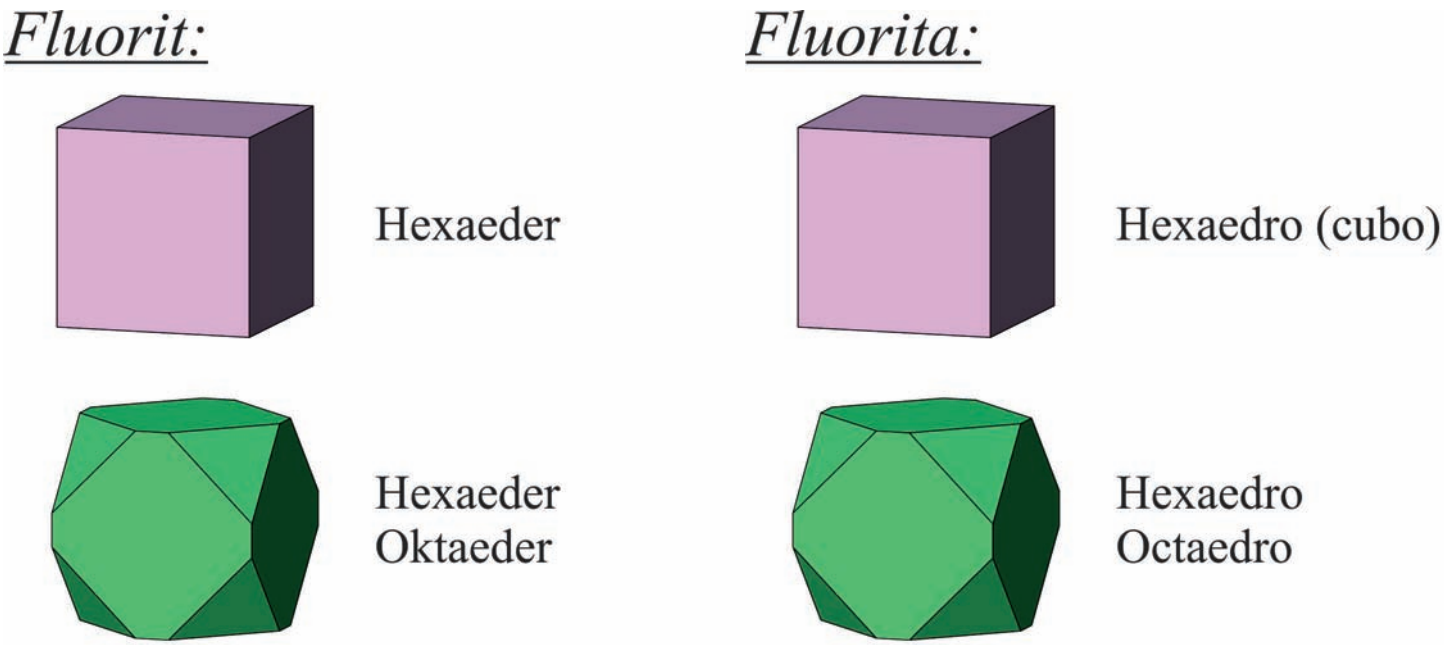
HALLESCHES JAHRBUCH
FÜR
GEOWISSENSCHAFTEN

BEIHEFT 30



HERBERT PÖLLMANN & MARCONDES LIMA DA COSTA

SYMMETRIEN	SIMETRIA
DIE 32 PUNKTGRUPPEN	OS 32 GRUPOS DE PONTOS
MINERALE UND IHRE FORMEN	MINERAIS E SUAS FORMAS

HALLE (SAALE) 2013

Mitarbeit	Colaboracão
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Titelbild / Imagem da capa

Fluorit / Fluorita

HALLESCHES JAHRBUCH FÜR GEOWISSENSCHAFTEN

BEIHEFT 30

Halle (Saale) 2013
Institut für Geowissenschaften und Geographie
der Martin - Luther Universität Halle-Wittenberg

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Vorwort

Im vorliegenden zusammenfassenden Buch wird versucht, die Grundlagen der Kristallographie und insbesondere der Symmetrielehre in deutscher und portugiesischer Sprache darzustellen. Die Zusammenfassung der Symmetrielehre basierend auf den 32 Punktgruppen wird erweitert durch Anwendungsbeispiele der makroskopischen Form von wichtigen Mineralen sowie Hinweisen zu den Raumgruppen.

Die Zusammenarbeit zwischen deutschen und brasilianischen Wissenschaftlern über lange Jahre basiert hierbei nicht nur auf der Kooperation in wissenschaftlichen Projekten sondern wurde darüber hinaus auch durch einen regen Wissenschaftler- und Studentenaustausch weiter intensiviert. Die Unterstützung des Deutschen Akademischen Austauschdienstes (DAAD) auf deutscher Seite, bzw. Capes/Cnpq auf brasilianischer Seite soll an dieser Stelle besonders hervorgehoben werden.

Die Idee, Sprachbarrieren durch gemeinsame Grundlagenpublikationen abzubauen, ergab sich aus den Schwierigkeiten von Austauschstudenten, Vorlesungen und Übungen in einer fremden Sprache und zudem einer fremden Fachsprache zu verstehen. Oft werden fehlende Kenntnisse der deutschen oder portugiesischen Sprache dann über Englisch ausgeglichen.

Das Buch ist vor allem dahingehend ausgerichtet, zu helfen, erste Sprachbarrieren zu überwinden und entsprechendes Grundlagenwissen anschaulich darzustellen. Durch die Komplexizität des Gesamtgebietes kann hier natürlich nur ein kleiner Ausschnitt aufgezeigt werden, der trotzdem Basisdaten in beiden Sprachen darstellt und als Einführung verwendet werden kann.

Hier soll bewusst der Versuch unternommen werden, die für den Austausch zwischen Brasilien und Deutschland notwendigen Sprachen in den Vordergrund zu stellen. Es ist geplant, diese Zusammenstellung in den kommenden Jahren auszuweiten, zu vervollständigen sowie auch eine entsprechende Zusammenstellung in englischer Sprache zur Verfügung zu stellen.

Besonderer Dank gebührt Frau PD Dr. Dorothee Mertmann für die geduldige und hilfreiche Umsetzung des Manuskriptes in die vorliegende Endform.

Herbert Pöllmann, Halle, September 2013

Prefácio

O presente livro é uma introdução aos princípios da cristalografia, com ênfase principalmente ao ensino da simetria, usando para tal linguagem e apresentação gráfica a mais clara possível, em dois idiomas, alemão e português.

A cooperação científica duradoura, por décadas, entre pesquisadores alemães e brasileiros, não esteve centrada tão somente em projetos científicos, mas também na contínua e aprofundada formação de recursos humanos em quase todos os níveis, do graduado ao pós-doutorado. Para este sucesso continuado foi muito importante, e continua sendo, o apoio do DAAD pelo lado Alemão e do CNPq e CAPES pelo lado brasileiro.

A ideia para amenizar as barreiras de idiomas surgiu por ocasião das aulas ministrada e durante a discussão e o desenvolvimento de projetos de pesquisas conjuntos, que nos levaram a elaborar publicações introdutórias em conjunto. Em geral se tenta corrigir a falta de conhecimento da língua alemã ou portuguesa através da inglesa, o que nem sempre é óbvia.

Portanto o presente o livro tem também como objetivo auxiliar nesta empreitada voltada para o intercâmbio de estudantes e pesquisadores do Brasil e da Alemanha.
Simplificando o ensino de simetria centrado nos 32 pontos de simetria é enriquecido com desenhos das formas dos minerais mais importantes, além de informações sobre os grupos espaciais. Planejamos enriquecer e ampliar este livro nos próximos anos, em uma nova edição mais completa, considerando inclusive uma edição em língua inglesa.

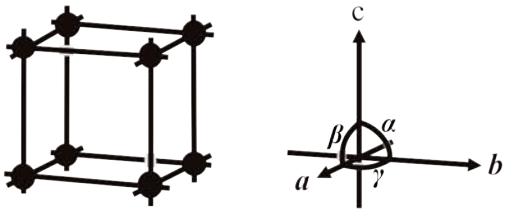
Este livro pensado para ajudar a amenizar as barreiras dos idiomas, também espera principalmente contribuir para uma visão geral do conhecimento sobre cristalografia e mineralogia. É claro que devido a complexidade e a amplitude do conhecimento na área de cristalografia e mineralogia, o presente livro é tão somente uma pequena amostra do mesmo, mesmo assim acreditamos que ao apresentá-lo nos dois idiomas, ele poderá ser utilizado como uma introdução a este vasto conhecimento.

Este livro pensado para ajudar a amenizar as barreiras dos idiomas, também espera principalmente contribuir para uma visão geral do conhecimento sobre cristalografia e mineralogia. É claro que devido a complexidade e a amplitude do conhecimento na área de cristalografia e mineralogia, o presente livro é tão somente uma pequena amostra do mesmo, mesmo assim acreditamos que ao apresentá-lo nos dois idiomas, ele poderá ser utilizado como uma introdução a este vasto conhecimento.

A tentativa em apresentar um texto resumido nos dois idiomas também deverá eliminar a lacuna existente nesta área do conhecimento, já que poderá ser um importante suporte aos estudantes.

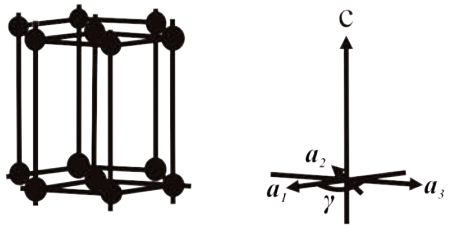
Marcondes Lima da Costa, Belem, September 2013

Die 7 Kristallsysteme



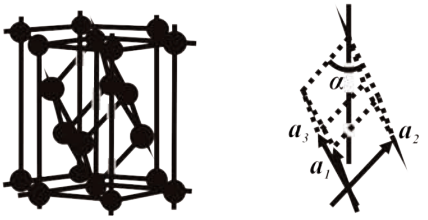
Kubisch:

$a_0 = b_0 = c_0$
$\alpha = \beta = \gamma = 90°$



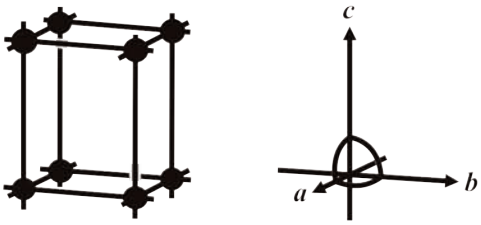
Hexagonal:

$a_1 = a_2 = a_3 \neq c_0$
$\alpha = \beta = 90°; \gamma = 120°$



Rhomboedrisch:

$a_1 = a_2 = a_3$
$\alpha_1 = \alpha_2 = \alpha_3 \neq 90°$



Tetragonal:

$a_0 = b_0 \neq c_0$
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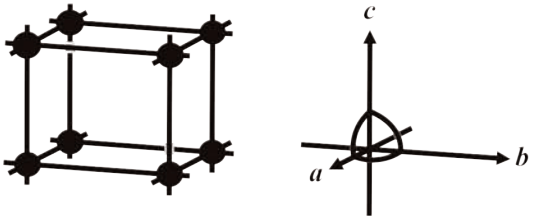
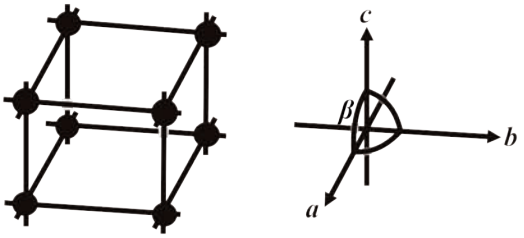


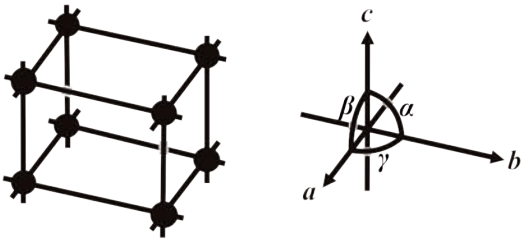
Orthorhombisch:

$a_0 \neq b_0 \neq c_0$
$\alpha = \beta = \gamma = 90°$



Monoklin:

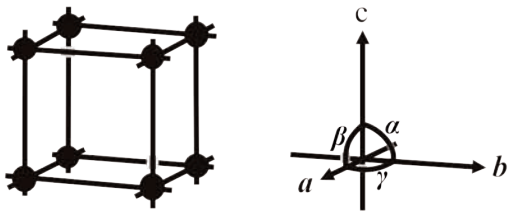
$a_0 \neq b_0 \neq c_0$
$\alpha = \gamma = 90°; \beta \neq 90°$



Triklin:

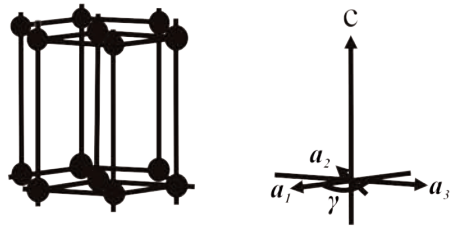
$a_0 \neq b_0 \neq c_0$
$\alpha \neq \beta \neq \gamma \neq 90°$

Os 7 sistemas cristalinos



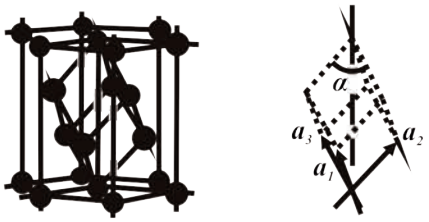
Cúbico ou Isométrico:

$a_0 = b_0 = c_0$
$\alpha = \beta = \gamma = 90°$



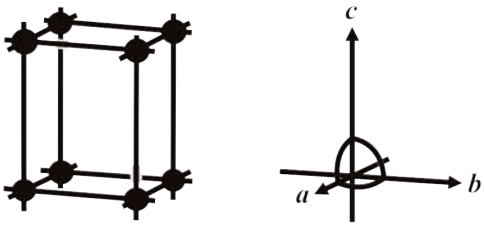
Hexagonal:

$a_1 = a_2 = a_3 \neq c_0$
$\alpha = \beta = 90°; \gamma = 120°$



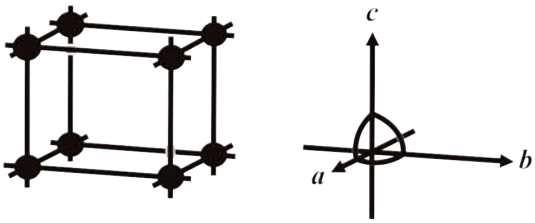
Romboédrico:

$a_1 = a_2 = a_3$
$\alpha_1 = \alpha_2 = \alpha_3 \neq 90°$



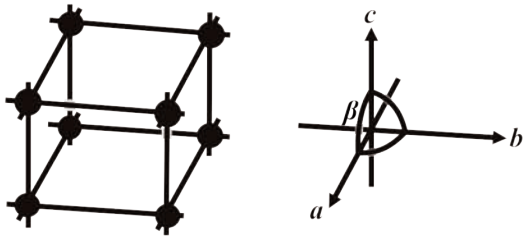
Tetragonal:

$a_0 = b_0 \neq c_0$
$\alpha = \beta = \gamma = 90°$



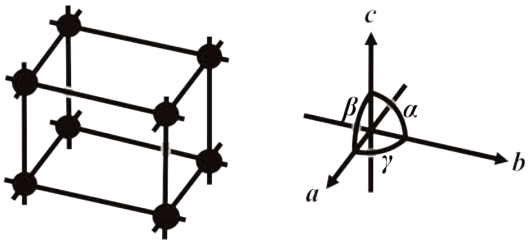
Ortorrombico:

$a_0 \neq b_0 \neq c_0$
$\alpha = \beta = \gamma = 90°$



Monoclínico:

$a_0 \neq b_0 \neq c_0$
$\alpha = \gamma = 90°; \beta \neq 90°$



Triclínico:

$a_0 \neq b_0 \neq c_0$
$\alpha \neq \beta \neq \gamma \neq 90°$

Häufigkeit von Mineralen

Von 3510 bekannten Mineralen (Stand Mai 1993) sind:

Kubisch	5 Kristallklassen	346	9,9%
Hexagonal	7 Kristallklassen	326	9,3%
Trigonal - Rhomboedrisch	5 Kristallklassen	295	8,4%
Tetragonal	7 Kristallklassen	278	7,9%
Orthorhombisch	3 Kristallklassen	774	22%
Monoklin	3 Kristallklassen	1129	32,2%
Triklin	2 Kristallklassen	332	9,5%

Es gibt 30 Arten amorpher Minerale, sie machen 0,8% der Mineralvorkommen aus.
Aus „Minerale: Bestimmen nach äußeren Kennzeichen / HOCHLEITNER; PHILIPSBORN; WEINER“

Wirkung der verschiedenen Drehachsen

Name	Symbol	Wirkung
Inversion	* / i	Inversion am Zentrum
Zweizählige Drehachse	◖ / 2	Drehungen um 180°
Spiegelebene / inverse zweizählige Drehachse.	m = $\bar{2}$	Spiegelung an einer Ebene
Dreizählige Drehachse	▲ / 3	Drehungen um 120°
Inverse dreizählige Drehachse.	⏃ / $\bar{3}$	Drehungen um 120° und Inversion
Vierzählige Drehachse	◆ / 4	Drehungen um 90°
Inverse vierzählige Drehachse	◈ / $\bar{4}$	Drehungen um 90° und Inversion
Sechszählige Drehachse	⬢ / 6	Drehungen um 60°
Inverse sechszählige Drehachse	◭ / $\bar{6}$	Drehungen um 60° und Inversion

Freqüência dos Minerais

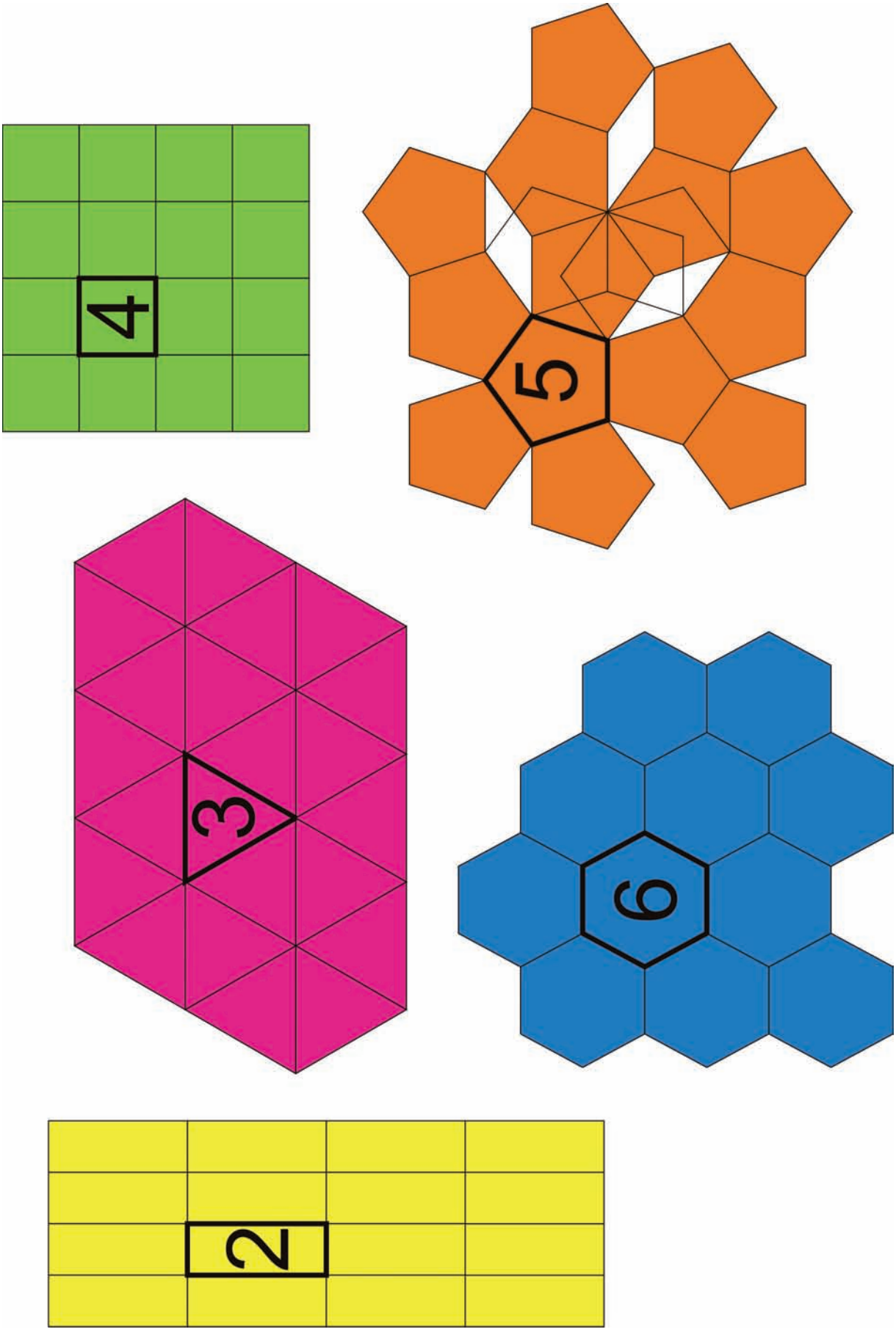
Os 3510 minerais conhecidos até maio de 1993 distribuem-se da seguinte forma:

Sistemas	Grupo de Pontos/classes cristalinas	Espécies de minerais	Frequência em percentagem
Isométrico	5	346	9,9%
Hexagonal	7	326	9,3%
Romboédrico	5	295	8,4%
Tetragonal	7	278	7,9%
Ortorrômbico	3	774	22%
Monoclínico	3	1129	32,2%
Triclínico	2	332	9,5%

Os minerais amorfos envolvem 30 espécies, ou seja 0,8 % em frequência. Fonte: “Minerais: Identificação através de características externas / HOCHLEITNER; PHILIPSBORN; WEINER”

