



Supplement of

Insights into microphysical and optical properties of typical mineral dust within urban snowpack via wet and dry deposition in Changchun, northeastern China

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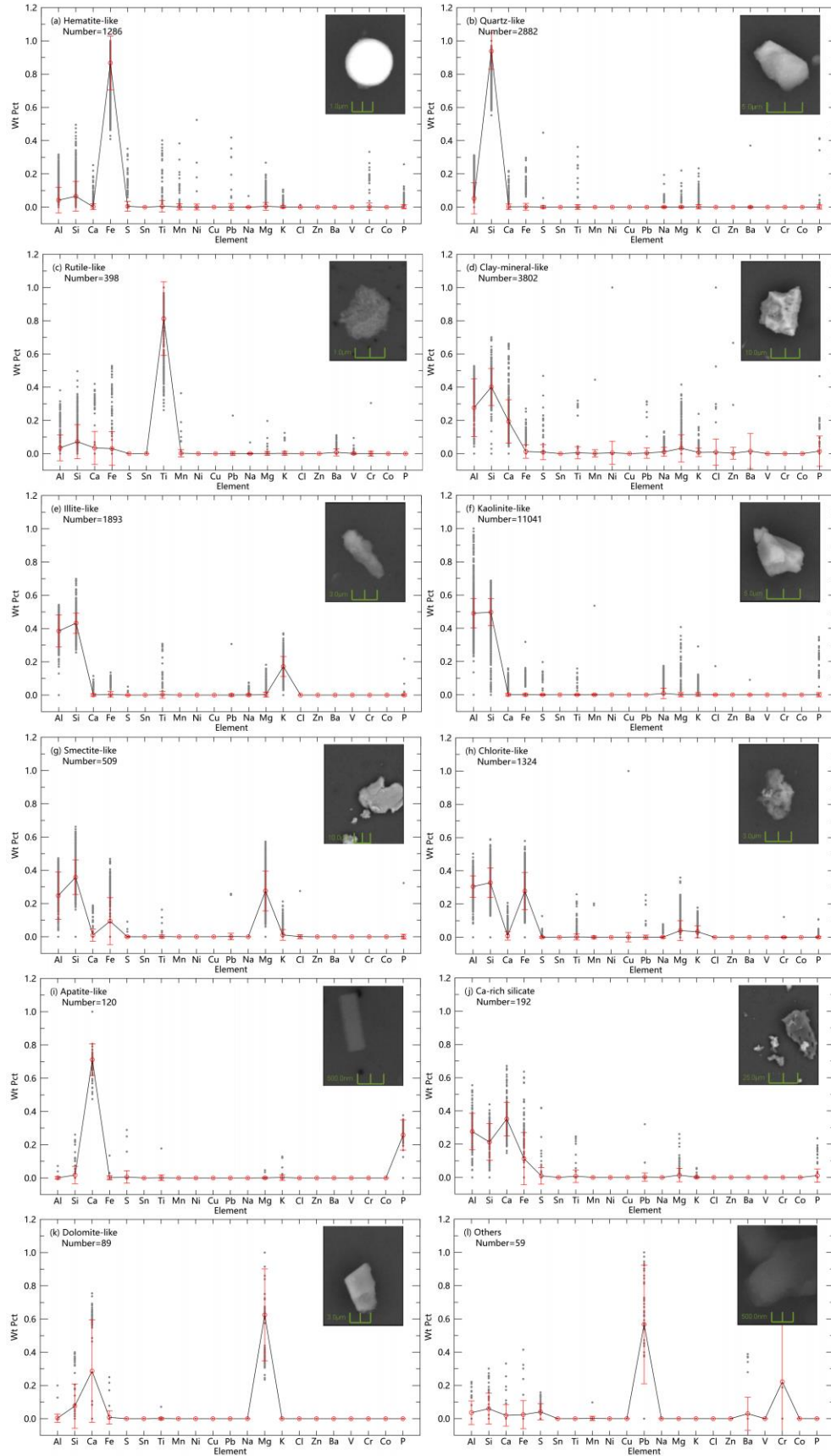


Figure S1. The percentage of each elemental index (without C and O) for the 12 categories of mineral particles. Subplots (a)-(l) represent results for hematite-like, quartz-like, rutile-like, clay-mineral-like, illite-like, kaolinite-like, smectite-like, chlorite-like, apatite-like, Ca-rich silicates, domolite-like, and others, respectively. Correspondingly, representative SEM images of particles are presented within each mineral category panel. The red circle and whiskers denote the average value and mean deviation. The data for each particle is shown as gray solid dots.

