Supplementary Materials:

Table S1. Selected statistical parameters of the bulk and clay matrix geochemical compositions of the pottery in the complete data set of twelve analyzed samples. [1] Clarke values (Cv) were taken from data provided in [56,57]. [2-4] Percentiles. [4] Median values. [5] Mean (average) values. [6] Coefficient of variations (CV, %). [7] Constants indicating the ratios of the median amounts of analytes to corresponding Cv. –: not analyzed. Analytes are sorted according descending Cv values.

Variable	Cv [1]	25th [2]	75th [3]	50th [4]	Mean [5]	CV [6]	50th/Cv [7]	25th	75th	50th	Mean	CV	50th/Cv
				Bulk composition						Clay matrix composition			
Major elements, wt.%													
SiO_2	66.6	55.2	61.2	58.9	58.4	8.5	0.88	51.1	56.6	54.9	53.9	7.6	0.82
Al_2O_3	15.4	14.9	18.1	16.1	16.2	12.1	1.04	19.8	21.9	21.0	21.0	10.1	1.36
Fe_2O_3	5.6	5.63	7.21	6.60	6.57	16.4	1.18	10.2	11.5	10.4	10.8	15.8	1.86
CaO	3.57	0.477	0.613	0.532	0.56	25.7	0.15	0.550	0.935	0.656	0.733	31.0	0.18
Na_2O	3.27	0.425	0.698	0.554	0.58	35.7	0.17	0.213	0.303	0.288	0.258	29.1	0.09
K_2O	2.80	3.59	4.27	4.02	3.91	13.1	1.44	4.47	5.02	4.80	4.71	12.6	1.71
MgO	2.48	1.19	1.92	1.64	1.63	33.5	0.66	2.32	2.99	2.59	2.62	24.3	1.05
TiO_2	0.64	0.780	0.919	0.849	0.84	11.8	1.33	0.992	1.21	1.07	1.25	40.4	1.68
P_2O_5	0.15	0.686	1.43	1.00	1.18	61.7	6.68	0.902	1.86	1.11	1.36	47.7	7.41
MnO	0.10	0.119	0.180	0.138	0.160	63.8	1.38	0.032	0.095	0.057	0.074	76.5	0.57
Microelemets, µg g^{-1}													
S	621	203	229	207	212	10	0.33	–	–	–	–	–	–
Sr	320	89.3	193	124	150	60	0.39	–	–	–	–	–	–
Zr	193	119	149	131	131	22	0.68	–	–	–	–	–	–
V	97	82.8	103	93.6	93.6	16	0.96	–	–	–	–	–	–
Cr	92	79.4	97.1	95.3	89.5	15	1.04	–	–	–	–	–	–
Rb	84	52.2	78.5	58.2	64.5	26	0.69	–	–	–	–	–	–
Zn	67	52.9	72.4	59.8	64.2	34	0.89	–	–	–	–	–	–
Ni	47	38.4	44.3	40.4	42.9	25	0.86	–	–	–	–	–	–
Cu	28	14.9	17.3	15.1	15.8	13	0.54	–	–	–	–	–	–
Nb	12	8.14	10.1	8.96	9.55	23	0.75	–	–	–	–	–	–
Hf	5.3	6.00	6.28	6.11	6.11	3.4	1.15	–	–	–	–	–	–

Table S2. Elemental content of the light (LMC) and dark (DCM) clay matrix parts of the pottery samples (%, average values of the SEM-EDS analysis data for the sample's clay matrix type). [*1] Area occupied by a clay matrix type in a pottery sample (OA)

ID	Al_2O_3	CaO	Fe_2O_3	K_2O	MgO	MnO	Na_2O	P_2O_5	SiO_2	TiO_2	OA, %
Light clay matrix (LCM)											
CW-E_M1	20.7	0.53	13.98	3.61	3.12	0.0258	0.2157	3.02	48.71	1.88	42
CW-E_M2	21.4	0.71	4.99	6.04	1.61	0.0194	0.2426	1.99	59.83	1.80	4.0
CW-E_M3	20.0	0.92	10.89	4.25	3.15	0.1162	0.2561	0.87	53.65	0.87	44
CW-L_M4	16.8	0.95	9.56	4.08	2.42	0.0904	0.3235	0.37	58.16	0.92	94
HG-E_M5	21.1	0.52	9.66	5.20	1.64	0.0904	0.3640	0.87	53.76	1.17	8.8
CW-L_S1	20.7	0.94	14.50	4.94	1.94	0.0904	0.2292	4.54	46.72	1.30	37
CW-L_S2	18.2	0.66	15.74	5.43	2.62	0.2841	0.2157	3.44	48.05	0.98	4.3
HG -E_S3	24.8	0.91	11.28	4.18	1.96	0.0516	0.3505	1.28	47.68	1.27	36
HG-L_B1	22.7	1.13	10.33	4.61	3.94	0.0191	0.0896	2.07	52.00	2.73	88
HG-L_B2	21.4	0.59	11.28	5.26	3.03	0.2453	0.3505	1.08	51.88	0.97	52
HG-L_B3	20.1	0.50	10.67	5.44	3.05	0.0387	0.2561	0.96	51.34	1.10	54
HG-L_B4	22.6	0.53	9.84	4.75	2.65	0.0258	0.3235	2.64	51.34	0.98	18
Dark clay matrix (DCM)											
CW-E_M1	23.5	0.35	14.85	3.45	1.91	0.1033	0.1213	0.66	52.82	1.47	48
CW-E_M2	19.3	1.01	7.63	4.82	2.65	0.0516	0.2157	0.87	60.69	1.05	96
CW-E_M3	19.2	0.76	10.02	4.87	2.91	0.0898	0.3346	0.82	59.54	1.04	56
CW-L_M4	18.6	1.08	10.85	3.58	2.50	0.1291	0.6470	0.57	58.16	0.97	5.6
HG-E_M5	19.9	0.56	10.38	4.69	1.63	0.0258	0.2831	1.31	56.77	1.02	91
CW-L_S1	22.4	0.45	11.51	5.04	1.71	0.2841	0.2831	0.99	53.80	1.12	63
CW-L_S2	20.6	0.69	11.08	5.24	3.00	0.0516	0.2022	1.72	55.51	1.00	96
HG -E_S3	25.8	0.94	12.38	4.01	2.06	0.0516	0.2696	0.71	46.70	1.18	64
HG-L_B1						No data					
HG-L_B2	21.6	0.48	9.58	4.88	3.30	0.0387	0.2157	0.82	57.69	0.97	48
HG-L_B3	19.5	0.51	9.17	5.99	2.56	0.0256	0.4137	0.75	59.32	1.32	46
HG-L_B4	21.6	0.62	10.55	5.06	2.55	0.0258	0.3100	2.22	47.34	1.08	82