Efeitos dos diversos eixos de rotação

Nome	**Símbolo**	**Efeito**
Inversão (eixo unitário de inversão)	* / i	Centro de inversão
Eixo de rotação binária	⧫ / 2	Rotação 180°
Plano de reflexão (Espelho)/ Eixo de rotação binária inversa	$m = \bar{2}$	Plano de Reflexão
Eixo de rotação ternária	▲ / 3	Rotação a 120°
Eixo de rotação ternária inversa	⧋ / $\bar{3}$	Rotação a 120° mais inversão
Eixo de rotação quaternária	◆ / 4	Rotação a 90°
Eixo de rotação quaternária inversa	◈ / $\bar{4}$	Rotação a 90° mais inversão
Eixo de rotação senária	⬢ / 6	Rotação a 60°
Eixo de rotação senária inversa	⧊ / $\bar{6}$	Rotação a 60° mais inversão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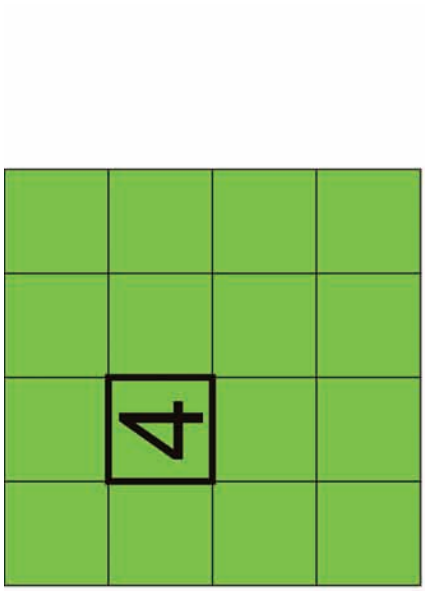
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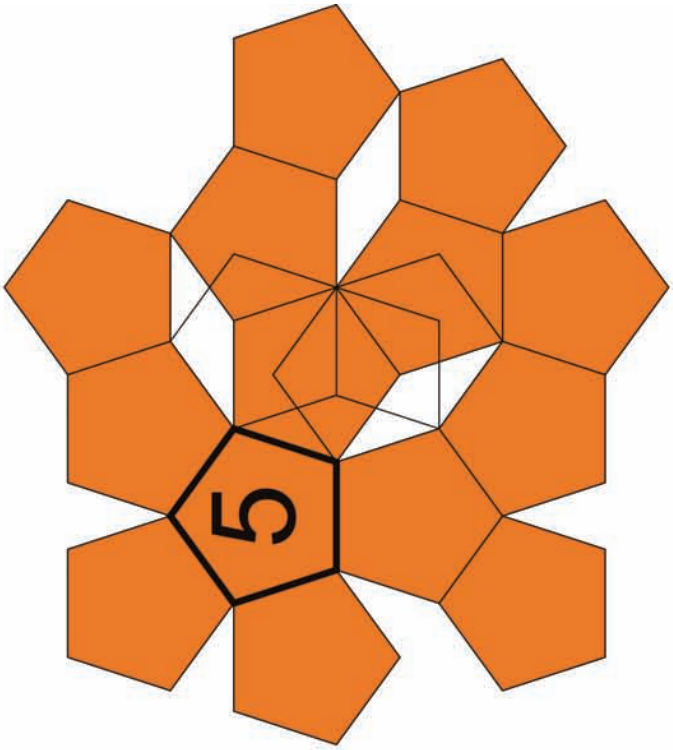
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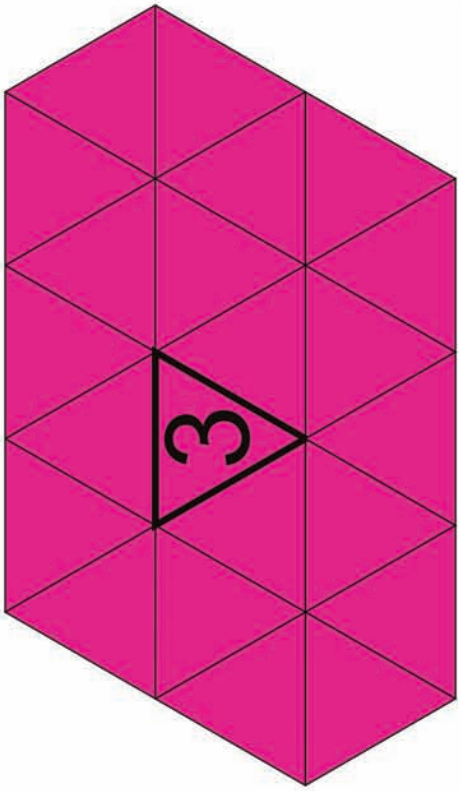
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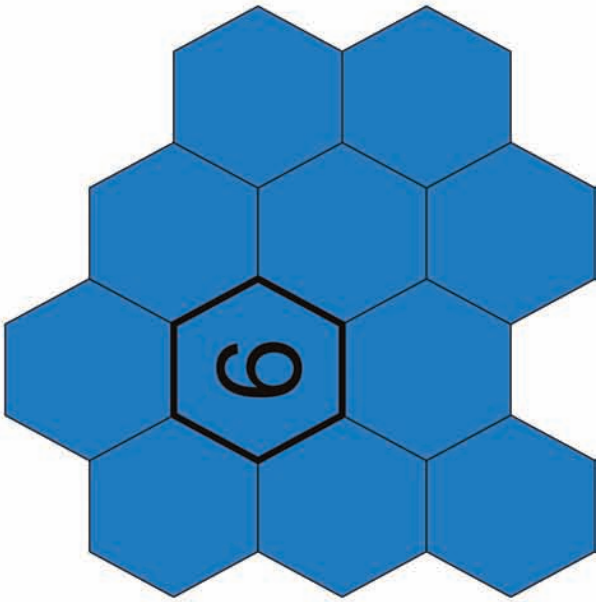
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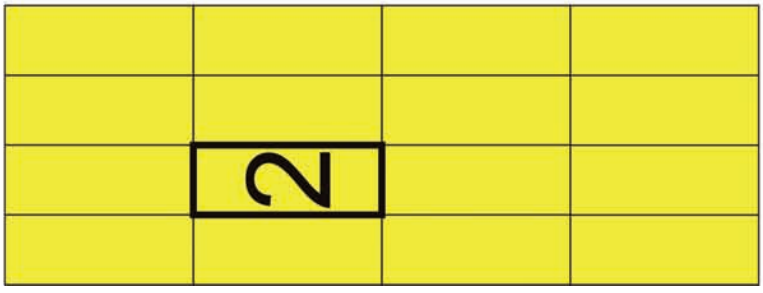
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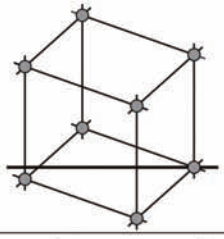
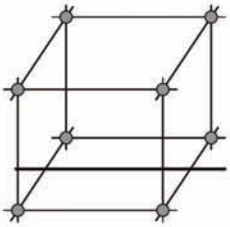
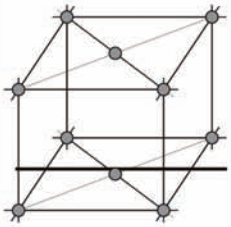
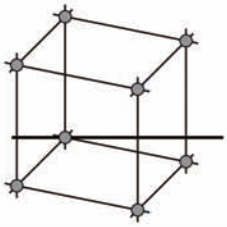
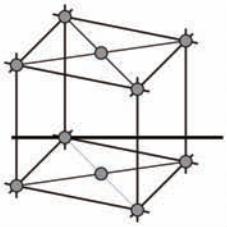
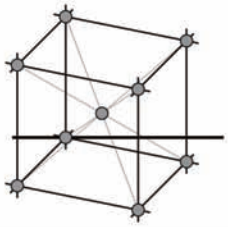
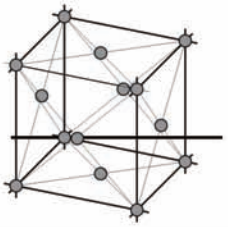
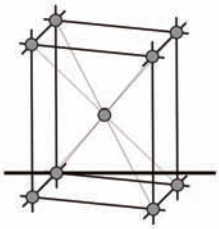
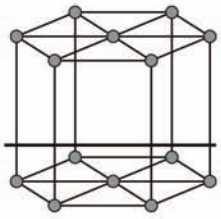
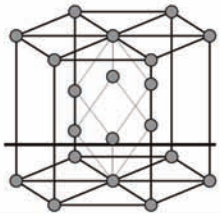
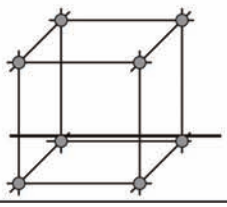
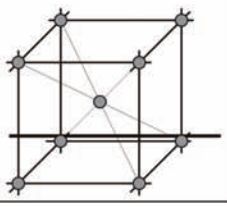
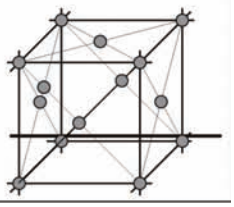
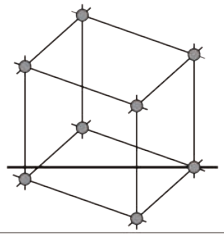
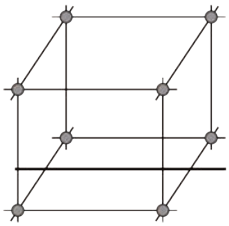
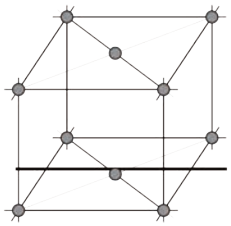
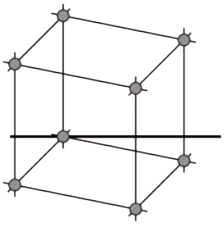
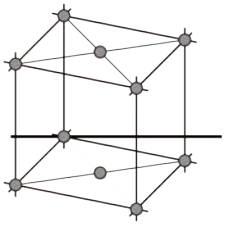
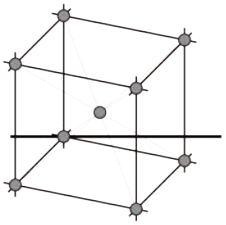
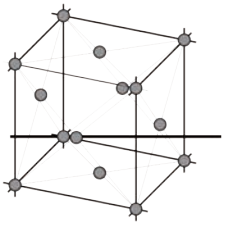
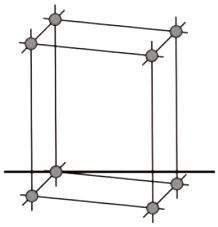
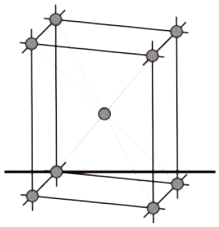
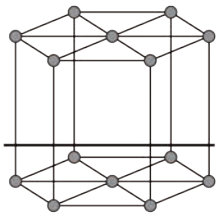
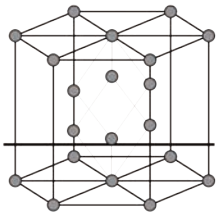
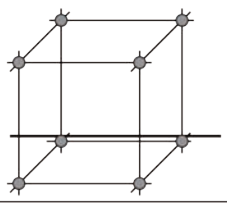
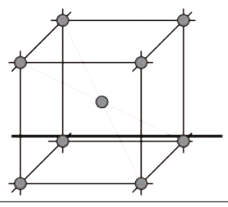
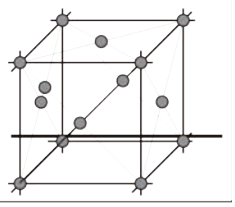
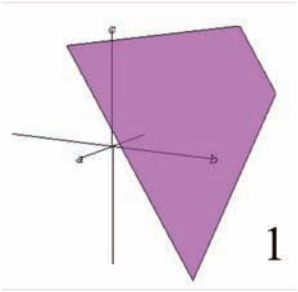
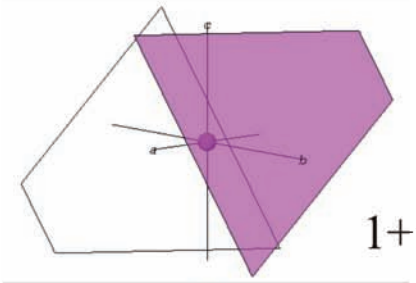
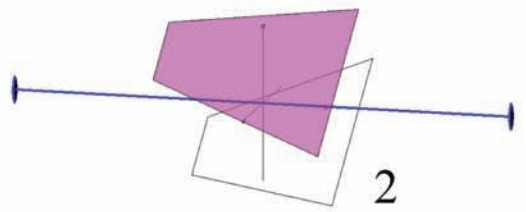
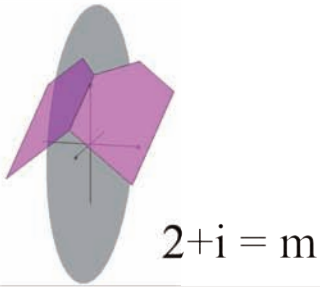
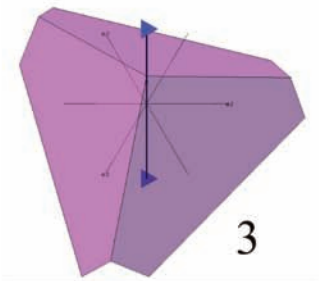
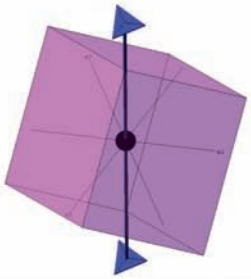
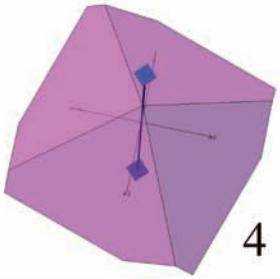
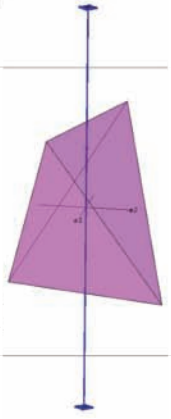
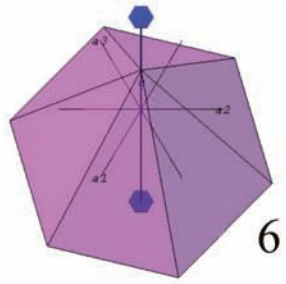
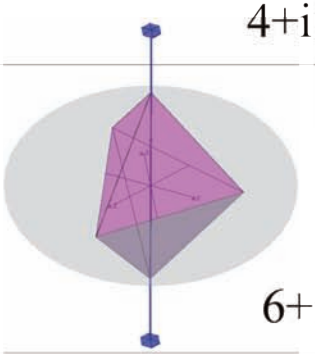
triklin				
monoklin			identisch mit C-Gitter	identisch mit C-Gitter
ortho-rhombisch				
tetragonal		identisch mit P-Gitter		identisch mit I-Gitter
trigonal				
hexagonal				
kubisch		unmöglich		

	P	C	I	F
triclínico				
monoclínico			idêntico como retículo tipo C	idêntico como retículo tipo C
ortorrômbico				
tetragonal		idêntico como retículo tipo P		idêntico como retículo tipo I
trigonal				
hexagonal				
cúbico		impossível		

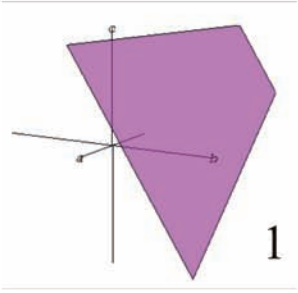
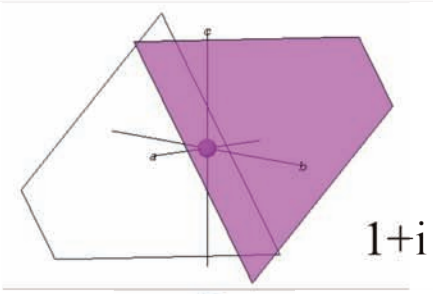
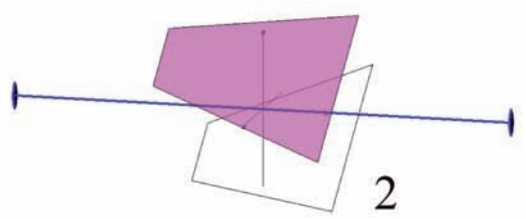
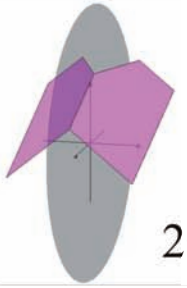
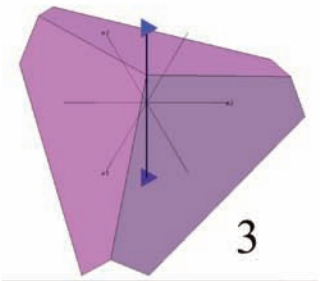
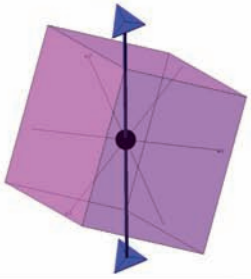
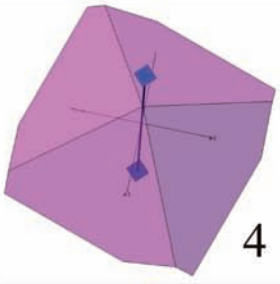
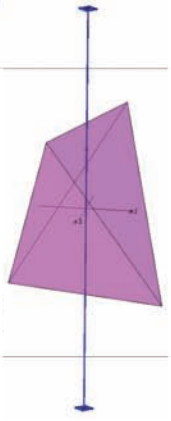
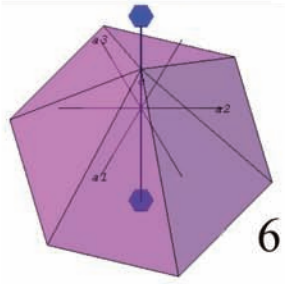
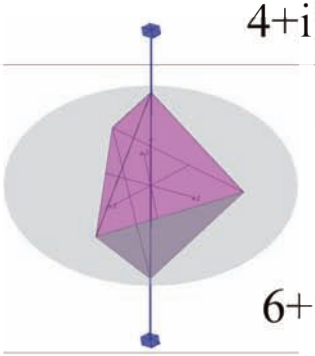
Die Symmetrieelemente

(normale Drehachsen, Drehachsen kombiniert mit Inversion)

normal		kombiniert mit Inversionszentrum
	1	
	2	
	3	
	4	
	6	

Os Elementos de Simetria

(eixos normal, eixos com centro de inversão)

normal		Combinado com centro de inversão
 1	1	 1+i
 2	2	 2+i = m
 3	3	 3+i
 4	4	 4+i
 6	6	 6+i

Symmetrie	***Symbole nach***	***Symbol***				
		*	⬮	▱	◆	⬢
(polare Drehachse)	*Schönflies*	C_1	C_2	C_3	C_4	C_6
	Hermann-Mauguin	*1*	*2*	*3*	*4*	*6*
Kombination von Drehachsen und horizontalen Symmetrieebenen	*Schönflies*		C_{2h}	C_{3h}	C_{4h}	C_{6h}
	Hermann-Mauguin		*2/m*	*3/m (*	*4/m*	*6/m*
Kombination von Drehachsen und vertikalen Symmetrieebenen	*Schönflies*	C_s	C_{2v}	C_{3v}	C_{4v}	C_{6v}
	Hermann-Mauguin	*m*	*mm2*	*3m*	*4mm*	*6mm*
Kombination von Drehachsen, horizontalen und vertikalen Symmetrieebenen	*Schönflies*		D_{2h}	D_{3h}	D_{4h}	D_{6h}
	Hermann-Mauguin		*mmm*	$\bar{6}$*2m*	*4/mmm*	*6/mmm*
Kombination mit zweizähligen Drehachsen	*Schönflies*		D_2	D_3	D_4	D_6
	Hermann-Mauguin		*222*	*32*	*422*	*622*
Symmetriezentrum und Inversionsachsen	*Schönflies*	C_i		C_{3i} D_{3d}	S_4 D_{2d}	
	Hermann-Mauguin	$\bar{1}$	$\bar{2}$ *(m)*	$\bar{3}$ *3m*	$\bar{4}$ $\bar{4}$*2m*	$\bar{6}$ *(3/m)* $\bar{6}$*2m*

Simetria	***Simbologia segundo***	*Simbologia*				
		*	⬮	▱	◆	⬢
(Eixos de rotação polar)	*Schönflies*	C_1	C_2	C_3	C_4	C_6
	Hermann-Mauguin	*1*	*2*	*3*	*4*	*6*
Combinação de eixos de rotação e plano de simetria horizontal	*Schönflies*		C_{2h}	C_{3h}	C_{4h}	C_{6h}
	Hermann-Mauguin		*2/m*	*3/m (*$\bar{6}$*)*	*4/m*	*6/m*
Combinação de eixos de rotação com plano de simetria vertical	*Schönflies*	C_s	C_{2v}	C_{3v}	C_{4v}	C_{6v}
	Hermann-Mauguin	*m*	*mm2*	*3m*	*4mm*	*6mm*
Combinação de eixo de rotação com plano de simetrial verical e horizontal	*Schönflies*		D_{2h}	D_{3h}	D_{4h}	D_{6h}
	Hermann-Mauguin		*mmm*	$\bar{6}$*2m*	*4/mmm*	*6/mmm*
Combinação com eixos de simetria binário	*Schönflies*		D_2	D_3	D_4	D_6
	Hermann-Mauguin		*222*	*32*	*422*	*622*
Centro de simetria e eixo de inversão	*Schönflies*	C_i		C_{3i} D_{3d}	S_4 D_{2d}	
	Hermann-Mauguin	$\bar{1}$	$\bar{2}$ *(m)*	$\bar{3}$ $\bar{3}$*m*	$\bar{4}$ $\bar{4}$*2m*	$\bar{6}$ *(3/m)* $\bar{6}$*2m*

Die 32 Punktgruppen

Kristallsystem	**Triklin**	**Monoklin**	**Orthorhombisch**	**Trigonal**	**Hexagonal**	**Tetragonal**	**Kubisch**
Holoedrie	$\bar{1}$	$\frac{2}{m}$	$\frac{2}{m}\frac{2}{m}\frac{2}{m}$	$\bar{3}\frac{2}{m}$	$\frac{6}{m}\frac{2}{m}\frac{2}{m}$	$\frac{4}{m}\frac{2}{m}\frac{2}{m}$	$\frac{4}{m}\bar{3}\frac{2}{m}$
Blickrichtung	- keine-	[010]	[100] [010] [001]	[001] [100]	[001] [100] [1$\bar{1}$0]	[001] [100] [1$\bar{1}$0]	[001] [111] [1$\bar{1}$0]
Punktgruppen	1	2	2 2 2	3	6	4	2 3
	$\bar{1}$	m	m m 2	3 2	6 2 2	4 2 2	4 3 2
		$\frac{2}{m}$	$\frac{2}{m}\frac{2}{m}\frac{2}{m}$	3 m	6 m m	4 m m	$\frac{2}{m}\bar{3}$
				$\bar{3}$	$\bar{6}$	$\bar{4}$	$\bar{4}$ 3 m
				$\bar{3}\frac{2}{m}$	$\bar{6}$ 2 m	$\bar{4}$ 2 m	$\frac{4}{m}\bar{3}\frac{2}{m}$
					$\bar{6}$ m 2	$\bar{4}$ m 2	
					$\frac{6}{m}$	$\frac{4}{m}$	
					$\frac{6}{m}\frac{2}{m}\frac{2}{m}$	$\frac{4}{m}\frac{2}{m}\frac{2}{m}$	

