

**PERFORMANCE OF LOW-GRADE CALCINED CLAYS AS SUPPLEMENTARY
CEMENTITIOUS MATERIAL IN RELATION TO THEIR GEOLOGICAL
CHARACTERISTICS**

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SUPPORTING INFORMATION (Data of figures)

Table S1. Chemical composition data of paragneiss raw clay (Fig. 3) of the deposit.

Oxide (%) and box plot		Depth range of deposit (m)				
features		[0-10]	[10-20]	[20-30]	[30-40]	[40-50]
SiO ₂	Upper limit	64.34669	65.59818	65.96478	65.39592	64.86498
	Median	59.82110	60.38996	63.32274	61.72994	61.17372
	Lower limit	53.61421	55.78852	56.78718	50.74463	54.30948
Al ₂ O ₃	Upper limit	25.82294	23.96513	24.86873	26.71208	23.11937
	Median	20.09050	20.81338	18.09535	17.97246	20.18447
	Lower limit	18.20378	17.51705	16.70742	16.14358	16.39658
Fe ₂ O ₃	Upper limit	8.81213	8.39052	8.31484	9.00132	7.73648
	Median	7.37973	7.09865	6.88244	7.57432	6.77974
	Lower limit	6.27705	6.29327	5.87165	6.29867	5.89868
TiO ₂	Upper limit	1.19452	1.26666	1.08588	1.30146	1.01799
	Median	0.96791	0.98658	0.90595	0.99507	0.91105
	Lower limit	0.78374	0.88389	0.82193	0.80835	0.77185
Na ₂ O	Upper limit	0.23869	0.25350	0.24550	0.21174	0.11222
	Median	0.12732	0.24610	0.15220	0.12644	0.10600
	Lower limit	0.00000	0.00000	0.00000	0.00000	0.00000
K ₂ O	Upper limit	2.51355	2.60995	2.43719	2.36083	2.00575
	Median	1.78144	2.14129	2.04011	1.44355	1.49414
	Lower limit	0.95198	1.49223	1.52277	0.72767	0.99111

Lower limit corresponds to 25th percentile and upper limit to 75th percentile.

12 **Table S2.** Chemical composition data of ortho-amphibolite raw clay (Fig. 3) of the deposit.

Oxide (%) and box plot features		Depth range of deposit (m)				
		[0-10]	[10-20]	[20-30]	[30-40]	[40-50]
SiO ₂	Uper limit	53.79119	47.93826	59.06262	53.69006	57.58358
	Median	46.53507	43.14720	52.42593	46.74998	57.15378
	Lower limit	39.72140	39.92367	49.73333	46.50979	49.75861
Al ₂ O ₃	Uper limit	28.99638	30.16022	27.9482	29.82769	29.05421
	Median	23.13382	23.94345	21.53626	29.50239	20.40134
	Lower limit	21.78204	21.53626	19.50497	22.47600	17.82789
Fe ₂ O ₃	Uper limit	16.15792	17.54167	10.32561	12.62286	10.79587
	Median	9.94724	14.50931	8.92024	9.36347	10.60128
	Lower limit	8.36890	11.75801	8.54187	8.88240	9.55266
TiO ₂	Uper limit	2.39462	2.70016	1.18858	1.58918	1.30570
	Median	1.23611	2.10945	1.15039	1.19537	0.99167
	Lower limit	1.04854	1.65368	1.04599	1.09352	0.68953
Na ₂ O	Uper limit	0.21322	0.28401	0.23247	0.26416	0.09622
	Median	0.15250	0.24224	0.15161	0.25824	0.08823
	Lower limit	0.00000	0.04854	0.00000	0.00000	0.00000
K ₂ O	Uper limit	1.87880	1.21351	1.96566	1.19729	2.09643
	Median	0.86035	0.78971	1.37101	1.14765	1.89503
	Lower limit	0.31342	0.40314	1.11234	1.07988	1.49605

13 Lower limit corresponds to 25th percentile and upper limit to 75th percentile.

14 **Table S3.** Mineralogical composition data of paragneiss raw clay (Fig. 4) of the deposit.

Mineral (%) and box plot features		Depth range of deposit (m)				
		[0-10]	[10-20]	[20-30]	[30-40]	[40-50]
Kaolinite	Uper limit	32.64139	29.46124	34.32147	36.00156	29.86626
	Median	24.96102	22.47090	26.14608	28.39619	22.80092
	Lower limit	19.09574	18.48071	20.56581	26.62610	15.06054
Micas	Uper limit	20.80677	22.17101	20.93739	17.56307	14.23229
	Median	16.70679	18.09280	17.97669	10.67655	10.53142
	Lower limit	7.08454	12.46168	13.12928	5.45180	7.94807
Quartz	Uper limit	41.88784	43.15683	46.78807	45.87050	44.73818
	Median	36.34336	38.52991	43.25444	40.03317	37.88566
	Lower limit	26.71860	28.18281	26.95287	21.19364	28.49518

15 Lower limit corresponds to 25th percentile and upper limit to 75th percentile. Micas: illite-muscovite and
 16 vermiculite.