Table S3. Selected statistical parameters of the elemental contents in the light and dark clay matrixes of the independent (not harmonized in matched pairs) pottery samples (%). [1–3] Percentiles. [3] Median values. [4] Mean (average) values. [5] Coefficient of variations (%). [6] Parameters for the results of 12 pottery samples with light shades. [7] Parameters for the results of 11 pottery samples with dark shade. [8] Constants indicating the ratios of median values of analytes for light to dark clay matrix and formula for their calculation. [9] Part of the area of the light or dark clay matrixes in the set of studied samples (%).

Variable	25th [1]	75th [2]	50th [3]	Mean[4]	CV [5]	25th	75th	50th	Mean	CV	50^{th}_{IND} =
		Light clay matrix (LCM) [6]					Dark clay matrix (DCM) [7]				$50^{th}_{LCM}/50^{th}_{DCM}$ [8]
SiO_2	48.5	53.7	51.6	51.9	7.8	53.3	58.7	56.8	55.3	8.6	0.91
Al_2O_3	20.1	21.7	20.9	20.9	9.9	19.4	22.0	20.6	21.1	10	1.01
Fe_2O_3	9.79	12.0	10.8	11.1	25	9.80	11.3	10.6	10.7	17	1.02
K_2O	4.23	5.31	4.84	4.82	15	4.35	5.05	4.87	4.69	16	0.99
MgO	1.95	3.07	2.64	2.59	27	1.98	2.78	2.55	2.43	22	1.03
TiO_2	0.980	1.43	1.13	1.33	41	1.01	1.15	1.05	1.11	14	1.08
P_2O_5	0.94	2.73	1.64	1.93	66	0.73	1.15	0.82	1.04	49	1.99
CaO	0.532	0.927	0.686	0.741	29	0.494	0.851	0.62	0.676	36	1.11
Na_2O	0.226	0.330	0.256	0.268	29	0.216	0.322	0.28	0.300	46	0.90
MnO	0.026	0.097	0.071	0.091	96	0.032	0.097	0.052	0.080	95	0.91
Area [9]	15.8	52.0	39.4	40.1	74	47.0	84.2	63.1	59.9	48	0.76

Table S4. The Spearman rank order correlation coefficients calculated in eleven pottery samples between the ratios of the content in the lighter clay matrix to respective content in the darker clay matrix. The marked correlations are significant at $p < 0.05$.

Variable	SiO_2	Al_2O_3	Fe_2O_3	MgO	K_2O	TiO_2	Na_2O	CaO	P_2O_5	MnO
SiO_2	1.000	0.282	**− 0.818**	− 0.227	0.373	0.136	0.155	− 0.591	− 0.309	− 0.351
Al_2O_3	0.282	1.000	− 0.409	− 0.218	0.045	− 0.064	− 0.082	− 0.518	− 0.345	0.210
Fe_2O_3	**− 0.818**	− 0.409	1.000	0.245	− 0.582	− 0.245	− 0.036	**0.664**	0.336	0.392
MgO	− 0.227	− 0.218	0.245	1.000	− 0.555	− 0.191	− 0.200	0.564	0.027	− 0.369
K_2O	0.373	0.045	− 0.582	− 0.555	1.000	**0.655**	0.382	− 0.400	0.000	− 0.150
TiO_2	0.136	− 0.064	− 0.245	− 0.191	**0.655**	1.000	**0.636**	0.064	**0.655**	− 0.483
Na_2O	0.155	− 0.082	− 0.036	− 0.200	0.382	**0.636**	1.000	0.200	0.436	0.036
CaO	− 0.591	− 0.518	**0.664**	0.564	− 0.400	0.064	0.200	1.000	0.436	− 0.073
P_2O_5	− 0.309	− 0.345	0.336	0.027	0.000	**0.655**	0.436	0.436	1.000	− 0.433
MnO	− 0.351	0.210	0.392	− 0.369	− 0.150	− 0.483	0.036	− 0.073	− 0.433	1.000

Table S5. Selected main statistical parameters of the geochemical bulk compositions in the hunter-gatherer and Corded Ware pottery. [1] 50th percentile (median values). [2] Mean (average) value. [3] Coefficient of variations (%). [4] Number of analyzed samples. [5] p-level of the differences in the values between the hunter-gatherer and Corded Ware pottery data sets according to the Mann-Whitney U-test.

	50th [1]	Mean [2]	CV [3]	50th	Mean	CV	U'test p-value [5]
	Hunter-gatherer pottery, n=6 [4]			Corded Ware pottery, n=6			
Major (crustal) elements, wt.%							
Al_2O_3	18.1	17.6	8.4	14.8	14.8	7.9	0.0104
CaO	0.47	0.54	37	0.57	0.59	13	0.1495
Fe_2O_3	7.32	7.23	13	5.56	5.91	14	0.0250
K_2O	4.15	4.07	11	3.85	3.74	15	0.2623
MgO	1.80	1.77	37	1.44	1.49	29	0.5218
MnO	0.18	0.22	46	0.12	0.10	53	0.0104
Na_2O	0.51	0.53	30	0.61	0.63	40	0.5218
P_2O_5	1.16	1.25	47	0.77	1.11	81	0.4233
SiO_2	55.4	56.2	8.8	60.5	60.7	6.9	0.1093
TiO_2	0.89	0.88	8.1	0.78	0.79	13	0.1495
Microelements, $\mu g\ g^{-1}$							
Cr	95	94	12	86	85	18	0.4233
Cu	10	11	21	8.1	8.2	13	0.0250
Hf	6.1	6.1	3.3	6.1	6.1	3.8	0.7483
Nb	16	17	12	15	15	12	0.0782
Ni	44	49	25	38	37	13	0.0163
Rb	144	141	20	131	121	22	0.3367
S	132	172	64	108	127	52	0.4233
Sr	58	65	30	59	64	23	0.7488
V	99	100	14	88	87	15	0.1495
Zn	74	77	31	51	52	22	0.0250
Zr	205	208	12	220	215	8.9	0.5218

Table S6. Selected main statistical parameters of the geochemical clay matrix compositions in the hunter-gatherer and Corded Ware pottery. [*1] 50th percentile (median value). [*2] Mean (average) value. [*3] Coefficient of variations (%). [*4] Number of analyzed samples. [*5] p-level of the differences in the values between the hunter-gatherer and Corded Ware pottery data sets according to the Mann-Whitney U-test.

