Supplemental Material

Effects of Eyjafjallajökull Volcanic Ash on Innate Immune System Responses and Bacterial Growth *in Vitro*

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Figure S1

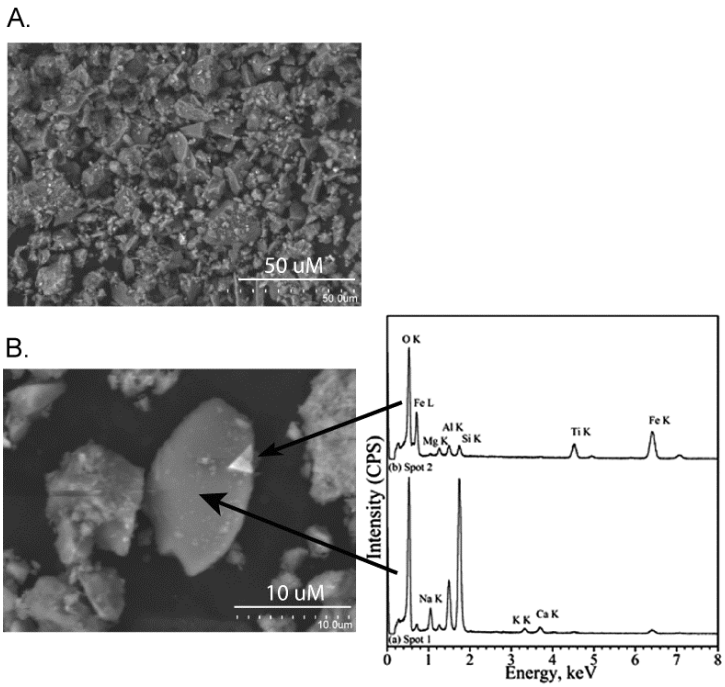

Figure S1.

Figure S1. A. Scanning electron microscopy (SEM) images of sieved volcanic ash particles (<20 μm) showing distribution of sizes. B. SEM image of a typical volcanic ash particle shows bright inclusion rich in Fe and Ti. SEM/EDS point spectra confirms particle analysis. The majority component was oxygen with 60.7±0.1 atomic % showing that particles are largely comprised of metal oxides and aluminosilicate clays. Titanium and iron were not uniformly distributed in the particles but instead were present mostly as metal oxide inclusions (Figure S1B). Oxygen did not change in the spot analysis indicating that iron and titanium were present as the corresponding oxides and/or oxyhydroxides.

Supplemental Material, Table S1. EDS and XPS elemental characterization of volcanic ash samples (values are in atomic percent)

Elements	O	Na	Mg	Al	Si	K	Ca	Ti	Fe
300x700 mm scan[a]									
Conc.	60.7	3.5	1.6	6.3	19.6	1	2.6	0.7	4
St Dev	0.1	0.1	0	0.1	0.1	0	0.1	0	0.2
Spot scans[b]									
Spot 1	67	4.5	1.1	5.9	17.4	0.8	1.4	0	2
Spot 2	66.7	2.1	2.5	2.2	1.7	0	0	4.3	20.3
XPS									
Conc.	62.2	2.7	2.3	7.1	17.9	0.6	2.8	0.3	4.2

[a] Three measurement average

[b] Spot scan in Figure 1

Supplemental Material, Table S2. ICP-MS elemental composition (mg/kg) of total (unsieved) ash, <20 □m fraction, and leachates.

	Ash analysis			Leachate Analysis			
Element	Total ash, Literature values[a]	Total ash, this study mean ± SD[b] (n=3)	<20 um ash (this study)	Total ash, Literature values[a]	Total ash H_2O leaching, this study	Total ash acid leaching, this study	<20 um ash, acid leaching, this study
Si	274108	-	-	-	-	-	-
Ti	9529	-	12410	0.14	0.18	2.3	-
Al	77999	-	-	0.6	81	100	862
Fe	74679	-	-	0.8	1.8	33	908
Mg	15014	-	-	13.5	-	-	362
Mn	1916	-	2045	0.34	3.2	4.6	186
Ca	35661	-	-	97	-	-	9088
Na	39427	-	-	685	-	-	1021
K	16131	-	-	29	-	-	226
P	1919	-	-	0.3	-	-	295
Li	-	14 ± 1	16	0.19	0.12	0.13	-
Be	3.5	-	4	-	0.003	0.011	-
Sc	16	18 ± 1	20	0.009	-	-	-
V	83	79 ± 1	110	0.1	0.1	0.1	1.8
Cr	54	50 ± 27	18	-	0.003	0.021	-
Co	22	15 ± 1	18	0.0005	0.026	0.029	0.26
Ni	39	31 ± 14	17	0.004	0.098	0.12	0.12
Cu	27	28 ± 2	43	0.005	0.077	0.54	2.4
Zn	161	152 ± 11	153	0.037	13.4	15.7	7.6
Ga	27	29 ± 1	34	0.007	-	-	-
As	-	-	-	0.006	0.06	0.18	0.88
Rb	36	39 ± 2	44	0.026	0.05	0.07	-
Sr	310	323 ± 16	354	0.22	1.2	1.8	14
Y	63	65 ± 1	77	-	-	-	-
Zr	479	486 ± 20	554	0.004	-	-	-
Nb	50	61 ± 2	71	0.0005	-	-	-
Mo	3.9	-	5.5	0.05	0.04	0.03	-
Sn	4.3	-	4.5	-	-	-	-
Cs	0.5	0.47 ± 0.02	0.55	0.00006	0.0003	0.0007	-
Ba	421	434 ± 13	459	0.002	0.25	1.2	3.6
La	46	53.0 ± 1.7	63.6	0.0004	0.004	0.28	-
Ce	107	120 ± 6	141	0.0009	0.01	0.59	-
Pr	13.4	15.1 ± 0.4	18.1	0.0001	-	-	-
Nd	56	62.7 ± 1.4	74.9	0.0005	-	-	-
Sm	12.6	14.1 ± 0.4	16.8	0.0002	-	-	-
Eu	4.1	4.58 ± 0.14	5.13	0.00004	-	-	-
Gd	12.1	13.6 ± 0.3	16.6	0.0003	-	-	-
Tb	1.9	2.17 ± 0.05	2.56	0.00003	-	-	-
Dy	10.9	12.6 ± 0.2	14.8	0.0001	-	-	-
Ho	2.1	2.43 ± 0.05	2.84	0.00003	-	-	-
Er	5.6	6.18 ± 0.13	7.68	0.00007	-	-	-
Yb	5.3	5.79 ± 0.14	6.67	0.00006	0.0005	0.02	-
Lu	0.8	0.85 ± 0.02	0.96	0.00001	-	-	-
Hf	10.7	11.7 ± 0.5	13.4	0.0001	-	-	-
Ta	3.9	3.8 ± 0.2	4.2	0.00007	-	-	-
Pb	4.2	4.9 ± 0.7	5.2	0.0004	0.0016	0.06	-
Th	5.6	5.6 ± 0.3	6.4	0.00004	-	-	-
U	1.8	1.84 ± 0.08	2.1	0.001	0.0004	0.006	-