17 **Table S4.** Mineralogical composition data of ortho-amphibolite raw clay (Fig. 4) of the deposit.

Mineral (%) and box plot features		Depth range of deposit (m)				
		[0-10]	[10-20]	[20-30]	[30-40]	[40-50]
Kaolinite	Uper limit	38.02665	36.13656	35.65654	44.73198	9.34527
	Median	48.73717	56.17753	46.00704	45.45201	41.52182
	Lower limit	44.13195	45.45201	43.32191	45.12200	28.59120
Micas	Uper limit	15.73440	9.60983	16.30042	11.52558	15.73440
	Median	5.69127	6.50401	11.70699	9.58806	12.36734
	Lower limit	3.04261	3.39818	9.98718	8.90594	11.18451
Quartz	Uper limit	23.98540	20.06131	30.34985	30.33032	38.62753
	Median	16.62529	17.40620	28.43661	12.62311	34.29346
	Lower limit	12.0179	12.03742	17.52334	10.47560	15.90295

18 Lower limit corresponds to 25th percentile and upper limit to 75th percentile. Micas: illite-muscovite and
 19 vermiculite.

20 **Table S5.** Physical variables data of paragneiss raw clay (Fig. 5) of the deposit.

Variable and box plot features		Depth range of deposit (m)				
		[0-10]	[10-20]	[20-30]	[30-40]	[40-50]
SSA (m ² /g)	Uper limit	36.25123	24.47843	24.75479	24.73110	21.47009
	Median	29.72921	20.26202	20.42783	21.32797	21.27270
	Lower limit	24.86533	18.85655	18.99867	18.94340	19.75668
Particle (%)	Uper limit	0.26671	0.21498	0.20697	0.22007	0.22048
	Median	0.25313	0.20629	0.20378	0.20581	0.21912
	Lower limit	0.20853	0.19604	0.18687	0.18497	0.19366
P ₀	Uper limit	0.72823	0.73810	0.73898	0.73986	0.73986
	Median	0.69894	0.68849	0.68819	0.73633	0.73633
	Lower limit	0.65286	0.66773	0.66802	0.63858	0.64403
l* (%)	Uper limit	60.7056	62.07107	61.36860	61.33703	61.66853
	Median	58.17198	59.10334	60.36621	60.14520	60.71349
	Lower limit	55.03851	57.30376	57.28798	58.02202	59.61638
a* (%)	Uper limit	17.92391	17.06358	15.14934	15.06330	13.88572
	Median	16.04193	14.68153	14.11694	13.10067	13.13831
	Lower limit	14.26750	13.23510	13.15982	12.10591	12.89097
b* (%)	Uper limit	29.43283	28.77891	29.07192	28.87539	27.49966
	Median	27.20664	27.79267	27.99278	28.00707	26.78142
	Lower limit	25.80590	26.13822	26.92435	25.27347	25.25918

21 Lower limit corresponds to 25th percentile and upper limit to 75th percentile. SSA: Specific Surface Area.

22 Particle: particles < 5 μm. P₀: order/disorder degree of kaolinite. l*, a*, b*: colorimetric Coordinates.

23 **Table S6.** Physical variables data of ortho-amphibolite raw clay (Fig. 5) of the deposit.

Variable and box plot features		Depth range of deposit (m)				
		[0-10]	[10-20]	[20-30]	[30-40]	[40-50]
SSA (m ² /g)	Uper limit	33.18762	33.17972	25.42594	24.81796	18.16171
	Median	28.34743	28.97910	20.54627	22.59131	18.16171
	Lower limit	26.14447	21.04371	17.21420	20.41204	17.95642
Particle (%)	Uper limit	0.37954	0.36317	0.23046	0.21477	0.16854
	Median	0.31572	0.28721	0.21858	0.19889	0.16752
	Lower limit	0.25238	0.24200	0.20025	0.18321	0.16610
P ₀	Uper limit	0.67921	0.65139	0.77637	0.58617	0.55128
	Median	0.64359	0.62813	0.67921	0.57336	0.54819
	Lower limit	0.61370	0.59927	0.61105	0.55997	0.54421
L* (%)	Uper limit	59.86895	57.05119	60.96607	61.70010	66.12802
	Median	58.68502	55.81990	60.04260	60.77664	63.68122
	Lower limit	54.61229	53.42836	58.28248	60.44513	62.40257
a* (%)	Uper limit	18.10135	18.00457	15.91826	15.26763	11.03587
	Median	16.07957	16.33767	15.51498	11.92309	6.03519
	Lower limit	15.12245	15.29990	12.66513	9.91744	2.42718
b* (%)	Uper limit	30.19037	30.24754	30.82642	30.03314	28.45016
	Median	28.46088	29.42568	28.68957	29.28275	27.50680
	Lower limit	26.59203	27.93560	27.68904	27.52467	26.94222

24 Lower limit corresponds to 25th percentile and upper limit to 75th percentile. SSA: Specific Surface Area.

25 Particle: particles < 5 μm. P₀: order/disorder degree of kaolinite. L*, a*, b*: colorimetric Coordinates.

26 **Table S7.** Mineralogical composition mean data of the weathering profile (Fig. 7) of the clay deposit.