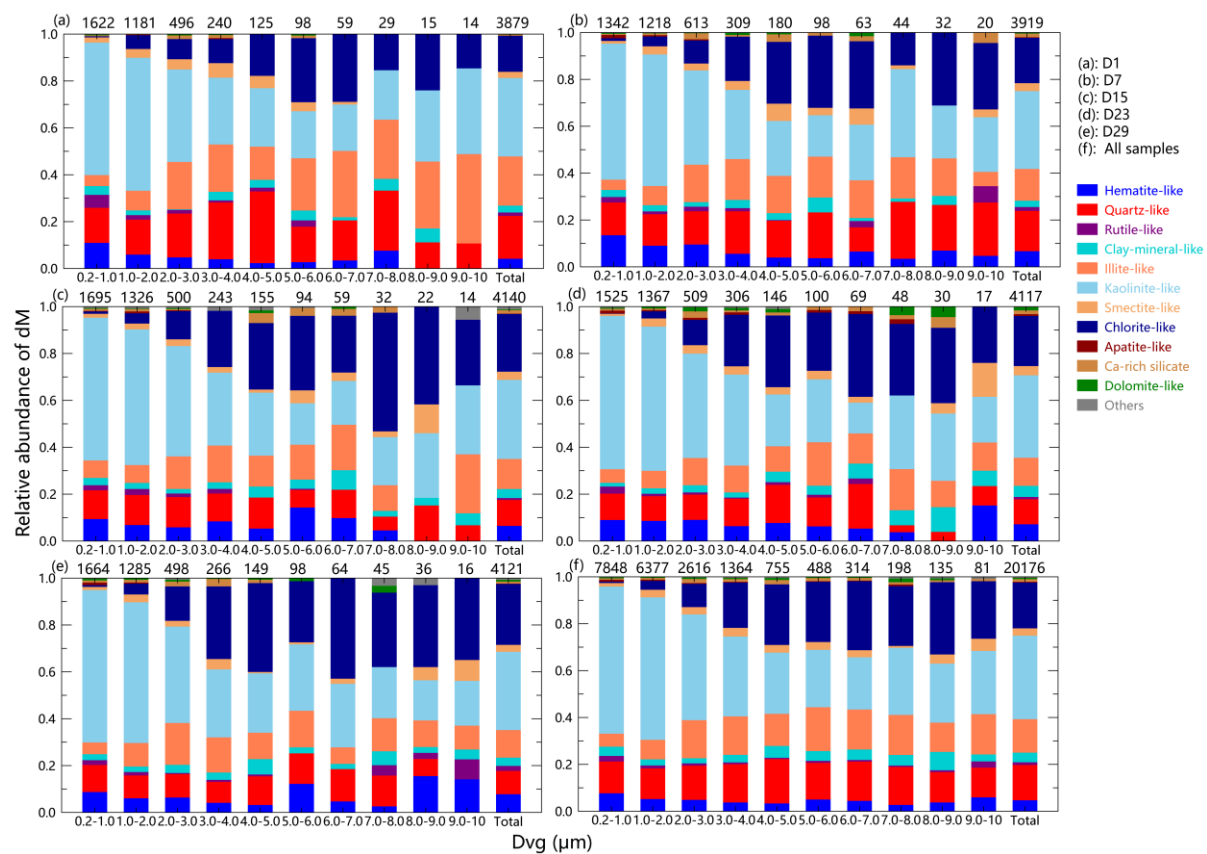


Figure S2. Size-resolved mass abundance of different particle groups for different samples.

The numbers on top represent total particle counts in the given size bin.