Os 32 Grupos de Pontos

Sistema Cristalino	Triclínico	Monoclínico	Ortorrombico	Trigonal	Hexagonal	Tetragonal	Cubico
Holoedria	$\bar{1}$	$\frac{2}{m}$	$\frac{2}{m}\frac{2}{m}\frac{2}{m}$	$\bar{3}\frac{2}{m}$	$\frac{6}{m}\frac{2}{m}\frac{2}{m}$	$\frac{4}{m}\frac{2}{m}\frac{2}{m}$	$\frac{4}{m}\bar{3}\frac{2}{m}$
Perspectiva	- nenhum-	[010]	[100] [010] [001]	[001] [100]	[001] [100] [1$\bar{1}$0]	[001] [100] [1$\bar{1}$0]	[001] [111] [1$\bar{1}$0]
Grupos de Pontos	1	2	2 2 2	3	6	4	2 3
	$\bar{1}$	m	m m 2	3 2	6 2 2	4 2 2	4 3 2
		$\frac{2}{m}$	$\frac{2}{m}\frac{2}{m}\frac{2}{m}$	3 m	6 m m	4 m m	$\frac{2}{m}\bar{3}$
				$\bar{3}$	$\bar{6}$	$\bar{4}$	$\bar{4}$ 3 m
				$\bar{3}\frac{2}{m}$	$\bar{6}$ 2 m	$\bar{4}$ 2 m	$\frac{4}{m}\bar{3}\frac{2}{m}$
					$\bar{6}$ m 2	$\bar{4}$ m 2	
					$\frac{6}{m}$	$\frac{4}{m}$	
					$\frac{6}{m}\frac{2}{m}\frac{2}{m}$	$\frac{4}{m}\frac{2}{m}\frac{2}{m}$	

Die 32 Kristallklassen

Anzahl der Klassen	Bezeichnung nach Herman-Mauguin		Bezeichnung der Kristallklasse
	komplett	abgekürzt	
Triklines System			
2 Klassen	1	1	Triklin Pedial
	-1	-1	Triklin Pinakoidal
Monoklines System			
3 Klassen	2/*m*	2/*m*	Monoklin Prismatisch
	m	*m*	Monoklin Domatisch
	2	2	Monoklin Sphenoid
Orthorhombisches System			
3 Klassen	2/*m*2 /*m*/*m*	*mmm*	Orthorhombisch Dipyramidal
	*mm*2	*mm*2	Orthorhombisch Pyramidal
	222	222	Orthorhombisch Disphenoid
Tetragonales System			
7 Klassen	4/*m*2/*m*2/*m*	4/*mmm*	Ditetragonal Dipyramidal
	4*mm*	4*mm*	Ditetragonal Pyramidal
	422	422	Tetragonal Trapezoedrisch
	4/*m*	4/*m*	Tetragonal Dipyramidal
	4	4	Tetragonal Pyramidal
	4-2 *m*	4-2 *m*	Tetragonal Skalenoedrisch
	-4	-4	Tetragonal Disphenoidisch
Hexagonales System:			
7 Klassen	6/*m*2/*m*2/*m*	6/*mmm*	Dihexagonal Dipyramidal
	6*mm*	6*mm*	Dihexagonal Pyramidal
	622	622	Hexagonal Trapezoedrisch
	6/*m*	6/*m*	Hexagonal Dipyramidal
	6	6	Hexagonal Pyramidal
	-6*m*2	-6*m*2	Ditrigonal Dipyramidal
	-6	-6	Trigonal Dipyramidal
Trigonales System:			
5 Klassen	-3 2*m*	-3*m*	Ditrigonal Skalenoedrisch
	3*m*	3*m*	Ditrigonal Pyramidal
	32	32	Trigonal Trapezoedrisch
	3	3	Trigonal Pyramidal
	-3	-3	Trigonal Rhomboedrisch
Kubisches System			
5 Klassen	4/*m*-3 2/*m*	*m*3*m*	Hexakisoktaedrisch
	432	432	Pentagonikositetraedrisch
	2/*m* -3	*m*3	Disdodekaedrisch
	-4 3*m*	-4 3*m*	Hexakistetraedrisch
	23	23	Tetraedrisch Pentagondodekaedrisch

As 32 classes de simetria

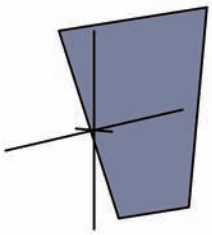
Número de classes	Índices de Hermann-Mauguin		Denominação da classe
	completos	abreviados	
Sistema triclínico:			
2 classes	1	1	classe pinacoidal
	-1	-1	classe pedial
Sistema monoclínico:			
3 classes	2/*m*	2/*m*	classe prismática
	m	*m*	classe domática
	2	2	classe esfenóidica
Sistema ortorrômbico:			
3 classes	2/*m*2 /*m*/*m*	*mmm*	classe dipiramidal ortorrômbica
	*mm*2	*mm*2	classe piramidal ortorrômbica
	222	222	classe diesfenóidica ortorrômbica
Sistema tetragonal:			
7 classes	4/*m*2/*m*2/*m*	4/*mmm*	classe dipiramidal ditetragonal
	4*mm*	4*mm*	classe piramidal ditetragonal
	422	422	classe trapezoédrica tetragonal
	4/*m*	4/*m*	classe dipiramidal tetragonal
	4	4	classe piramidal tetragonal
	4-2 *m*	4-2 *m*	classe escalenoédrica tetragonal
	-4	-4	classe diesfenóidica tetragonal
Sistema hexagonal: -1 -2 -4 -6 -3			
7 classes	6/*m*2/*m*2/*m*	6/*mmm*	classe dipiramidal dihexagonal
	6*mm*	6*mm*	classe piramidal- dihexagonal
	622	622	classe trapezoédrica-hexagonal
	6/*m*	6/*m*	classe dipiramidal-hexagonal
	6	6	classe piramidal-hexagonal
	-6*m*2	-6*m*2	classe dipiramidal ditrigonal
	-6	-6	classe dipiramidal trigonal
Sistema trigonal:			
5 classes	-3 2*m*	-3*m*	classe escalenoédrica ditrigonal
	3*m*	3*m*	classe piramidal ditrigonal
	32	32	classe trapezoédrica trigonal
	3	3	classe piramidal trigonal
	-3	-3	classe romboédrica
Sistema cúbico ou isométrico:			
5 classes	4/*m*-3 2/*m*	*m*3*m*	classe hexaoctaédrica
	432	432	classe pentagontrioctaédrica
	2/*m* -3	*m*3	classe didodecaédrica
	-4 3*m*	-4 3*m*	classe hexatetraédrica
	23	23	classe pentagontritetraédrica

Triklines Kristallsystem

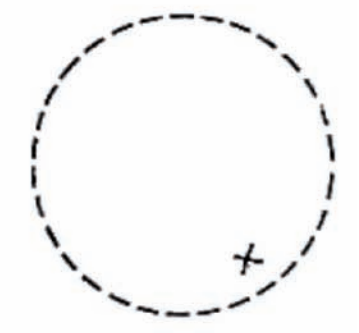
Trikline Hemiedrie
Triklin-pediale Klasse

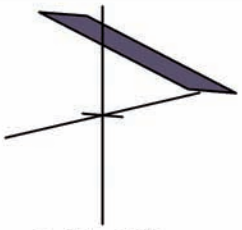
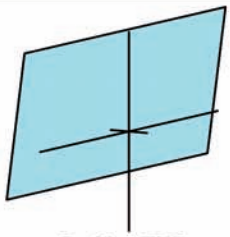
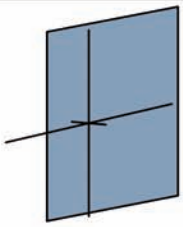
Symbol: 1 oder C_1

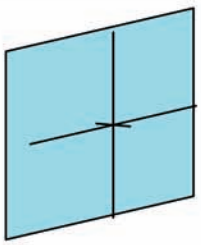
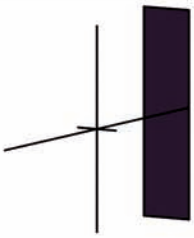
Allgemeine Form:
{hkl}



Pedien IV.St.



{0kl}	{h0l}	{hk0}
		
Pedien I.St.	**Pedien II.St.**	**Pedien III.St.**

{100}	{010}	{001}
		
I. Pedion	**II. Pedion**	**III. Pedion**

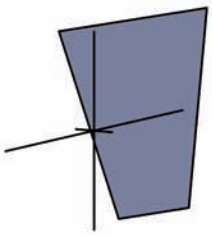
Mineral-Bsp.:
Sinnerite $Cu_6As_4S_9$
Hartite $C_{20}H_{34}$
Nekoite $Ca_3[Si_6O_{15}]*7H_2O$

Sistema Cristalino Triclínico

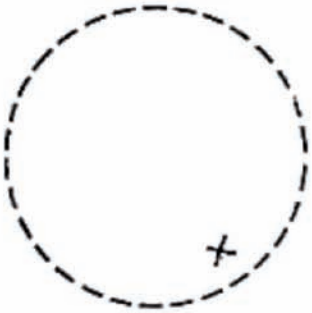
Hemiedria Triclínico
Classe pedial triclínica

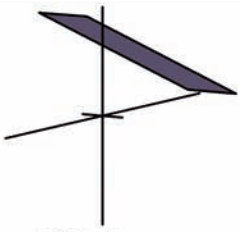
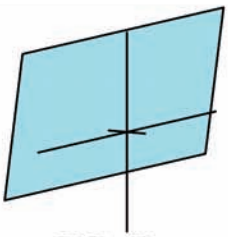
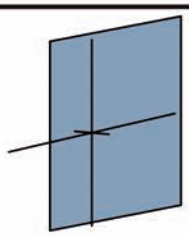
Símbolo: 1 ou C_1

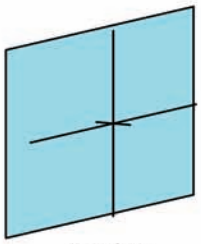
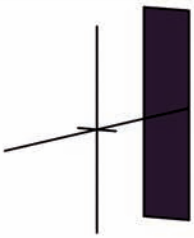
Forma geral:
{hkl}



Pédio IV.pos.



{0kl}	{h0l}	{hk0}
 Pédio I.pos.	 Pédio II.pos.	 Pédio III.pos.

{100}	{010}	{001}
 I. Pédio	 II. Pédio	 III. Pédio

Exemplos de minerais:

Sinnerita $Cu_6As_4S_9$

Hartita $C_{20}H_{34}$

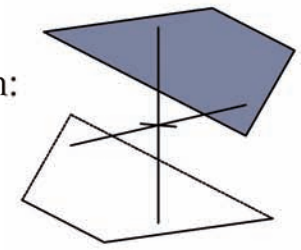
Nekoita $Ca_3[Si_6O_{15}]*7H_2O$

Triklines Kristallsystem

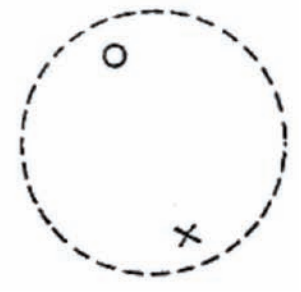
Trikline Holoedrie — Symbol: $\bar{1}$ oder C_i

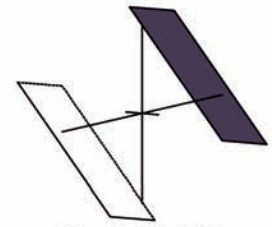
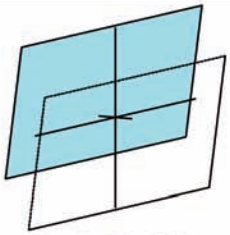
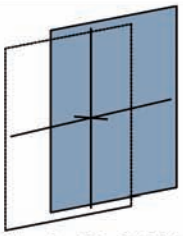
Triklin-pinakoidale Klasse

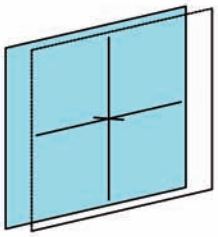
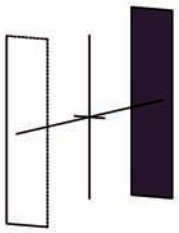
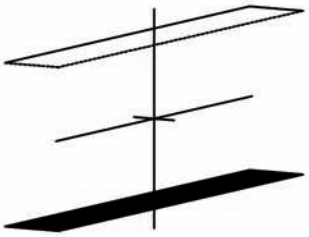
Allgemeine Form:
{hkl}



Pinakoide IV.St.



{0kl}	{h0l}	{hk0}
 Pinakoide I.St.	 Pinakoide II.St.	 Pinakoide III.St.

{100}	{010}	{001}
 I. Pinakoid	 II. Pinakoid	 III. Pinakoid

Mineral-Bsp.:

Albit $Na[AlSi_3O_8]$

Kyanit/Disthen $Al_2[O/SiO_4]$

Wollastonit $Ca[SiO_3]$

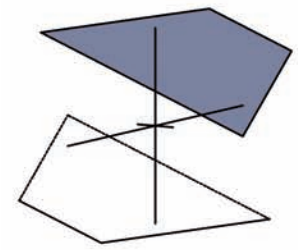
Axinit $Ca_2(Fe,Mn)Al_2[BO_3OH/Si_4O_{12})$

Sistema Cristalino Triclínico

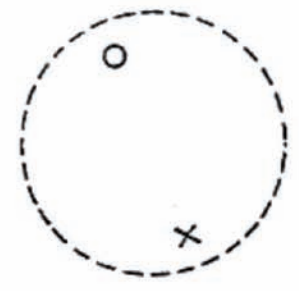
Holoedria Triclínico Símbolo: $\bar{1}$ ou C_i

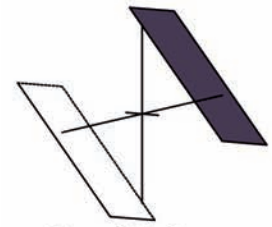
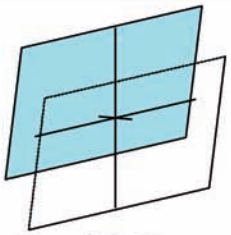
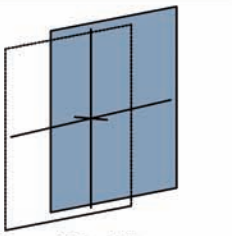
Classe pinacoidal triclínica

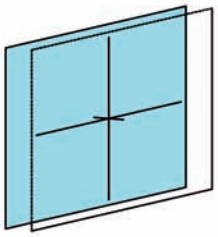
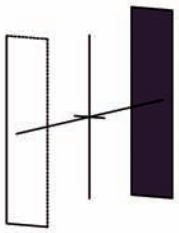
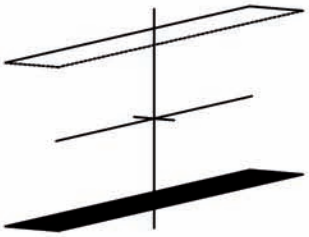
Forma geral:
{hkl}



Pinacóide IV. pos.



{0kl}	{h0l}	{hk0}
 Pinacóide I. pos.	 Pinacóide II. pos.	 Pinacóide III. pos.

{100}	{010}	{001}
 I.Pinacóide	 II. Pinacóide	 III. Pinacóide

Exemplos de Minerais:

Albita $Na[AlSi_3O_8]$

Cianita/Distênio $Al_2[O/SiO_4]$

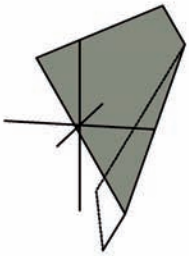
Wollastonita $Ca[SiO_3]$

Axinita $Ca_2(Fe,Mn)Al_2[BO_3OH/Si_4O_{12})$

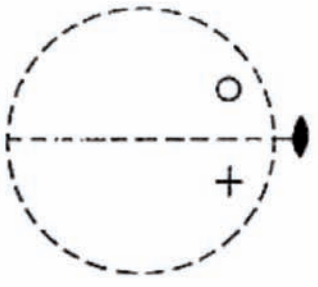
Monoklines Kristallsystem

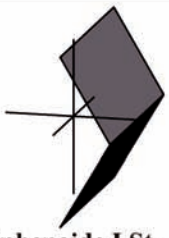
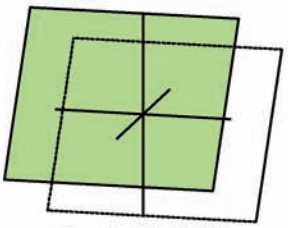
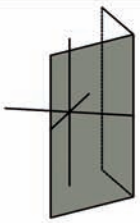
Monokline Hemimorphie Symbol: 2 oder C_2
Monoklin-sphenoidische Klasse

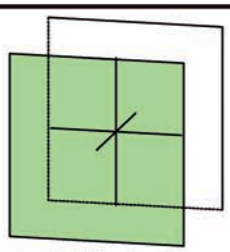
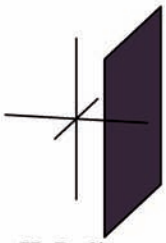
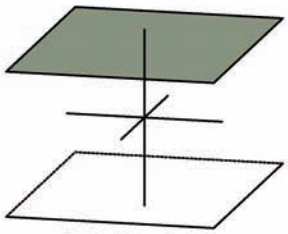
Allgemeine Form:
{hkl}



Sphenoide IV.St.



{0kl}	{h0l}	{hk0}
 Sphenoide I.St.	 Pinakoide II.St.	 Sphenoide III.St.

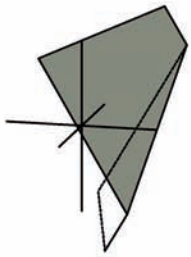
{100}	{010}	{001}
 I. Pinakoid	 II. Pedion	 III. Pinakoid

Mineral-Bsp.:
(Rohr-/Kandis-)Zucker $C_{12}H_{22}O_{11}$
Weinsäure $C_4H_6O_6$
Latiumite $(Ca,K)_8(Al,Mg,Fe)[(Si,Al)_{10}O_{25}/(SO_4)]$

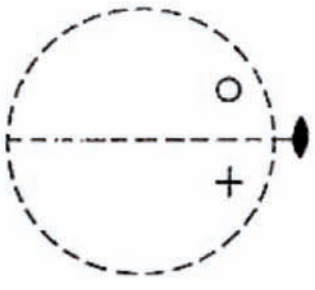
Sistema Cristalino Monoclínico

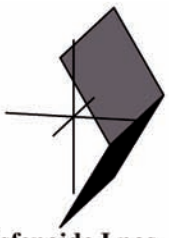
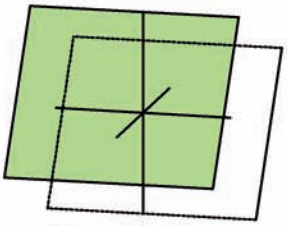
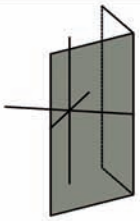
Monoclínico hemimorfite Símbolo: 2 ou C_2
Classe monoclínica-esfenoidal

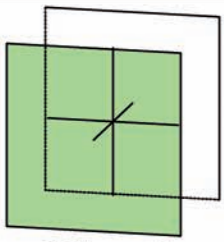
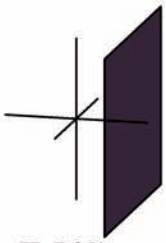
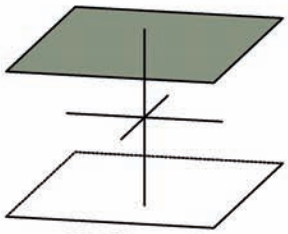
Forma geral:
{hkl}



Esfenoide IV.pos.



{0kl}	{h0l}	{hk0}
 Esfenoide I.pos.	 Pinacoide II.pos.	 Esfenoide III.pos.

{100}	{010}	{001}
 I. Pinacoide	 II. Pédion	 III. Pinacoide

Exemplos de minerais:

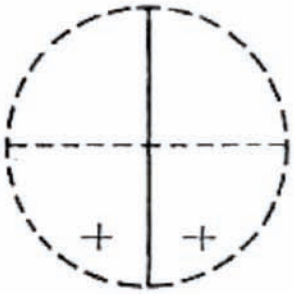
Açucar de cana $C_{12}H_{22}O_{11}$
Àcido tartàrico $C_4H_6O_6$
Latiumita $(Ca,K)_8(Al,Mg,Fe)[(Si,Al)_{10}O_{25}/(SO_4)]$

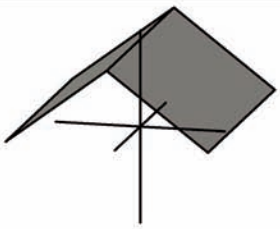
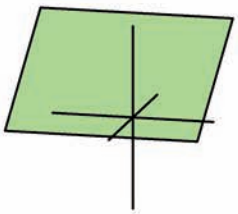
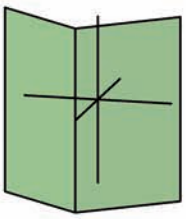
Monoklines Kristallsystem

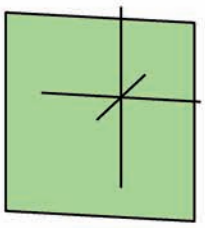
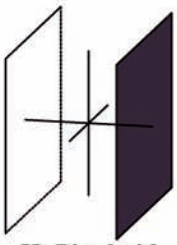
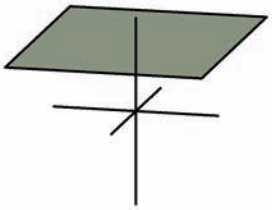
Monokline Hemiedrie II.Art Symbol: m oder C_s
Monoklin-domatische Klasse

Allgemeine Form:
{hkl}

Domen IV.St.



