**Aqueous alteration without initial water: Possibility of organic-induced hydration of anhydrous silicates in meteorite parent bodies**

Naoki Hirakawa1, Yoko Kebukawa1\*, Yoshihiro Furukawa2, Masashi Kondo3,   
and Kensei Kobayashi1

1Graduate School of Engineering Science, Yokohama National University, 79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan.

2Department of Earth Science, Tohoku University, 6-3 Aramakiaoba, Aoba-ku, Sendai 980-8578, Japan.

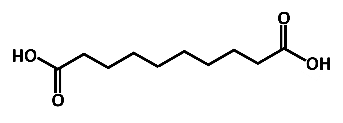
3Instrumental Analysis Center, Yokohama National University, 79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan.

\*Corresponding author: Yoko Kebukawa.

Table S1. Organic compounds in the molecular cloud organic matter analog and their structural formula (Kouchi et al. 2002; Nakano et al. 2002, 2003, 2020).

|  |  |  |
| --- | --- | --- |
| **Compounds** | **Molecular weight** | **Concentration (wt.%)** |
| (1) Acetamide | 59.07 | 6.6 |
| (2) Urea | 60.06 | 0.9 |
| (3) Ethylene glycol | 62.07 | 1.9 |
| (4) Glycolic acid | 76.05 | 11.8 |
| (5) Lactamide | 89.09 | 8.8 |
| (6) Glycerol | 92.09 | 2.3 |
| (7) Hexamethylenetetramine | 140.19 | 1.1 |
| (8) Indene | 116.16 | 7.6 |
| (9) 1,2-Dimethylnaphthalene | 156.22 | 2.6 |
| (10) 1,4-Diisopropenylbenzene | 158.24 | 3.2 |
| (11) Cyclohexylphenylketone | 188.27 | 8.1 |
| (12) 4’-Cyclohexylacetophenone | 202.30 | 7.1 |
| (13) 4-(1-Adamantyl) phenol | 228.34 | 2.1 |
| (14) 4,4’-Methylenebis-(2,6-dimethylphenol) | 256.35 | 2.3 |
| (15) αα’-Bis(4-hydroxyphenyl)-1,4-diisopropenylbenzene | 346.46 | 0.2 |
| (16) Phenanthrene | 178.23 | 11.1 |
| (17) Lauric acid | 200.32 | 6.2 |
| (18) Sebacic acid | 202.25 | 6.3 |
| (19) Eicosanoic acid | 312.54 | 9.7 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Structural formula** | (1) | (2) | (3) |
| (4) | (5) | (6) | (7) |
| (8) | (9) | (10) | (11) |
| (12) | (13) | (14) | (15) |
| (16) | (17) | (18) | (19) |



