SUGGESTIONS AS TO STANDARDIZING THE NAMES OF THE CRYSTAL FORMS*

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The names for the crystal forms in common use in this country have been brought together from a variety of sources, and as a result they not only lack uniformity, but in some cases are unnecessarily complicated, ambiguous, or even incorrect. Some proposals directed toward the improvement of this situation are here put forward, in the hope that discussion may be started which will ultimately lead to the adoption of a set of standard terms as free as practicable from such objectionable features.

It is felt that the closed forms which occur in this system should be systematically assigned terms which state the *number* of faces present in each, with prefixes describing their arrangement when necessary. Terms which refer to the shapes of faces of the theoretical forms seem particularly objectionable, in view of the extreme rarity of crystals bounded by single forms (except of course (100) and (111)); thus to call a form a trapezohedron when its faces on natural crystals are actually trapeziums in only the most exceptional cases is incongruous and misleading. The selection of the form-names listed in the last column of the above tabulation has been based on these considerations.

In the holosymmetric class no new terms are required. The name for (*hhl*) is often spelled with an *s* between the *i* and *o*, but this seems unnecessary and is omitted in the interest of simplification.

The one form which is unique in the holoaxial class is frequently called a pentagonal-icositetrahedron, but this is both unduly long and misleading in that the faces almost never have pentagonal shape in nature; as its peculiar feature is a gyroidal arrangement, *gyricositetrahedron* is proposed as the simplest name adequately describing it.

For (*hk0*) in the alternating class there are two terms in common use, pentagonal-dodecahedron, which is erroneous in that the geometrical solid to which this name properly belongs can not

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CUBIC SYSTEM

	Class[1]	Representative	Symbol	Form-names	
				Undesirable	Proposed
O^h	Holosymmetric	fluorite	(*100*)	cube	hexahedron
			(*111*)		octahedron
			(*110*)	rhombic dodecahedron	dodecahedron
			(*hk0*)		tetrahexahedron
			(*hhl*)	trisoctahedron	trioctahedron
			(*hll*)	trapezohedron	icositetrahedron
			(*hkl*)		hexoctahedron
O	Holoaxial	cuprite	(*hkl*)	plagihedron	gyricositetrahedron
T^h	Alternating	pyrite	(*hk0*)	pyritohedron	dihexahedron
			(*hkl*)	diploid	didodecahedron
T^d	Alternating-polar	sphalerite	(*111*)		tetrahedron
			(*hhl*)	tetragonal-trisoctahedron	hemicositetrahedron
			(*hll*)	trigonal-tristetrahedron	tritetrahedron
			(*hkl*)		hextetrahedron
T	Digonal-polar	ullmannite	(*hkl*)	tetartohedron	gyrotritetrahedron

[1] The class-names are those proposed by the writer, *Am. Min.*, **12**, 219, 1927, with modifications in some of the hexagonal classes to accord with space-group theory; the Schönfliess space-group symbols are entered at the left side opposite each name.

TETRAGONAL SYSTEM

	Class	Representative	Symbol	Form-names	
				Undesirable	Proposed
	Tetragonal subsystem				
D_4^h	Holosymmetric	octahedrite	(*001*)	base, basal pinacoid	pinacoid
			(*100*)	2nd order prism	normo-prism
			(*110*)	1st order prism	chordo-prism
			(*hk0*)	ditetragonal prism	duplo-prism
			(*h0l*)	2nd order dipyramid	normo-dipyramid
			(*hhl*)	1st order dipyramid	chordo-dipyramid
			(*hkl*)	ditetragonal dipyramid	duplo-dipyramid
C_4^v	Polar	silver fluoride	(*001*)	pedion, "pinacoid"	monohedron
			(*h0l*)	2nd order pyramid	normo-pyramid
			(*hhl*)	1st order pyramid	chordo-pyramid
			(*hkl*)	ditetragonal pyramid	duplo-pyramid
D_4	Holoaxial	nickel sulfate	(*hkl*)	trapezohedron	gyro-dipyramid
C_4^h	Monoaxial	scheelite	(*hk0*)	3rd order prism	clino-prism
			(*hkl*)	3rd order dipyramid	clino-dipyramid
C_4	Monoaxial-polar	wulfenite	(*hkl*)	3rd order pyramid	clino-pyramid
	Alternating subsystem				
V^d	Alternating	chalcopyrite	(*hhl*)	disphenoid, 1st order	chordo-disphenoid
			(*hkl*)	scalenohedron	duplo-disphenoid
S_4	Alternating-monoaxial	meliphanite	(*h0l*)	2nd order disphenoid	normo-disphenoid
			(*hkl*)	3rd order disphenoid	clino-disphenoid

occur on crystals, and pyritohedron, which is not descriptive of the form at all. The corresponding form in the holosymmetric class being well characterized by the name tetrahexahedron, in the present class the simple term *dihexahedron* seems to fulfil all requirements. Similarly, the complex expressions often used for the (*hkl*) form may be simplified to *didodecahedron*.