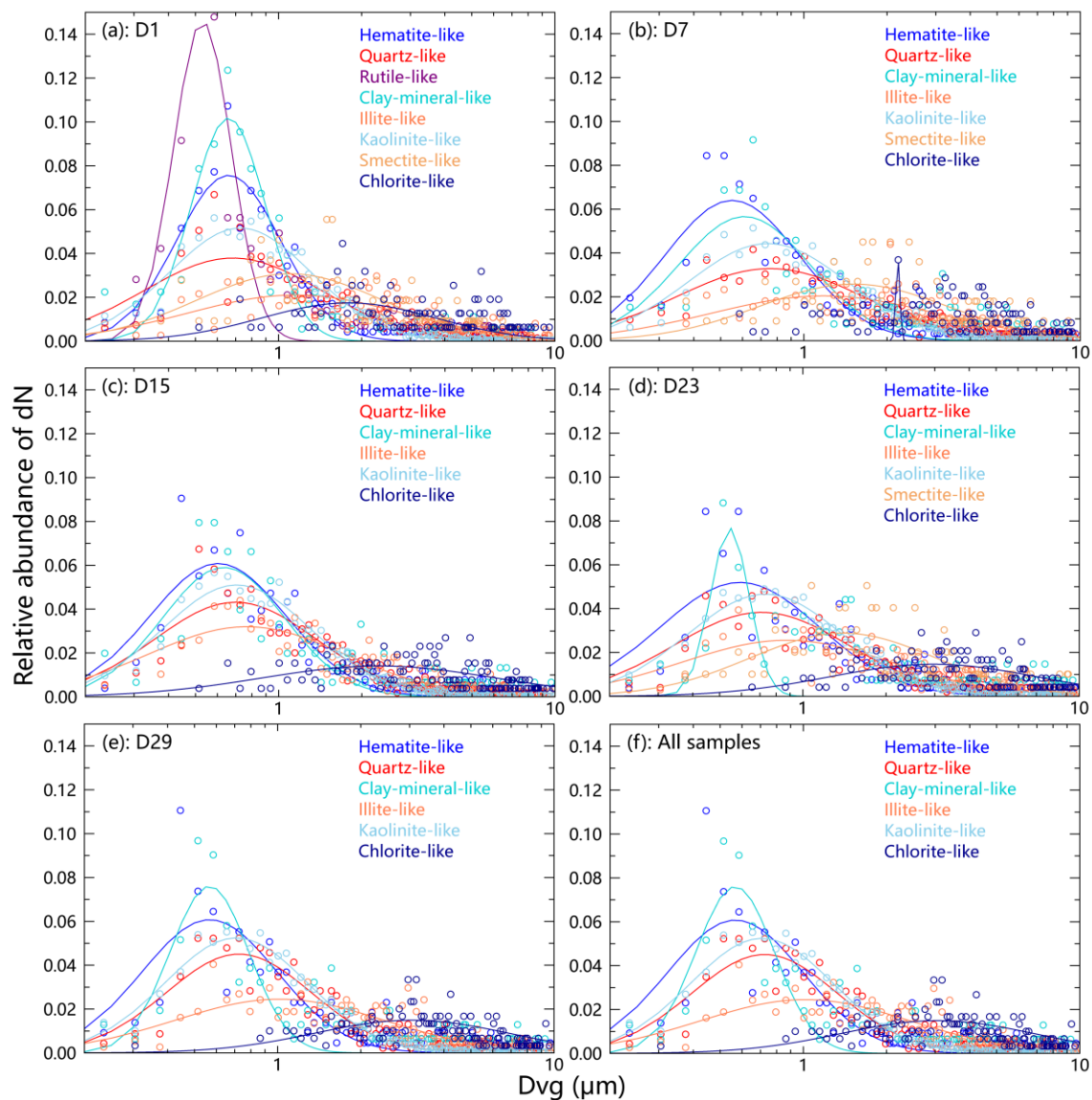


Figure S3. Relative abundances of logarithmic size number distributions $dN/(d \log D_p)$ of different mineral components for each sample and all samples. D_{vg} : particle diameter of dust in snow.

