




## Short Paper

# Recommended abbreviations for the names of clay minerals and associated phases

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A large number of research papers and book articles are published each year on the topic of clay minerals and their accessory phases in clay-bearing soils, sediments and rocks. These publications commonly use mineral abbreviations to save valuable journal space in the text, tables and figures. Despite the existence of an established convention for abbreviating rock-forming minerals (Kretz, 1983), there is still a wide range of symbols used in the clay minerals community that often follow no common set of rules. Normalizing these abbreviations will help to bring more clarity and consistency to research papers.

Kretz (1983) was the first to provide a systemized list of abbreviations for rock-forming minerals, which was expanded by Siivola & Schmid (2007) and Whitney & Evans (2010). The abbreviations are typically two to three letters long, starting with a capital letter and with the rest being lower case. Four-letter abbreviations are only used to include prefixes (e.g. ferro- or magnesio-) and to preserve consistency between mineral abbreviations (e.g. Prl for pyrophyllite and Fprl for ferropyrophyllite). The first letter of a chosen symbol represents the initial letter of the mineral name and the subsequent letters are selected from the rest of the name. Abbreviations are also selected to avoid correspondence with the symbols of elements or other minerals already designated with such a representation.

Following a check of 166 post-millennium research articles (not journal-specific) in the author's literature collection, which were compiled using the Internet search words 'clay minerals' and 'quantification', a total of 472 mineral abbreviations common to clay materials and clay-sized (<2 µm) fractions were examined. Some 33% were found to be consistent with the guidelines initially laid out by Kretz (1983), and the remaining 67% adopted a diverse range of abbreviations, often with no apparent system. In addition, 34% of studies used initials such as 'I' for illite, 'S' for smectite and 'V' for vermiculite, but this practice quickly becomes limited, as many minerals share the same first letter (e.g. saponite, stevensite, sepiolite). As an example of the number of symbols used for the same mineral, there were 11 types of abbreviation for kaolinite: 23% using the recommended 'Kln' abbreviation of Kretz (1983), 34% using 'K', 14% using 'Kao', 9% using 'Kaol' and the remaining 20% using one of the following: 'Ka', 'KA', 'ka', 'k', 'kaol', 'Ko' or 'Kl'. A check of other

common clay minerals revealed similar diversity in the symbols used: illite with nine variations, smectite with eight variations, vermiculite with seven variations and chlorite with ten variations. Even within the systems of Kretz (1983), Siivola & Schmid (2007) and Whitney & Evans (2010), some differences occur. For example, Kretz (1983) recommended 'Ill' for illite, whereas Whitney & Evans (2010) proposed 'Ilt'.

This short note presents a comprehensive list of 291 abbreviations (123 established and 168 new) for the names of clay minerals and associated phases related to clay science which conform with the Kretz (1983) approach and the updated recommendations of Whitney & Evans (2010). The clay minerals included in Table 1 represent all known hydrous aluminosilicates and a broad range of accompanying phases in the form of oxides, hydroxides, oxyhydroxides and zeolites. The compilation includes all of the clay-related minerals listed by the Clay Minerals Society Glossary of Clay Science, Part 2 ([http://clays.org/CMS\\_Nomenclature\\_Glossary\\_April\\_2018\\_Part\\_2.pdf](http://clays.org/CMS_Nomenclature_Glossary_April_2018_Part_2.pdf)) and available information on the nomenclature of micas (Rieder *et al.*, 1998). Micas and other phyllosilicate groups are included because they are commonly present in clay deposits and clay-bearing rocks. These crystalline sheet silicate minerals are prone to alteration to clay minerals *via* layer-by-layer replacements or *via* dissolution and neocrystallization when reacted under low-temperature hydrous conditions. Most of the minerals selected are recognized by the International Mineralogical Association (IMA; <http://cnmnc.main.jp>), and their status is added to Table 1 accordingly. The compilation of abbreviations is also largely compatible with *The Canadian Mineralogist* symbol list of rock- and ore-forming minerals (<https://www.mineralogicalassociation.ca/wordpress/wp-content/uploads/2020/01/symbols.pdf>).

