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A solid state ^{29}Si nuclear magnetic resonance study of opal and other hydrous silicas

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For deposit: Table 4

American Mineralogist, 76, 11-12, 1863-1871.

Major Element (wt %) Analysis of Silicate Samples.

	S 1	S 2	S 3	S 4	S 5*	S 6	S 7	S 8	S 9	S 10	S 11	S 12	S 13	S 14	S 15
SiO ₂	93.17	97.69	88.94	90.67	74.21	88.16	98.11	91.81	96.37	90.48	95.46	95.47	93.46	98.20	91.72
TiO ₂	0.00	0.01	0.37	0.05	0.05	0.01	0.01	0.01	0.01	0.02	0.00	0.01	0.01	0.01	0.01
Al ₂ O ₃	0.07	0.07	5.32	0.93	0.96	1.65	0.12	0.47	0.03	0.62	0.03	0.10	0.05	0.10	0.11
Fe ₂ O ₃	0.75	0.50	0.17	0.83	0.40	0.44	0.08	0.07	0.11	0.12	0.08	0.14	0.08	0.13	0.33
MnO	0.02	0.01	0.00	0.01	0.02	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.07
MgO	0.78	0.02	0.01	0.20	0.62	0.02	0.01	0.04	0.52	0.08	0.02	0.05	0.01	0.01	0.71
CaO	0.04	0.14	0.09	0.13	12.18	0.05	0.14	0.12	1.15	0.16	0.16	0.08	0.17	0.16	0.04
Na ₂ O	0.14	0.01	0.14	0.11	0.17	0.20	0.03	0.02	0.01	0.02	0.11	0.03	0.03	0.03	0.01
K ₂ O	0.00	0.01	0.27	0.05	0.17	0.29	0.01	0.02	0.00	0.02	0.00	0.00	0.01	0.02	0.00
H ₂ O	5.02	1.53	4.66	7.01	2.26	9.16	1.46	7.43	1.77	8.47	4.13	4.12	6.17	1.32	7.00
P ₂ O ₅	0.01	0.01	0.03	0.01	0.05	0.01	0.03	0.01	0.01	0.01	0.01	0.00	0.01	0.02	0.00

	S16	S17	S18	S19	S20	S21**	S22	S23	S24	S25	S26	S27	S28	S29
SiO ₂	92.60	91.16	99.53	99.21	86.41	82.42	84.14	99.38	91.10	90.15	89.50	92.46	92.85	99.98
TiO ₂	0.18	0.12	0.00	0.01	0.00	0.24	0.03	0.03	0.01	0.01	0.02	0.01	0.01	0.00
Al ₂ O ₃	0.10	0.30	0.02	0.13	9.84	2.83	0.18	0.05	0.02	0.40	0.27	0.74	0.06	0.01
Fe ₂ O ₃	0.10	0.05	0.21	0.03	0.03	1.88	0.02	0.05	0.12	0.03	0.40	0.06	0.02	0.00
MnO	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
MgO	0.14	0.02	0.01	0.01	0.01	0.44	0.02	0.01	0.40	0.03	0.87	0.01	0.02	0.00
CaO	0.08	0.07	0.01	0.26	0.04	3.92	0.09	0.05	0.02	0.07	0.46	0.04	0.08	0.01
Na ₂ O	0.01	0.03	0.00	0.04	0.04	0.16	0.07	0.01	0.00	0.01	0.02	0.02	0.01	0.00
K ₂ O	0.01	0.02	0.00	0.03	0.07	0.72	0.13	0.00	0.00	0.01	0.00	0.28	0.01	0.00
H ₂ O	6.77	8.22	0.22	0.26	3.54	4.13	15.31	0.40	8.32	9.28	8.35	6.38	6.82	0.00
P ₂ O ₅	0.01	0.01	0.00	0.02	0.02	0.07	0.01	0.02	0.00	0.01	0.11	0.00	0.11	0.00

* This sample contains some carbonate; calculated from CaO value = 8.91% CO₂ - mineralogy confirmed by XRD.

** This sample contains some carbonate; calculated from CaO value = 3.18% CO₂ - mineralogy confirmed by XRD.

Trace Element Concentrations (ppm) Analysis of Silicate Samples.

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
Ba	107	198	314	4	23	26	9	7	3	3	2	5	4	4	45
Ce	0	0	36	3	3	15	2	2	1	8	0	1	0	1	2
Co	8	1	1	1	0	0	1	1	2	1	1	1	1	1	3
Cr	17	4	4	2	0	0	2	2	22	7	6	2	4	7	64
Cu	3	2	21	5	39	4	13	104	8	11	3	7	2	5	13
La	0	1	17	2	0	9	2	2	1	1	1	1	1	1	1
Li	1	2	5	2	16	2	2	1	1	2	0	1	1	3	1
Nb	0	0	17	7	3	2	1	8	1	6	1	1	1	0	1
Ni	96	2	4	2	10	2	5	3	8	4	0	3	0	2	190
Sc	1	0	4	1	2	1	0	0	0	1	0	0	0	0	1
Sr	6	29	48	6	375	1	6	7	20	8	8	4	6	5	1
V	5	17	8	70	12	4	3	2	1	24	16	18	4	3	2
Y	0	1	19	2	8	9	4	3	0	16	0	1	1	2	4
Zn	9	41	19	17	22	16	27	53	9	112	7	30	6	13	18
	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	
Ba	26	8	13	12	10	131	18	5	4	2	4	32	268	1	
Ce	2	3	0	0	18	22	15	5	0	0	0	6	2	1	
Co	1	1	0	1	6	6	1036	1	0	0	20	1	1	0	
Cr	4	4	2	1	18	64	25	0	72	0	3	1	1	0	
Cu	2	4	2	5	8	6	11	38	5	0	2	1	2	0	
La	1	1	0	2	3	12	3	1	0	0	10	1	1	0	
Li	19	1	9	6	91	9	2	1	0	1	0	1	1	5	
Nb	3	5	0	1	3	5	4	0	0	1	4	1	1	0	
Ni	1	1	1	4	8	16	50	3	74	0	8	1	3	1	
Sc	1	1	0	0	1	4	1	1	0	0	7	0	0	0	
Sr	55	5	1	14	4	4	2	3	1	4	8	2	7	0	
V	19	1	1	5	10	36	5	2	1	0	8	2	7	0	
Y	1	5	1	1	1	10	1	1	0	3	10	3	7	0	
Zn	7	28	7	18	773	26	25	20	12	5	12	12	9	4	