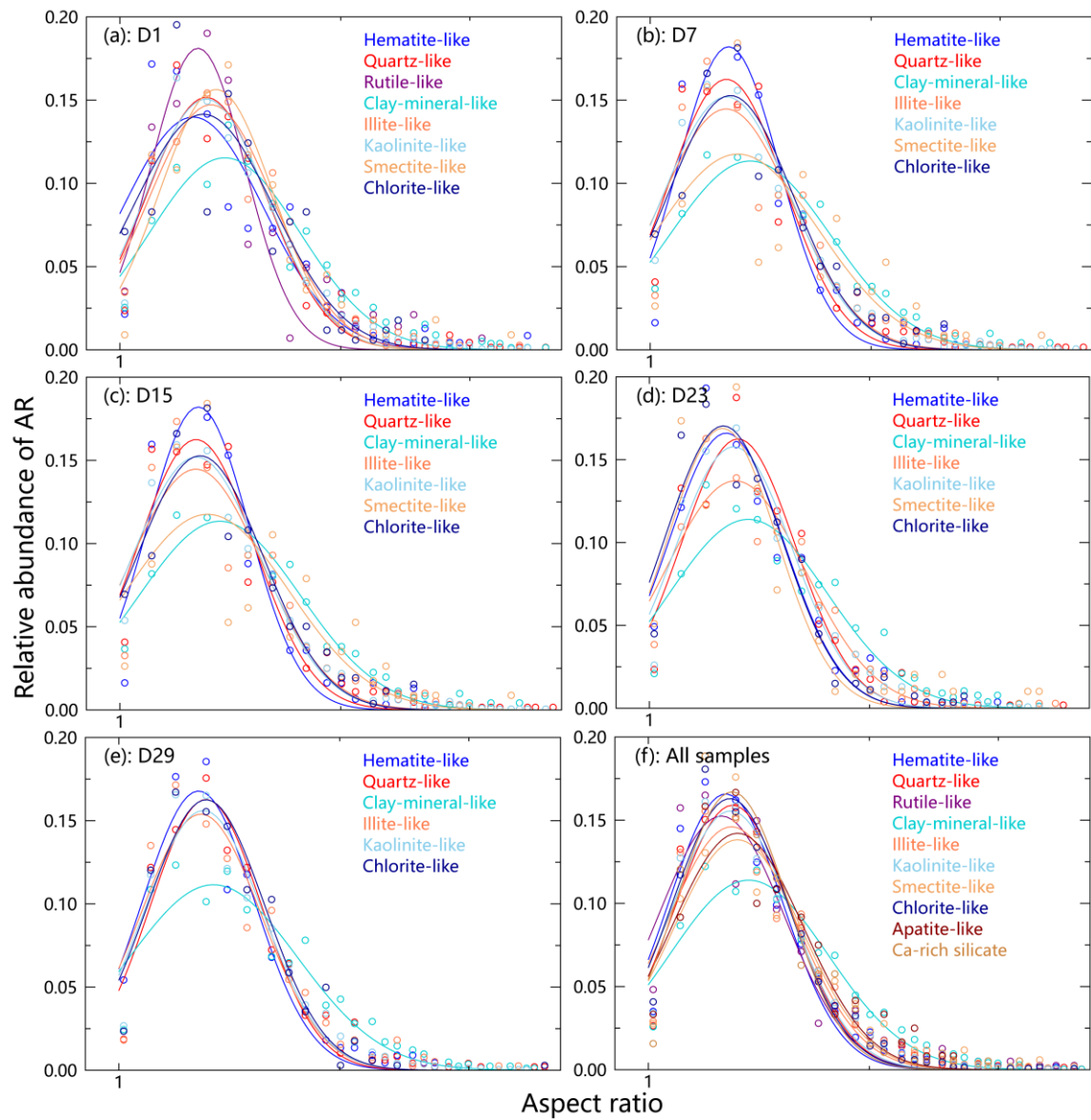


Figure S4. Relative abundances of logarithmic dust AR number distributions $dN/(d\log AR)$ of different mineral components for each sample and all samples.