Examples of common mixed-layered clay minerals (e.g. illite-smectite, chlorite-serpentine) are included whereby all combinations of mixed-layered structures can be described by combining the abbreviations of the phase components present and placing them in alphabetical order. Some additional accessory minerals found in clays and the clay-sized size fraction are also included at the bottom of Table 1, along with a shortlist of some discredited clay mineral names.

The proposed compilation of symbols is provided to encourage uniformity in abbreviating mineral names within the clay mineral community and to achieve compatibility with the procedures adopted by the mineral sciences as a whole. New symbols were selected to be as unique as possible for any given name and to leave options for defining new abbreviations for remaining

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**Table 1.** List of abbreviations for clay minerals and associated phases.

Mineral name	Symbol	Status	Mineral name	Symbol	Status
<b>Aliettite</b>	Ali	Rd	<b>Laumontite</b> (a, b, c, d)	Lmt	A
<b>Allophane</b>	Alp	G	<b>Lennilapeite</b>	Lnl	A
<b>Aluminoceladonite</b>	Acel	A	<b>Lepidocrocite</b> (d)	Lpc	A
<b>Amesite</b> (c)	Ame	G	<b>Lepidolite</b> (a, b, c, d)	Lpd	GROUP
<b>Anandite</b>	Ana	A	<b>Lithiophorite</b>	Lpr	G
<b>Annite</b> (a, b, c, d)	Ann	A	<b>Lizardite</b> (a, b, c, d)	Lz	G
<b>Antigorite</b> (a, b, c, d)	Atg	Rd	<b>Lobanovite</b>	Lbv	A
<b>Armbusterite</b>	Abr	A	<b>Loughlinite</b> (d)	Lou	A
<b>Aspidolite</b> (d)	Asp	Rd	<b>Magadiite</b>	Mgd	A
<b>Astrophyllite</b> (d)	Ast	G	<b>Manandonite</b>	Mnd	G
<b>Baileychlore</b>	Blc	A	<b>Manganarsite</b>	Mna	A
<b>Balestraitite</b>	Bls	A	<b>Manganite</b>	Mnn	G
<b>Bannisterite</b>	Ban	A	<b>Manganosite</b> (c)	Mng	G
<b>Bayerite</b>	Byr	G	<b>Manjiroite</b>	Mji	A
<b>Beidellite</b> (c)	Bei	G	<b>Margarite</b> (a, b, c)	Mrg	A
<b>Bementite</b>	Bem	Rd	<b>Masutomilite</b>	Msu	A
<b>Berthierine</b> (d)	Brh	G	<b>Mcgillite</b>	Mcg	A
<b>Biotite</b> (a, b, c, d)	Bt	GROUP	<b>Meixnerite</b>	Mxn	A
<b>Birnessite</b>	Bir	G	<b>Mica</b> (b)	Mca	GROUP
<b>Bityite</b>	Bty	A	<b>Minehillite</b>	Mhl	A
<b>Bixbyite</b> (c)	Bxb	G	<b>Minnesotaite</b> (b, c)	Mns	G
<b>Böhmite</b> (a, b, c, d)	Bhm	G	<b>Mogánite</b> (c)	Mog	Rn
<b>Borcookeite</b>	Bckt	A	<b>Montdorite</b>	Mdr	Rd
<b>Boromuscovite</b>	Bms	A	<b>Montmorillonite</b> (a, b, c, d)	Mnt	G
<b>Brammalite</b>	Bml	GROUP	<b>Mordenite</b> (c, d)	Mor	A
<b>Brindleyite</b>	Bly	A	<b>Motukoreaitite</b>	Mtu	Q