	50th [*1]	Mean [*2]	CV [*3]	50th	Mean	CV	U'test p-value [*5]
	Hunter-gatherer pottery, n=6 [*4]			Corded Ware pottery, n=6			
Al_2O_3	21.6	21.9	9.4	20.0	20.1	9.5	0.1495
CaO	0.58	0.71	36	0.76	0.76	28	0.5218
Fe_2O_3	10.37	10.58	6.7	10.8	11.0	22	0.7488
K_2O	4.87	4.87	11	4.73	4.55	14	0.3367
MgO	2.70	2.69	31	2.54	2.55	18	0.7488
MnO	0.032	0.051	93	0.080	0.098	61	0.0547
Na_2O	0.29	0.27	33	0.24	0.25	26	0.5218
P_2O_5	1.11	1.39	45	1.34	1.33	55	0.5218
SiO_2	53.3	52.2	7.5	56.1	55.5	7.0	0.1495
TiO_2	1.13	1.37	49	1.04	1.14	24	0.3367

Table S7. The Spearman rank order correlation coefficients of the major analyte values in the clay matrix of the hunter-gatherer and Corded Ware pottery. The marked correlations are significant at $p < 0.05$. _HG: correlation coefficients linked to hunter-gatherer pottery. _CW: correlation coefficients linked to Corded Ware pottery.

Variable	Al$_2$O$_3$_HG	CaO_HG	Fe$_2$O$_3$_HG	K$_2$O_HG	MgO_HG	MnO_HG	Na$_2$O_HG	P$_2$O$_5$_HG	SiO$_2$_HG	TiO$_2$_HG
Al$_2$O$_3$_HG	1.000	**0.886**	0.771	**− 0.829**	0.086	− 0.143	− 0.371	0.314	**− 0.886**	0.543
CaO_HG	**0.886**	1.000	0.429	**− 0.886**	0.086	− 0.543	− 0.486	0.543	− 0.657	0.657
Fe$_2$O$_3$_HG	0.771	0.429	1.000	− 0.486	− 0.029	0.429	− 0.257	0.086	− 0.771	− 0.029
K$_2$O_HG	**− 0.829**	**− 0.886**	− 0.486	1.000	0.257	0.257	0.429	− 0.257	0.543	− 0.543
MgO_HG	0.086	0.086	− 0.029	0.257	1.000	− 0.143	− 0.429	0.086	− 0.086	0.257
MnO_HG	− 0.143	− 0.543	0.429	0.257	− 0.143	1.000	0.143	− 0.714	0.029	− 0.486
Na$_2$O_HG	− 0.371	− 0.486	− 0.257	0.429	− 0.429	0.143	1.000	− 0.371	− 0.029	− 0.029
P$_2$O$_5$_HG	0.314	0.543	0.086	− 0.257	0.086	− 0.714	− 0.371	1.000	− 0.200	− 0.029
SiO$_2$_HG	**− 0.886**	− 0.657	− 0.771	0.543	− 0.086	0.029	− 0.029	− 0.200	1.000	− 0.486
TiO$_2$_HG	0.543	0.657	− 0.029	− 0.543	0.257	− 0.486	− 0.029	− 0.029	− 0.486	1.000

Variable	Al$_2$O$_3$_CW	CaO_CW	Fe$_2$O$_3$_CW	K$_2$O_CW	MgO_CW	MnO_CW	Na$_2$O_CW	P$_2$O$_5$_CW	SiO$_2$_CW	TiO$_2$_CW
Al$_2$O$_3$_CW	1.000	**− 0.943**	**0.943**	0.029	− 0.143	0.200	− 0.714	0.771	**− 0.943**	**0.829**
CaO_CW	**− 0.943**	1.000	**− 1.000**	0.086	0.257	− 0.371	0.543	− 0.657	**1.000**	− 0.657
Fe$_2$O$_3$_CW	**0.943**	**− 1.000**	1.000	− 0.086	− 0.257	0.371	− 0.543	0.657	**− 1.000**	0.657
K$_2$O_CW	0.029	0.086	− 0.086	1.000	0.143	− 0.086	− 0.086	0.600	0.086	− 0.029
MgO_CW	− 0.143	0.257	− 0.257	0.143	1.000	− 0.371	− 0.143	− 0.257	0.257	− 0.314
MnO_CW	0.200	− 0.371	0.371	− 0.086	− 0.371	1.000	0.543	0.086	− 0.371	− 0.086
Na$_2$O_CW	− 0.714	0.543	− 0.543	− 0.086	− 0.143	0.543	1.000	− 0.600	0.543	− 0.771
P$_2$O$_5$_CW	0.771	− 0.657	0.657	0.600	− 0.257	0.086	− 0.600	1.000	− 0.657	0.714
SiO$_2$_CW	**− 0.943**	**1.000**	**− 1.000**	0.086	0.257	− 0.371	0.543	− 0.657	1.000	− 0.657
TiO$_2$_CW	**0.829**	− 0.657	0.657	− 0.029	− 0.314	− 0.086	− 0.771	0.714	− 0.657	1.000

Table S8. Conditionally color-formatted ratios of the mean values and the coefficient of variations of the major crustal elements in the clay matrix of the pottery, which is clustered in dendrogram groups in accordance with Figure 8a panel. [1] ID of the tree branches. [2] Cultural assignment of the pottery samples to the hunter-gatherer (HG) and/or Corded Ware (CW) cultures. The number before the cultural group's abbreviation indicates the quantity of samples. [3] The main clusters, named by the dendrogram branches. [4] The sample sub-branches joined in the first-level clusters or by chains of them (**FLC**). The samples in an **FLC** are joined at a linkage distance of less than 10.

