**Additional Information**

**Onboard experiment investigating metal leaching of fresh hydrothermal sulfide cores into seawater**

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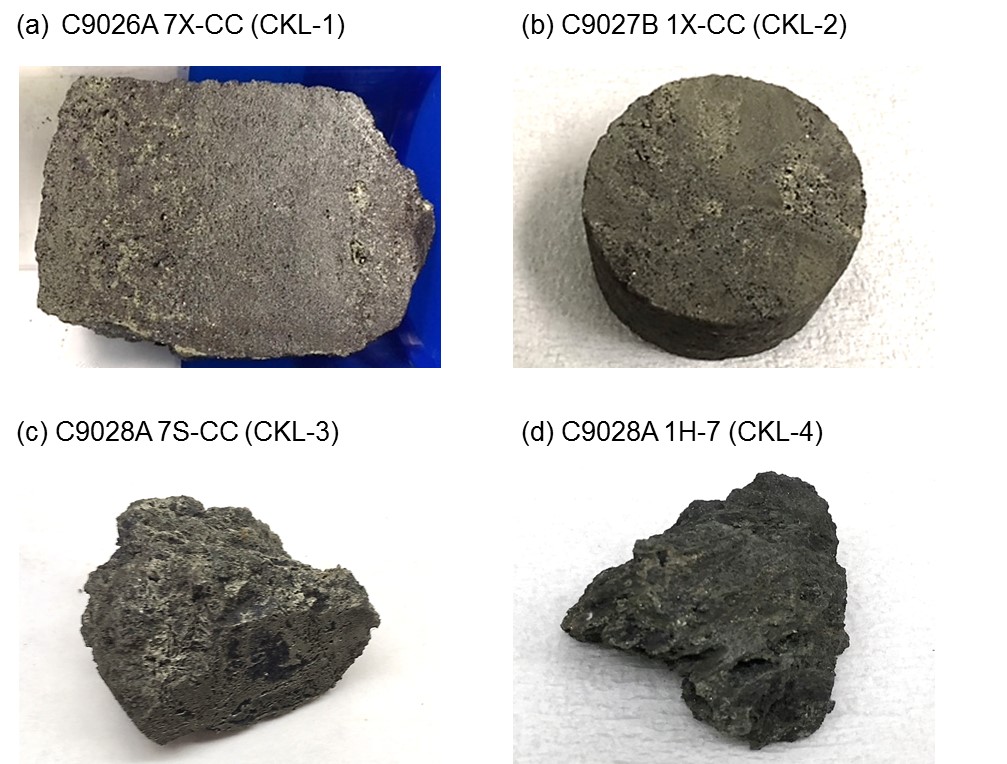
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CKL-1 (C9026A 7X-CC)**  C9026A | | |  |  |  |  |  |  |  |  |  |  |  |  |
| (oxic) | Time (h) | pH | Fe (μM) | Cu (μM) | Zn (μM) | Pb (μM) |  | (anoxic) | Time (h) | pH | Fe (μM) | Cu (μM) | Zn (μM) | Pb (μM) |
| 5°C | 1 | 8.0 | \*- | - | 17 | 3.2 |  | 5°C | 1 | 8.0 | - | - | 8.1 | 3.7 |
|  | 4 | 8.2 | - | - | 17 | 1.8 |  |  | 4 | 8.1 | - | - | 12 | 2.2 |
|  | 10 | 8.6 | - | - | 7.4 | 1.3 |  |  | 10 | 8.2 | - | - | 9.3 | 1.2 |
|  | 18 | 8.9 | - | - | 1.8 | 0.93 |  |  | 18 | 8.6 | - | - | 4.2 | 1.3 |
|  | 30 | 9.0 | - | - | 1.1 | 0.74 |  |  | 30 | 8.9 | - | - | 1.8 | 1.1 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20°C | 1 | 8.0 | - | - | 15 | 3.7 |  | 20°C | 1 | 8.0 | - | - | 5.8 | 3.1 |
|  | 4 | 8.3 | - | - | 11 | 2.3 |  |  | 4 | 8.0 | - | - | 9.3 | 3.0 |
|  | 10 | 8.5 | - | - | 6.3 | 1.8 |  |  | 10 | 8.2 | - | - | 8.2 | 2.0 |
|  | 18 | 8.7 | - | - | 4.0 | 1.6 |  |  | 18 | 8.3 | - | - | 5.8 | 1.9 |
|  | 30 | 8.8 | - | - | 2.1 | 1.5 |  |  | 30 | 8.7 | - | - | 1.8 | 1.5 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **CKL-2 (C9027B 1X-CC)** | | |  |  |  |  |  |  |  |  |  |  |  |  |
| (oxic) | Time (h) | pH | Fe (μM) | Cu (μM) | Zn (μM) | Pb (μM) |  | (anoxic) | Time (h) | pH | Fe (μM) | Cu (μM) | Zn (μM) | Pb (μM) |
| 5°C | 1 | 7.7 | - | - | 38 | 6.0 |  | 5°C | 1 | 7.7 | - | - | 25 | 1.9 |
|  | 4 | 7.7 | - | - | 54 | 3.9 |  |  | 4 | 7.7 | - | - | 26 | 2.0 |
|  | 10 | 8.1 | - | - | 50 | 1.8 |  |  | 10 | 7.8 | - | - | 40 | 3.1 |
|  | 18 | 8.4 | - | - | 20 | 1.4 |  |  | 18 | 7.7 | - | - | 50 | 2.4 |
|  | 30 | 8.6 | - | - | 5.0 | 1.3 |  |  | 30 | 7.8 | - | - | 52 | 1.8 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20°C | 1 | 7.6 | - | - | 47 | 10 |  | 20°C | 1 | 7.7 | - | - | 7.9 | 0.76 |
|  | 4 | 7.6 | - | - | 57 | 5.1 |  |  | 4 | 7.7 | - | - | 13 | 1.3 |
|  | 10 | 8.3 | - | - | 17 | 2.3 |  |  | 10 | 7.7 | - | - | 43 | 4.1 |
|  | 18 | 8.6 | - | - | 7.8 | 2.0 |  |  | 18 | 7.6 | - | - | 63 | 4.5 |
|  | 30 | 8.2 | - | - | 18 | 3.0 |  |  | 30 | 7.8 | - | - | 54 | 4.1 |