<b>Brinrobertsite</b>	Brb	A (ML)	<b>Mountkeithite</b>	Mke	A
<b>Brucite</b> (a, b, c, d)	Brc	G	<b>Muscovite</b> (a, b, c, d)	Ms	A
<b>Bulgakite</b>	Bgk	A	<b>Nacrite</b>	Ncr	G
<b>Buserite</b>	Bsr	A	<b>Nafertisite</b>	Naf	A
<b>Cairncrossite</b>	Ccs	A	<b>Nalivkinite</b>	Nlv	A
<b>Carlosturanite</b>	Csr	A	<b>Nanpingite</b>	Npg	A
<b>Carrboydite</b>	Cby	Q	<b>Nelenite</b>	Nln	A
<b>Caryopilite</b> (d)	Cpl	A	<b>Népouite</b>	Npo	G
<b>Celadonite</b> (b, c, d)	Cel	A	<b>Nimite</b>	Nim	A
<b>Chalcophanite</b>	Cph	G	<b>Niobokupletskite</b>	Nbk	A
<b>Chamosite</b> (b, c, d)	Chm	G	<b>Niobophyllite</b>	Nbp	A
<b>Chernykhite</b>	Cyk	A	<b>Nontronite</b>	Non	A
<b>Chlormagaluminite</b>	Cma	A	<b>Nordstrandite</b>	Nsd	A
<b>Chlorite</b> (a, b, c, d)	Chl	GROUP	<b>Norrishite</b>	Nrr	A
<b>Chlorite-serpentine</b>	Chl-Srp	ML	<b>Nsutite</b>	Nsu	A
<b>Chlorite-smectite</b>	Chl-Sme	ML	<b>Odinite</b>	Odn	A
<b>Chromphyllite</b>	Crp	A	<b>Opal</b> (c)	Opl	G
<b>Chrysotile</b> (a, b, c, d)	Ctl	Rd	<b>Orlymanite</b>	Orl	A
<b>Clinochlore</b> (b, c)	Clc	G	<b>Oxykinoshitalite</b>	Okns	A
<b>Clinoptilolite</b> (c, d)	Cpt	A	<b>Palygorskite</b> (c)	Plg	G
<b>Clinotobermorite</b>	Ctbn	Rd	<b>Paragonite</b> (a, b, c, d)	Pg	A
<b>Clintonite</b>	Cln	A	<b>Parsettensite</b>	Psn	G
<b>Coalingite</b>	Clg	A	<b>Pecoraite</b>	Pco	A
<b>Cookeite</b> (d)	Ckt	Rd	<b>Pennantite</b>	Pnn	G
<b>Coombsite</b>	Cmb	A	<b>Perraultite</b>	Prt	Rd
<b>Coronadite</b>	Cor	G	<b>Phillipsite</b> (c)	Php	A
<b>Corrensites</b> (c, d)	Crr	G (ML)	<b>Phlogopite</b> (a, b, c, d)	Phl	G
<b>Cristobalite</b> (a, b, c, d)	Crs	A	<b>Plombièrite</b>	Plm	Rd
<b>Cronstedtite</b>	Cro	G	<b>Polyolithionite</b> (d)	Pln	A
<b>Cryptomelane</b>	Cml	A	<b>Preiswerkite</b>	Pwk	A
<b>Desautelsite</b>	Des	A	<b>Priderite</b>	Pdr	G
<b>Devitoite</b>	Dvt	A	<b>Pyroaurite</b> (d)	Pya	Rd
<b>Diaspore</b> (a, b, c, d)	Dsp	G	<b>Pyrochroite</b> (d)	Pyc	G
<b>Dickite</b> (c, d)	Dck	G	<b>Pyrolusite</b> (d)	Pyl	A
<b>Donbassite</b>	Dbss	G	<b>Pyrophyllite</b> (a, b, c, d)	Prl	G
<b>Dozyite</b>	Doz	G	<b>Pyrosmalite</b>	Pys	Rd
<b>Eastonite</b> (c, d)	Eas	Rd	<b>Quartz</b> (c)	Qz	A
<b>Eggletonite</b>	Egg	A	<b>Raite</b>	Rai	A
<b>Ephesite</b>	Eph	A	<b>Roscoelite</b> (d)	Rcl	A
<b>Erionite</b> (c)	Eri	A	<b>Salioite</b> (d)	Sal	A
<b>Falcondoite</b>	Fcd	A	<b>Saponite</b> (c, d)	Sap	G
<b>Fedorite</b>	Fdr	A	<b>Sauconite</b>	Sau	G
<b>Feitknechtite</b>	Fkn	A	<b>Schallerite</b>	Slr	G
<b>Ferrihollandite</b>	Fhol	A	<b>Seidozerite</b>	Sdz	Rd
<b>Ferrihydrite</b>	Fhy	A	<b>Sepiolite</b> (b, c, d)	Sep	G

(Continued)

Table 1. (Continued.)