Mineral (%)	Lithology and horizon of weathering profile under Little (1969) and Dearman (1974)					
	Paragneiss			Ortho-amphibolite		
	VI	V	IV-III	VI	V	IV-III
Kaolinite	22.95	19.50	19.30	45.63	51.70	27.90
Illite-muscovite	9.00	28.10	3.20	6.60	9.20	22.75
Vermiculite	2.20	0.00	0.30	0.00	0.00	3.40
Primary minerals	1.75	0.00	10.30	0.60	0.00	3.30
Goethite	0.00	0.40	0.00	4.97	2.80	0.10
Goethite Al	2.45	7.10	0.00	6.20	10.70	2.40
Gibbsite	0.65	5.00	0.00	1.01	0.00	0.00
Rutile + Anatase	1.65	2.20	0.40	2.33	2.90	0.40

27 Primary minerals correspond to K-Feldspar (microcline), Na-Plagioclase (albite), micas (biotite), and
 28 chlorites (clinochlore).

29 **Table S8.** Relationship data between Chemical Index of Alteration (CIA), loss on ignition (LOI),
 30 weathering profile and depth (Fig.8)

Variable	Lithology and horizon of weathering profile under Little (1969) and Dearman (1974)					
	Paragneiss			Ortho-amphibolite		
	VI	V	IV-III	VI	V	IV-III
Average depth range (m)	[0-7]	[7-22]	[22-46]	[0-7]	[7-22]	[22-46]
CIA (%)	91.00	84.39	81.19	94.79	93.86	86.05
LOI (%)	8.35	8.40	7.40	11.67	11.40	8.55

31

32 Data of Figures 9-11 are presented in the attached spreadsheets named "ESM_2".

33 **Table S9.** SAI results data of calcined clay at different temperature (Fig. 12)

Variable and box plot features	Temperature (°C)	Depth range of deposit (m)					
		[0-10]	[10-20]	[20-30]	[30-40]	[40-50]	
SAI at 28 curing days (%)	Uper limit	107.89	103.98	102.51	95.86	91.42	
	Median	650	107.23	103.25	101.68	95.26	89.41
	Lower limit		104.06	100.901	99.61	93.72	88.31
SAI at 28 curing days (%)	Uper limit		108.66	105.70	105.05	101.69	96.00
	Median	750	107.63	104.50	104.06	99.82	94.98
	Lower limit		106.49	103.55	102.88	97.93	93.83
	Uper limit		98.77	93.37	92.13	90.44	88.69
SAI at 28 curing days (%)	Median	850	93.50	91.46	90.78	89.18	87.54
	Lower limit		88.93	87.36	87.54	86.83	86.15

34 Lower limit corresponds to 25th percentile and upper limit to 75th percentile. SAI: Strength Activity Index.

35 **Table S10.** Kaolinite/mica ratio and mica content of ortho-amphibolite raw clay (Fig. 12)

Variable and box plot features	Depth range of deposit (m)					
	[0-10]	[10-20]	[20-30]	[30-40]	[40-50]	
Kaolinite/mica ratio	Uper limit	12.50	10.63	3.70	5.02	2.64
	Median	7.75	6.99	3.70	4.71	2.31
	Lower limit	3.10	5.85	2.82	3.94	0.84
Mica (%)	Uper limit	15.73	9.61	16.30	11.53	15.73
	Median	5.69	6.50	11.71	9.59	12.37
	Lower limit	3.04	3.40	9.99	8.91	11.18

36 Lower limit corresponds to 25th percentile and upper limit to 75th percentile. Mica: illite-musovite +
 37 vermiculite.

38 **Table S11.** Frattini test data of raw and calcined clay of deposit for the different horizons of weathering
 39 profile (Fig. 13).

Variable	Temperature (°C)	Lithology and horizon of weathering profile under Little (1969) and Dearman (1974)					
		Paragneiss			Ortho-amphibolite		
		VI	V	IV-III	VI	V	IV-III
[OH] (mmol/L)	RT	47.7016	46.0567	47.8853	50.2314	51.3340	46.9943
	650	37.6925	42.0934	35.0243	39.0395	39.9748	41.9692
	750	38.9855	43.8507	40.3502	42.1651	43.4553	44.9546
	850	39.0576	46.0032	39.5375	43.6688	46.0347	45.1817
[CaO] (mmol/L)	RT	23.6257	20.9855	26.6882	23.6065	23.5158	22.3661
	650	12.5543	14.3875	10.0989	13.0890	11.6785	13.8471
	750	9.8934	13.1516	9.5560	8.7630	8.1655	13.1580
	850	11.2637	11.4291	12.7834	12.3124	12.7572	11.2005

40 RT: room temperature 25 °C.