Clusters [1]	Cultures [2]	Al_2O_3	Fe_2O_3	P_2O_5	TiO_2	MnO	CaO	SiO_2	K_2O	MgO	Na_2O
Main clusters [3]		Mean values, %									
B'L	3HG+4CW	19.67	9.94	1.00	1.02	0.074	0.72	56.74	4.90	2.66	0.28
B'R	3HG+2CW	22.77	11.96	1.87	1.57	0.075	0.74	49.84	4.44	2.56	0.23
The first-level clusters (**FLC**) [4]											
B'L2a	2HG	19.92	10.14	1.07	1.12	0.032	0.53	55.77	5.21	2.23	0.31
B'L2b	HG+2CW	20.52	10.71	1.20	0.98	0.103	0.68	55.61	4.97	3.06	0.26
B'L1	2CW	18.15	8.58	0.65	1.00	0.071	0.98	59.41	4.46	2.52	0.28
B'R1a'R	HG+CW	21.76	11.52	2.30	1.13	0.119	0.61	49.63	5.00	2.18	0.29
Main clusters		Coefficients of variations (CV), %									
B'L, n7	3HG+4CW	7	12	43	9	57	28	4	11	20	19
B'R, n5	3HG+2CW	7	14	31	44	105	38	4	14	33	42
The first-level clusters (**FLC**)											
B'L2a, n2	2HG	1	2	27	10.9	2	6	2	13.1	38	9
B'L2b, n3	HG+2CW	5	5	43	2	41	22	2	7	3	20
B'L1, n2	2CW	9	17	59	11.3	42	3	3	12.9	5	32
B'R1a'R,n2	HG+CW	0	13	0	7	111	3	4	0	25	12

Table S9. Conditionally color-formatted ratios of the mean values and the coefficient of variations of the major and trace elements in the bulk composition of the pottery, which is clustered in dendrogram groups in accordance with Figure 9. [1] ID of the tree branches. [2] Cultural assignment of the pottery samples to the hunter-gatherer (HG) and/or Corded Ware (CW) cultures. The number before the cultural group's abbreviation indicates the quantity of samples. [3] The main clusters, named by the dendrogram branches. [4] The sample sub-branches joined in the first-level clusters or by chains of them (*FLC*). The samples in an *FLC* are joined at a linkage distance of less than 25.

Clusters [1]	Main clusters [3]		The first-level clusters (*FLC*) [4]					The first-level clusters (*FLC*)				
	C'L	C'R	C'L	C'R2	C'R1a'L	C'R1a'R	C'R1b	C'L	C'R2	C'R1a'L	C'R1a'R	C'R1b
Cultures [2]	3HG	3HG+6CW	3HG	2CW	HG+CW	2CW	2HG+1CW	3HG	2CW	HG+CW	2CW	2HG+1CW
	Mean values, %							Coefficients of variations (CV), %				
Al_2O_3	18.63	15.38	18.63	14.05	14.23	16.07	16.59	3	4	9	1	9
Fe_2O_3	7.95	6.11	7.95	5.37	5.97	6.04	6.74	7	1	7	21	7
TiO_2	0.95	0.80	0.95	0.69	0.76	0.90	0.84	1	5	8	3	3
V	113	87	113	72	82	99	93	6	4	2	4	4
Cr	102	85	101.80	69.84	77.95	99.52	91.38	8	2	5	4	8
Nb	19	15	18.53	12.81	14.93	16.80	15.05	5	5	1	3	1
MgO	2.24	1.43	2.24	1.13	1.67	1.98	1.09	18	30	13	8	13
Cu	13	9	12.62	8.10	8.35	9.32	8.41	15	1	16	10	17
Zn	89	56	89	43	60	59	59	30	12	50	11	10
Ni	57	38	56.87	31.45	39.01	41.30	40.21	24	7	7	8	2
K_2O	4.44	3.73	4.44	4.28	3.42	3.85	3.49	4	2	9	5	15
Rb	165	120	165	142	116	131	99	4	3	16	1	25
MnO	0.22	0.14	0.22	0.14	0.24	0.07	0.12	47	15	73	95	59
P_2O_5	0.86	1.29	0.86	1.18	0.75	0.63	2.17	26	35	87	5	32
S	118	160	118	108	81	135	265	23	30	36	63	40
CaO	0.43	0.61	0.43	0.51	0.57	0.63	0.68	10	2	28	8	32
Na_2O	0.42	0.63	0.42	0.91	0.57	0.36	0.67	26	12	14	3	11
Sr	52	69	52	81	62	52	76	14	5	8	0	31
Zr	195	217	195	194	244	221	213	10	6	6	6	7
Hf	6.15	6.09	6.15	5.86	6.31	6.20	6.03	4	4	1	2	2
SiO_2	55.79	59.32	55.79	60.49	66.01	60.54	53.25	4	1	3	2	6

Table S10. Representative SEM–EDS analyses of the **feldspar minerals**. Abbreviations: Ab—albite, An—anorthite, Mc—microcline, Olg—oligoclase, Or—orthoclase. * The number of ions in the chemical formulae for potassium feldspar and plagioclase were calculated on an 8-oxygen basis.