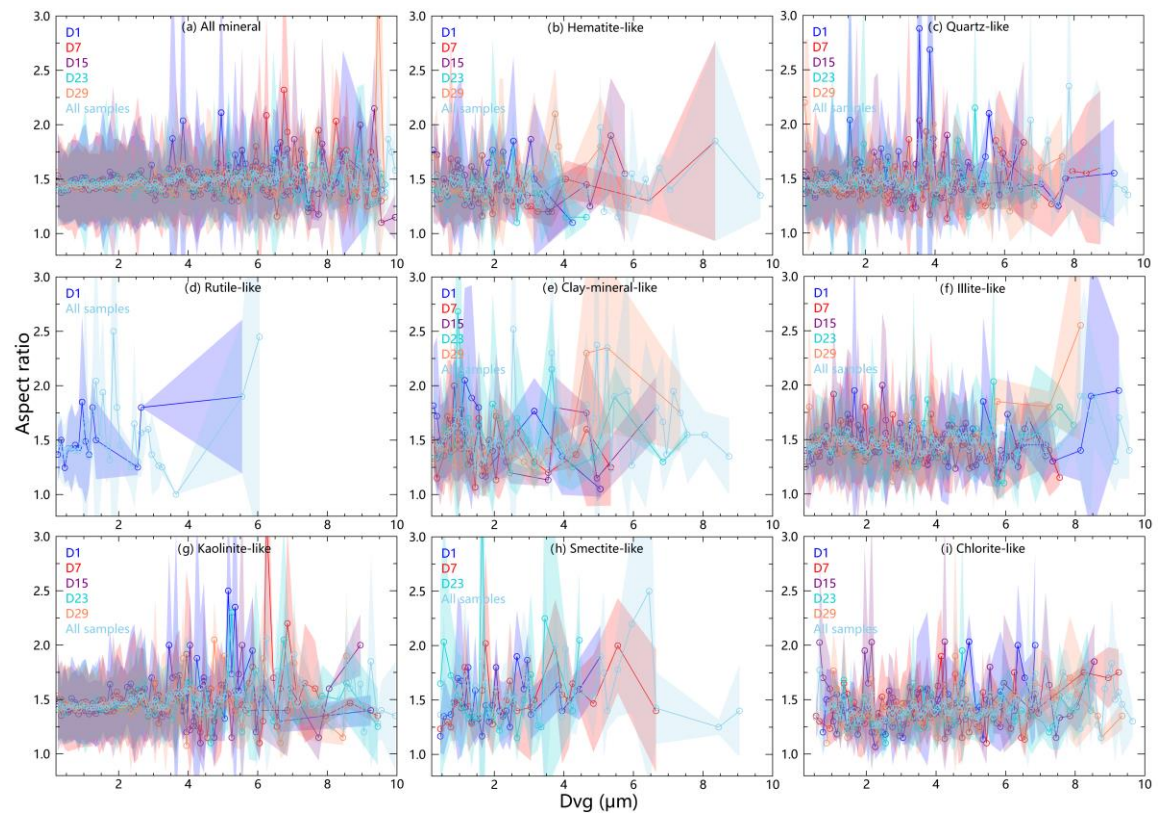


Figure S5. Size-resolved particle aspect ratio for different mineral components, the shaded area represents the mean error.