Mineral name	Symbol	Status	Mineral name	Symbol	Status
<b>Ferripyrophyllite</b>	Fprl	A	<b>Serpentine</b> (a, b, c, d)	Srp	GROUP
<b>Ferrisepiolite</b>	Fsep	A	<b>Shafanovskite</b>	Sfn	A
<b>Ferroaluminoceladonite</b>	Facel	Rn	<b>Shirokshinite</b> (d)	Shk	A
<b>Ferrociladonite</b> (c)	Fcel	A	<b>Siderophyllite</b> (d)	Sid	A
<b>Ferrokinoshitalite</b>	Fkns	A	<b>Smectite</b> (b, c)	Sme	GROUP
<b>Ferrosaponite</b>	Fsap	A	<b>Smectite-talc</b>	Sme-Tlc	ML
<b>Foshagite</b> (c, d)	Fos	G	<b>Stevensite</b> (c)	Stv	Q
<b>Fraipontite</b>	Fpt	G	<b>Stichtite</b>	Stt	Rd
<b>Franklinfurnaceite</b>	Fkf	A	<b>Stilbite</b> (a, b, c, d)	Stb	A
<b>Franklinphilite</b>	Fkp	A	<b>Stilpnomelane</b> (a, b, c, d)	Stp	A
<b>Friedelite</b>	Fdl	G	<b>Strontiomelane</b>	Sml	A
<b>Ganophyllite</b>	Gnp	G	<b>Sudoite</b> (c)	Sud	Rd
<b>Ganterite</b>	Gtr	A	<b>Suhailite</b>	Suh	A
<b>Gibbsite</b> (a, b, c, d)	Gbs	A	<b>Svanbergite</b>	Svb	A
<b>Glagolevite</b>	Ggl	A	<b>Swinefordite</b>	Sfd	A
<b>Glauconite</b> (a, b, c, d)	Glt	GROUP	<b>Tainiolite</b> (d)	Tai	G
<b>Glauconite-smectite</b>	Glt-Sme	ML	<b>Takanelite</b>	Tkn	A
<b>Goethite</b> (c)	Gth	A	<b>Takovite</b>	Tkv	A
<b>Gonyerite</b>	Gye	G	<b>Talc</b> (a, b, c, d)	Tlc	G
<b>Greenalite</b> (b, c, d)	Gre	G	<b>Tarbagataite</b>	Tbg	A
<b>Grooutite</b>	Gro	G	<b>Tetraferriannite</b>	Tfann	Rn
<b>Guidottiite</b>	Gdt	A	<b>Tetraferriphlogopite</b>	Tfphl	Rn
<b>Gyrolite</b>	Gyr	G	<b>Tobelite</b>	Tbl	A
<b>Halloysite</b>	Hly	G	<b>Tobermorite</b>	Tbm	Rd
<b>Hausmannite</b> (d)	Hsm	G	<b>Todorokite</b>	Tdr	A
<b>Hectorite</b>	Htr	Q	<b>Tosudite</b>	Tos	G (ML)
<b>Hendricksite</b>	Hds	A	<b>Tridymite</b> (a, b, c, d)	Trd	G
<b>Henrymeyerite</b> (d)	Hmy	A	<b>Trilithionite</b> (d)	Tln	Rd
<b>Heulandite</b> (a, b, c, d)	Hul	A	<b>Truscottite</b>	Tst	G
<b>Hisingerite</b>	Hsg	G	<b>Tupersuatsiaite</b>	Tup	A
<b>Hollandite</b> (d)	Hol	Rd	<b>Varennesite</b>	Vrn	A
<b>Honessite</b>	Hon	A	<b>Vermiculite</b> (a, b, c, d)	Vrm	G
<b>Hydrobiotite</b>	Hbt	Rd (ML)	<b>Vernadite</b>	Vnd	Q
<b>Hydrohonessite</b>	Hhon	A	<b>Volkonskoite</b>	Vkn	Rd
<b>Hydrotalcite</b> (d)	Htc	GROUP	<b>Wairakite</b> (b, c, d)	Wrk	A