In the alternating-polar class the only wholly new name proposed is that for (*hhl*). For reasons already stated, the usual face-shape names for this form are considered undesirable, but a substitute which is reminiscent of the corresponding holosymmetric form is *hemicositetrahedron*.

Finally, following the plan adopted in the holoaxial class, the (*hkl*) form in the digonal-polar is termed the *gyrotritetrahedron*.

The widespread plan of naming prisms, pyramids, etc., according to their "order" is arbitrary and meaningless, so prefixes are here preferred. Those suggested are *normo-*, for the forms the trace of which lies normal (perpendicular) to one of the lateral axes; *chordo-* for those the trace of which is the chord of the angle between the two lateral axes; and *clino-* for those the trace of which is inclined differently to the two axes.

Other novelties are the use of the prefix *duplo-* instead of the cumbersome adjective ditetragonal; the replacement of the face-shape name trapezohedron by a term analogous to those used in the Cubic system, namely *gyro-dipyramid*; and the corresponding change of scalenohedron to *duplo-disphenoid*.

The innovations suggested here are in part mere extensions of the Tetragonal ones, the prefix *normo-* thus designating forms the trace of which lies normal to a lateral axis and *chordo-* those the trace of which is the chord of the angle between two lateral axes. The proposals made in the Alternating subsystem, however, are so far-reaching as to require special discussion.

It is with considerable hesitation that a substitute is proposed for the term rhombohedron, yet in the interest of consistency that appears to be necessary. This term is based on face-shape, and in nature to find the form unmodified, and its faces of the theoretical rhombus outline, is highly exceptional. For the same reason, then, which leads to the rejection of cube, trapezohedron, etc., in favor of names based on face-number and arrangement, rhombohedron should be replaced by a corresponding term, the simplest appearing to be *ditrihedron*. The so-called scalenohedron,

HEXAGONAL SYSTEM

	Class	Representative	Symbol	Form-names	
				Undesirable	Proposed
	Hexagonal subsystem.				
D_6^h	Holosymmetric	beryl	(*00–1*)	base, basal pinacoid	pinacoid
			(*11–0*)	2nd order prism	normo-prism
			(*10–0*)	1st order prism	chordo-prism
			(*hk–0*)	dihexagonal prism	duplo-prism
			(*hh–l*)	2nd order dipyramid	normo-dipyramid
			(*h0–l*)	1st order dipyramid	chordo-dipyramid
			(*hk–l*)	dihexagonal dipyramid	duplo-dipyramid
C_6^v	Polar	iodyrite	(*00–1*)	pedion, "pinacoid"	monohedron
			(*hh–l*)	2nd order pyramid	normo-pyramid
			(*h0–l*)	1st order pyramid	chordo-pyramid
			(*hk–l*)	dihexagonal pyramid	duplo-pyramid
D_6	Holoaxial	high-quartz	(*hk–l*)	trapezohedron	gyro-dipyramid
C_6^h	Monoaxial	apatite	(*hk–0*)	3rd order prism	clino-prism
			(*hk–l*)	3rd order dipyramid	clino-dipyramid
C_6	Monoaxial-polar	nephelite	(*hk–l*)	3rd order pyramid	clino-pyramid
	Alternating subsystem.				
D_3^d	Alternating	calcite	(*h0–l*)	rhombohedron (1st ord.)	chordo-ditrihedron
			(*hk–l*)	scalenohedron	duplo-ditrihedron
C_3^i	Alternating-monoaxial	dolomite	(*hh–l*)	2nd order rhombohedron	normo-ditrihedron
			(*hk–l*)	3rd order rhombohedron	clino-ditrihedron

HEXAGONAL SYSTEM (*Continued*)

Class	Representative	Symbol	Form-names	
			Undesirable	Proposed
	Pseudotrigonal subsystem.			
D_3^h	Ditrigonal.....benitoite	(*10–0*)	1st trigonal prism	chordo-trigonoprism
		(*hk–0*)	ditrigonal prism	duplo-trigonoprism
		(*h0–l*)	1st trigonal dipyramid	chordo-trigonodipyramid
C_3^h	Trigonal-monoaxial.....——	(*hk–l*)	ditrigonal dipyramid	duplo-trigonodipyramid
		(*hk–0*)	3rd trigonal prism	clino-trigonoprism
		(*hk–l*)	3rd trigonal dipyramid	clino-trigonodipyramid
	Trigonal subsystem.			
C_3^v	Ditrigonal-polar.....tourmaline	(*h0–l*)	1st trigonal pyramid	chordo-trigonopyramid
D_3	Trigonal-holoaxial.....quartz	(*hk–l*)	ditrigonal pyramid	duplo-trigonopyramid
		(*11–0*)	2nd trigonal prism	normo-trigonoprism
		(*hh–l*)	2nd trigonal dipyramid	normo-trigonodipyramid
		(*hk–l*)	trigonal trapezohedron	gyro-trigonodipyramid
C_3	Trigonal-monoaxial-polar..sodium periodate	(*hk–l*)	3rd trigonal pyramid	clino-trigonopyramid