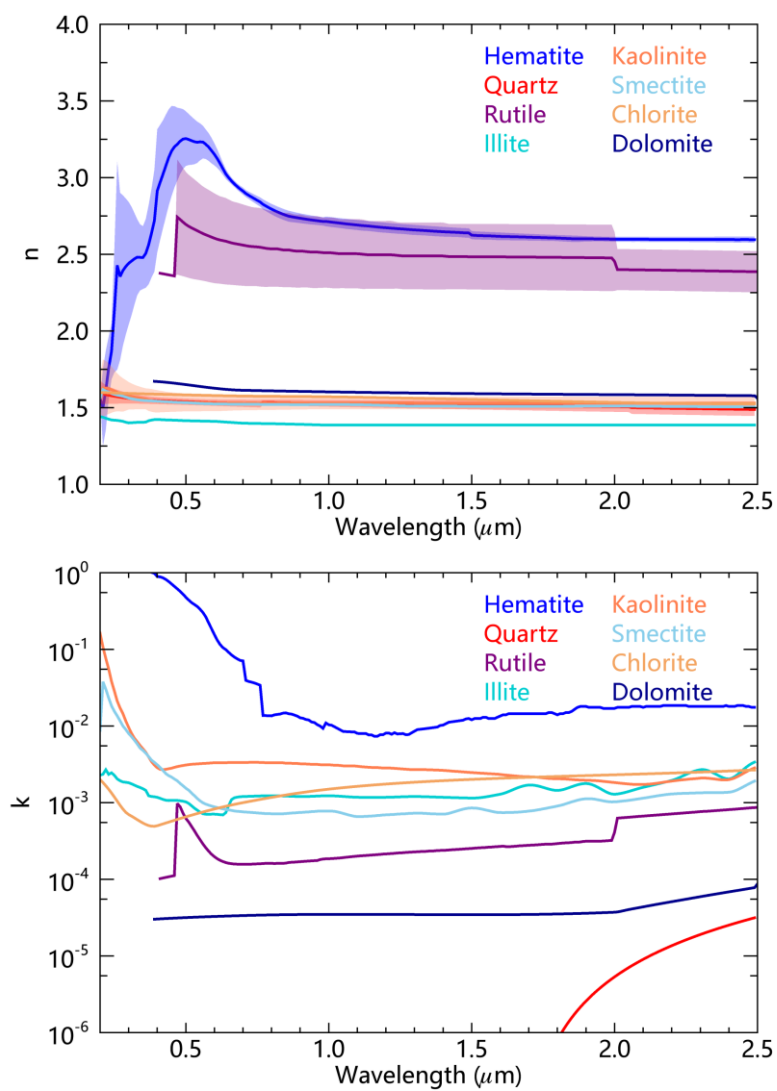


Figure S6. Real (a) and imaginary (b) parts of the spectral complex refractive indices for different mineral components, the shaded area represents the mean error.

Table S1. The number/mass fraction (%) of particles in each particle class for different samples.

Samples Particle type	D1	D7	D15	D23	D23	Total
Hematite-like	3.49/4.16	5.37/6.69	4.41/6.44	5.06/7.12	4.95/7.75	4.66/6.43
Quartz-like	20.09/18.31	19.11/17.17	13.02/11.04	12.06/10.70	11.13/9.97	15.08/13.43
Rutile-like	1.56/1.42	1.48/1.68	0.80/0.87	0.78/1.00	1.55/2.12	1.24/1.42
Clay-mineral-like	3.76/2.95	3.10/2.70	4.81/3.81	5.55/4.74	4.88/3.55	4.42/3.55
Illite-like	20.64/21.00	13.72/13.52	12.76/12.83	12.17/11.94	12.48/11.75	14.35/14.21
Kaolinite-like	34.73/33.41	34.80/33.22	35.26/33.76	37.90/35.19	36.98/33.41	35.93/33.80
Smectite-like	2.55/2.67	3.70/3.39	3.21/3.47	3.65/3.97	3.20/2.98	3.26/3.30
Chlorite-like	12.58/15.34	16.60/19.33	22.52/24.59	19.12/21.33	22.62/25.97	18.68/21.31
Apatite-like	0.06/0.06	0.21/0.24	0.17/0.14	0.84/0.79	0.17/0.16	0.29/0.28
Ca-rich silicate	0.31/0.46	1.43/1.58	1.37/1.53	1.50/1.61	0.81/0.87	1.09/1.21
Dolomite-like	0.20/0.19	0.43/0.41	0.38/0.30	1.19/1.35	0.63/0.75	0.57/0.60
Others	0.02/0.02	0.06/0.06	1.28/1.20	0.19/0.26	0.60/0.72	0.43/0.45

Table S2. Parameters of the size distribution, mean radius r , the geometric standard deviation σ , and coefficient of determination (R^2) for different particle classes in each sample.

