

Supplementary Materials

Table S1. Fundamental information about study sites and soil classification

Profile	Horizons†	longitude	latitude	Altitude m	Terrain‡	Parent rock/ material	Vegetation type¶	Chinese Soil Taxonomy (Soil subgroup)	Soil Taxonomy (Soil subgroup)	World Reference Base for Soil Resources (Second Level)
CS18	Ah-Bt-BC-C	113.325	28.551	100	LH-LS	Granite	SH	Typic Argi-Udic Ferrosols	Typic Paleudults	Hyperdystric Chromic Sideralic Cambisols
CZ06	Ah-Bw-BC-C	113.682	26.187	350	HH-MS		SH	Red Ferri-Udic Cambosols	Typic Dystrudepts	Dystric Cambisols
HY07	Ah-Bw1-Bw2-Bw3-Bw4	112.799	27.312	81	LH-LS		SH	Typic Hapli-Udic Ferrosols	Oxic Dystrudepts	Hyperdystric Sideralic Cambisols
LY03	Ah-Bt1-Bt2-Bt4	114.016	28.451	179	LM-MS		AR	Typic Argi-Udic Ferrosols	Typic Paleudults	Chromic Acrisols
LY04	Ah-Bt-C	114.055	28.425	482	LM-LS		M-F	Typic Ali-Udic Argosols	Typic Paleudults	Chromic Alisols
LY21	Ah-BC-C	114.067	28.428	650	LM-MS		M-F	Xanthic Ali-Udic Cambosols	Typic Dystrudepts	Hyperdystric Cambisols
SY08	Ah-Bw1-Bw2-Bw3-Bw4	110.946	27.418	416	HH-LS		SH	Xanthic Hapli-Udic Ferrosols	Oxic Dystrudepts	Hyperdystric Sideralic Cambisols
XT02	Ah-Bt1-Bt2-Bt3-C	112.317	27.815	89	LH-LS		SH	Typic Argi-Udic Ferrosols	Typic Paleudults	Chromic Acrisols
YY05	Ah-Bt1-Bt2-BC-C	113.020	28.567	87	LH-LS		M-F	Typic Argi-Udic Ferrosols	Typic Paleudults	Acric Umbrisols
YY10	Ah-Bw1-Bw2-BC	113.509	29.023	128	LH-MS		M-F	Typic Hapli-Udic Ferrosols	Oxic Dystrudepts	Sideralic Chromic Cambisols
CD01	Ah-Bw1-Bw2-Bw3	111.936	28.772	58	LH-US	Quaternary red clays (QRC)	M-F	Typic Ali-Udic Cambosols	Typic Dystrudepts	Hyperdystric Chromic Cambisols
CD06	Ah-Bw1-Bw2-Bw3	111.617	29.219	66	LH-TS		AR	Typic Ali-Udic Cambosols	Typic Humudepts	Cambic Umbrisols
CS02	Ah-Bt1-Bt2-Bs	113.166	28.205	63	LH-MS		SH	Typic Argi-Udic Ferrosols	Typic Paleudults	Rhodic Ferric Acrisols
CS11	Ah-Apb-Bls-Blst1-Blst2	112.657	28.470	41	LH-MS		AR	Typic Ali-Udic Argosols	Typic Plinthudults	Aric Plinthosols
CS15	Ah-Bw1-Bw2-Bw3-Bw4	113.499	28.306	109	LH-LS		AR	Rhodic Hapli-Udic Ferrosols	Oxic Dystrudepts	Dystric Rhodic Sideralic Cambisols
XT03	Ah-Bw-Bt1-Bt2	112.469	27.732	77	LH-LS		SH	Typic Ali-Udic Argosols	Typic Paleudults	Chromic Alisols
YY04	Ah-Bw-Bt1-Bt2-Bt3	113.055	28.742	69	LH-US		M-F	Plinthic Ali-Udic Cambosols	Typic Dystrudepts	Plinthofractic Plinthosols
YY06	Ah-AB-Bw-Bs1-Bs2	112.928	28.637	56	LH-LS		M-F	Mottlic Ali-Udic Cambosols	Typic Dystrudepts	Dystric Chromic Cambisols
YY07	Ah-Bt-Blst1-Blst2	113.541	29.488	83	LH-MS		SH	Plinthic Ali-Udic Cambosols	Typic Plinthudults	Alic Umbric Plinthosols
ZZ08	Ah-Bw1-Bw2-Bw3	113.365	27.072	105	LH-LS		M-F	Typic Argi-Udic Ferrosols	Typic Paleudults	Rhodic Acrisols
CS16	Ah-Bt-BC-C	113.487	28.220	126	LH-MS	Slate	SH	Typic Argi-Udic Ferrosols	Typic Paleudults	Haplic Acrisols
SY01	Ah-AC	110.516	27.105	379	HH-TS		M-F	Humic Ali-Udic Cambosols	Typic Humudepts	Cambic Umbrisols
XT04	Ah-AB-Bt-BC	112.498	27.958	107	LH-MS		M-F	Typic Argi-Udic Ferrosols	Typic Paleudults	Dystric Chromic Sideralic Cambisols
XX03	Ah-Bt1-Bt2-BC	109.919	29.281	421	HH-BS		M-F	Xanthic Ali-Udic Argosols	Typic Paleudults	Haplic Alisols
YIY02	Ah-AC	111.537	28.420	107	LH-BS		M-F	Lithic Usti-Orthic Primosols	Lithic Ustorthents	Dystric Lithic Leptosols
YIY07	Ah-Bw-BC-C	112.300	28.531	59	LH-MS		M-F	Typic Ali-Udic Cambosols	Typic Humudepts	Cambic Umbrisols