<b>Hydroxide-interlayered smectite</b>	HIS	ML	<b>Wermlandite</b>	Wld	A
<b>Hydroxide-interlayered vermiculite</b>	HIV	ML	<b>Willemsite</b>	Wls	A
<b>Illite</b> (c)	Illt	GROUP	<b>Windhoekite</b>	Whk	A
<b>Illite-smectite</b>	Illt-Sme	ML	<b>Wonesite</b>	Wns	A
<b>Illite-vermiculite</b>	Illt-Vrm	ML	<b>Woodwardite</b>	Wwd	G
<b>Imogolite</b>	Imo	Rd	<b>Yakhontovite</b>	Ykh	A
<b>Innsbruckite</b>	Ibk	A	<b>Yangzhumingite</b>	Yzh	A
<b>Iowaite</b>	Iow	A	<b>Yofortierite</b>	Yof	A
<b>Jennite</b>	Jnn	A	<b>Zeolite</b> (b, c)	Zeo	GROUP
<b>Kalifersite</b>	Klf	A	<b>Zincsilite</b>	Zs	Q
<b>Kaolin</b>	Kn	Group	<b>Zinnwaldite</b> (c, d)	Znw	GROUP
<b>Kaolinite</b> (a, b, c, d)	Kln	A	<b>Zircophyllite</b>	Zcp	Rd
<b>Kaolinite-smectite</b>	Kln-Sme	ML	<b>Zussmanite</b>	Zus	A
<b>Kellyite</b>	Kly	A			
<b>Kerolite</b>	Krl	NL	<i>Discredited</i>		
<b>Kinoshitalite</b> (d)	Kns	A	<b>Orthochamosite</b>	Ochm	D
<b>Kulkeite</b>	Klk	A	<b>Phengite</b> (c)	Ph	D
<b>Kupletskite</b>	Kpt	G	<b>Ripidolite</b>	Rpd	D
<b>Lamprophyllite</b> (d)	Lmp	Rd	<b>Sericite</b> (c)	Ser	D
			<b>Sheridanite</b>	Shd	D
<i>Other accessories</i>					
<b>Actinolite</b> (a, b, c, d)	Act	Rd	<b>K-feldspar</b> (a, b, c, d)	Kfs	I
<b>Albite</b> (a, b, c, d)	Ab	G	<b>Magnesite</b> (a, b, c, d)	Mgs	A
<b>Anatase</b> (a, b, c, d)	Ant	A	<b>Magnetite</b> (a, b, c)	Mag	G
<b>Ankerite</b> (a, b, c, d)	Ank	G	<b>Microcline</b> (a, b, c, d)	Mc	G
<b>Anorthite</b> (a, b, c, d)	An	A	<b>Olivine</b> (a, b, c, d)	Ol	GROUP
<b>Apatite</b> (a, b, c, d)	Ap	GROUP	<b>Orthoclase</b> (a, b, c, d)	Or	A
<b>Aragonite</b> (a, b, c, d)	Arg	G	<b>Plagioclase</b> (a, b, c, d)	Pl	GROUP
<b>Baryte</b> (a, b, c, d)	Brt	A	<b>Pyrite</b> (a, b, c, d)	Py	G
<b>Borax</b>	Brx	G	<b>Pyrrhotite</b>	Pyh	G
<b>Calcite</b> (a, b, c, d)	Cal	G	<b>Ranciéite</b>	Rnc	G
<b>Crandallite</b> (d)	Cdl	Rd	<b>Rutile</b> (a, b, c, d)	Rt	G
<b>Diopside</b> (a, b, c, d)	Di	A	<b>Sanidine</b> (a, b, c, d)	Sa	G
<b>Dolomite</b> (a, b, c, d)	Dol	G	<b>Schwertmannite</b>	Swm	A
<b>Epidote</b> (a, b, c, d)	Ep	G	<b>Siderite</b> (a, b, c, d)	Sd	A