**Table S1**. pH and concentrations of Fe, Cu, Zn and Pb in seawater from powdered core samples at different temperature and redox conditions.

**Table S1.** (continued)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CKL-3 (C9028A 7S-CC)** | | |  |  |  |  |  |  |  |  |  |  |  |  |
| (oxic) | Time (h) | pH | Fe (μM) | Cu (μM) | Zn (μM) | Pb (μM) |  | (anoxic) | Time (h) | pH | Fe (μM) | Cu (μM) | Zn (μM) | Pb (μM) |
| 5°C | 1 | 7.5 | - | - | 8.7 | 3.5 |  | 5°C | 1 | 7.8 | - | - | 2.7 | 1.2 |
|  | 4 | 7.5 | - | - | 13 | 3.6 |  |  | 4 | 7.7 | - | - | 4.4 | 1.8 |
|  | 10 | 7.3 | - | - | 21 | 3.7 |  |  | 10 | 7.7 | - | - | 7.2 | 3.3 |
|  | 18 | 7.2 | - | - | 32 | 3.7 |  |  | 18 | 7.6 | - | - | 10 | 2.9 |
|  | 30 | 6.7 | - | - | 47 | 3.8 |  |  | 30 | 7.4 | - | - | 15 | 3.4 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20°C | 1 | 7.3 | - | - | 8.2 | 4.2 |  | 20°C | 1 | 7.9 | - | - | 1.0 | 0.55 |
|  | 4 | 7.3 | - | - | 19 | 4.3 |  |  | 4 | 7.5 | - | - | 6.9 | 4.5 |
|  | 10 | 7.1 | - | 0.38 | 44 | 4.8 |  |  | 10 | 7.5 | - | - | 13 | 6.6 |
|  | 18 | 6.5 | - | 0.91 | 96 | 12 |  |  | 18 | 7.4 | - | - | 17 | 6.7 |
|  | 30 | 4.5 | 130 | 23 | 190 | 130 |  |  | 30 | 7.2 | - | - | 21 | 5.9 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **CKL-4 (C9028A 1H-7)** | | |  |  |  |  |  |  |  |  |  |  |  |  |
| (oxic) | Time (h) | pH | Fe (μM) | Cu (μM) | Zn (μM) | Pb (μM) |  | (anoxic) | Time (h) | pH | Fe (μM) | Cu (μM) | Zn (μM) | Pb (μM) |
| 5°C | 1 | 7.4 | - | - | 93 | 9.7 |  | 5°C | 1 | 7.5 | - | - | 62 | 17 |
|  | 4 | 7.5 | - | - | 110 | 6.3 |  |  | 4 | 7.6 | - | - | 67 | 7.3 |
|  | 10 | 7.5 | - | - | 130 | 2.7 |  |  | 10 | 7.6 | - | - | 76 | 3.7 |
|  | 18 | 7.3 | - | - | 200 | 3.3 |  |  | 18 | 7.5 | - | - | 90 | 2.6 |
|  | 30 | 7.2 | - | - | 310 | 5.2 |  |  | 30 | 7.4 | - | - | 120 | 3.2 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20°C | 1 | 7.3 | - | - | 100 | 14 |  | 20°C | 1 | 7.5 | - | - | 69 | 14 |
|  | 4 | 7.4 | - | - | 130 | 12 |  |  | 4 | 7.6 | - | - | 80 | 7.5 |
|  | 10 | 7.3 | - | - | 190 | 6.6 |  |  | 10 | 7.4 | - | - | 85 | 6.4 |
|  | 18 | 7.0 | - | - | 340 | 12 |  |  | 18 | 7.4 | - | - | 110 | 7.1 |
|  | 30 | 6.9 | - | - | 610 | 21 |  |  | 30 | 7.1 | - | - | 140 | 11 |