{0kl}	{h0l}	{hk0}
		
Domen I.St.	Pedien II.St.	Domen III.St.

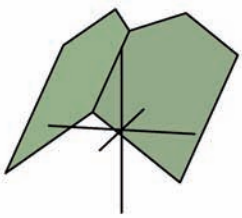
{100}	{010}	{001}
		
I. Pedion	II. Pinakoid	III. Pedion

Mineral-Bsp.:
Posnjakite $Cu_4[(OH)_6/SO_4]*H_2O$
Hilgardit $Ca_2[Cl/B_5O_8(OH)_2]$
Skolezit $Ca[Al_2Si_3O_{10}]*3H_2O$

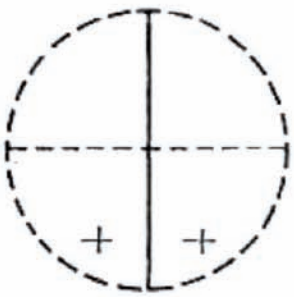
Sistema Cristalino Monoclínico

Monoclínico Hemiédrico II.Art Símbolo: m ou C_s
Monoclínico- Classe domática

Forma geral:
{hkl}



Domo IV.pos.



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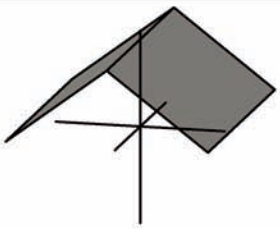
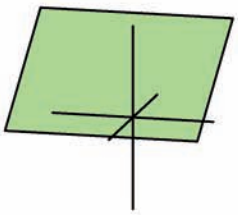
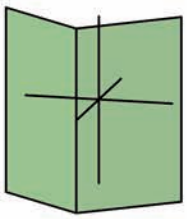
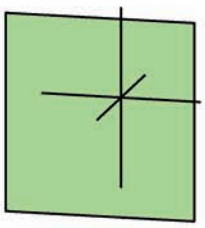
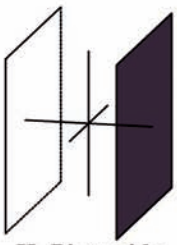
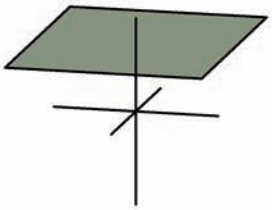
		
Domo I.pos.	Pédion II.pos.	Domo III.pos.

{100}	{010}	{001}
		
I. Pédio	II. Pinacoide	III. Pédio

Exemplos de minerais:

Posnjaquita $Cu_4[(OH)_6/SO_4]*H_2O$

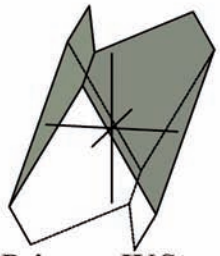
Hilgardita $Ca_2[Cl/B_5O_8(OH)_2]$

Escolecita $Ca[Al_2Si_3O_{10}]*3H_2O$

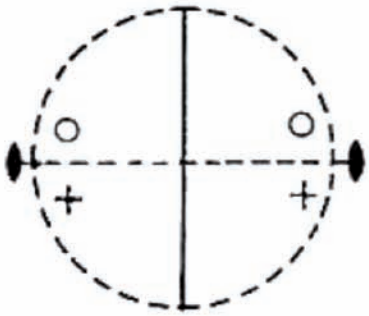
Monoklines Kristallsystem

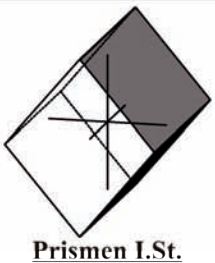
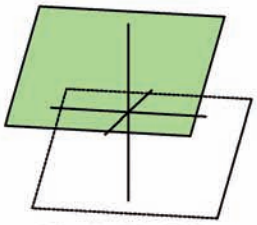
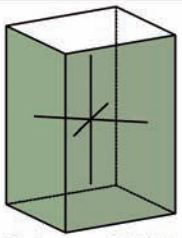
Monokline Holoedrie Symbol: 2/m oder C_{2h}
Monoklin-prismatische Klasse

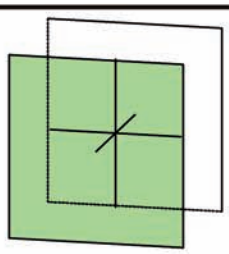
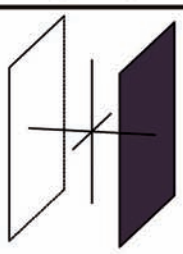
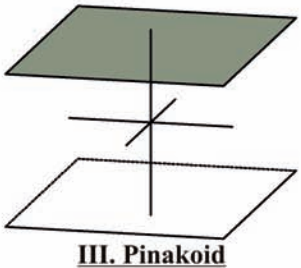
Allgemeine Form:
{hkl}



Prismen IV.St.



{0kl}	{h0l}	{hk0}
 Prismen I.St.	 Pinakoide II.St.	 Prismen III.St.

{100}	{010}	{001}
 I. Pinakoid	 II. Pinakoid	 III. Pinakoid

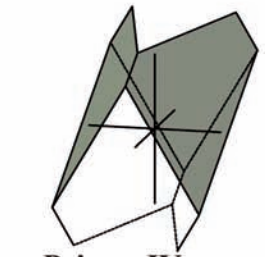
Mineral-Bsp.:

- häufigste Kristallklasse
- siehe Zusatzseite

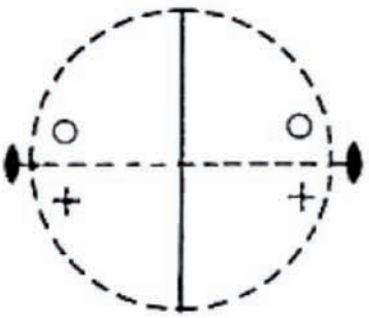
Sistema Cristalino Monoclínico

Monoclínico Holoedro Símbolo: 2/m ou C_{2h}
Classe monoclínico-prismático

Forma geral:
{hkl}



Prisma IV.pos.



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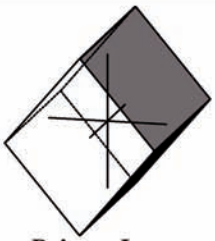
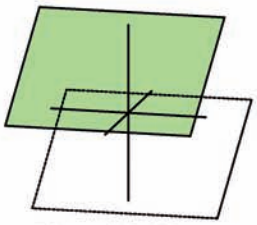
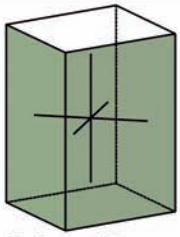
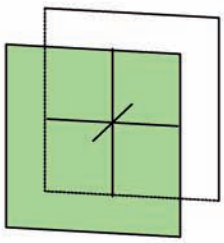
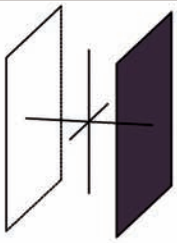
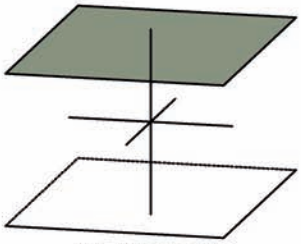
 Prisma I.pos.	 Pinacoide II.pos.	 Prisma III.pos.

{100}	{010}	{001}
 I. Pinacoide	 II. Pinacoide	 III. Pinacoide

Exemplos de minerais:

- classe cristalina mais frequente
- ver a página adicional

Mineral-Bsp. für 2/m: (häufigste Kristallklasse)

Gips $Ca[SO_4]*2H_2O$

Diopsid $Ca(Mg,Fe)[Si_2O_6]$

Orthoklas $K[AlSi_3O_8]$

Soda $Na_2[CO_3]*10H_2O$

Arsenopyrit FeAsS

Azurit $Cu_3[(CO_3)_2/(OH)_2]$

Biotit $K(Mg,Fe^{2+},Mn^{2+})_3[(OH,F)_2/Al, Fe^{3+},Ti^{3+})Si_3O_{10}]$

Borax $Na_2[B_4O_5/(OH)_4]*8H_2O$

Chalkosin Cu_2S

Epidot $Ca_2(Fe,Al)_3[(Si_2O_7)/(SiO_4)_3/(OH)_2]$

Hornblende $Ca_2(Mg,Fe,Al)_5[(Al,Si)_8O_{22}/(OH)_2]$

Kryolith Na_3AlF_6

Malachit $Cu_2\ [(CO_3)/(OH)_2]$

Muskovit $KAl_2[Si_3AlO_{10}/(OH,F)_2]$

Phlogopit $KMg_3[Si_3AlO_{10}/(F,OH)_2]$

Realgar AsS

Sanidin $(K,Na)[Al_3SiO_8]$

Staurolith $(Fe^{2+},Mg,Zn)_2Al_9[(Si,Al)_4/O_{22}/(OH)_2]$

Titanit $CaTi[O/SiO_4]$

Exemplos de minerais 2/m: (classe cristalográfica mais frequente)

Gipso $Ca[SO_4]*2H_2O$

Diopsídio $Ca(Mg,Fe)[Si_2O_6]$

Ortoclásio $K[AlSi_3O_8]$

Sodalita $Na_2[CO_3]*10H_2O$

Arsenopirita FeAsS

Azurita $Cu_3[(CO_3)_2/(OH)_2]$

Biotita $K(Mg,Fe^{2+},Mn^{2+})_3[(OH,F)_2/Al, Fe^{3+},Ti^{3+})Si_3O_{10}]$

Bórax $Na_2[B_4O_5/(OH)_4]*8H_2O$

Calcocita Cu_2S

Epidoto $Ca_2(Fe,Al)_3[(Si_2O_7)/(SiO_4)_3/(OH)_2]$

Hornblenda $Ca_2(Mg,Fe,Al)_5[(Al,Si)_8O_{22}/(OH)_2]$

Criolita Na_3AlF_6

Malaquita $Cu_2\ [(CO_3)/(OH)_2]$

Muscovita $KAl_2[Si_3AlO_{10}/(OH,F)_2]$

Flogopita $KMg_3[Si_3AlO_{10}/(F,OH)_2]$

Realgar AsS

Sanidina $(K,Na)[Al_3SiO_8]$

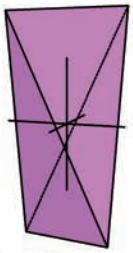
Estaurolita $(Fe^{2+},Mg,Zn)_2Al_9[(Si,Al)_4/O_{22}/(OH)_2]$

Titanita $CaTi[O/SiO_4]$

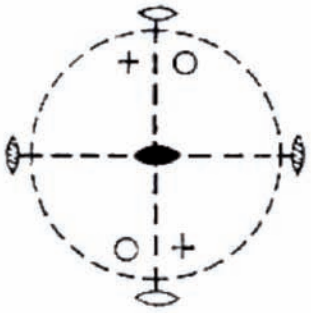
Orthorhombisches Kristallsystem

Rhombische Hemiedrie Symbol: 222 oder D_2
Rhombisch-disphenoidische Klasse

Allgemeine Form:
{hkl}



Rhombische Disphenoide



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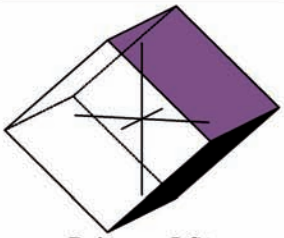
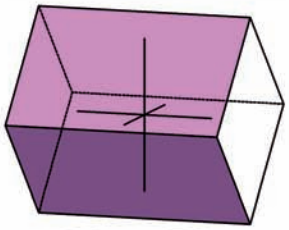
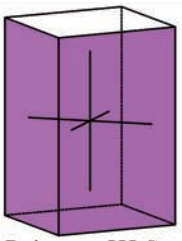
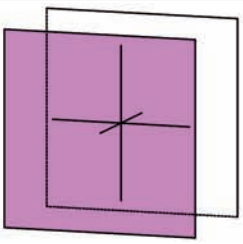
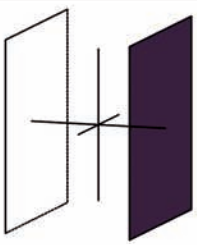
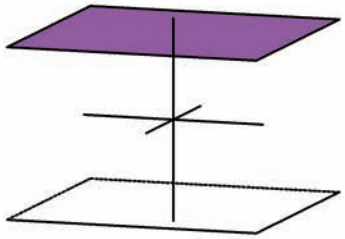
		
Prismen I.St.	Prismen II.St.	Prismen III.St.

{100}	{010}	{001}
		
I. Pinakoid	II. Pinakoid	III. Pinakoid

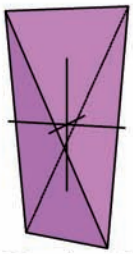
Mineral-Bsp.:
Epsomit (Bittersalz) $MgSO_4*7H_2O$
Zinkvitriol/Goslarit $ZnSO_4*7H_2O$
Austinit $CaZn[(AsO_4)/(OH)]$
Arsenoclasite $Mn_5[(AsO_4)_2/(OH)_4]$

Sistema Cristalino Ortorrômbico

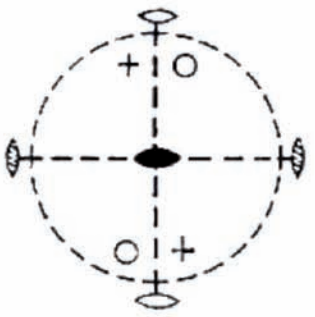
Hemiedro rômbico — Símbolo: 222 ou D_2

Classe Disfenóide rômbico

Forma geral:
{hkl}



Disfenoide rômbico



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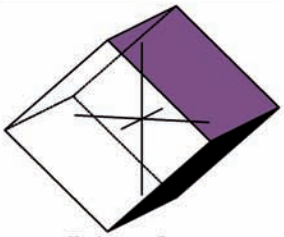
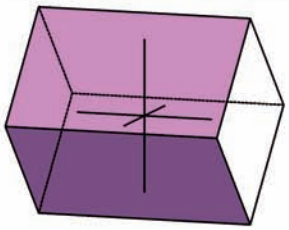
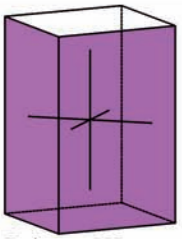
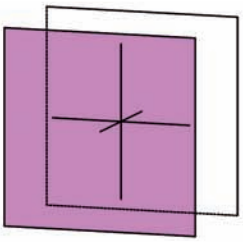
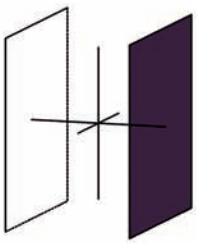
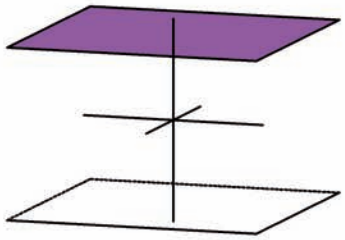
 Prisma I.pos.	 Prisma II.pos.	 Prisma III.pos.

{100}	{010}	{001}
 I. Pinacóide	 II. Pinacóide	 III. Pinacóide

Exemplos de minerais:

Epsomita $MgSO_4*7H_2O$

Goslarita $ZnSO_4*7H_2O$

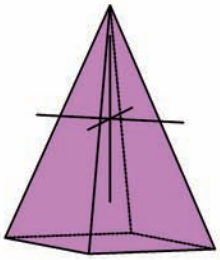
Austinita $CaZn[(AsO_4)/(OH)]$

Arsenoclosita $Mn_5[(AsO_4)_2/(OH)_4]$

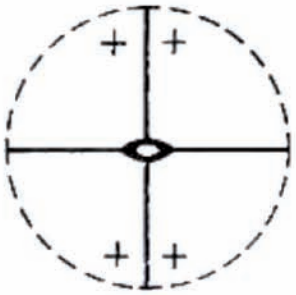
Orthorhombisches Kristallsystem

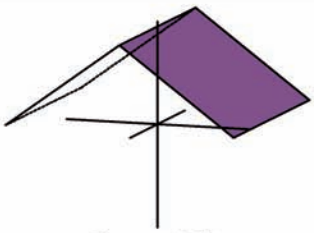
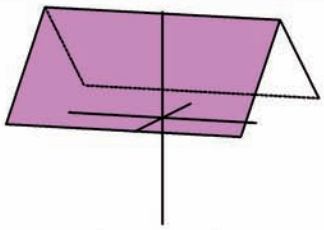
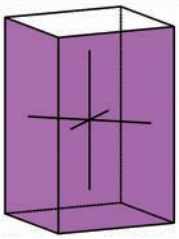
Rhombische Hemimorphie Symbol: mm2 oder C_{2v} (mm)
Rhombisch-pyramidale Klasse

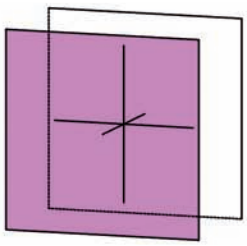
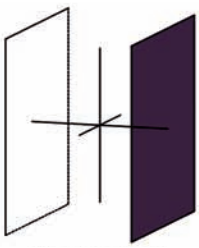
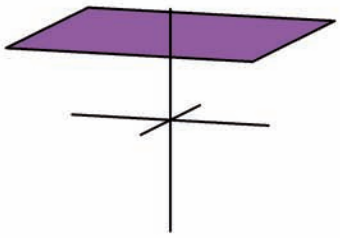
Allgemeine Form:
{hkl}



Rhombische Pyramiden



{0kl}	{h0l}	{hk0}
 Domen I.St.	 Domen II.St.	 Prismen III.St.

{100}	{010}	{001}
 I. Pinakoid	 II. Pinakoid	 III. Pedien

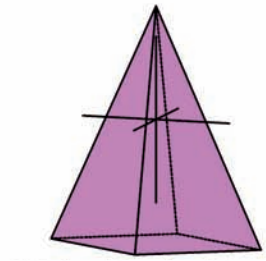
Mineral-Bsp.:
Hemimorphit/Kieselzinkerz $Zn_4[(OH)_2/Si_2O_7]*H_2O$
Struvit $MgNH_4[PO_4]*6H_2O$
Prehnit $Ca_2Al_2[Si_3O_{10}/(OH)_2]$

Sistema Cristalino Ortorrômbico

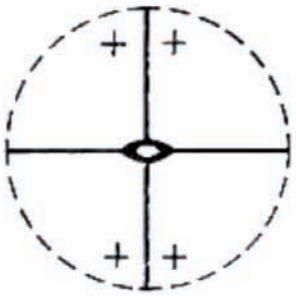
Hemimorfia rômbica
Classe piramidal rômbica

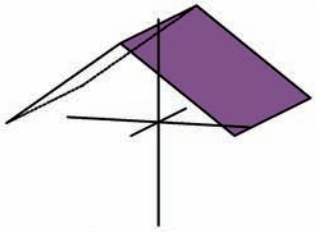
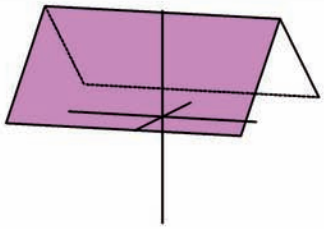
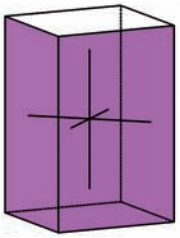
Símbolo: mm2 ou C_{2v}
(mm)

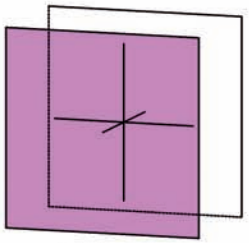
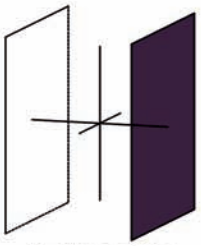
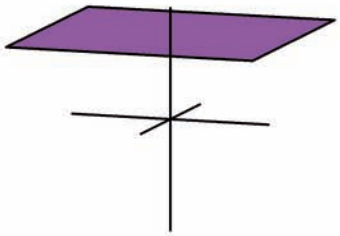
Forma geral:
{hkl}



Pirâmide rômbica



{0kl}	{h0l}	{hk0}
 Domo I.pos.	 Domo II.pos.	 Prisma III.pos.