Sample	CW-E_M3	CW-E_M3	CW-L_M4	CW-L_M4	CW-L_S2	HG-L_B2	CW-E_M1	CW-E_M3	CW-E_M3	CW-E_M3	CW-L_M4	CW-L_M4	CW-L_M4	CW-L_M4	HG-E_M5	HG-E_M5	HG-E_M5	CW-L_S1	CW-L_S2	CW-L_S2	HG-E_S3	HG-E_S3	HG-L_B3	HG-L_B3	HG-L_B4	HG-L_B4
Wt. %	Mc	Perthite	Perthite	Mc	Mc	Perthite	Olg	Olg	Ab	Olg	Ab+Mc	Ab	Olg	Ab	Ab+Mc	Olg	Olg	Ab	Ab in Mc	Ab in Mc	Ab	Ab	Ab	Olg	Olg	Ab
SiO$_2$	63.85	63.77	65.11	65.5	64.6	64.31	57.41	60.58	64.68	62.99	66.38	68.09	63.72	66.59	50.97	63.21	60.14	64.85	56.62	65.73	66.92	69.55	67.15	62.67	64.2	67.77
TiO$_2$	0	0.22	0	0	0	0.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Al$_2$O$_3$	17.66	17.86	18.24	18.18	18.21	18.16	21.51	23.88	20.06	23.73	18.77	19.24	22.76	20.62	19.69	22.21	24.24	19.25	21.2	19.08	19.22	19.8	20.7	23.6	23.18	20.1
FeO	0.2	0	0	0.33	1.22	0.32	0	0.29	0.16	0.12	0	0	0	0	1.67	0.17	0.13	0	0.73	0	0.24	0.31	0	0.16	0.54	0
MnO																										
MgO	0	0	0	0	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CaO	0	0	0	0	0.15	0.12	4.56	5.87	1.64	5.28	0.16	0.25	4.5	1.68	1.62	3.69	6.58	1.09	0.72	0.52	0.3	0.2	1.67	5.2	4.2	0.9
Na$_2$O	0.21	1.25	0.89	0	0.13	1.73	7.97	8.32	10.4	8.91	10.86	11.28	9.16	10.75	7.02	9.22	7.98	10.84	7.75	11.1	11.34	11.94	10.8	8.72	9.47	10.31
K$_2$O	15.62	14.85	15.44	16.6	15.71	14.02	0.18	0.28	0.11	0.22	2.13	0.17	0.29	0.08	2.01	0.09	0.28	0.15	2.35	0.12	0.15	0.09	0.15	0.24	0.22	1.09
P$_2$O$_5$																										
Total	97.54	97.95	99.68	100.61	100.23	98.92	91.63	99.22	97.05	101.25	98.3	99.03	100.43	99.72	83.08	98.59	99.35	96.18	89.37	96.55	98.17	101.89	100.47	100.59	101.81	100.17

Number of ions in the chemical formulae *

Si	3.04	3.00	3.01	3.02	2.99	2.99	2.778	2.711	2.926	2.756	2.952	2.979	2.807	2.928	2.722	2.835	2.692	2.950	2.803	2.976	2.980	2.982	2.933	2.763	2.789	2.977
Ti																										
Al	0.99	0.99	0.99	0.99	0.99	1.00	1.227	1.259	1.070	1.224	0.984	1.018	1.182	1.068	1.239	1.174	1.279	1.032	1.237	1.018	1.009	1.000	1.066	1.226	1.187	1.041
Fe^{+2}	0.01	0.00	0.00	0.01	0.05	0.01	0.000	0.011	0.006	0.004	0.000	0.000	0.000	0.000	0.075	0.006	0.005	0.000	0.030	0.000	0.009	0.011	0.000	0.006	0.020	0.000
Mn																										
Mg																										
Ca	0.00	0.00	0.00	0.00	0.01	0.01	0.236	0.281	0.079	0.248	0.008	0.012	0.212	0.079	0.093	0.177	0.316	0.053	0.038	0.025	0.014	0.009	0.078	0.246	0.195	0.042
Na	0.02	0.11	0.08	0.00	0.01	0.16	0.748	0.722	0.912	0.756	0.936	0.982	0.782	0.916	0.727	0.802	0.693	0.956	0.744	0.974	0.979	0.993	0.915	0.745	0.798	0.878
K	0.95	0.89	0.91	0.98	0.93	0.83	0.011	0.016	0.006	0.012	0.121	0.010	0.016	0.008	0.137	0.005	0.016	0.009	0.148	0.007	0.009	0.005	0.008	0.013	0.012	0.061
Tot.cat.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Tot.oxy.	8.05	8.00	8.02	8.03	8.02	8.00	8.01	8.00	8.00	7.98	7.91	7.99	8.00	8.00	7.91	8.02	7.98	7.98	7.97	7.99	7.99	7.98	8.00	8.00	7.98	8.03
An	0.00	0.00	0.00	0.00	0.79	0.60	23.75	27.61	7.96	24.37	0.72	1.20	21.01	7.88	9.69	18.02	30.81	5.22	4.10	2.51	1.43	0.91	7.81	24.45	19.45	4.32
Ab	2.00	11.34	8.05	0.00	1.23	15.70	75.13	70.82	91.40	74.42	87.94	97.83	77.38	91.28	75.99	81.46	67.63	93.93	79.95	96.81	97.72	98.60	91.36	74.20	79.34	89.46
Or	98.00	88.66	91.95	100.0	97.98	83.70	1.12	1.57	0.64	1.21	11.35	0.97	1.61	0.84	14.32	0.52	1.56	0.86	15.95	0.69	0.85	0.49	0.83	1.34	1.21	6.22

Table S11. Representative SEM–EDS analyses of the **mica and amphibole minerals**. Abbreviations: Bt—biotite, Chl—chlorite, Hbl—hornblende, Ill—illite, Ms—muscovite, Phl—phlogopite, w—weathered. * The number of ions in the chemical formulae for muscovite, biotite, and chlorite were calculated on a 22-oxygen basis, for amphibole on a 23-oxygen basis, respectively.