YY08	Ah-Bw-BC	113.264	29.490	48	LH-MS	M-F	Typic Hapli-Udic Ferrosols	Oxic Dystrudepts	Hyperdystric Sideralic Cambisols
YY09	Ah-Bw-C	113.438	29.087	103	LH-LS	SH	Typic Ali-Udic Cambosols	Typic Dystrudepts	Hyperdystric Chromic Cambisols
YZ01	Ah-Bt-C	111.443	26.554	209	HH-MS	SH	Xanthic Ali-Udic Argosols	Typic Paleudults	Haplic Alisols
ZJ05	Ah-AB-Bt-C	110.255	29.372	484	HH-TS	M-F	Humic Ferri-Udic Argosols	Typic Paleudults	Haplic Luvisols
CZ03	Ah-Bw-Ahb-Bwb-BCb	113.112	25.443	313	HH-MS	M-F	Typic Ferri-Udic Cambosols	Typic Dystrudepts	Dystric Cambisols
CZ04	Ah-Bt1-Bt2-Bt3	112.628	25.588	404	HH-TS	M-F	Humic Ferri-Udic Argosols	Ultic Hapludalfs	Luvic Umbrisols
CZ05	Ah-Bw-Bt1-Bt2	112.465	25.687	255	HH-MS	M-F	Typic Argi-Udic Ferrosols	Typic Paleudults	Acric Umbrisols
SY04	Ah-Bt-Bts-Btsx	110.341	26.434	462	LM-LS	SH	Red Ferri-Udic Argosols	Typic Rhodudalfs	Placic Rhodic Ferric Luvisols
SY07	Ah-Bs1-Bs2-Bs3	110.345	26.961	343	LH-BS	M-F	Mottlic Hapli-Udic Ferrosols	Oxic Dystrudepts	Dystric Sideralic Cambisols
YZ03	Ah-Bw-Bt1-Bt2-Bt3	111.646	25.393	201	LH-BS	M-F	Typic Argi-Udic Ferrosols	Typic Paleudults	Acric Umbrisols
YZ06	Ah-Bt-Bts-Bts1-Bts2-Bts3	112.153	25.588	290	HH-MS	M-F	Mottlic Argi-Udic Ferrosols	Aquic Paleudults	Ferric Lixisols
YZ08	Ah-Bts1-Bts2-Bts3	112.349	25.876	380	HH-MS	SH	Trunc Argi-Udic Ferrosols	Typic Paleudults	Chromic Ferric Acrisols
ZJJ01	Ah1-Ah2-Bs1-Bs2	111.251	29.560	124	LH-LS	M-F	Typic Ferri-Udic Cambosols	Typic Eutrudepts	Eutric Cambisols
ZZ05	Ah-Bt1-Bt2-Bt3	113.657	26.383	263	LH-MS	M-F	Typic Argi-Udic Ferrosols	Typic Paleudults	Acric Umbrisols
CD02	Ah1-Ah2-Bt-BC	111.233	29.666	197	LH-MS	SH	Typic Ferri-Udic Argosols	Typic Paleudults	Alic Umbrisols
CZ02	Ah-Bw-BC	113.457	25.773	606	LM-MS	SH	Typic Ferri-Udic Cambosols	Typic Dystrudepts	Dystric Cambisols
SY03	Ah-AB-Bw-BC	110.079	26.670	317	LH-MS	M-F	Typic Hapli-Udic Ferrosols	Oxic Dystrudepts	Cambic Umbrisols
SY06	Ah-Bw-BC	110.726	26.472	375	LH-MS	AR	Typic Ali-Udic Cambosols	Typic Dystrudepts	Hyperdystric Cambisols
XT05	Ah-Bw-BC1-BC2	112.694	27.744	59	LH-BS	M-F	Typic Ali-Udic Cambosols	Typic Dystrudepts	Dystric Chromic Cambisols
YIY01	Ah-AB-Bw-C	111.263	28.312	226	LH-BS	M-F	Typic Ferri-Udic Cambosols	Typic Dystrudepts	Eutric Cambisols
YZ02	Ah-Bw1-Bw2-BC	111.754	26.098	238	LH-US	SH	Typic Ali-Udic Cambosols	Typic Dystrudepts	Hyperdystric Chromic Cambisols
YZ04	Ah-AC-C	111.182	25.356	216	LH-MS	AR	Typic Usti-Orthic Primosols	Typic Udorthents	Dystric Leptosols
YZ07	Ah-Bw-BC	112.347	25.420	309	HH-MS	M-F	Typic Ali-Udic Cambosols	Typic Dystrudepts	Hyperdystric Cambisols
ZZ06	Ah-AB-Bw1-Bw2-Bw3	113.656	26.517	190	LH-BS	SH	Typic Ali-Udic Cambosols	Typic Dystrudepts	Hyperdystric Cambisols