{100}	{010}	{001}
 I. Pinacóide	 II. Pinacóide	 III. Pédio

Exemplos de minerais:

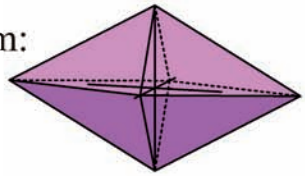
Hemimorfita/Calamina $Zn_4[(OH)_2/Si_2O_7]*H_2O$
Estrovita $MgNH_4[PO_4]*6H_2O$
Prehnita $Ca_2Al_2[Si_3O_{10}/(OH)_2]$

Orthorhombisches Kristallsystem

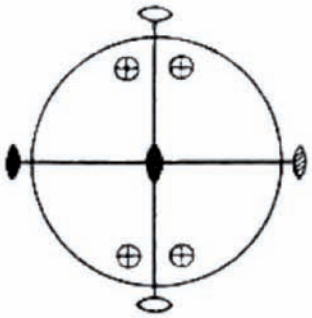
Rhombische Holoedrie
Rhombisch-dipyramidale Klasse

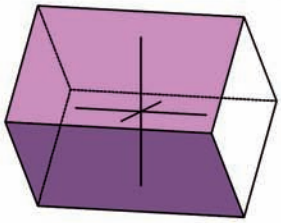
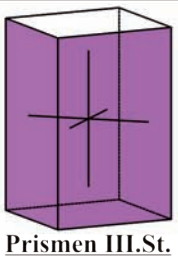
Symbol: 2/m 2/m 2/m (mmm) oder D_{2h}

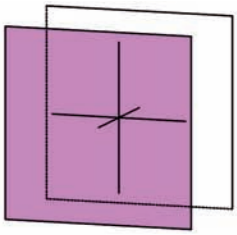
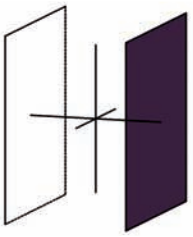
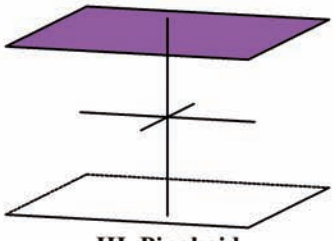
Allgemeine Form:
{hkl}



Rhombische Dipyramiden



{0kl}	{h0l}	{hk0}
		
Prismen I.St.	**Prismen II.St.**	**Prismen III.St.**

{100}	{010}	{001}
		
I. Pinakoid	**II. Pinakoid**	**III. Pinakoid**

Mineral-Bsp.:

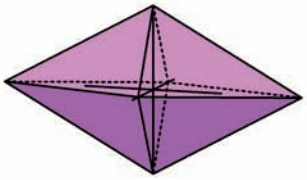
Schwefel S
Aragonit $Ca[CO_3]$
Anhydrit $Ca[SO_4]$
Baryt $Ba[SO_4]$
Topas $Al_2[F_2/SiO_4]$
Olivin $(Mg,Fe)_2[SiO_4]$

Sistema Cristalino Ortorrômbico

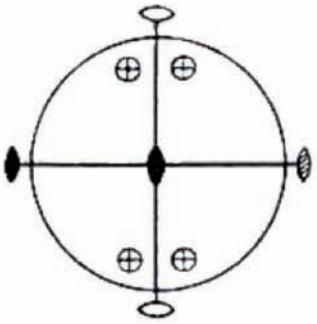
Holoedro rômbico
Classe dipiramidal ortorrômbica

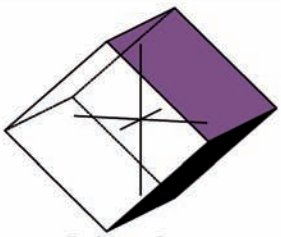
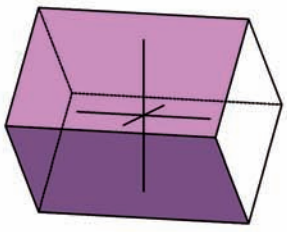
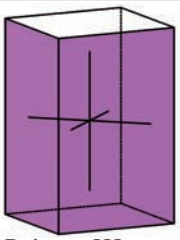
Símbolo: 2/m 2/m 2/m (mmm) ou D_{2h}

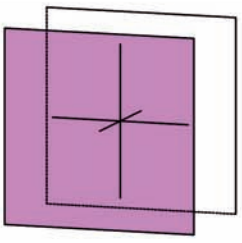
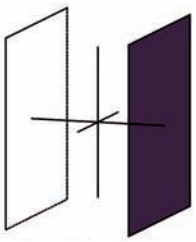
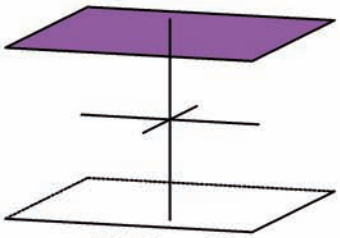
Forma geral: {hkl}



Dipiramidal ortorrômbica



{0kl}	{h0l}	{hk0}
		
Prisma I.pos.	**Prisma II.pos.**	**Prisma III.pos.**

{100}	{010}	{001}
		
I. Pinacóide	**II. Pinacóide**	**III. Pinacóide**

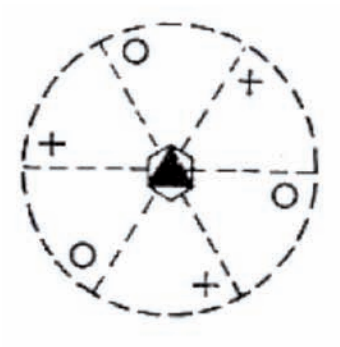
Exemplos de minerais:

Enxofre S
Aragonita $Ca[CO_3]$
Anidrita $Ca[SO_4]$
Barita $Ba[SO_4]$
Topázio $Al_2[F_2/SiO_4]$
Olivina $(Mg,Fe)_2[SiO_4]$

Trigonales Kristallsystem

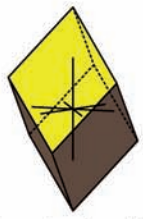
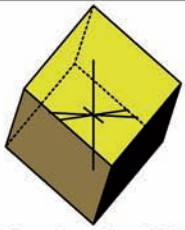
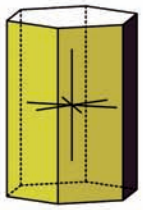
Hexagonal-rhomboedrische
Tetartoedrie
Rhomboedrische Klasse

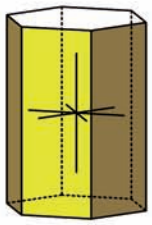
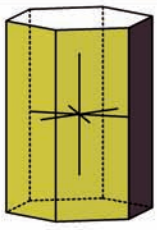
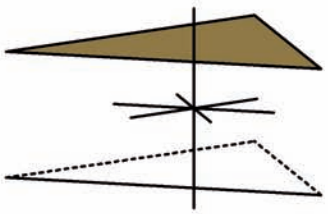
Symbol: $\bar{3}$ oder C_{3i}



Allgemeine Form:
{hkl} / {hkil}

Rhomboeder III.St.

{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2}$hl}	{hk0} / {hki0}
		
Rhomboeder I.St.	Rhomboeder II.St.	Hex. Prismen II.St.

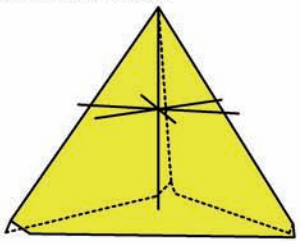
{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Hex. Prisma I.St.	Hex. Prisma II.St.	Basispinakoid

Mineral-Bsp.:
Dolomit $CaMg[(CO_3)_2]$
Dioptas $Cu[Si_6O_{18}]$
Phenakit Be_2SiO_4

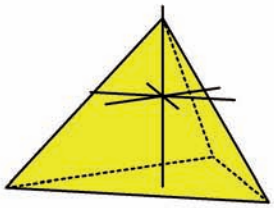
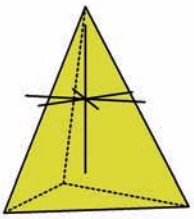
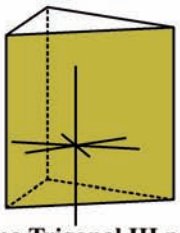
Sistema Cristalino Trigonal

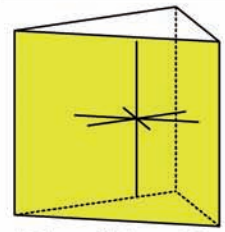
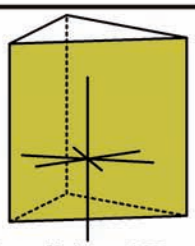
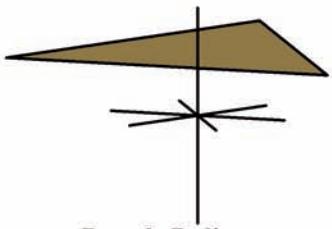
Hemimorfo Trigonal Tetraedro Símbolo: 3 ou C_3
Classe Trigonal-Piramidal

Forma geral:
{hkl} / {hkil}



Piramide Trigonal III. pos.

{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Piramide Trigonal I.pos.	Piramide Trigonal II.pos.	Prisma Trigonal III.pos.

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma Trigonal I.pos.	Prisma Trigonal II.pos.	Base de Pedium

Exemplos de minerais:

Susannita $Pb_4[(SO_4)/(CO_3)_2/(OH)_2]$

Carlinita TlS_2

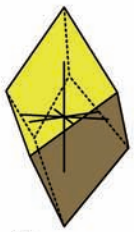
Beligermanita(Modificação de baixa temperatura)
$Pb_5Ge_3O_{11}$

Trigonales Kristallsystem

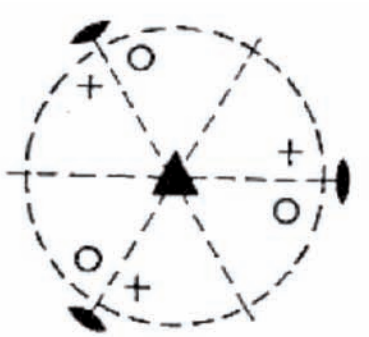
Hexagonal-trapezoedrische
Tetartoedrie
Trigonal-trapezoedrische Klasse

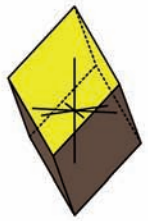
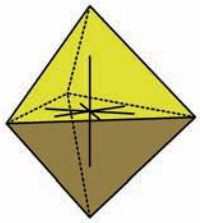
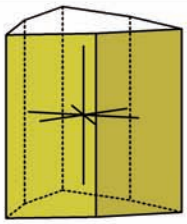
Symbol: 32 oder D_3

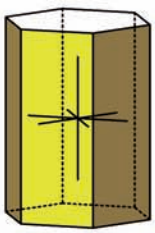
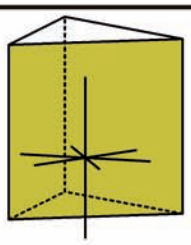
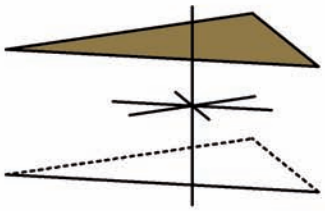
Allgemeine Form:
{hkl} / {hkil}



Trig. Trapezoeder



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Rhomboeder I.St.	Trig. Diyramiden II.St.	Ditrig. Prismen II.St.

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Hex. Prisma I.St.	Trig. Prismen II.St.	Basispinakoid

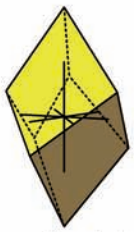
Mineral-Bsp.:
Zinnober/Cinnabarit HgS
Tiefquarz SiO_2
Selen Se
Tellur Te

Sistema Cristalino Trigonal

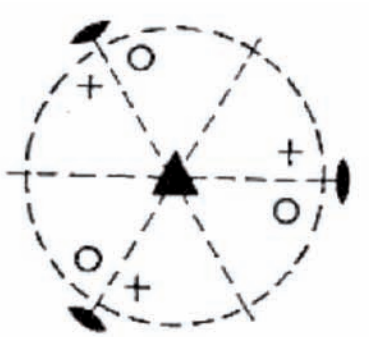
Hexagonal trapezoedral
Tetardoedro
Classe trigonal trapezoédrica

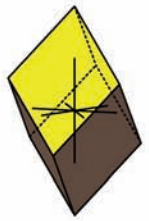
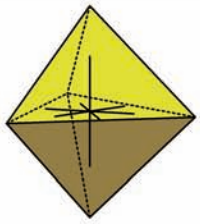
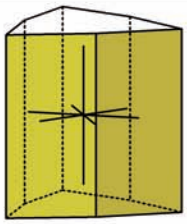
Símbolo: 32 ou D_3

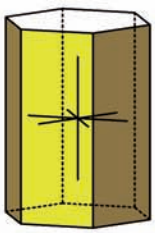
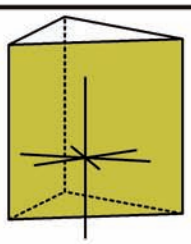
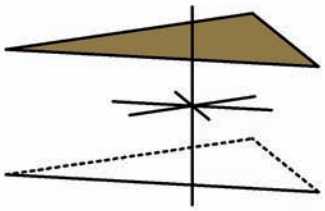
Forma geral:
{hkl} / {hkil}



Trapezoedro trigonal



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Romboedro I.pos.	Dipiramide Trigonal II.pos.	Prisma Ditrigonal II.pos.

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma Hexagonal I.pos.	Prisma Trigonal II.pos.	Base pinacoidal

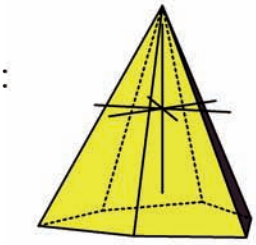
Exemplos de minerais:
Cinábrio HgS
Quartzo baixa Temperatura SiO_2
Selênio Se
Telúrio Te

Trigonales Kristallsystem

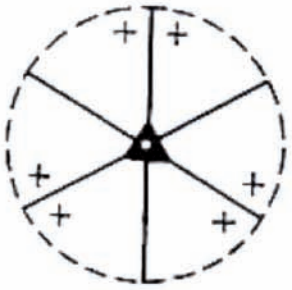
Hemimorphie d. rhomboedrischen Hemiedrie
Ditrigonal-pyramidale Klasse

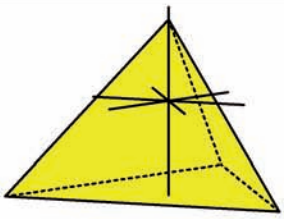
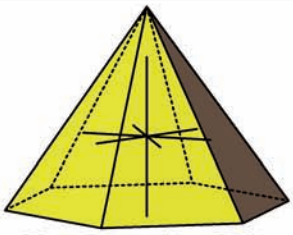
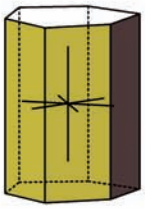
Symbol: 3m oder C_{3v}

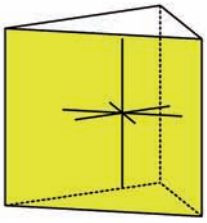
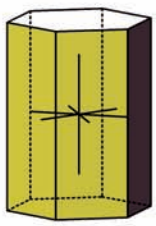
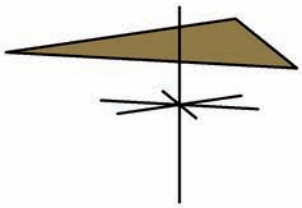
Allgemeine Form:
{hkl} / {hkil}



Ditrig. Pyramiden I.St.



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2}$hl}	{hk0} / {hki0}
		
Trig. Pyramiden I.St.	Hex. Pyramiden II.St.	Ditrig. Prismen II.St.

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Trig. Prismen I.St.	Hex. Prisma II.St.	Basispedien

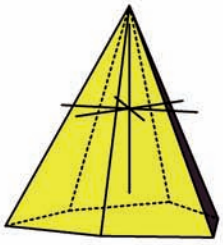
Mineral-Bsp.:
Turmalin $(X)(Y_3)(Z_6)[Si_6O_{18}/(BO_3)_3/(V_3)(W)]$
Proustit Ag_3AsS_3
Lithiumniobat $LiNbO_3$

Sistema Cristalino Trigonal

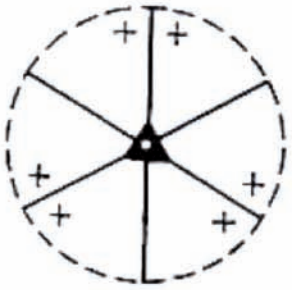
Hemimorfia Romboédrica
Hemiedria
Classe Ditrigonal-Piramidal

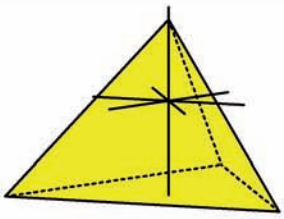
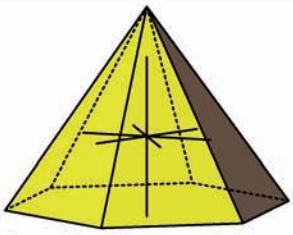
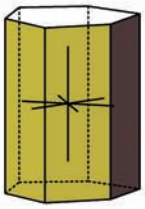
Símbolo: 3m ou C_{3v}

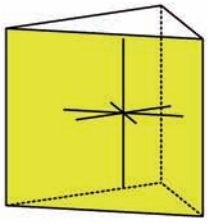
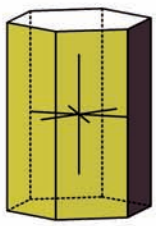
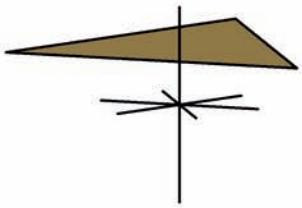
Forma geral:
{hkl} / {hkil}



Ditrigonal Piramidal I.pos.



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Piramide Trigonal I.pos.	Piramide Hexagonal II.pos.	Prisma Ditrigonal II.pos.

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma Trigonal I.pos.	Prisma Hexagonal II.pos.	Base de Pedium

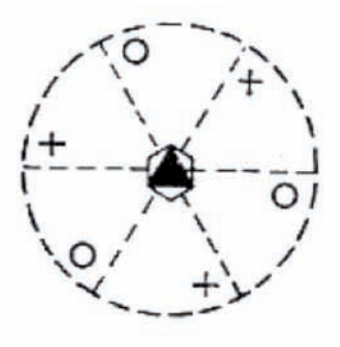
Exemplos de minerais e compostos inorgânicos:

Turmalina $(X)(Y_3)(Z_6)[Si_6O_{18}/(BO_3)_3/(V_3)(W)]$
Proustita Ag_3AsS_3
Niobato de lítico $LiNbO_3$

Trigonales Kristallsystem

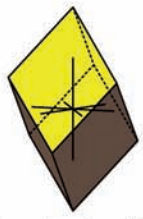
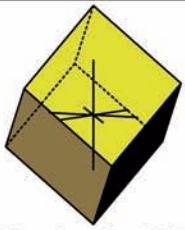
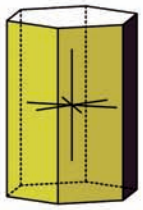
Hexagonal-rhomboedrische
Tetartoedrie
Rhomboedrische Klasse

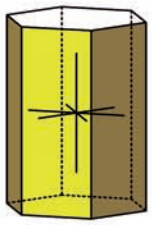
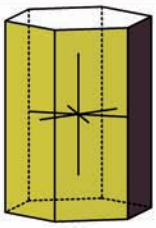
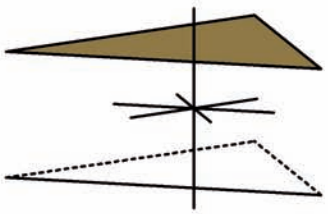
Symbol: $\bar{3}$ oder C_{3i}



Allgemeine Form:
{hkl} / {hkil}

Rhomboeder III.St.

{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2}$hl}	{hk0} / {hki0}
		
Rhomboeder I.St.	**Rhomboeder II.St.**	**Hex. Prismen II.St.**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Hex. Prisma I.St.	**Hex. Prisma II.St.**	**Basispinakoid**

Mineral-Bsp.:
Dolomit $CaMg[(CO_3)_2]$
Dioptas $Cu[Si_6O_{18}]$
Phenakit Be_2SiO_4

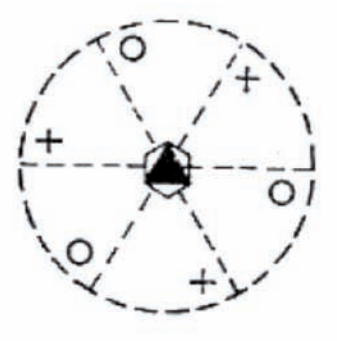
Sistema Cristalino Trigonal

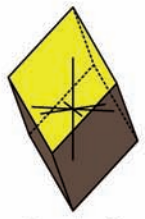
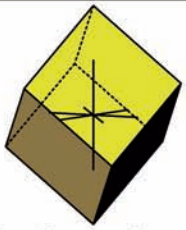
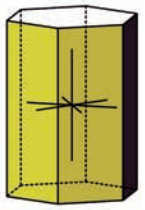
Hexagonal-romboédrica
Tetartoédrica
Classe Romboédrica

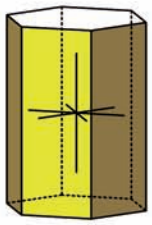
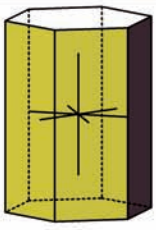
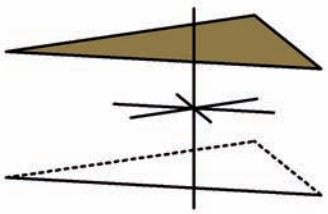
Símbolo: $\bar{3}$ ou C_{3i}

Forma geral:
{hkl} / {hkil}

Romboedro III.pos.