a Borisova et al. 2012; Sigmarsson et al. 2011

b Data represent the mean ± 1 s.d. for analyses of three separate digestions of ash

Supplemental Material, Table S3. ICP-MS element data on standard reference materials to assess data quality

	Ash analysis				Leachate analysis			
	BIR-1	**BIR-1**	**ATHO-G**	**ATHO-G**	**SLRS-5**	**SLRS-5**	**NIST1640a**	**NIST1640a**
	measured	expected	measured	expected	measured	expected	measured	expected
Element	µg/g	µg/g	µg/g	µg/g	ng/ml	ng/ml	ng/ml	ng/ml
Li	3.3	3.2	29.3	28.6	0.5	0.5	0.5	0.4
Be	0.09	0.12	3.5	3.2	0.005	0.005	3.1	3.0
Sc	42	43	5	5	7.0	7.5	317	303
Ti	5557	5600	1421	1529	4630	5380	2853	3112
V	321	319	3	4	2585	2540	1080	1050
Cr	377	391	5	6	48	50	53	53
Mn	1313	1363	845	821	1649	1881	3974	
Co	52	52	1	2	8	13	14	
Ni	168	166	6	13	816		575	575
Cu	115	119	12	19	10614	10500	6111	5570
Zn	70	72	124	141	2.6	2.3	1	
Ga	16	15	23	25	0.41	0.32	14	15
Rb	0.2	0.2	65	65	0.28	0.21	37	41
Sr	103	109	95	94	4.2	4.3	39	40
Y	16	15.6	103	95	106	91	50	37
Zr	14	14	532	512	0.05	0.05	18	20
Nb	0.58	0.55	57	62	0.66	0.48	25	
Mo	0.06	0.07	4.2	4.8	17.2	17.4	80	86
Sn	1.2	0.6	5.9	5.4	1.04	0.85	56	56
Cs	0.01	0.01	0.72	1.08	0.48	0.41	7.6	8.1
Ba	6.43	7.14	576	547	0.7		22	20
La	0.6	0.615	60.3	55.6	1.1	1.2	1.1	1.2
Ce	1.87	1.92	132	121	50	54	118	126
Pr	0.37	0.37	16.3	14.6	0.33	0.5	42	46
Nd	2.36	2.38	65.6	60.9	0.02		7.2	8.1
Sm	1.09	1.12	15.3	14.2	0.009	0.006	3.9	4.0
Eu	0.53	0.53	3.00	2.76	0.32	0.30	4.9	5.1
Gd	1.83	1.87	16.1	15.3	0.004		0.024	
Tb	0.36	0.36	2.79	2.51	13.5	14.0	144	152
Dy	2.54	2.51	17.6	16.2	0.18	0.20	0.01	
Ho	0.57	0.56	3.70	3.43	0.25	0.24	0.013	
Er	1.61	1.66	10.6	10.3	0.009	0.009	0.02	
Yb	1.63	1.65	10.9	10.5	0.003	0.004	1.5	1.6
Lu	0.25	0.25	1.62	1.54	0.07	0.08	11	12
Hf	0.62	0.58	14.5	13.7	0.08	0.10	23.6	25.4
Ta	0.06	0.04	3.7	3.9				
Pb	3.3	3.1	6.38	5.67				
Th	0.04	0.03	7.64	7.40				
U	0.01	0.01	2.33	2.37				

BIR-1: Iceland basalt rock reference material (source: United States Geological Survey).
expected values from GEOREM database (http://georem.mpch-mainz.gwdg.de: accessed 24th Feb 2013).
ATHO: Iceland rhyolite rock reference material (source: Max Planck Institute, Mainz, Germany).
expected values from GEOREM database (http://georem.mpch-mainz.gwdg.de: accessed 24th Feb 2013).
SLRS-5: river water reference material (source: National Research Council Canada).
expected values from NRCC certificate and Heimburger et al. (2013).
NIST1640a: natural water reference material (source: National Institute of Standards and Technology).
expected values from NIST certificate.

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