† h: illuvial organic matter accumulation; t: illuvial accumulation of silicate clay; w: weak color or structure within B; s: illuvial accumulation of ferric oxide; l: plinthite; x: fragipan characteristics; b: buried genetic horizon

‡ LH-TS: Low Hill-Top of slope; LH-US: Low Hill-Upslope; LH-MS: Low Hill-Mesoslope; LH-LS: Low Hill-Lower Slope; LH-BS: Low Hill-Bottom slopes; HH-US: High Hill-Upslope; HH-MS: High Hill-Mesoslope; HH-LS: High Hill-Lower Slope; HH-BS: High Hill-Bottom slopes; LM-MS: Low Mountain-Mesoslope; LM-LS: Low Mountain-Lower Slope

¶ AR: Arable; M-F: Mixed-forest; SH: Shrub

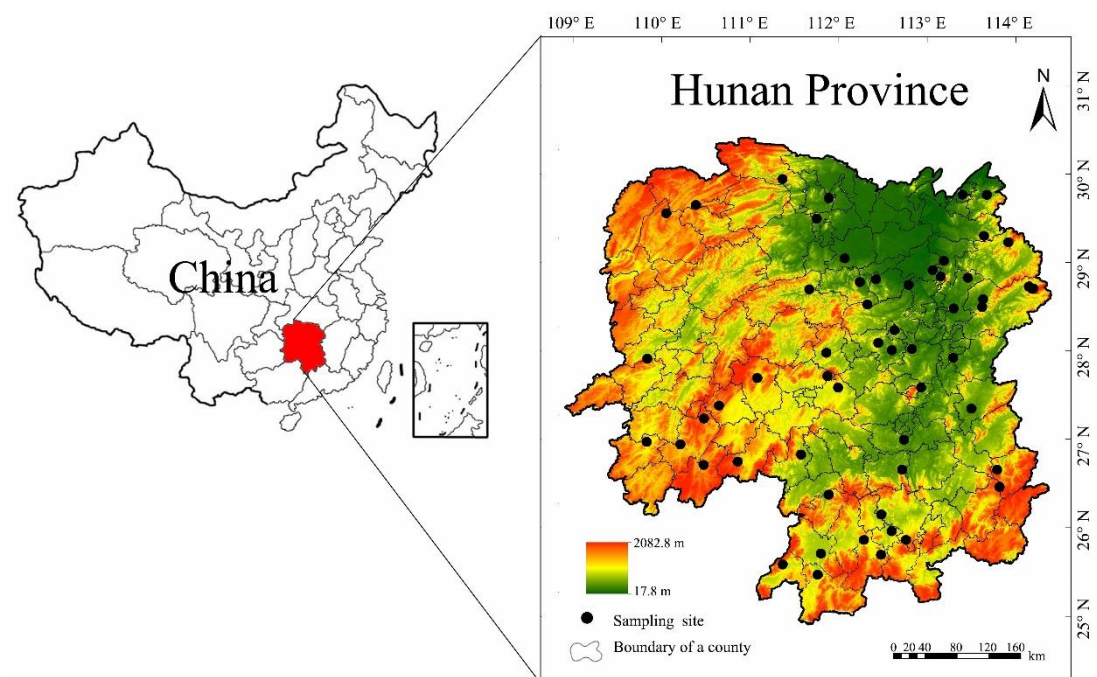


Figure S1. The study area and geographic distribution of sampling sites

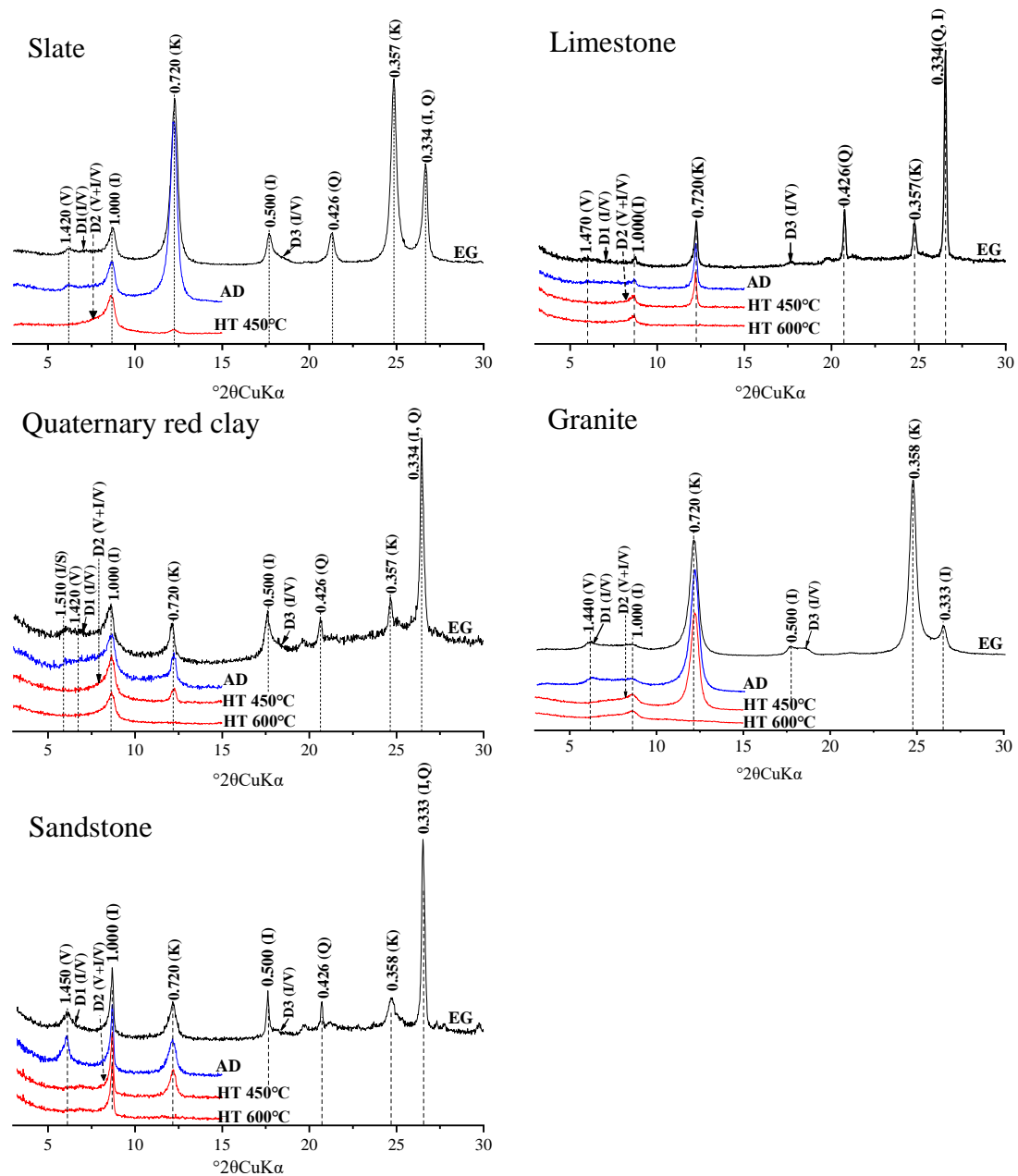


Figure S2. X-ray diffraction patterns of the representative upland soil profiles derived from different parent materials (K: kaolinite; I: illite; V: vermiculite; I/S: illite/smectite mixed-layer mineral; I/V: illite/vermiculite mixed-layer mineral; Q: quartz; AD: air-dried sample; EG: ethylene-glycol saturated sample; HT 450°C: sample heated at 450°C; HT 600°C: sample heated at 600°C)