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2}$hl}	{hk0} / {hki0}
		
Romboedro I.pos.	**Romboedro II.pos.**	**Prisma Hexagonal II.pos.**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma Hexagonal I.pos.	**Prisma Hexagonal II.pos.**	**Bases de Pinacóide**

Exemplos de minerais:

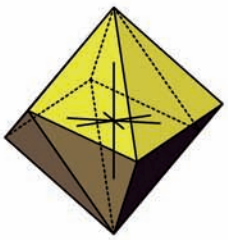
Dolomita $CaMg[(CO_3)_2]$
Dioptásio $Cu[Si_6O_{18}]$
Fenacita Be_2SiO_4

Trigonales Kristallsystem

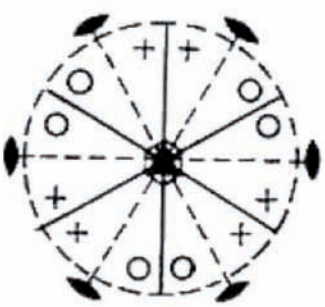
Hexagonal-rhomboedrische Hemiedrie
Ditrigonal-skalenoedrische Klasse

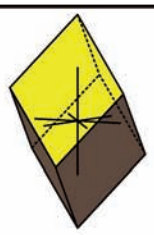
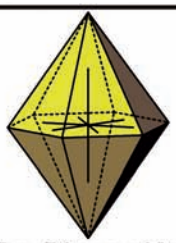
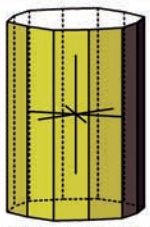
Symbol: $\bar{3}$ 2/m oder D_{3d} ($\bar{3}$m)

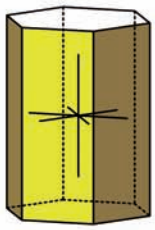
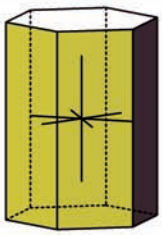
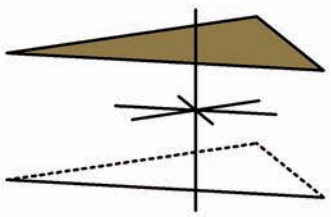
Allgemeine Form:
{hkl} / {hkil}



Ditrig. Skalenoeder



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2}$hl}	{hk0} / {hki0}
		
Rhomboeder I.St.	Hex. Dipyramiden II.St.	Dihex. Prismen

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Hex. Prisma I.St.	Hex. Prisma II.St.	Basispinakoid

Mineral-Bsp.:

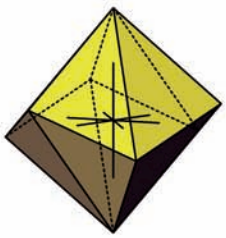
Calcit $Ca[CO_3]$
Korund Al_2O_3
Hämatit Fe_2O_3
Siderit $Fe[CO_3]$
Rhodochrosit $Mn[CO_3]$

Sistema Cristalino Trigonal

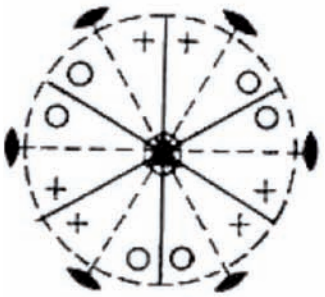
Hexagonal-romboédrica
Hemiedro
Classe ditrigonal escalonétrica

Símbolo: $\bar{3}$ 2/m ou D_{3d}
($\bar{3}$m)

Forma geral:
{hkl} / {hkil}



Escalenoedro ditrigonal



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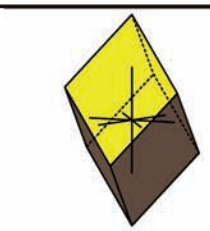
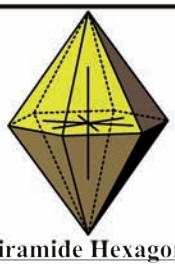
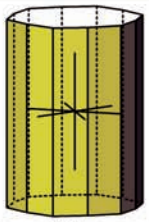
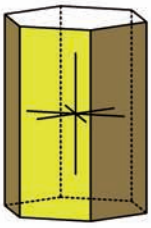
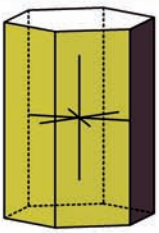
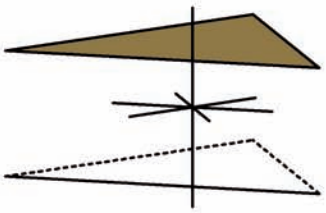
		
Romboedral I.pos.	Dipiramide Hexagonal II.pos.	Prisma Dihexagonal

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma Hexagonal I.pos.	Prisma Hexagonal II.pos.	Base Pinacoidal

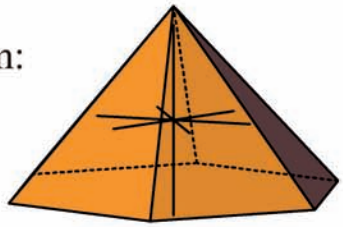
Exemplos de minerais:

Calcita $Ca[CO_3]$ Siderita $Fe[CO_3]$
Coríndon Al_2O_3 Rodocrosita $Mn[CO_3]$
Hematita Fe_2O_3

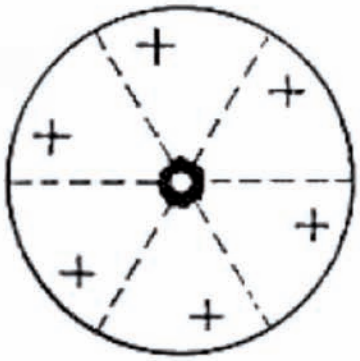
Hexagonales Kristallsystem

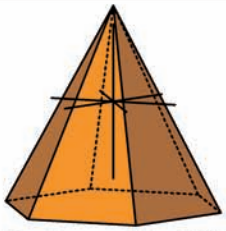
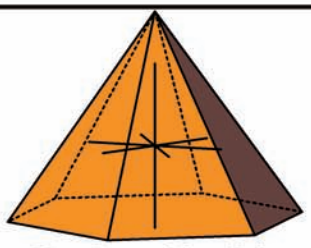
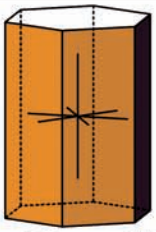
Hexagonale Tetartoedrie Symbol: 6 oder C_6
Hexagonal-pyramidale Klasse

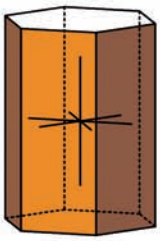
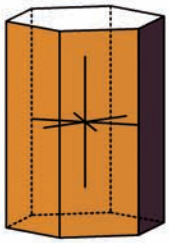
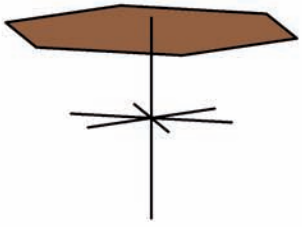
Allgemeine Form:
{hkl} / {hkil}



Hexagonale Pyramiden III. St.



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Hex.Pyramiden I.St.	Hex. Pyramiden II.St.	Hex.Prismen III.St.

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Hex.Prisma I.St.	Hex.Prisma II.St.	Basispedien

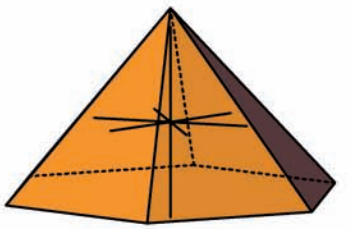
Mineral-Bsp.:
Lithiumiodat α-$LiIO_3$
Nephelin $(Na,K)[AlSiO_4]$
Thaumasit $Ca_3[SO_4/CO_3/Si(OH)_6]*12H_2O$

Sistema Cristalino Hexagonal

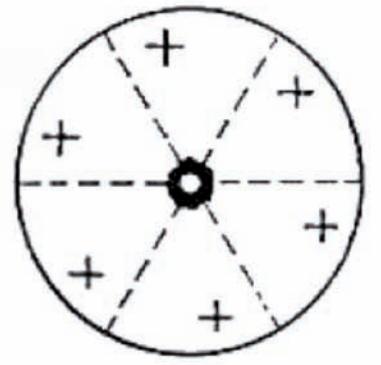
Tetraedro Hexagonal — Símbolo: 6 ou C_6

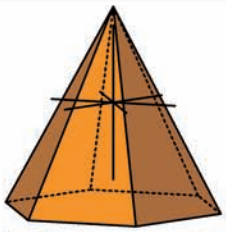
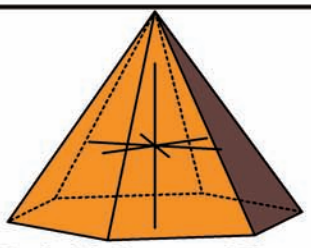
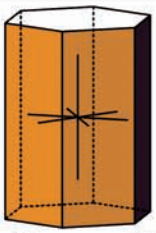
Classe piramidal hexagonal

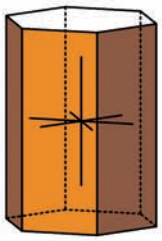
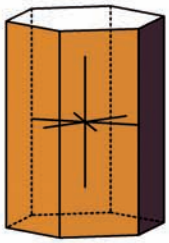
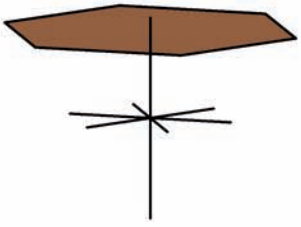
Forma geral::
{hkl} / {hkil}



Pirâmide hexagonal III. pos.



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Pyrâmide hexagonal I.pos.	Pyrâmide hexagonal II.pos.	Prisma Hexagonal III.pos.

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma Hexagonal I.pos.	Prisma Hexagonal II.pos.	Base pedal

Exemplos de minerais e compostos inorgânicos:

Iodato de lítico α-$LiIO_3$

Nefelina $(Na,K)[AlSiO_4]$

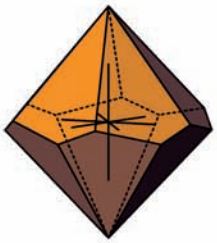
Thaumasita $Ca_3[SO_4/CO_3/Si(OH)_6]*12H_2O$

Hexagonales Kristallsystem

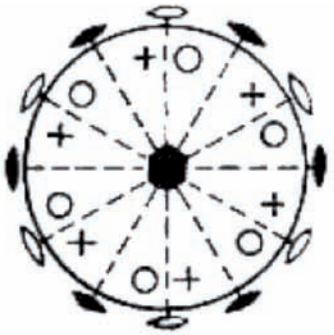
Hexagonal-trapezoedrische Hemiedrie
Hexagonal-trapezoedrische Klasse

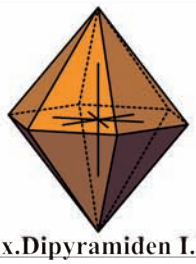
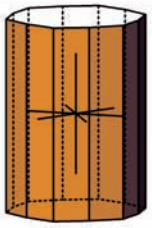
Symbol: 622 oder D_6
(6 2)

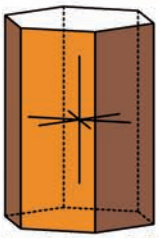
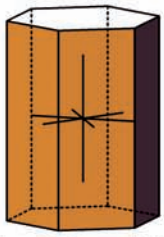
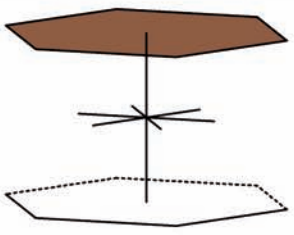
Allgemeine Form:
{hkl} / {hkil}



Hexagonaler Trapezoeder



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2}$hl}	{hk0} / {hki0}
		
Hex.Dipyramiden I.St.	**Hex. Dipyramiden II.St.**	**Dihex. Prismen**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Hex.Prisma I.St.	**Hex. Prisma II.St.**	**Basispinakoid**

Mineral-Bsp.:
Hochquarz SiO_2
Virgilit $LiAlSi_2O_6$
Rhabdophan $(Ce,La)PO_4*H_2O$

Sistema Cristalino Hexagonal

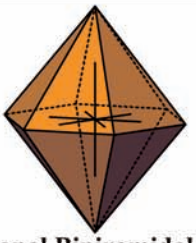
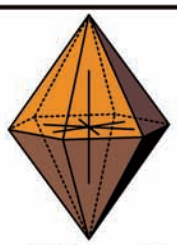
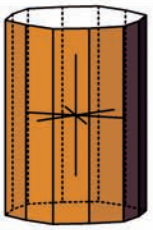
Trapezoedro Hexagonal
Hemiedria
Classe Trapezoédrica hexagonal

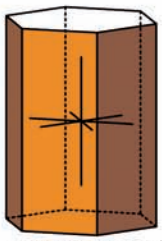
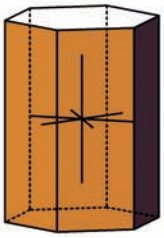
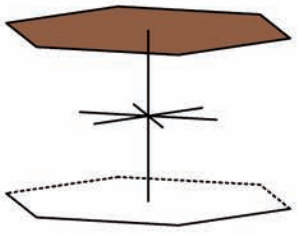
Símbolo: 622 ou D_6

(6 2)

Forma geral:
{hkl} / {hkil}

Trapezoedro Hexagonal

{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Hexagonal Bipiramidal I.pos.	**Hexagonal Bipiramidal II.pos.**	**Prisma Dihexagonal**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma Hexagonal I.pos.	**Prisma Hexagonal II.pos.**	**Base Pinacoidal**

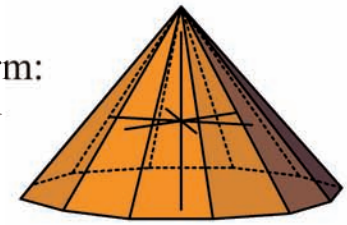
Exemplos de minerais:

Quartzo beta SiO_2
Virgilita $LiAlSi_2O_6$
Rhabdofana $(Ce,La)PO_4*H_2O$

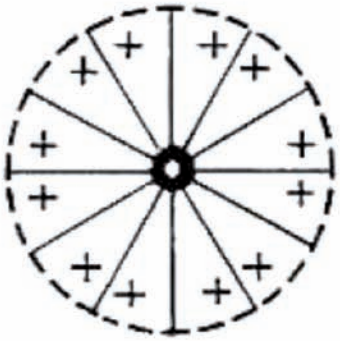
Hexagonales Kristallsystem

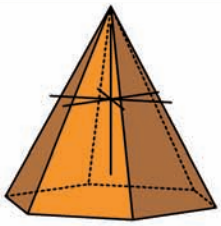
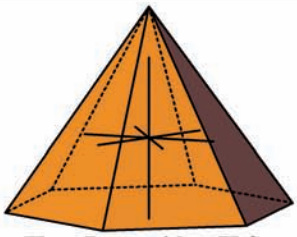
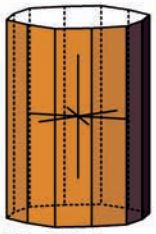
Hexagonale Hemimorphie Symbol: 6mm oder C_{6v}
Dihexagonal-pyramidale Klasse

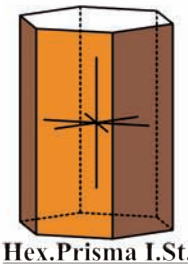
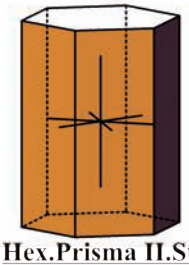
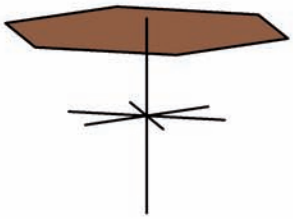
Allgemeine Form:
{hkl} / {hkil}



Dihexagonale Pyramide



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2}$hl}	{hk0} / {hki0}
		
Hex.Pyramiden I.St.	**Hex. Pyramiden II.St.**	**Dihex.Prismen**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Hex.Prisma I.St.	**Hex.Prisma II.St.**	**Basispedien**

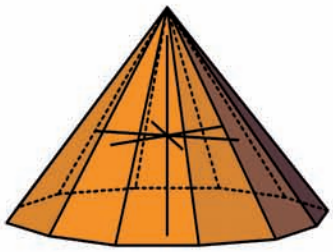
Mineral-Bsp.:
Wurzit ZnS
Zinkit ZnO
Greenockit CdS

Sistema Cristalino Hexagonal

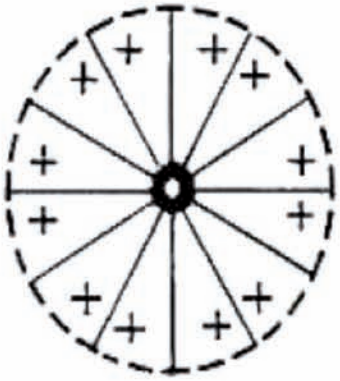
Hemimorfia Hexagonal — Símbolo: 6mm ou C_{6v}

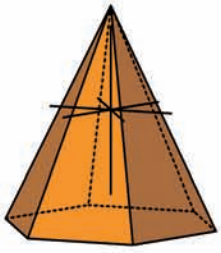
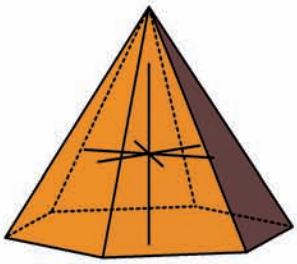
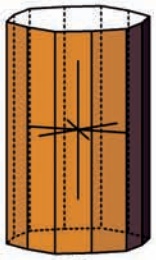
Classe Dihexagonal Piramidal

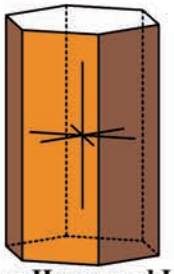
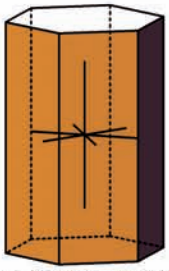
Forma geral:
{hkl} / {hkil}



Dihexagonal Piramidal



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Hexagonal Piramidal I.pos.	**Hexagonal Piramidal II.pos.**	**Prisma Dihexagonal**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma Hexagonal I.pos.	**Prisma Hexagonal II.pos.**	**Base de Pediem**

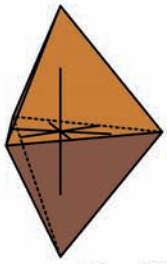
Exemplos de minerais:

Wurzita ZnS
Zincita ZnO
Greenoquita CdS

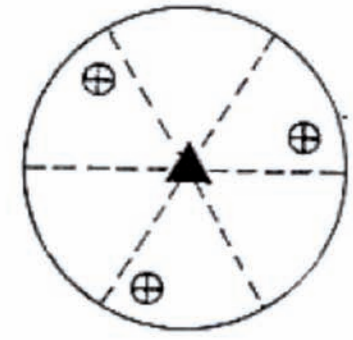
Hexagonales Kristallsystem

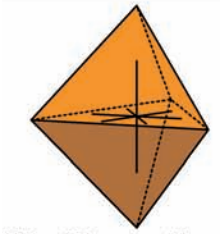
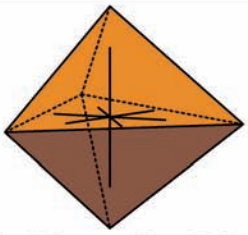
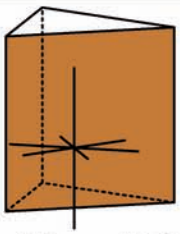
Trigonale Tetartoedrie Symbol: $\bar{6}$ oder C_{3h}
Trigonal-dipyramidale Klasse

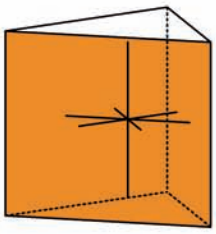
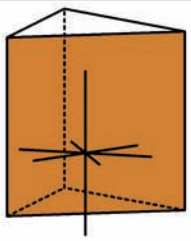
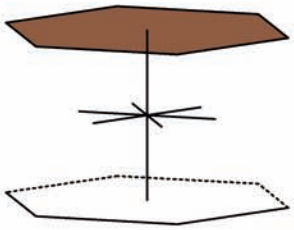
Allgemeine Form:
{hkl} / {hkil}



Trig. Dipyramiden III.St.



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Trig. Dipyramiden I.St.	**Trig. Dipyramiden II.St.**	**Trig.Prismen III.St.**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Trig.Prismen I.St.	**Trig.Prismen II.St.**	**Basispinakoid**

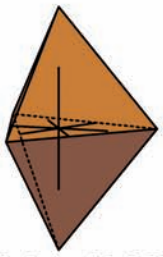
Mineral-Bsp.:
Bleigermanat(Hochtemp.Modifikation) $Pb_5[Ge_3O_{11}]$
Penfieldit $Pb_2[Cl_3/OH]$
Ganomalit $Pb_9Ca_5Mn[(Si_2O_7)_3/(SiO_4)_3]$

Sistema Cristalino Hexagonal

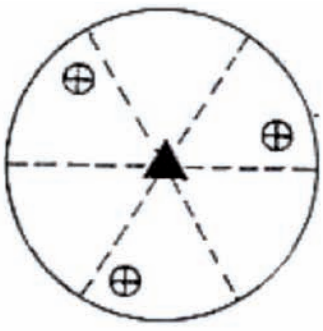
Tetraedro Trigonal
Classe Trigonal Bipiramidal

Símbolo: $\bar{6}$ ou C_{3h}

Forma geral:
{hkl} / {hkil}



Trigonal Bipiramidal III.pos.



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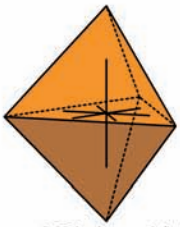
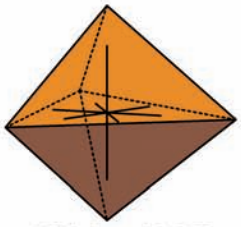
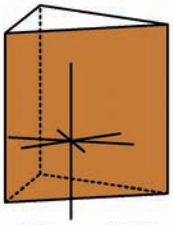
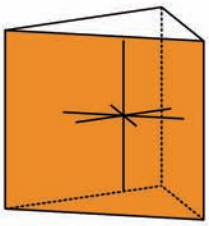
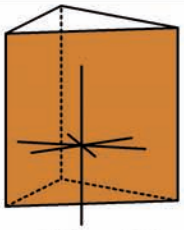
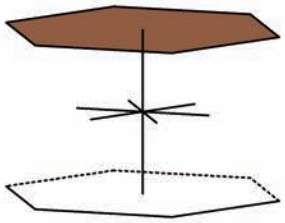
		
Trigonal Bipiramidal I.pos.	Trigonal Bipiramidal II.pos.	Prisma Trigonal III.pos.

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma Trigonal I.pos.	Prisma Trigonal II.pos.	Base de Pinacoide

Exemplos de minerais e compostos inorgânicos:

Germanato de chumbo, modificação de baixa temperatura $Pb_5[Ge_3O_{11}]$

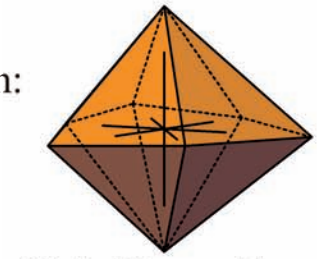
Penfieldita $Pb_2[Cl_3/OH]$

Ganomalita $Pb_9Ca_5Mn[(Si_2O_7)_3/(SiO_4)_3]$

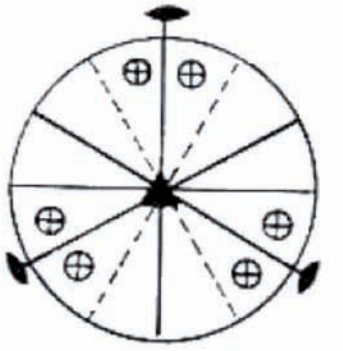
Hexagonales Kristallsystem

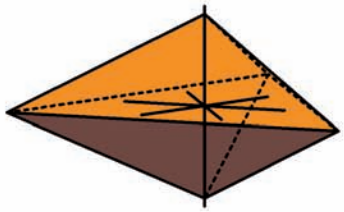
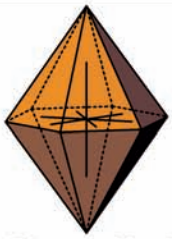
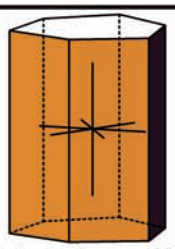
Trigonale Hemiedrie Symbol: $\bar{6}2m$ oder D_{3h}
Ditrigonal-dipyramidale Klasse

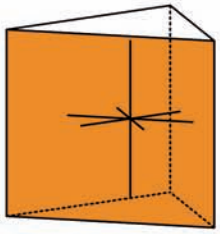
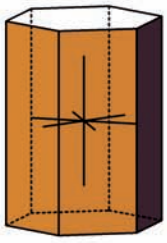
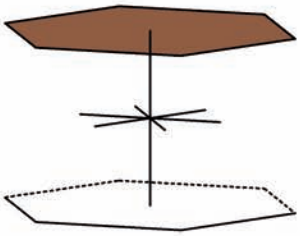
Allgemeine Form:
{hkl} / {hkil}



Ditrig. Dipyramiden



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2}$hl}	{hk0} / {hki0}
		
Trig. Dipyramiden I.St.	Hex. Dipyramiden II.St.	Ditrig.Prismen III.St.