(Continued)

**Table 1.** (Continued.)

Mineral name	Symbol	Status	Mineral name	Symbol	Status
<b>Graphite</b> (a, b, c, d)	Gr	G	<b>Spinel</b> (a, b, c, d)	Spl	G
<b>Greigite</b> (d)	Grg	A	<b>Strontianite</b> (a, b, c, d)	Str	G
<b>Gypsum</b> (a, b, c, d)	Gp	G	<b>Sylvite</b> (c)	Syl	G
<b>Halite</b> (a, b, c, d)	Hl	G	<b>Titanite</b> (a, b, c, d)	Ttn	G
<b>Hematite</b> (a, b, c, d)	Hem	A	<b>Tremolite</b> (a, b, c, d)	Tr	Rd
<b>Hornblende</b> (a, b, c, d)	Hbl	GROUP	<b>Witherite</b> (a, b, c, d)	Wth	G
<b>Jarosite</b> (c, d)	Jrs	Rd	<b>Zircon</b> (a, b, c, d)	Zrn	G
<i>Other materials</i>					
<b>Amorphous</b>	AM	–	<b>Iron oxides</b>	IO	–
<b>Glass</b>	GL	–	<b>Organic matter</b>	OM	–

IMA Commission on New Minerals, Nomenclature and Classification status: A = approved; D = discredited; G = grandfathered (generally regarded as a valid mineral name); GROUP = name of a group of mineral species; Rd = redefinition approved; Rn = renamed; Q = questioned. Others: I = informal; ML = mixed-layer phases; NL = name not listed by the IMA Commission on New Minerals, Nomenclature and Classification. See Supplementary Materials for a more detailed list of the proposed mineral symbols.

a = Kretz (1983); b = Siivolam & Schmid (2007); c = Whitney & Evans (2010); d = *The Canadian Mineralogist* (<https://www.mineralogicalassociation.ca/wordpress/wp-content/uploads/2020/01/symbols.pdf>).

names that have not yet been allocated symbol. The 168 new mineral abbreviations are proposed following the established rules and selected using one of four methods: (1) as the first two or three letters of the mineral name (e.g. **Saponite** = Sap) if not common to many mineral phases; (2) as a combination of typically three letters that are characteristic of the mineral name (e.g. **Chamosite** = Chm); (3) as a selection of typically three letters representing components of the name (commonly syllables), if not already in use (e.g. **Brammalite** = Bml); and (4) as three-, four- or five-letter abbreviations when one or two prefixes are present and related mineral symbols have been defined previously (e.g. ferroaluminoceladonite is abbreviated to Facel, whereby the Kretz symbol for celadonite is cel). In this case, ‘F’ is used for ferro, but in other cases, it may refer to ferri, as in ‘Fprl’ for ferri-pyrophyllite. This emphasizes the fact that the individual letters in the Kretz system are not specific to any name components. Exceptions to methods (1) to (4) are made for two simplified and well-accepted abbreviations for mixed-layered minerals: ‘HIV’ for hydroxyl-interlayered vermiculite and ‘HIV’ for hydroxide-interlayered vermiculite. The ‘-’ symbol is also recommended for denoting mixed-layered phases (e.g. Ilt-Sme) and the ‘/’ symbol is recommended for physical mixtures (e.g. Ilt/Ms).

Widespread adoption of the recommended abbreviations is expected to simplify the usage of mineral symbols in a similar

way in which elements are symbolized on the periodic table. More details of the minerals, their proposed symbols and the methods of abbreviation used are available as Supplementary Material.

**Supplementary material.** To view supplementary material for this article, please visit <https://doi.org/10.1180/clm.2020.30>.

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