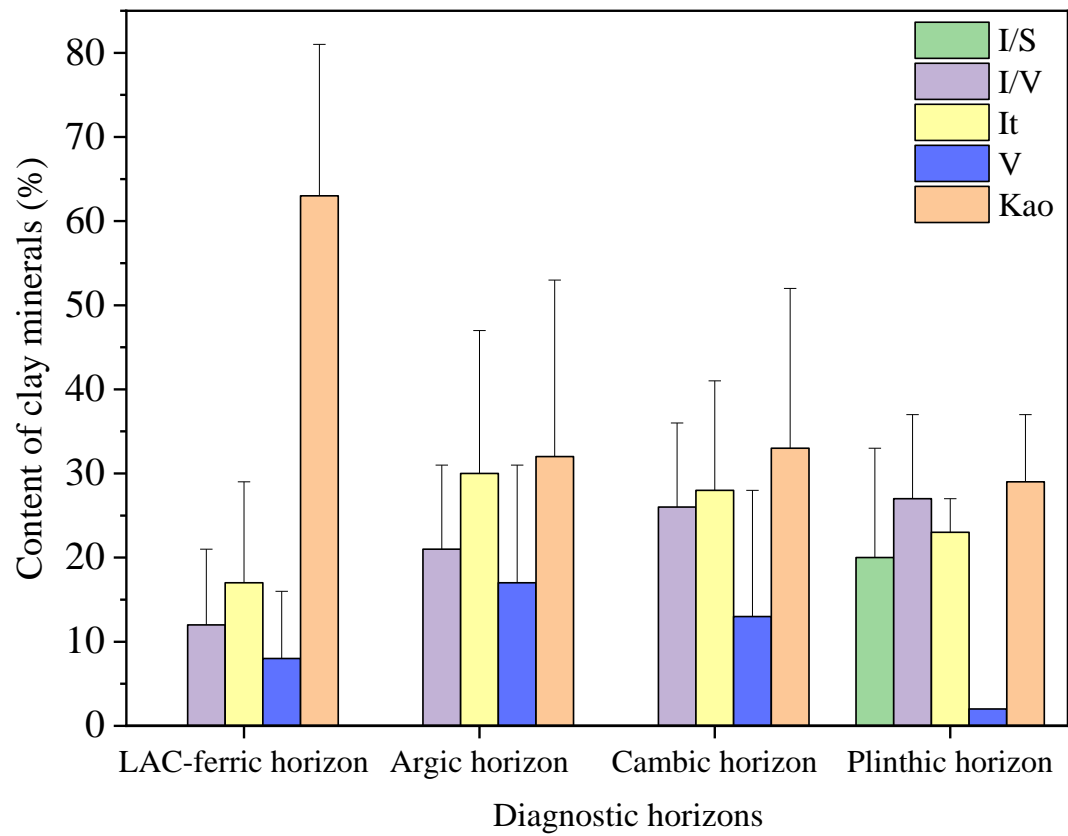


Figure S3. Relative content of clay minerals of different diagnostic horizons (Kao: kaolinite; It: illite; V: vermiculite; I/S: illite/smectite mixed-layer mineral; I/V: illite/vermiculite mixed-layer mineral)

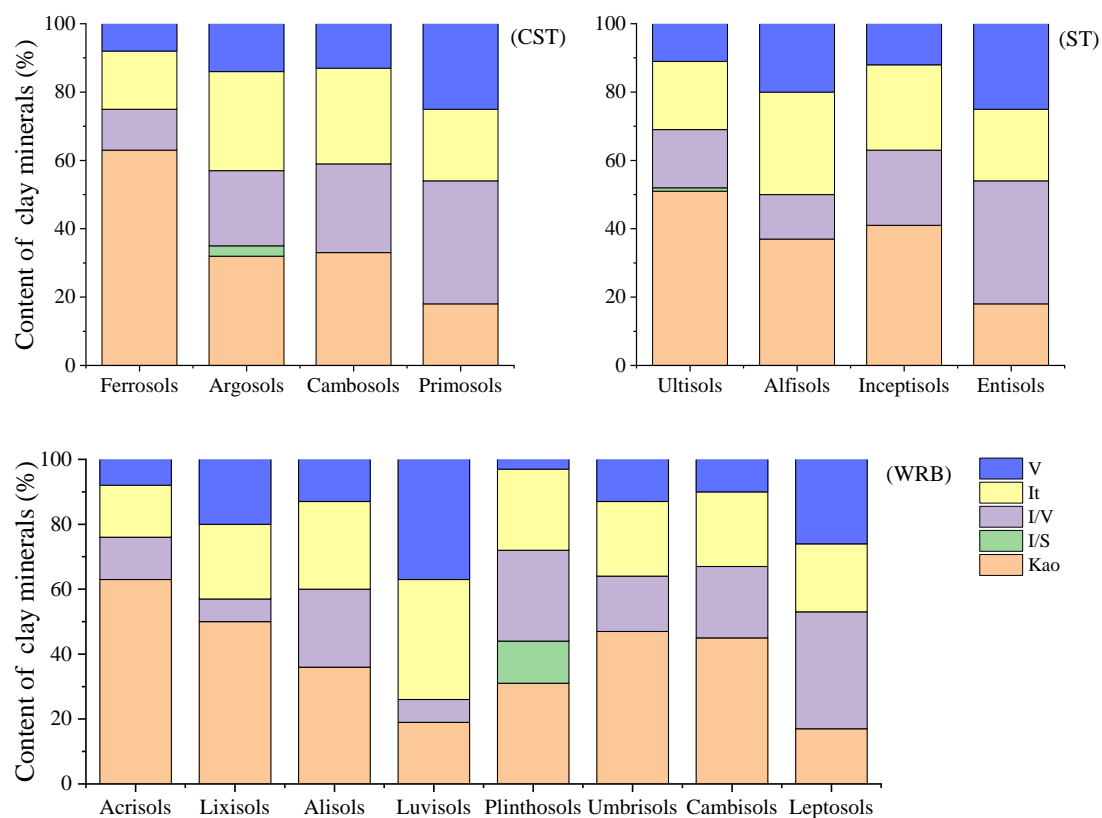


Figure S4. Relative contents of clay minerals of different soil types (i.e., soil orders) (Kao: kaolinite; It: illite; V: vermiculite; I/S: illite/smectite mixed-layer mineral; I/V: illite/vermiculite mixed-layer mineral; CST: Chinese Soil Taxonomy; ST: Soil Taxonomy; WRB: World Reference Base for Soil Resources)