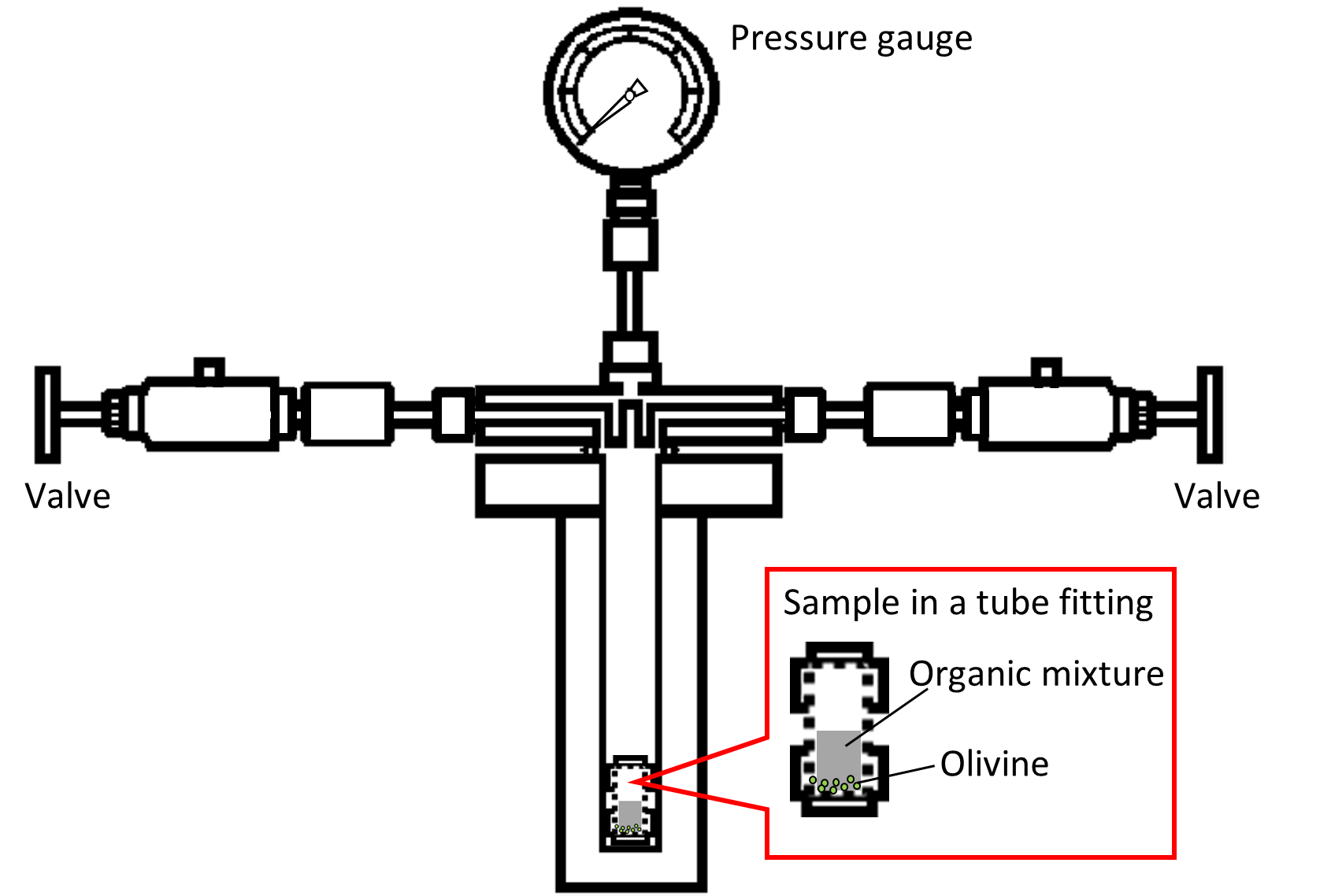


Figure S1. Schematic image of the experimental setup. Samples were placed in a stainless-steel tube (inner volume: 3.0 cm3) sealed with Swagelok tube fitting union (3/8 in.) and 316 stainless-steel plugs (3/8 in.) under N2 gas, and then heated inside an autoclave.

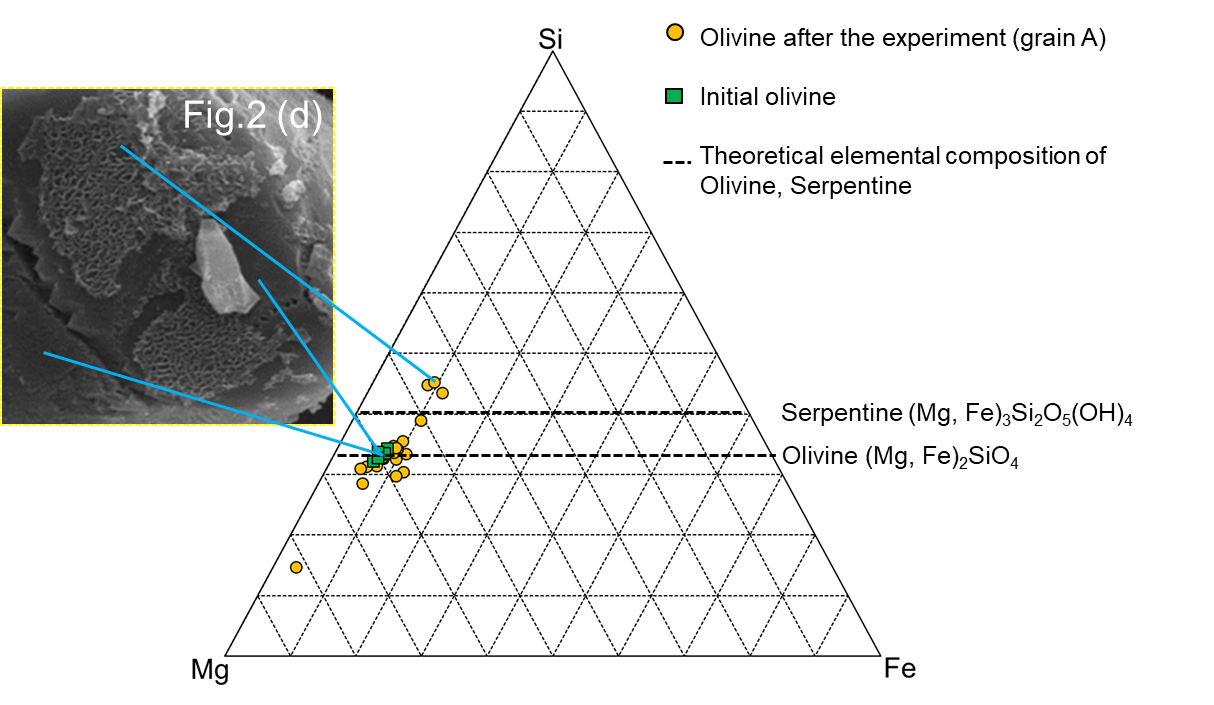


Figure S2. A plot from SEM/EDS analyses of the initial olivine and an olivine after the experiments (grain A). EDS plots for a flat surface of a reacted olivine had chemical compositions similar to those of typical olivine. Olivine surface with precipitation features had Si-rich and Mg-poor compositions as compared with a typical olivine.