RHOMBIC SYSTEM

	Class	Representative	Symbol	Form-names	
				Undesirable	Proposed
V_h	Holosymmetric	barite	(*001*)	basal pinacoid	basipinacoid
			(*100*)		macropinacoid
			(*010*)		brachypinacoid
			(*hk0*)		prism
			(*h0l*)	macrodome	macrodomoprism
			(*0kl*)	brachydome	brachydomoprism
			(*hkl*)		dipyramid
$C_2{}^v$	Polar	hemimorphite	(*001*)	pedion, "pinacoid"	basimonohedron
			(*h0l*)	macrodome	macrodihedron
			(*0kl*)	brachydome	brachydihedron
			(*hkl*)		pyramid
V	Holoaxial	epsomite	(*hkl*)	disphenoid	gyrodisphenoid

similarly objectionable, has two faces in place of each one of the "rhombohedron," and may appropriately be termed the *duplo-ditrihedron*.

When forms such as (*h0l*) and (*0kl*) are termed "domes," it is customary to explain to the student that a dome is interchangeable with a prism, upon re-orientation of the crystal. In making proposals for systematization of form-names, however, it is surely reasonable to require that all forms which are geometrically identical be given the same fundamental name. As (*hk0*), (*h0l*) and (*0kl*) are thus identical, it is here recommended that the term prism be applied to all of them. Prefixes may then be used to designate the position in which they chance to be held in a particular, arbitrary, orientation. Accordingly, (*h0l*), representing a prism held in macrodomal position for the time being, is termed a *macrodomoprism*; and other forms are treated correspondingly.

In the polar class the (*h0l*) and (*0kl*) forms have but two faces each, and instead of complicating the names by a prefix *hemi-*, as often done, it is suggested that they be termed *dihedrons*, with appropriate prefixes to indicate their temporary positions. The holoaxial class in the Rhombic system corresponds to the gyroidal classes in preceding systems, and its general form is accordingly prefixed with *gyro*.

Following the same plan as in the Rhombic system, of using but a single fundamental term for all forms of like geometrical relations, the so-called orthodome must be named the *orthodomo-pinacoid*, the "clinodome" a *clinodomoprism*, and the "pyramid" a *pyramidoprism*. In other words, the root-word describes geometry, while prefixes designate the position in which a form chances to be held.

In the triclinic-holosymmetric class all the forms are geometrically pinacoids, and should be so-called, the prefixes indicating their respective positions; and in the asymmetric, all are monohedrons, and are designated similarly. This yields terms which contain a good many syllables, yet are so much more correct than those in common use as to seem preferable.

MONOCLINIC SYSTEM

Class	Representative	Symbol	Form-names	
			Undesirable	Proposed
C_{2h}	Holosymmetric.....gypsum	(*001*)	basal pinacoid	basipinacoid
		(*100*)		orthopinacoid
		(*010*)		clinopinacoid
		(*hk0*)		prism
		(*h0l*)	orthodome	orthodomopinacoid
		(*0kl*)	clinodome	clinodomoprism
		(*hkl*)	pyramid	pyramidoprism
C_2	Holoaxial-polar.....lithium sulfate	(*010*)	"clinopinacoid"	clinomonohedron
		(*hk0*)	hemiprism, "prism"	prismatidihedron
		(*0kl*)	hemiclinodome	clinodomodihedron
		(*hkl*)	hemipyramid	pyramidodihedron
C_1	Anaxial.....clinohedrite	(*001*)	basal "pinacoid"	basimonohedron
		(*100*)	ortho "pinacoid"	orthomonohedron
		(*h0l*)	hemiorthodome	orthodomomonohedron

TRICLINIC SYSTEM

	Class	Representative	Symbol	Form-names	
				Undesirable	Proposed
S_2	Holosymmetric	chalcanthite	(*001*)	basal pinacoid	basipinacoid
			(*100*)		macropinacoid
			(*010*)		brachypinacoid
			(*hk0*)	"prism"	prismatipinacoid
			(*h0l*)	"macrodome"	macrodomopinacoid
			(*0kl*)	"brachydome"	brachydomopinacoid
			(*hkl*)	"pyramid"	pyramidopinacoid
C_1	Asymmetric	calcium thiosulfate	(*001*)	basal "pinacoid"	basimonohedron
			(*100*)	macro "pinacoid"	macromonohedron
			(*010*)	brachy "pinacoid"	brachymonohedron
			(*hk0*)	"prism"	prismatimonohedron
			(*h0l*)	"macrodome"	macrodomomonohedron
			(*0kl*)	"brachydome"	brachydomomonohedron
			(*hkl*)	"pyramid"	pyramidomonohedron