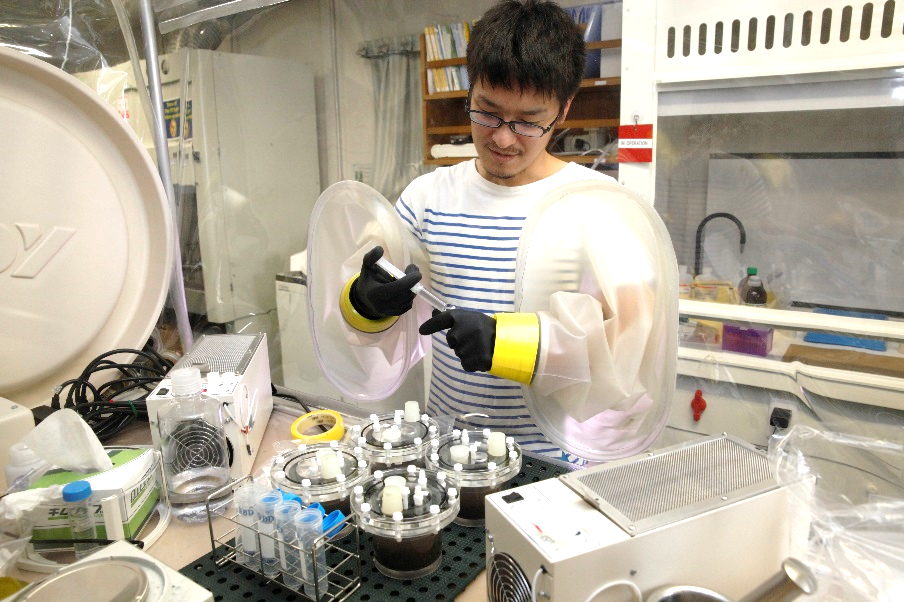
\*-: below limit of quantification



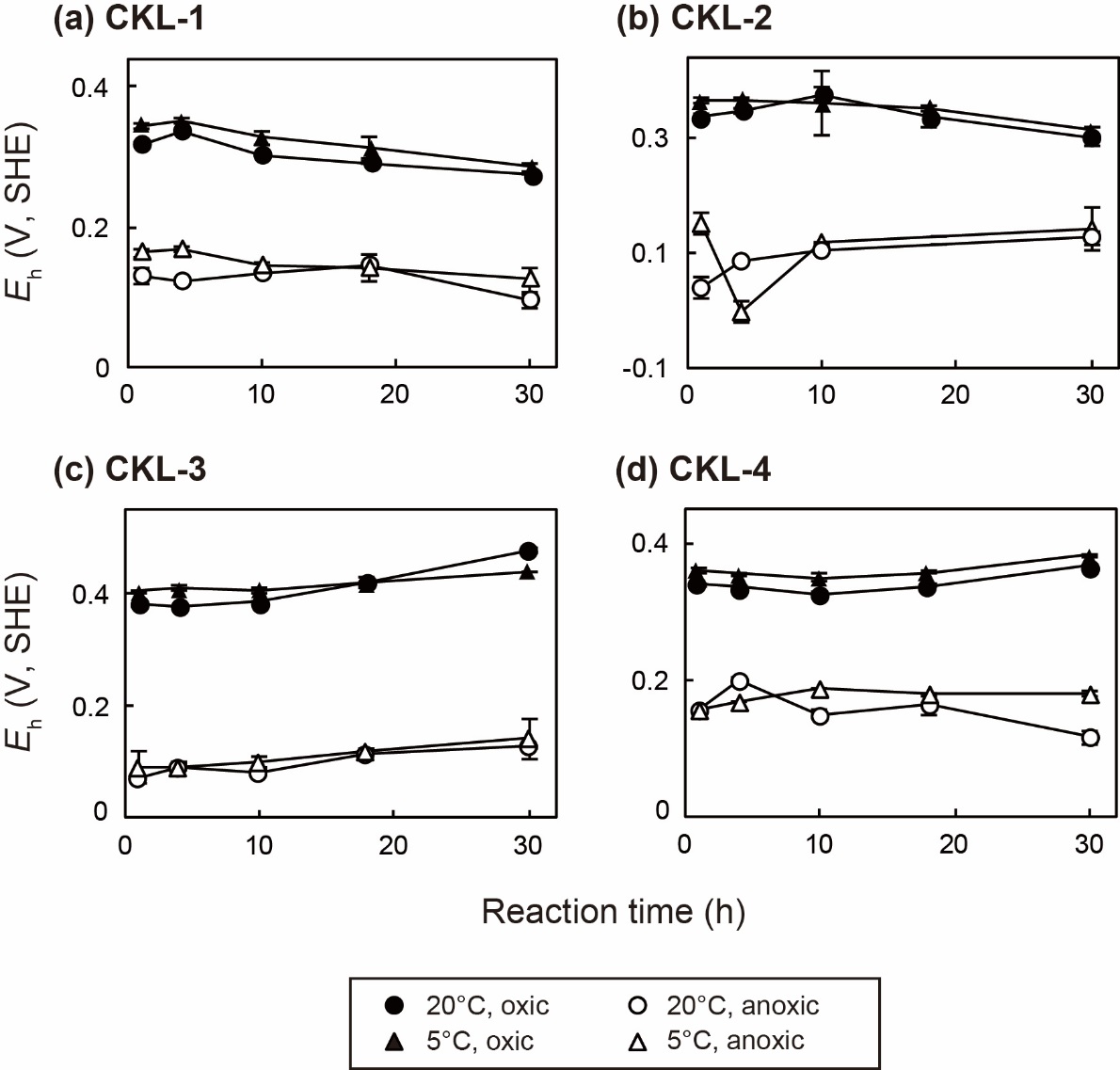
**Figure S1** Photographs of hydrothermal mineral cores for onboard leaching experiment: (a) C9026A 7X-CC (CKL-1), (b) C9027B 1X-CC (CKL-2), (c) C9028A 7S-CC (CKL-3), and (d) C9028A 1H-7 (CKL-4).

(a)

(b)



**Figure S2**. Images of onboard leaching experiment: (a) an operation in the anaerobic chamber and (b) sample reactions in the water baths.



**Figure S3**. Changes in *E*h (V, SHE) for (a) CKL-1, (b) CKL-2, (c) CKL-3, and (d) CKL-4 solutions under different redox and temperature conditions. Plots show mean values of duplicates, and error bars indicate range of duplicate (difference between the max and min values).