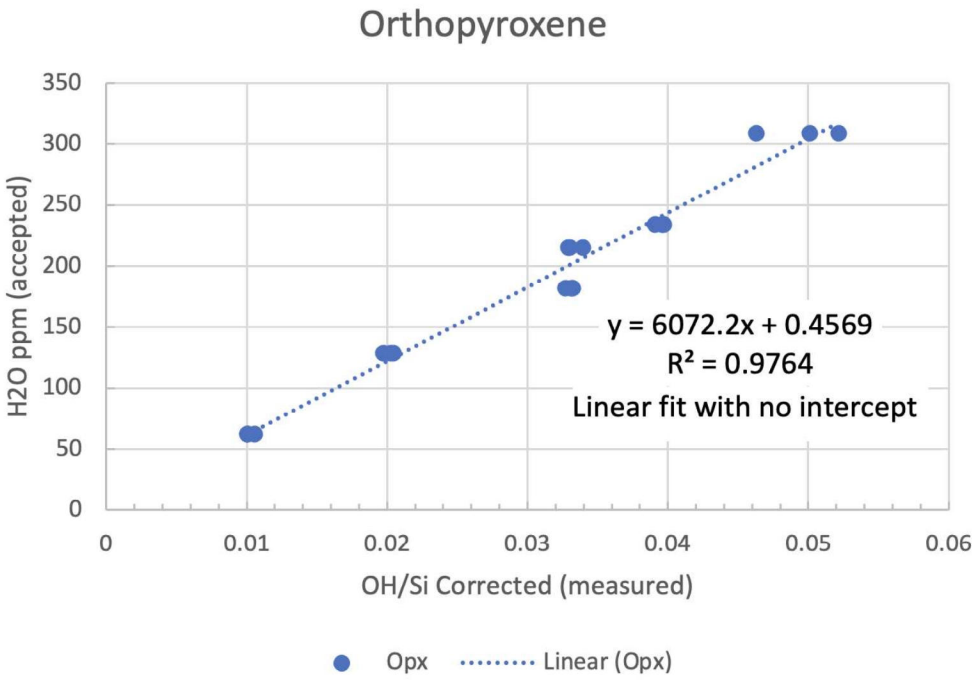
1. Checked for bad count cycles (large stdv values for OH/Si, F/Si, or P/Si). None found.
2. Checked for bad analyses (detectable C/Si, S/Si, or Cl/Si). These threshold values are arbitrarily set, but typically a clear jump in value occurs when analyses are bad. For the standard mounts, no bad analyses were found.
3. Background OH/Si subtraction based on Suprasil OH/Si ratios on this mount. Plotted Suprasil OH/Si as a function of analysis number and fit linear trendline. Used this equation to correct data based on analysis count number.
4. Drift correction based on analyses of ALV-519 in mount. Plot of ALV-519 OH/Si ratios as a function of analysis number indicated no drift, so correction not applied.

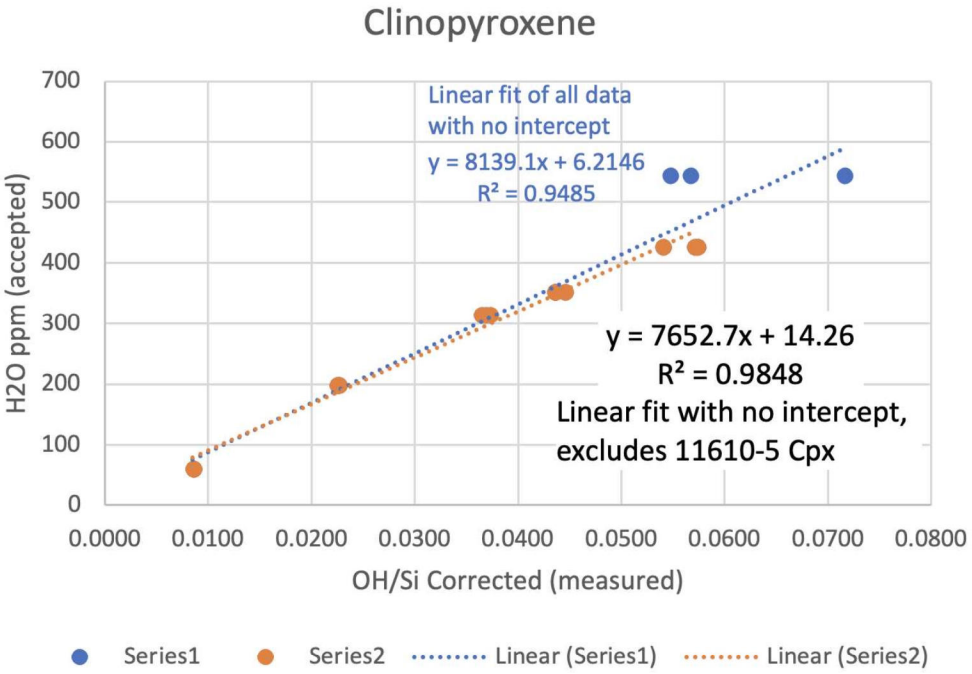
CPX *Mount SM3*	OH/Si *(corrected)*	H2O ppm *(accepted)*
610-18-cpx@267	0.0226	199
610-18-cpx@268	0.0225	199
610-18-cpx@269	0.0224	199
213-5-cpx@270	0.0373	315
213-5-cpx@271	0.0369	315
213-5-cpx@272	0.0365	315
610-21-cpx@275	0.0445	354
610-21-cpx@276	0.0436	354
610-21-cpx@277	0.0436	354
KH03-4-cpx@278	0.0571	427
KH03-4-cpx@279	0.0573	427
KH03-4-cpx@280	0.0541	427
610-5-cpx@283	0.0567	544
610-5-cpx@284	0.0716	544
610-5-cpx@285	0.0547	544
SC-J1-cpx@286	0.0086	62
SC-J1-cpx@287	0.0085	62
SC-J1-cpx@288	0.0085	62