Sample	CW-E_M2	CW-E_M3	CW-E_M3	CW-L_M4	CW-L_M4	CW-L_M4	HG-E_M5	HG-E_M5	HG-E_M5	CW-L_S1	CW-L_S1	CW-L_S2	HG-E_S3	HG-L_B3	HG-L_B3	HG-L_B3	HG-L_B3	HG-L_B3	HG-L_B3	HG-L_B4	HG-L_B4	HG-L_B4	HG-L_B4	CW-E_M2	CW-E_M2	HG-E_S3
Wt. %	Phl w	Bt w	Bt	Bt	Chl from Bt	Chl	Bt	Bt	Bt w	Bt w	Chl	Chl	Chl	Bt w	Bt to Chl	Bt	Bt	Bt	Bt	Bt	Bt	Ms	Ms	Hbl	Hbl w	Hbl
SiO$_2$	45.93	39.1	35.73	36.13	32.94	23.5	34.12	35.18	39.55	33.26	26.64	25.15	29.89	49.78	36.84	36.46	34.97	35.9	37.83	35.85	33.68	44.22	42.42	44.74	37.69	41.06
TiO$_2$	0.9	2.21	4.18	3.52	0	0.16	3.16	2.87	0	0.61	0.53	0.16	0.51	0.84	2.53	2.76	2.62	2.54	2.67	2.34	2.24	0.76	0.43	1.33	0	1.34
Al$_2$O$_3$	28.49	21.75	15.05	17.87	23.81	19.58	15.22	16.5	20.47	21.08	20.19	21.57	20.87	32.73	21.08	17.09	16.88	16.79	17.74	16.56	16.07	29.29	27.66	8.32	20.93	10.7
FeO	0.83	13.82	23.03	22.23	27.64	35.74	27.21	28.41	10.58	16.98	36.01	34.42	21.39	3.02	20.91	26.54	24.71	26.35	24.54	25.04	22.26	2.56	2.54	15.87	32.9	23.67
MnO	0	0	0	0	0	0	0.49	0.61	0.21	0.28	0.14	0.15	0.22	0	0	0.22	0	0.21	0.22	0.13	0	0	0	0	0.51	1.01
MgO	2.61	6.92	7.82	7.88	8.08	6.99	5.34	6.6	18.86	9.42	10.1	9.51	13.85	1.52	7.03	6.29	6	6.59	6.66	6.46	6.09	1.29	1.37	10.9	2.76	6.12
CaO	0	0.6	0.15	0	0.34	0.22	0	0.45	0.64	0.75	0.12	0	0.29	0	0.91	0	0.23	0	0	0	0	0	0	10.96	0.94	11.45
Na$_2$O	0.2	0	0	0	0.13	0	0	0	0	0.21	0	0	0.12	0.18	0	0	0	0	0	0	0	0.22	0.16	0.86	0	1.31
K$_2$O	9.98	2.45	8.95	9.2	0.64	0	8.93	7.59	0.27	2.64	0.65	0	1.31	11.34	0.44	9.8	7.99	9.2	9.76	9.39	8.6	10.31	9.73	0.73	0.18	1.54
P$_2$O$_5$	0	0.31	0	0	0	1.01	0	0	0.69	2.19	0.38	0	0.64	0	0	0	0	0	0	0	0	0	0	0	0	0
SO$_2$	0	0.17	0	0	0	0	0.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	88.94	87.33	94.91	96.83	93.58	87.2	94.62	98.21	91.27	87.42	94.76	90.96	89.09	99.41	89.74	99.16	93.4	97.58	99.42	95.77	88.94	88.65	84.31	93.71	95.91	98.2

Number of ions in the chemical formulae *

Si	3.269	2.986	2.785	2.734	2.516	2.105	2.745	2.701	2.838	2.693	2.158	2.100	2.392	3.204	2.815	2.760	2.774	2.757	2.814	2.793	2.800	3.196	3.220	6.918	5.955	6.409
Ti	0.048	0.127	0.245	0.200	0.000	0.011	0.191	0.166	0.000	0.037	0.032	0.010	0.031	0.041	0.145	0.157	0.156	0.147	0.149	0.137	0.140	0.041	0.025	0.155	0.000	0.157
Al	2.390	1.957	1.382	1.594	2.143	2.067	1.443	1.493	1.731	2.011	1.927	2.122	1.969	2.483	1.898	1.525	1.578	1.520	1.555	1.521	1.574	2.495	2.475	1.516	3.898	1.968
Fe^{+2}	0.049	0.883	1.501	1.407	1.765	2.677	1.831	1.824	0.635	1.150	2.439	2.403	1.432	0.163	1.336	1.680	1.639	1.693	1.526	1.632	1.548	0.155	0.161	2.052	4.347	3.090
Mn	0.000	0.000	0.000	0.000	0.000	0.000	0.033	0.040	0.013	0.019	0.010	0.011	0.015	0.000	0.000	0.014	0.000	0.014	0.014	0.009	0.000	0.000	0.000	0.000	0.068	0.134
Mg	0.277	0.788	0.909	0.889	0.920	0.933	0.640	0.755	2.018	1.137	1.220	1.184	1.653	0.146	0.801	0.710	0.710	0.755	0.738	0.750	0.755	0.139	0.155	2.512	0.650	1.424
Ca	0.000	0.049	0.013	0.000	0.028	0.021	0.000	0.037	0.049	0.065	0.010	0.000	0.025	0.000	0.074	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.000	1.816	0.159	1.915
Na	0.000	0.000	0.000	0.000	0.019	0.000	0.000	0.000	0.000	0.033	0.033	0.000	0.019	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.024	0.258	0.000	0.396
K	0.906	0.239	0.890	0.888	0.062	0.073	0.917	0.743	0.025	0.273	0.067	0.000	0.134	0.931	0.043	0.947	0.809	0.901	0.926	0.933	0.912	0.950	0.942	0.144	0.036	0.307
H	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
Mg/ (Mg+Fe)	85	47	38	39	34	26	26	29	76	50	33	33	54	47	37	30	30	31	33	32	33	47	49	55	13	32

Table S12. Representative SEM–EDS analyses of the **accessory minerals**. Abbreviations: Mt—magnetite, Ilm—ilmenite, Rt—rutile, Ap—apatite, Zrc—zircon. * The number of ions in the chemical formulae for magnetite were calculated on a 4-oxygen basis, for ilmenite and zircon on a 3-oxygen basis, for rutile on a 2-oxygen basis, for apatite on a 25-O,OH,Cl,F basis, respectively.