Samples	Particle type	r	σ	R^2
D1	Hematite-like	0.330	1.544	0.888
	Quartz-like	0.342	2.102	0.707
	Rutile-like	0.265	1.272	0.867
	Clay-mineral-like	0.329	1.364	0.908
	Illite-like	0.575	2.460	0.438
	Kaolinite-like	0.364	1.808	0.956
	Smectite-like	0.549	2.176	0.372
	Chlorite-like	0.897	2.064	0.173
D7	Hematite-like	0.275	1.753	0.812
	Quartz-like	0.377	2.191	0.864
	Clay-mineral-like	0.305	1.737	0.593
	Illite-like	0.590	2.576	0.405
	Kaolinite-like	0.370	1.939	0.955
	Smectite-like	0.756	2.192	0.243
	Chlorite-like	1.094	1.017	0.152
D15	Hematite-like	0.302	1.764	0.797
	Quartz-like	0.349	1.966	0.820
	Clay-mineral-like	0.316	1.668	0.717
	Illite-like	0.383	2.270	0.730
	Kaolinite-like	0.352	1.854	0.964
	Chlorite-like	1.152	2.673	0.093
D23	Hematite-like	0.296	1.944	0.661
	Quartz-like	0.354	2.074	0.818
	Clay-mineral-like	0.272	1.175	0.524
	Illite-like	0.437	2.400	0.604
	Kaolinite-like	0.365	1.907	0.976
	Smectite-like	0.699	2.171	0.297
	Chlorite-like	1.484	2.380	0.147
D29	Hematite-like	0.284	1.759	0.681
	Quartz-like	0.362	1.837	0.843
	Clay-mineral-like	0.283	1.389	0.762
	Illite-like	0.508	2.393	0.563
	Kaolinite-like	0.354	1.815	0.977
	Chlorite-like	1.528	2.231	0.176
Total	Hematite-like	0.296	1.740	0.889
	Quartz-like	0.356	2.036	0.912
	Rutile-like	0.271	1.434	0.845
	Clay-mineral-like	0.313	1.553	0.857
	Illite-like	0.484	2.375	0.824
	Kaolinite-like	0.360	1.863	0.984
	Smectite-like	0.570	1.943	0.784
	Chlorite-like	1.317	2.193	0.610
	Apatite-like	0.320	1.806	0.655
	Ca-rich silicate	0.317	3.369	0.288

Table S3. Parameters of the aspect ratio density distribution, mean radius r , the geometric standard deviation σ , and coefficient of determination (R^2) for different particle classes in each sample.

Samples	Particle type	AR	σ	R^2
D1	Hematite-like	1.259	1.249	0.796
	Quartz-like	1.311	1.208	0.923
	Rutile-like	1.277	1.160	0.886
	Clay-mineral-like	1.390	1.268	0.918
	Illite-like	1.330	1.219	0.951
	Kaolinite-like	1.310	1.213	0.952
	Smectite-like	1.352	1.195	0.902
	Chlorite-like	1.299	1.247	0.774
D7	Hematite-like	1.279	1.173	0.923
	Quartz-like	1.270	1.201	0.927
	Clay-mineral-like	1.368	1.288	0.959
	Illite-like	1.269	1.232	0.876
	Kaolinite-like	1.271	1.223	0.965
	Smectite-like	1.317	1.292	0.593
	Chlorite-like	1.286	1.218	0.914
D15	Hematite-like	1.275	1.196	0.940
	Quartz-like	1.299	1.198	0.933
	Clay-mineral-like	1.379	1.267	0.929
	Illite-like	1.289	1.208	0.880
	Kaolinite-like	1.280	1.205	0.960
	Chlorite-like	1.283	1.154	0.923
D23	Hematite-like	1.273	1.198	0.930
	Quartz-like	1.322	1.198	0.931
	Clay-mineral-like	1.365	1.284	0.886
	Illite-like	1.311	1.247	0.918
	Kaolinite-like	1.304	1.204	0.951
	Smectite-like	1.258	1.188	0.871
	Chlorite-like	1.262	1.201	0.925
D29	Hematite-like	1.284	1.192	0.951
	Quartz-like	1.314	1.191	0.947
	Clay-mineral-like	1.346	1.303	0.892
	Illite-like	1.293	1.209	0.891
	Kaolinite-like	1.304	1.206	0.944
	Chlorite-like	1.315	1.203	0.915
Total	Hematite-like	1.274	1.196	0.950
	Quartz-like	1.302	1.201	0.957
	Rutile-like	1.257	1.219	0.901
	Clay-mineral-like	1.370	1.283	0.941
	Illite-like	1.298	1.225	0.931
	Kaolinite-like	1.294	1.209	0.958
	Smectite-like	1.322	1.225	0.907
	Chlorite-like	1.291	1.201	0.958
	Apatite-like	1.323	1.229	0.876
	Ca-rich silicate	1.300	1.192	0.902