OPX *Mount SM3*	OH/Si *(corrected)*	H2O ppm *(accepted)*
610-5-opx@291	0.0521	309
610-5-opx@292	0.0502	309
610-5-opx@293	0.0463	309
610-15-opx@294	0.0397	234
610-15-opx@295	0.0391	234
610-15-opx@296	0.0396	234
610-21-opx@299	0.0339	215
610-21-opx@300	0.0330	215
610-21-opx@301	0.0329	215
KH03-27-opx@302	0.0332	182
KH03-27-opx@303	0.0331	182
KH03-27-opx@304	0.0327	182
610-10-opx@307	0.0204	128
610-10-opx@308	0.0203	128
610-10-opx@309	0.0197	128
610-29-opx@310	0.0100	62
610-29-opx@311	0.0101	62
610-29-opx@312	0.0106	62

Example working curves for SM3

- Constructed from data collected in 2018 using WUSTL 7f SIMS.
- Linear regression is not constrained to pass through [0,0].
- For Cpx, regression is shown including and excluding 11610-5Cpx.

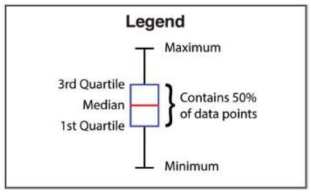


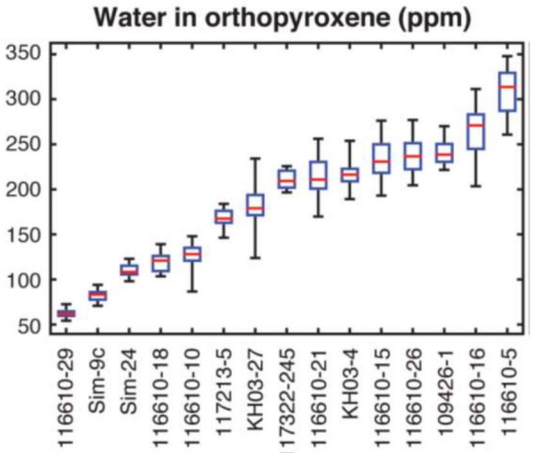


Plots of water concentrations in OPX and CPX grains on SM3

Orthopyroxene:

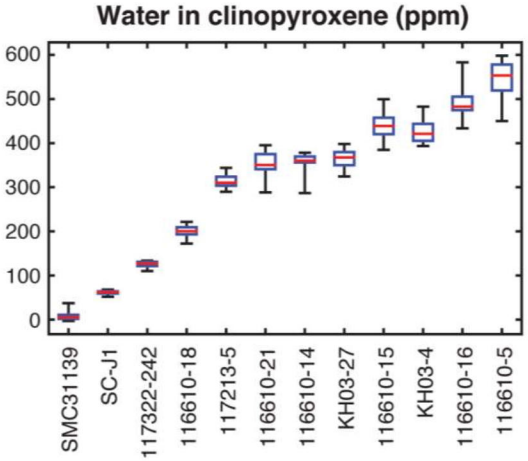
116610-29 (BCN-203)	62 ± 5 ppm
116610-10 (SLP-114)	128 ± 12 ppm
118317-2 (KH03-27)	182 ± 19 ppm
116610-21 (DGO-166)	215 ± 21 ppm
116610-15 (SLP-402)	234 ± 22 ppm
116610-5 (SLP-142)	309 ± 27 ppm





Clinopyroxene:

118318 (SC-J1)	62 ± 9 ppm
116610-18 (DGO-160)	199 ± 27 ppm
117213-5 (SLP-108)	315 ± 40 ppm
116610-21 (DGO-166)	354 ± 50 ppm
118316-1 (KH03-4)	427 ± 59 ppm
116610-5 (SLP-142)	heterogeneous



Glasses on NMNH 118331 (standard mount for cross-calibration)

Glass	Concentration	Notes
Suprasil	0 ppm	Use this grain to measure background water
ALV-519-4-1	1700 ± 43 ppm	Le Voyer et al., 2017
6K-490-2	unknown	
GL07 D30-1	1.54 wt%	Erik Hauri, Pers. Comm., 2017
ALV-1833-11	11700 ± 585 ppm	Kumamoto et al., 2017
ND70-01	1.0 wt%	Erik Hauri, Pers. Comm., 2017
WASVNTR-032GL (VE32)	0.287 wt%	Erik Hauri, Pers. Comm., 2017