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Trig.Prismen I.St.	Hex.Prismen II.St.	Basispinakoid

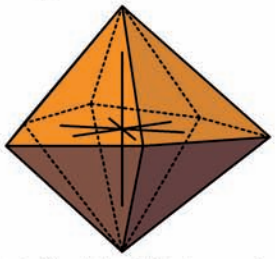
Mineral-Bsp.:
Benitoit $BaTi[Si_3O_9]$
Belkovit $Ba_3(Nb,Ti)_6(Si_2O_7)_2O_{12}$

Sistema Cristalino Hexagonal

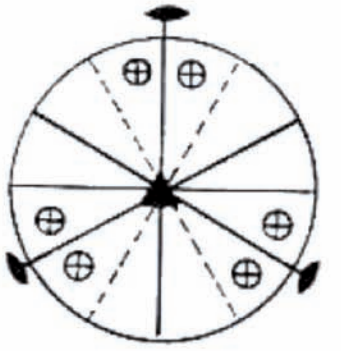
Hemiedro Trigonal — Símbolo: $\bar{6}2m$ ou D_{3h}

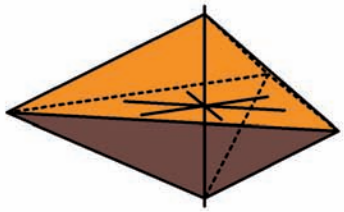
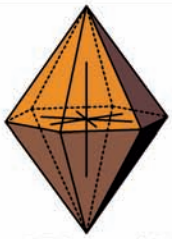
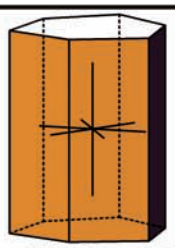
Classe Ditrigonal Bipiramidal

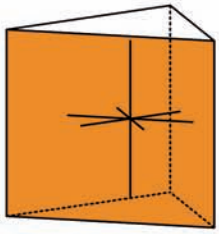
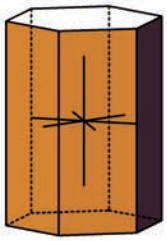
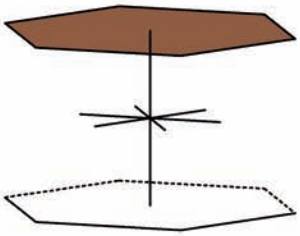
Forma geral:
{hkl} / {hkil}



Bipirâmide ditrigonal



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Trigonal Bipiramidal I.pos.	**Hexagonal Bipiramidal II.pos.**	**Prisma Ditrigonal III.pos.**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma Trigonal I.pos.	**Prisma Hexagonal II.pos.**	**Base de Pinacóide**

Exemplos de minerais:

Benitoíta $BaTi[Si_3O_9]$

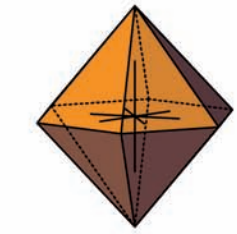
Belcovita $Ba_3(Nb,Ti)_6(Si_2O_7)_2O_{12}$

Hexagonales Kristallsystem

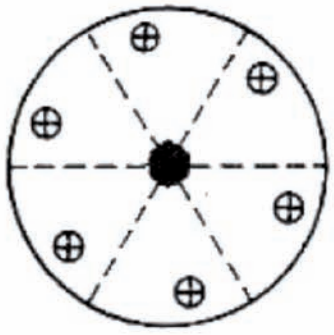
Hexagonal-pyramidale
Hemiedrie
Hexagonal-dipyramidale Klasse

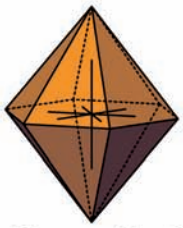
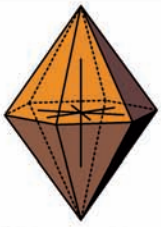
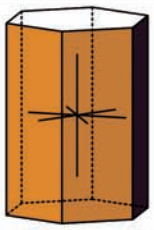
Symbol: 6/m oder C_{6v}

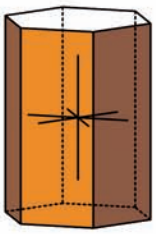
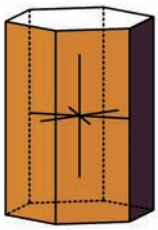
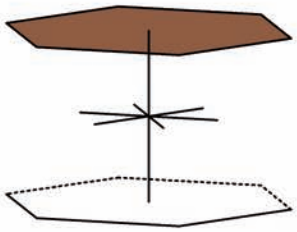
Allgemeine Form:
{hkl} / {hkil}



Hexagonale Dipyramide III.St.



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Hex.Dipyramiden I.St.	**Hex. Dipyramiden II.St.**	**Hex.Prismen III.St.**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Hex.Prisma I.St.	**Hex.Prisma II.St.**	**Basispinakoid**

Mineral-Bsp.:

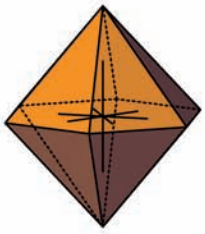
Apatit $(Ca,Ba,Pb,Sr,etc.)_5[(PO_4,CO_3)_3/(F,Cl,OH)]$
Pyromorphit $Pb_5[(PO_4)_3/Cl]$
Vanadinit $Pb_5[(VO_4)_3/Cl]$

Sistema Cristalino Hexagonal

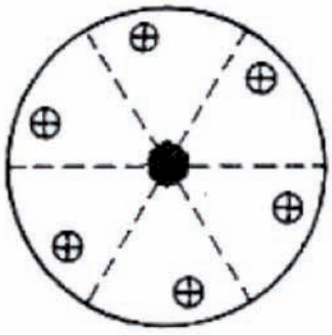
Hexagonal Piramidal
Hemiedria
Classe Hexagonal-Dipiramidal

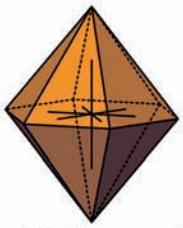
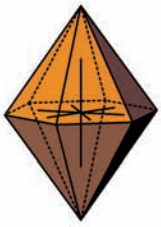
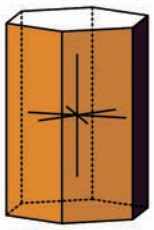
Símbolo: 6/m ou C_{6v}

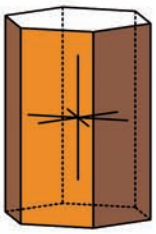
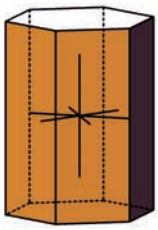
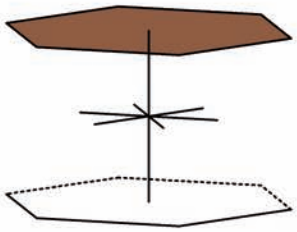
Forma geral:
{hkl} / {hkil}



Dipirâmide hexagonal III.pos.



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Dipiramide Hexagonal I.pos.	**Dipiramide Hexagonal II.pos.**	**Prisma Hexagonal III.pos.**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma Hexagonal I.pos.	**Prisma Hexagonal II.pos.**	**Bases Pinacóide**

Exemplos de minerais:

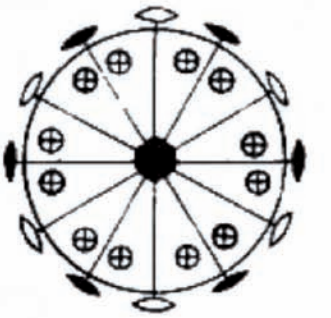
Apatita $(Ca,Ba,Pb,Sr,etc.)_5[(PO_4,CO_3)_3/(F,Cl,OH)]$
Piromorfita $Pb_5[(PO_4)_3/Cl]$
Vanadinita $Pb_5[(VO_4)_3/Cl]$

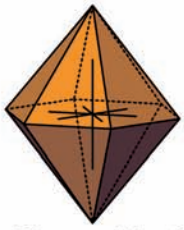
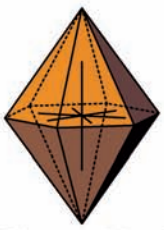
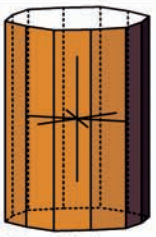
Hexagonales Kristallsystem

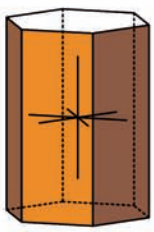
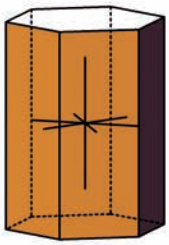
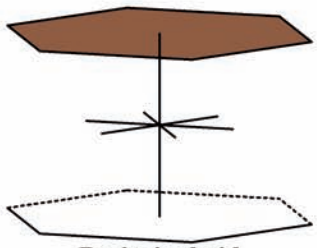
Hexagonale Holoedrie Symbol: 6/mmm oder D_{6h}
Dihexagonal-dipyramidale Klasse (6/m 2/m 2/m)

Allgemeine Form:
{hkl} / {hkil}

Dihexagonale Dipyramiden



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Hex.Dipyramiden I.St.	**Hex.Dipyramiden II.St.**	**Dihex.Prismen**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Hex.Prisma I.St.	**Hex.Prisma II.St.**	**Basispinakoid**

Mineral-Bsp.:

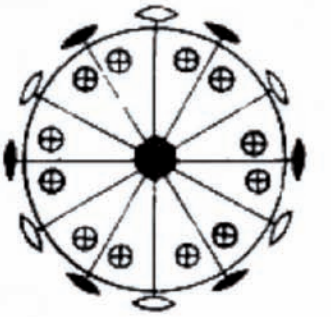
Beryll $Be_3Al_2[Si_6O_{18}]$ Covellin CuS
Graphit C Eis H_2O
Hochtridymit SiO_2

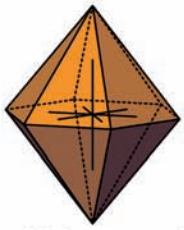
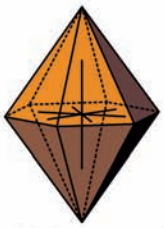
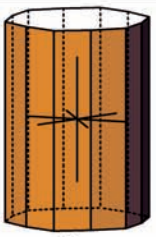
Sistema Cristalino Hexagonal

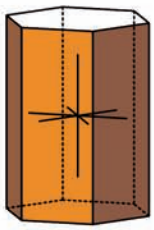
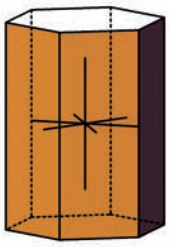
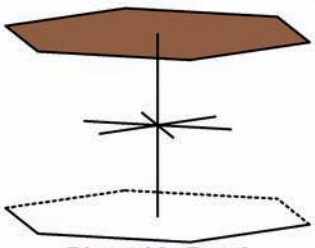
Holoedria hexagonal Símbolo: 6/mmm ou D_{6h}
Classe bipiramidal dihexagonal (6/m 2/m 2/m)

Forma geral:
{hkl} / {hkil}

Bipirâmide dihexagonal



{h0l} / {h0$\bar{h}$l}	{hhl} / {hh$\bar{2h}$l}	{hk0} / {hki0}
		
Bipiramide hexagonal I.pos.	**Bipiramide hexagonal II.pos.**	**Prisma dihexagonal**

{100} / {10$\bar{1}$0}	{110} / {11$\bar{2}$0}	{001} / {0001}
		
Prisma hexagonal I.pos.	**Prisma hexagonal II.pos.**	**Pinacoide Basal**

Exemplos de minerais:

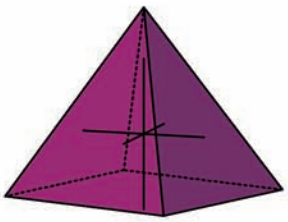
Berilo $Be_3Al_2[Si_6O_{18}]$ Covellita CuS
Grafita C Gelo H_2O
Tridimita SiO_2

Tetragonales Kristallsystem

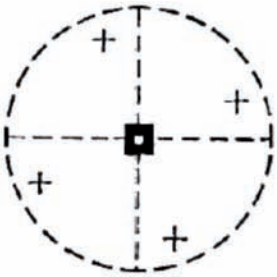
Hemimorphie d. tetragonal-pyramidalen Hemiedrie
Tetragonal-pyramidale Klasse

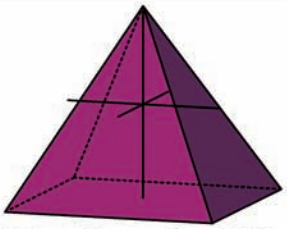
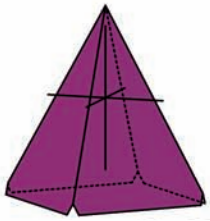
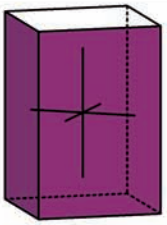
Symbol: 4 oder C_4

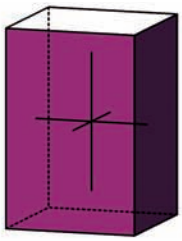
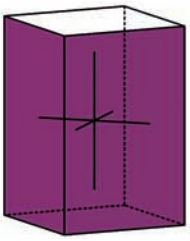
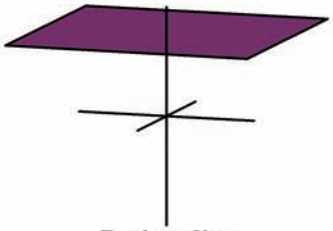
Allgemeine Form:
{hkl}



Tetrag. Pyramiden III.St.



{h0l}	{hhl}	{hk0}
		
Tetrag.Pyramiden II.St.	Tetrag.Pyramiden I.St.	Tetrag. Prismen III.St.

{100}	{110}	{001}
		
Tetrag.Prisma II.St.	Tetrag.Prisma I.St.	Basispedien

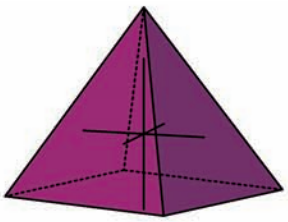
Mineral-Bsp.:
Piypite $K_2Cu_2[O/(SO_4)_2]$
Pinnoite $Mg[B_2O_4]*3H_2O$
Percleveite-(Ce) $(Ce,La,Nd)_2[Si_2O_7]$

Sistema Cristalino Tetragonal

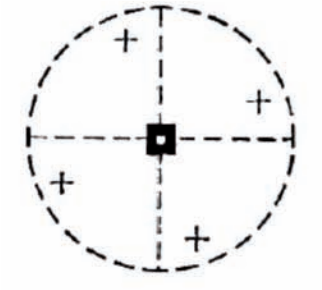
Ditetragonal Hemimorfo
Hemiedro Piramidal
Classe tetragonal piramidal

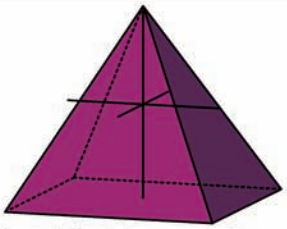
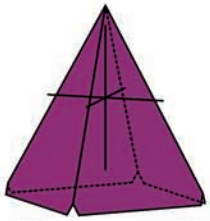
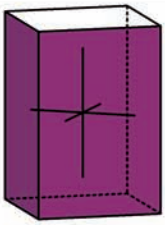
Símbolo: 4 ou C_4

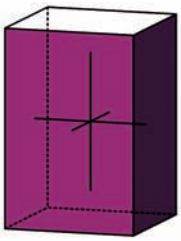
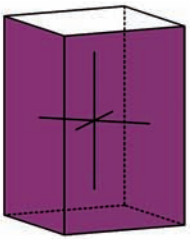
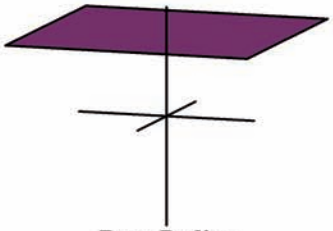
Forma geral:
{hkl}



Pirâmide tetragonal III.pos.



{h0l}	{hhl}	{hk0}
		
Piramide tetragonal II.pos.	Piramide tetragonal I.pos.	Prisma tetragonal III.pos.

{100}	{110}	{001}
		
Prisma tetragonal II.pos.	Prisma tetragonal I.pos.	Base Pedien

Exemplos de minerais:

Piypita $K_2Cu_2[O/(SO_4)_2]$
Pinnoíta $Mg[B_2O_4]*3H_2O$
Percleveíta-(Ce) $(Ce,La,Nd)_2[Si_2O_7]$

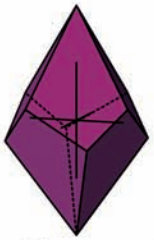
Tetragonales Kristallsystem

Tetragonal-trapezoedrische Hemiedrie

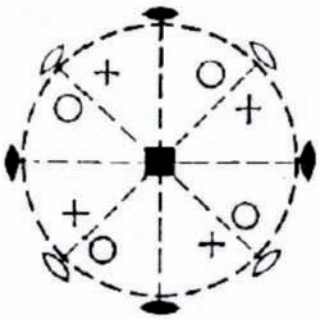
Symbol: 422 oder D_4

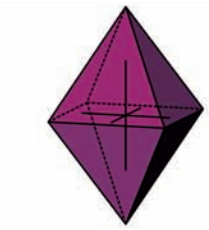
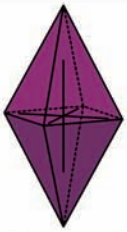
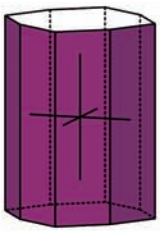
Tetragonal-trapezoedrische Klasse

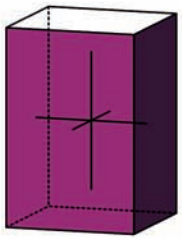
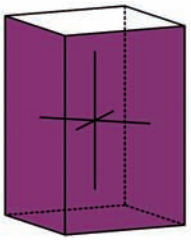
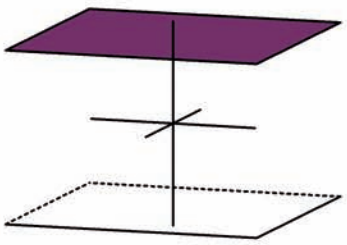
Allgemeine Form: {hkl}



Tetrag. Trapezoeder



{h0l}	{hhl}	{hk0}
		
Tetrag.Dipyramiden II.St.	Tetrag.Dipyramiden I.St.	Ditetrag. Prismen

{100}	{110}	{001}
		
Tetrag.Prisma II.St.	Tetrag.Prisma I.St.	Basispinakoid

Mineral-Bsp.:

Retgersit $Ni[SO_4]*6H_2O$

Maucherit $Ni_{11}As_8$

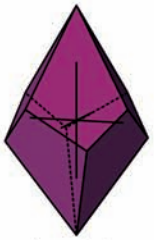
Cristobalit SiO_2

Sistema Cristalino Tetragonal

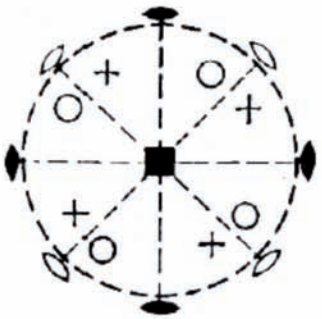
Trapezoedral tetragonal
Hemiedrio
Classe tetragonal trapezoédrica

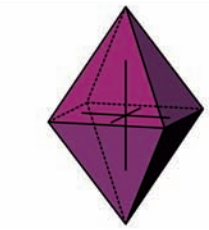
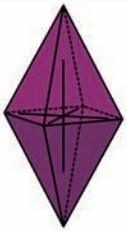
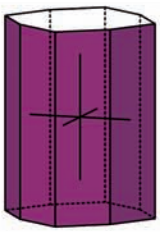
Símbolo: 422 ou D_4

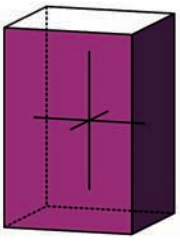
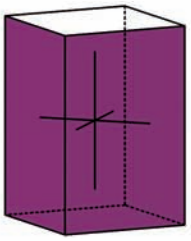
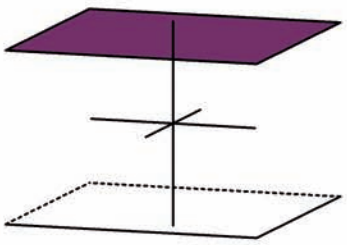
Forma geral:
{hkl}



Trapezoedro tetragonal



{h0l}	{hhl}	{hk0}
		
Dipyramide tetragonal II.pos.	Dipyramide tetragonal I.pos.	Prisma ditetragonal

{100}	{110}	{001}
		
Prisma tetragonal II.pos.	Prisma tetragonal I.pos.	Base pinacoide

Exemplos de minerais:

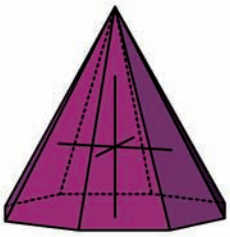
Retgersita $Ni[SO_4]*6H_2O$
Maucherita $Ni_{11}As_8$
Cristobalita SiO_2

Tetragonales Kristallsystem

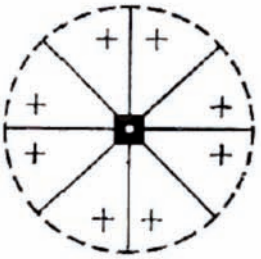
Hemimorphie d. tetragonalen
Holoedrie
Ditetragonal-pyramidale Klasse

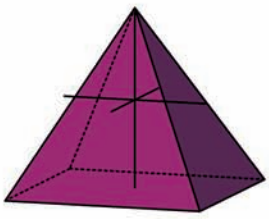
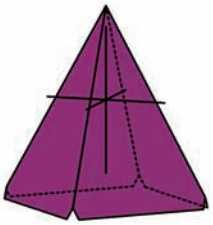
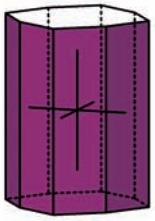
Symbol: 4mm oder C_{4v}