Sample	CW-E_M1	CW-L_M4	HG-E_M5	HG-E_M5	HG-E_M5	CW-E_M1	HG-L_B4	CW-L_M4	CW-L_S1	HG-E_S3	HG-L_B4	HG-L_B4	HG-L_B3	HG-L_B4	HG-L_B3
Wt. %	**Mt**	**Mt**	**Mt**	**Mt**	**Mt**	**Ilm**	**Ilm**	**Rt**	**Rt**	**Rt**	**Rt**	**Ap**	**Ap**	**Zrc**	**Zrc**
SiO_2	2.04	6.91	0.68	1.34	18.4	0.25	0.2	0.3	0.18	0.26	0.42	0.22	0.47	32.05	30.69
TiO_2	0	0.26	0	0.13	0.6	49.35	52.48	95.33	92.68	94.22	97.86				
Al_2O_3	1.27	4.72	0.49	0.59	5.81	0	0	0.16	0.2	0	0			0.17	0.6
FeO	88.45	66.99	88.74	88.88	65.49	43.18	44.58	1.56	1.24	2.49	0.52	0.21	0	0.63	0.94
MnO	0	0	0	0	0	1.78	1.81								
MgO	0	0	0	0	0	0.2	0								
CaO	0	0.32	0	0	0.29			0	0	0	0.09	54.75	54.89	0	0.33
Na_2O	0	0	0	0	0.26							0.18	0		
K_2O	0	0.3	0	0	3.62			0	0	0	0.06				
P_2O_5												43.56	43.67		
F												5.26	4.64		
Cl															
ZrO_2														66.17	65.07
SO_2															
Total	91.76	79.82	89.91	90.94	94.47	94.76	99.07	97.35	94.3	96.97	98.95	98.92	99.97	99.02	97.63
Number of ions in the chemical formulae *															
Si	0.08	0.30	0.03	0.05	0.67	0.01	0.01	0.00	0.00	0.00	0.01	0.03	0.07	0.65	0.64
Ti	0.00	0.01	0.00	0.00	0.02	0.99	1.01	0.98	0.99	0.98	0.99				
Al	0.06	0.24	0.02	0.03	0.25	0.00	0.00	0.00	0.00	0.00	0.00				
Fe^{+3}	1.78	1.14	1.92	1.86	0.34	0.01	-0.02								
Fe^{+2}	1.08	1.29	1.03	1.06	1.65	0.94	0.97	0.02	0.01	0.03	0.01	0.03	0.00		
Mn	0.00	0.00	0.00	0.00	0.00	0.04	0.04								
Mg	0.00	0.00	0.00	0.00	0.00	0.01	0.00								
Ca	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	9.17	9.22		
Na	0.00	0.00	0.00	0.00	0.02	0.00	0.00					0.05	0.00		
K	0.00	0.02	0.00	0.00	0.17	0.00	0.00								
P												5.76	5.79		
F												2.60	2.30		
Cl															
Zr														1.35	1.36
S															
Total	3.00	3.01	3.00	3.00	3.12	2.00	2.00	1.01	1.01	1.01	1.00	16.05	16.08	2.00	2.00

Table S13. Representative SEM–EDS analyses of the **illite minerals**. Abbreviations: Gth—goethite, Ill—illite. * The number of ions in the chemical formulae for the clay minerals were calculated on a 22-oxygen basis.

Sample	CW-E_M1	CW-E_M2	CW-E_M2	CW-E_M2	CW-E_M3	CW-E_M3	CW-E_M3	CW-E_M3	CW-L_M4	CW-L_M4	HG-E_S3	HG-L_B2	HG-L_B3	HG-L_B3	HG-L_B3	HG-L_B4	HG-L_B4
Wt. %	**Ill**	**Ill**	**Ill**	**Ill**	**Ill**	**Ill**	**Ill**	**Ill+Gth**	**Ill**	**Ill**	**Ill**	**Ill**	**Ill**	**Ill**	**Ill**	**Ill**	**Ill**
SiO_2	48.64	41.11	42.25	45.75	51.02	44.34	46.75	39.99	58.74	57.16	47.14	46	48.82	55.02	43.82	46.52	45.88
TiO_2	1.05	1.21	0.67	0.38	0.81	0.55	0.92	0.97	0.34	1.81	1.46	1.06	0.97	0.63	0.58	1.61	0.64
Al_2O_3	24	17.56	22.72	25.69	35.79	19.06	19.25	18.34	22.24	19.85	33.05	20.2	22.22	24.08	25.17	17.11	28.4
FeO	13.78	5.76	5.09	2.77	2.26	7.9	8.61	22.62	7.64	8.26	1.33	7.53	8.42	9.16	4.79	8.51	5.8
MnO	0.52	0	0	0	0	0	0	1.17	0	0	0	0	0	0	0	0.74	0
MgO	5.88	2.25	2.28	2.04	0.78	2.49	3.34	2.62	2.27	2.59	0.51	2.69	3.03	4.46	2.24	2.08	1.91
CaO	0.87	0.72	0.68	0.36	0	0.68	0.84	0.65	0.69	0.91	0.24	0.5	0.38	1.32	1.45	0.32	0.19
Na_2O	0	0	0.37	0	0.44	0.13	0.15	0	0.24	0.41	0.55	0	0	0.24	0.28	0	0.39
K_2O	4.25	3.75	4.63	5.06	9.99	4.73	4.65	3.13	8.07	3.07	9.19	4.86	5.66	3.97	7.1	3.59	6.93
P_2O_5	1.04	1.21	0.9	0	0	0.77	1	2.21	0.36	1.25	0.55	1.17	0.63	0.83	0.43	1.29	0.84
SO_2	0	0.18	0	0	0	0	0	0	0	0	0	0.15	0.25	0.15	0	0	0
Total	100.03	73.75	79.59	82.05	101.09	80.65	85.51	91.7	100.59	95.31	94.02	84.16	90.38	99.86	85.86	81.77	90.98

Number of ions in the chemical formulae *

Sample	CW-E_M1	CW-E_M2	CW-E_M2	CW-E_M2	CW-E_M3	CW-E_M3	CW-E_M3	CW-E_M3	CW-L_M4	CW-L_M4	HG-E_S3	HG-L_B2	HG-L_B3	HG-L_B3	HG-L_B3	HG-L_B4	HG-L_B4
Si	6.46	7.15	6.77	6.87	6.36	7.07	7.05	6.19	7.46	7.56	6.35	7.06	6.98	7.04	6.57	7.35	6.49
Al^{IV}	1.54	0.85	1.23	1.13	1.64	0.93	0.95	1.81	0.54	0.44	1.65	0.94	1.02	0.96	1.43	0.65	1.51
Al^{II}	2.22	2.76	3.05	3.42	3.62	2.65	2.47	1.53	2.79	2.66	3.59	2.72	2.72	2.66	3.02	2.54	3.22
Ti	0.10	0.16	0.08	0.04	0.08	0.07	0.10	0.11	0.03	0.18	0.15	0.12	0.10	0.06	0.07	0.19	0.07
Fe^{II}	1.53	0.84	0.68	0.35	0.24	1.05	1.09	2.93	0.81	0.91	0.15	0.97	1.01	0.98	0.60	1.12	0.69
Mn	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00
Mg	1.16	0.58	0.54	0.46	0.15	0.59	0.75	0.60	0.43	0.51	0.10	0.62	0.65	0.85	0.50	0.49	0.40
Ca	0.12	0.13	0.12	0.06	0.00	0.12	0.14	0.11	0.09	0.13	0.03	0.08	0.06	0.18	0.23	0.05	0.03
Na	0.00	0.00	0.11	0.00	0.11	0.04	0.04	0.00	0.06	0.11	0.14	0.00	0.00	0.06	0.08	0.00	0.11
K	0.72	0.83	0.95	0.97	1.59	0.96	0.89	0.62	1.31	0.52	1.58	0.95	1.03	0.65	1.36	0.72	1.25
Total	13.92	13.30	13.54	13.30	13.78	13.47	13.48	14.05	13.52	13.02	13.75	13.46	13.56	13.44	13.86	13.22	13.76
Fe/(Fe+Mg)	57	59	56	43	62	64	59	83	65	64	59	61	61	54	55	70	63

Table S14. Representative SEM–EDS analyses of the **clay matrix** points. The elevated Ti, Al, Fe, Ca, K and P content is highlighted.

