

Supplementary data

Table A1 Certified elemental composition of rocks (in wt. %)

Sample	Hyalopsite	Granite	Basalt	Cinder	Liparite	Shale	Calcareous tuff	Sandstone	Conglomerate	Limestone	Slate	Marble	Quartzite	Gneiss	Micacite
Na ₂ O	1.00	2.15	4.95	6.37	3.27	1.79	2.18	0.09	2.85	3.52	1.47	0.12	0.15	5.9	1.04
MgO	0.95	0.48	6.87	6.21	2.04	1.42	0.37	0.15	3.67	7.70	2.99	10.91	0.26	1.87	1.19
Al ₂ O ₃	12.02	13.6	16.55	10.34	1.34	13.14	0.22	3.87	4.24	7.04	19.21	0.40	0.31	15.89	23.7
SiO	74.18	75.17	52.64	63.84	74.21	44.16	0.28	90.49	78.26	12.22	50.76	0.21	92.14	65.37	42.57
P ₂ O ₅	0.10	0.61	0.30	0.19	0.12	1.5	0.79	0.92	0.31	0.87	0.45	0.02	0.18	0.83	0.43
SO ₃	0.09	0.21	0.42	0.49	0.44	0.58	0.14	0.35	0.39	0.14	1.1	0.06	0.12	0.57	0.20
K ₂ O	7.76	5.01	3.65	0.12	12.34	5.20	0.11	0.65	2.57	0.37	6.65	0.10	2.67	2.8	17.04
CaO	1.67	1.53	10.44	5.09	2.42	3.16	91.3	0.32	1.34	66.99	0.71	87.64	0.34	2.87	0.89
TiO ₂	0.25	0.17	0.87	0.32	0.21	0.40	-	0.15	0.64	0.39	1.20	0.06	0.21	0.18	1.09
MnO	0.13	0.046	0.65	0.12	0.37	0.14	0.035	0.015	0.25	0.08	0.09	0.16	0.18	0.043	0.14
FeO	1.85	1.02	2.68	6.91	3.42	30.11	0.17	2.99	5.48	0.69	15.34	0.32	3.44	3.67	12.19

Table A2 Description of samples. The characteristic size of the samples is ~5 cm

Sample	Aspect
Hyalopsite	Acidic vitreous volcanic rocks, dense block, Less water content
Granite	Mainly composed of quartz or feldspar and other minerals, High hardness, wear resistance
Basalt	A basic spouting rock whose chemical composition is similar to gabbro or diabase
Cinder	Porous and vitreous homogeneous volcanic gravel
Liparite	Volcanic acid sprayed rock, Most of the rhyolites have a patchy structure

Shale	Clay material hardening the formation of tiny particles easy to crack
Calcareous tuff	Irregular blocks, different sizes, white or yellowish, slightly smooth surface, dull
Sandstone	Mainly by a variety of sand cemented, the particle diameter of 0.05-2mm, which sand content of more than 50%, structural stability
Conglomerate	Particles with a diameter of more than 2 mm and rounds and rounds of gravel accounted for more than 30% of the total rock
Limestone	Almost by the pure calcite composition, the total content of other components often 5% or less
Slate	A metamorphic rock, the original rock is muddy, silty or neutral tuff, along the plate direction can be stripped into thin slices
Marble	Hardness of 2.5-5, density 2.6-2.8
Quartzite	Composed of quartz metamorphic rocks (quartz content greater than 85%), generally block-like structure, granular crystal structure
Gneiss	With a gneissic structure or striped structure, scaly granular crystal structure
Micacite	Mainly by the mica and other sheet-like minerals arranged in parallel, the film is often wavy-like curved structure