Sample	CW-E_M1	CW-E_M1	CW-E_M1	CW-E_M1	CW-E_M1	CW-E_M1	HG-E_M5	HG-E_M5	CW-L_S1	CW-L_S1	CW-L_S1	HG-E_S3	HG-E_S3	HG-L_B3	HG-L_B3
Wt. %															
SiO_2	35.6	62.33	28.3	22.8	33.39	24.3	36.98	29.66	33.57	27.99	31.37	45.91	34.61	52.95	46.81
TiO_2	0.76	**5.19**	0.56	0.73	0.69	0.52	1.37	0.63	1.04	0.78	0.8	0.97	**4.33**	0	2.11
Al_2O_3	16.56	17.75	21.11	16.33	22.58	17.26	28.17	23.82	20.54	17.92	19.94	18	26.09	**36.14**	**31.05**
FeO	11.75	7.03	**22.88**	**27.4**	**26.42**	**39.11**	11.49	**17.94**	9.37	12.52	13.53	7.02	12.79	2.15	5.12
MnO	1.34	0	0.39	0.33	1.5	0.18	0	0	0	0.4	0.38	0	0	0	0
MgO	1.5	1.2	1.95	1.79	2.04	2.14	2.7	1.98	1.39	1.14	1.64	1.26	3.08	0.95	1.62
CaO	0.63	0	0.33	0.31	0.53	0.41	0.42	0.67	0.25	0.57	0.66	0.74	**3.8**	0.15	0.34
Na_2O	0	0	0	0	0.15	0	0	0.3	0.12	0	0	0	0	0.62	0.15
K_2O	3.57	1.63	1.57	1.42	1.01	0.39	3.18	1.61	3.53	3.33	3.19	1.73	2.88	**10.74**	**7.19**
P_2O_5	0.83	1.06	0.8	0.8	1.69	1.65	**6.88**	**6.18**	0.95	**5.54**	**5.91**	**3.84**	**8.5**	0	0.34
SO_2	0	0	0	0	0	0	0	0	0.13	0.13	0.19	0.22	0.18	0	0
Total	72.54	96.19	77.89	71.91	90	85.96	91.19	82.79	70.89	70.32	78.25	79.69	96.26	103.7	94.73
Fe/ (Fe+Mg)	89	85	92	94	93	95	81	90	87	92	89	85	81	69	76

Figure S1. The volume ratios of the major minerals in the samples, containing mineral temper. Abbreviations: Qtz—quartz, Kfs—K-feldspar, Pl—plagioclase, Bt—biotite, Chl—chlorite, Ms—muscovite, Hbl—hornblende, Ap—apatite, Ilm—ilmenite, Mnz—monazite, Mt—magnetite, Rt—rutile, Spn—sphene, Zrc—zircon.
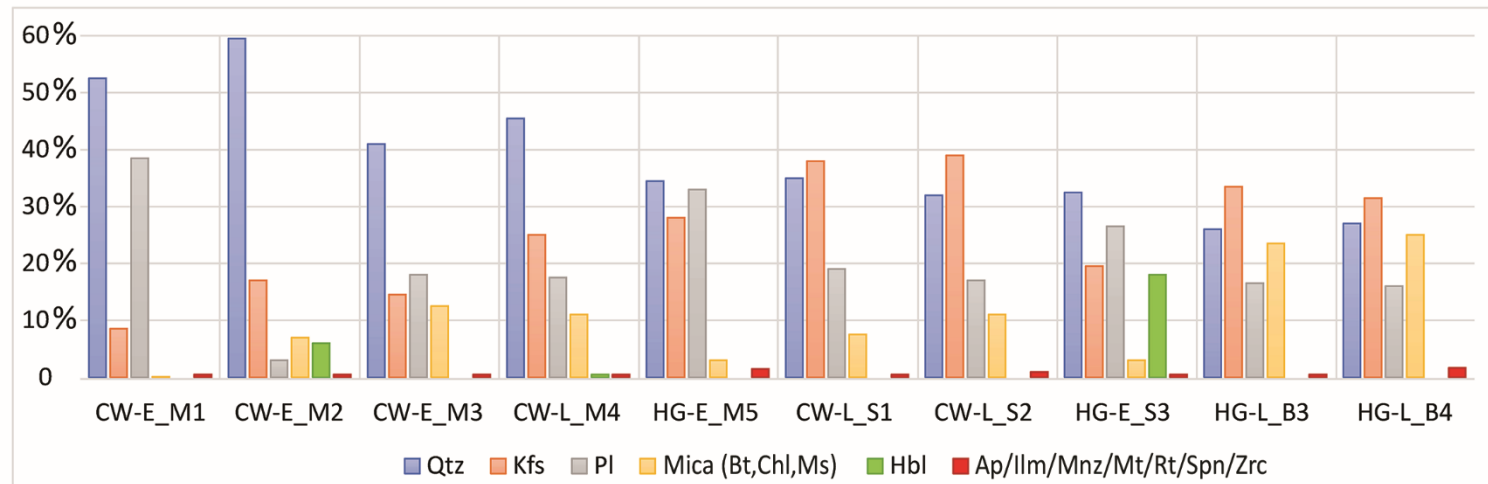
Figure S2. The boundary between the dark main clay matrix and the light upper layer of mature, sponge-textured clay in the sample HG-E_M5, as seen in: (**a**) a stereomicrograph (green square shows the location of Figure S2b, red square shows the location of Figure S2c; (**b**) SEM BSE image; (**c**) SEM SE image.