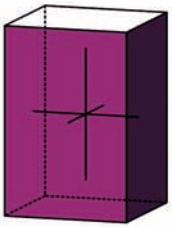
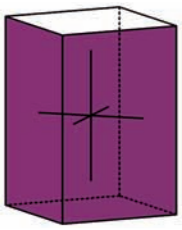
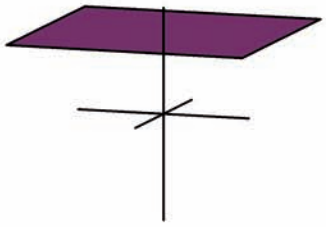
Allgemeine Form:
{hkl}



Ditetrag. Pyramiden



{h0l}	{hhl}	{hk0}
		
Tetrag.Pyramiden II.St.	Tetrag.Pyramiden I.St.	Ditetrag. Prismen

{100}	{110}	{001}
		
Tetrag.Prisma II.St.	Tetrag.Prisma I.St.	Basispedien

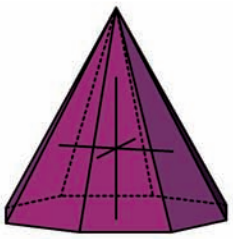
Mineral-Bsp.:
Diaboleit $Pb_2Cu[Cl_2/(OH)_4]$
Macedonite $PbTiO_3$
Nielsenite $PdCu_3$

Sistema Cristalino Tetragonal

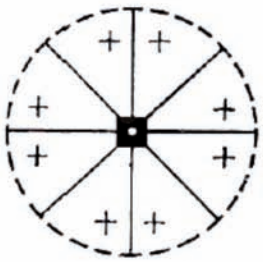
Tetragonal Hemimorfo
Holoedria
Classe ditetragonal piramidal

Símbolo: 4mm ou C_{4v}

Forma geral:
{hkl}



Pirâmide ditetragonal



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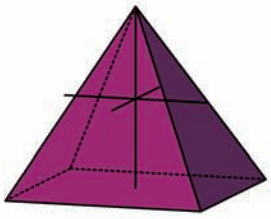
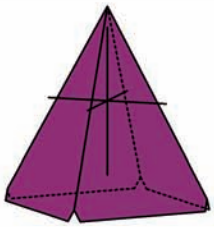
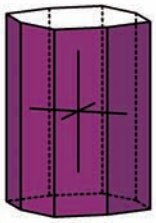
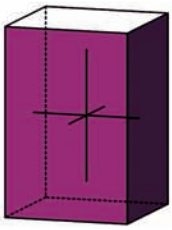
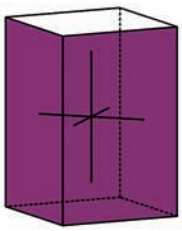
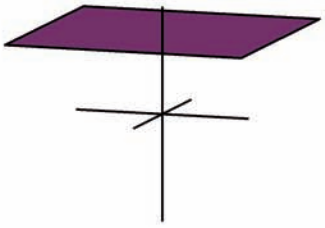
		
Piramide tetragonal II.pos.	Piramide tetragonal I.pos.	Prisma Ditetragonal

{100}	{110}	{001}
		
Prisma tetragonal II.pos.	Prisma tetragonal I.pos.	Base Pedien

Exemplos de minerais:

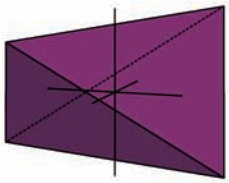
Diaboleita $Pb_2Cu[Cl_2/(OH)_4]$
Macedonita $PbTiO_3$
Nielsenita $PdCu_3$

Tetragonales Kristallsystem

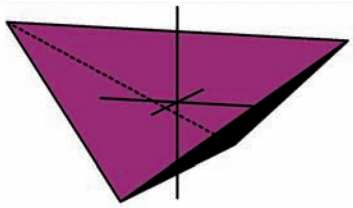
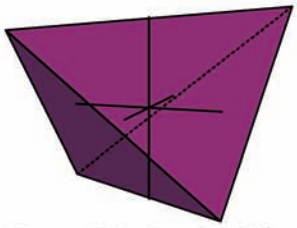
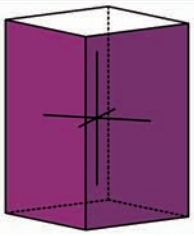
Tetragonal-sphenoidische
Tetartoedrie
Tetragonal-disphenoidische Klasse

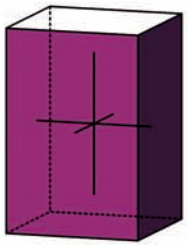
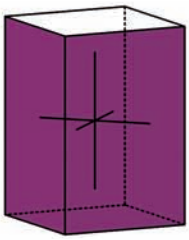
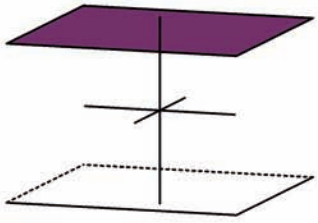
Symbol: $\bar{4}$ oder S_4

Allgemeine Form:
{hkl}



Tetrag.Disphenoide III.St.

{h0l}	{hhl}	{hk0}
		
Tetrag.Disphenoide II.St.	Tetrag.Disphenoide I.St.	Tetrag.Prismen III.St.

{100}	{110}	{001}
		
Tetrag.Prisma II.St.	Tetrag.Prisma I.St.	Basispinakoid

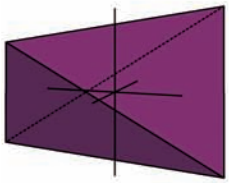
Mineral-Bsp.:
Cahnit $Ca_2[AsO_4/B(OH)_4]$
Tugtupit $Na_8[(AlBeSi_4O_{12})_2/Cl_2]$
Schreibersit $(Fe,Ni)_3P$

Sistema Cristalino Tetragonal

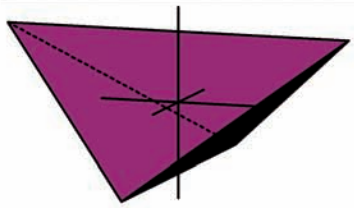
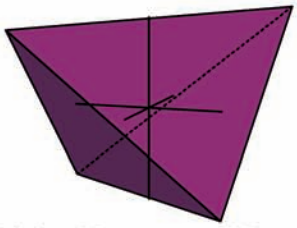
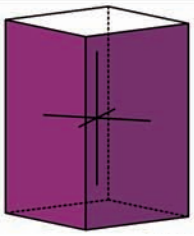
Esfenoide tetragonal
Tetardoedro
Classe tetragonal disfenoidral

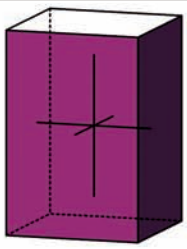
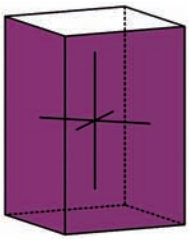
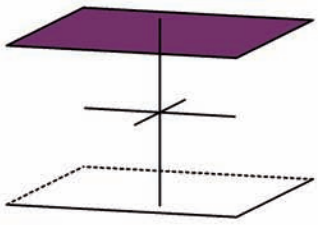
Símbolo: $\bar{4}$ ou S_4

Forma geral:
{hkl}



Disfenoide tetragonal III.pos.

{h0l}	{hhl}	{hk0}
		
Disfenoide tetragonal II.pos.	**Disfenoide tetragonal I.pos.**	**Prisma tetragonal III.pos.**

{100}	{110}	{001}
		
Prisma tetragonal II.pos.	**Prisma tetragonal I.pos.**	**Base Pinacóide**

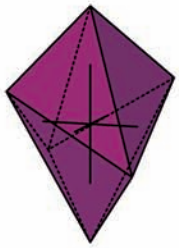
Exemplos de minerais:

Canita $Ca_2[AsO_4/B(OH)_4]$
Tugtupita $Na_8[(AlBeSi_4O_{12})_2/Cl_2]$
Schreibersita $(Fe,Ni)_3P$

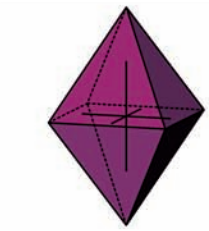
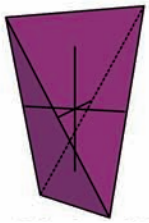
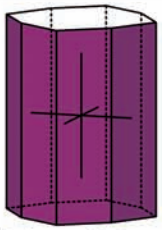
Tetragonales Kristallsystem

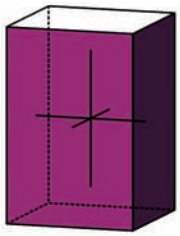
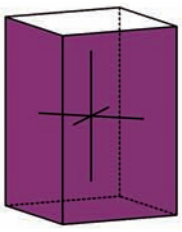
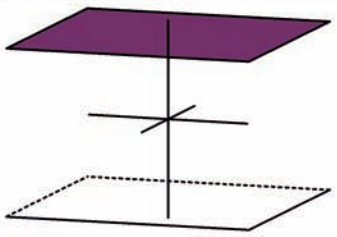
Tetragonal-sphenoidische
Hemiedrie Symbol: $\bar{4}2m$ oder D_{2d}
Tetragonal-skalenoedrische Klasse

Allgemeine Form:
{hkl}



Tetrag. Skalenoeder

{h0l}	{hhl}	{hk0}
		
Tetrag.Dipyramiden II.St.	**Tetrag.Disphenoide I.St.**	**Ditetrag. Prismen**

{100}	{110}	{001}
		
Tetrag.Prisma II.St.	**Tetrag.Prisma I.St.**	**Basispinakoid**

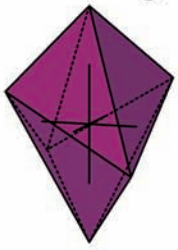
Mineral-Bsp.:
Chalkopyrit $CuFeS_2$
Mooihoekite $Cu_9Fe_9S_{16}$
Stannit Cu_2FeSnS_4

Sistema Cristalino Tetragonal

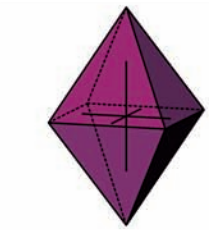
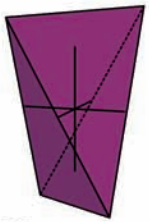
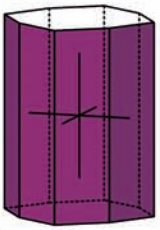
Esfenóide tetragonal
Hemiedria
Classe escalenoédrica tetragonal

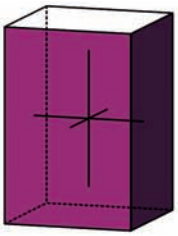
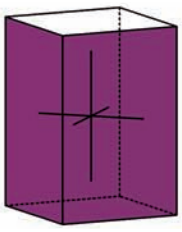
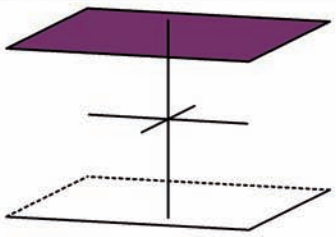
Símbolo: $\bar{4}2m$ ou D_{2d}

Forma geral:
{hkl}



Escalenoedro tetragonal

{h0l}	{hhl}	{hk0}
		
Dipiramide tetragonal II.pos.	**Diesfenóide tetragonal I.pos.**	**Prisma ditetragonal**

{100}	{110}	{001}
		
Prisma tetragonal II.pos.	**Prisma tetragonal I.pos.**	**Bases de Pinacóide**

Exemplos de minerais:

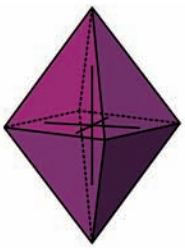
Calcopirita $CuFeS_2$
Mooihoequita $Cu_9Fe_9S_{16}$
Estanita Cu_2FeSnS_4

Tetragonales Kristallsystem

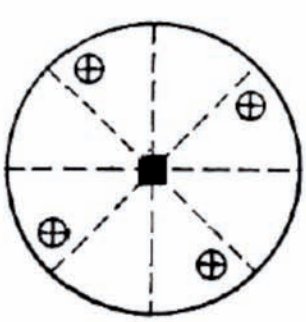
Tetragonal-dipyramidale
Hemiedrie
Tetragonal-dipyramidale Klasse

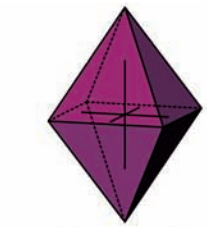
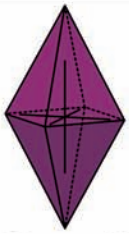
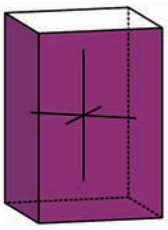
Symbol: 4/m oder C_{4h}

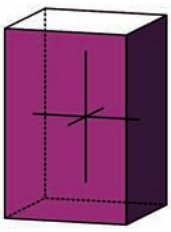
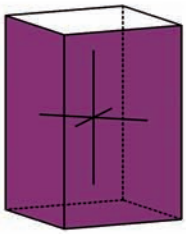
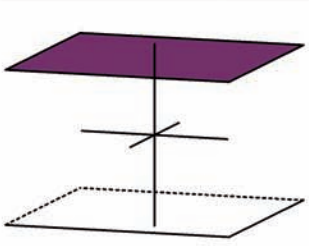
Allgemeine Form:
{hkl}



Tetrag.Dipyramiden III.St.



{h0l}	{hhl}	{hk0}
		
Tetrag.Dipyramiden II.St.	Tetrag.Dipyramiden I.St.	Tetrag.Prismen III.St.

{100}	{110}	{001}
		
Tetrag.Prisma II.St.	Tetrag.Prisma I.St.	Basispinakoid

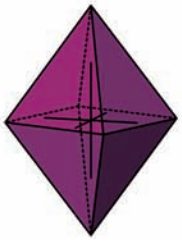
Mineral-Bsp.:
Scheelit $Ca[WO_4]$
Vesuvian $Ca_{19}(Mg,Fe,Ti)_4Al_9[(OH,F)_{10}/(SiO_4)_{10}/(Si_2O_7)_4]$
Fergusonit $YNbO_4$

Sistema Cristalino Tetragonal

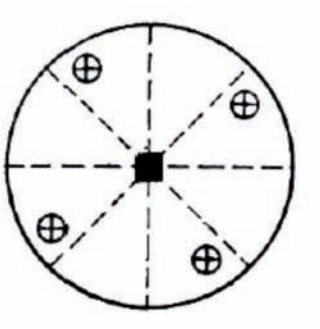
Tetragonal dipiramidal
Hemiedria
Classe Tetragonal dipiramidal

Símbolo: 4/m ou C_{4h}

Forma geral:
{hkl}



Dipirâmide tetragonal III.pos.



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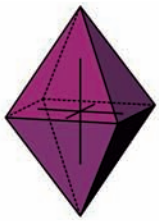
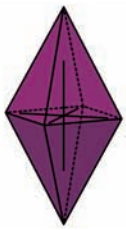
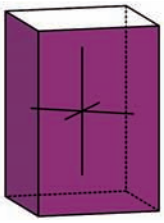
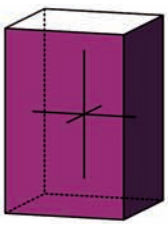
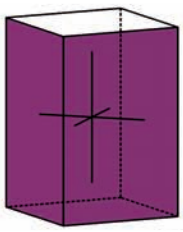
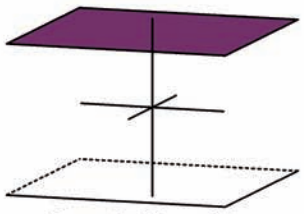
		
Dipiramide Tetragonal II.pos.	**Dipiramide Tetragonal I.pos.**	**Prisma Tetragonal III.pos.**

{100}	{110}	{001}
		
Prisma Tetragonal II.pos.	**Prisma Tetragonal I.pos.**	**Base de Pinacóide**

Exemplos de minerais:

Scheelita $Ca[WO_4]$

Vesuvianita $Ca_{19}(Mg,Fe,Ti)_4Al_9[(OH,F)_{10}/(SiO_4)_{10}/(Si_2O_7)_4]$

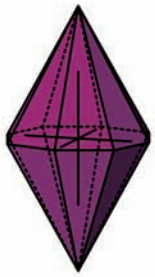
Fergusonita $YNbO_4$

Tetragonales Kristallsystem

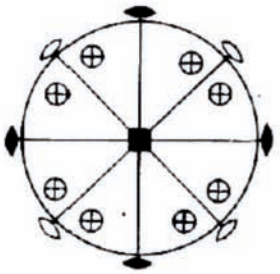
Tetragonale Holoedrie
Dietragonal-dipyramidale
Klasse

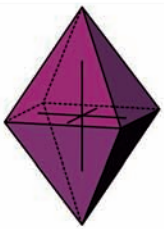
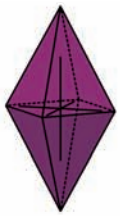
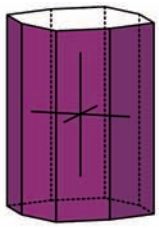
Symbol: 4/m 2/m 2/m
(4/m m m) oder D_{4h}

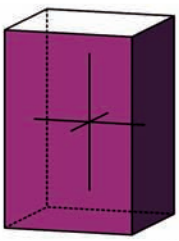
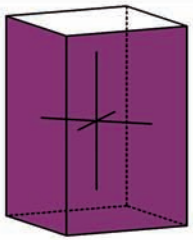
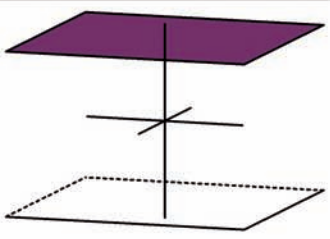
Allgemeine Form:
{hkl}



Ditetrag. Dipyramiden



{h0l}	{hhl}	{hk0}
		
Tetrag.Dipyramiden II.St.	**Tetrag.Dipyramiden I.St.**	**Ditetrag.Prismen**

{100}	{110}	{001}
		
Tetrag.Prisma II.St.	**Tetrag.Prisma I.St.**	**Basispinakoid**

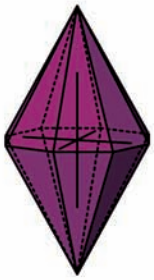
Mineral-Bsp.:
Rutil TiO_2
Anatas TiO_2
Zirkon $Zr[SiO_4]$

Sistema Cristalino Tetragonal

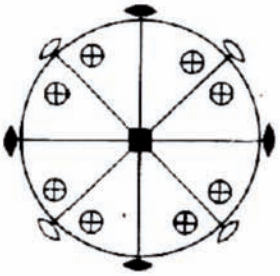
Holoedria Tetragonal
Classe dipiramidal
ditetragonal

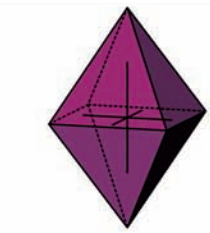
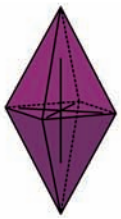
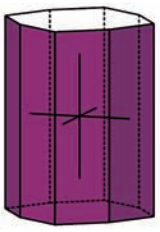
Símbolo: 4/m 2/m 2/m
(4/m m m) ou D_{4h}

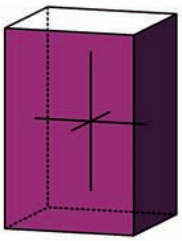
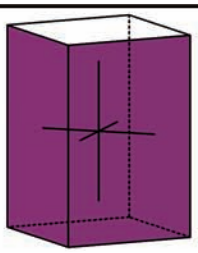
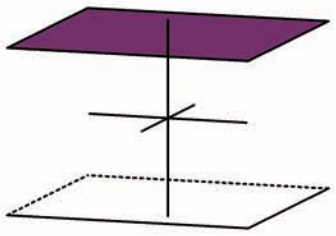
Forma geral:
{hkl}



Dipirâmide ditetragonal



{h0l}	{hhl}	{hk0}
		
Dipiramide Tetragonal II.pos.	**Dipiramide Tetragonal I.pos.**	**Prisma Ditetragonal**

{100}	{110}	{001}
		
Prisma Tetragonal II.pos.	**Prisma Tetragonal I.pos.**	**Base de Pinacóide**

Exemplos de minerais:

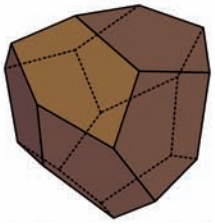
Rutilo TiO_2
Anatásio TiO_2
Zircão $Zr[SiO_4]$

Kubisches Kristallsystem

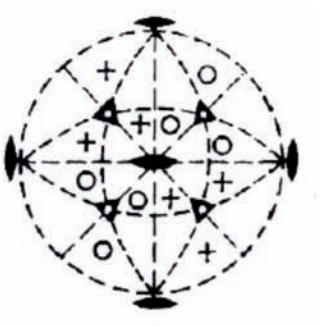
Kubische Tetartoedrie
Tetraedisch-pentagon-
doekaedrische Klasse

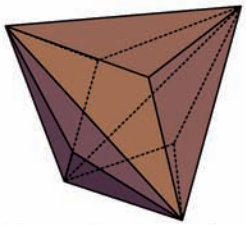
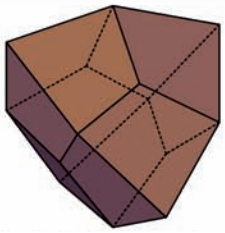
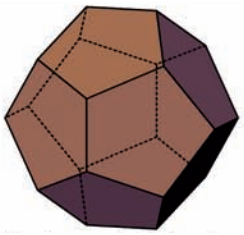
Symbol: 23 oder T

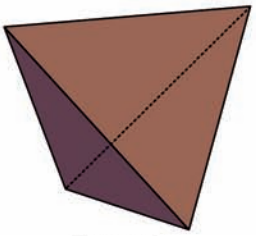
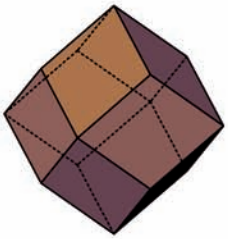
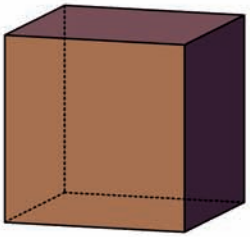
Allgemeine Form:
{hkl}



Tetraedr.Pentagondodekaeder



{hll}	{hhl}	{hk0}
		
Pyramidentetraeder	Deltoiddodekaeder	Pentagondodekaeder

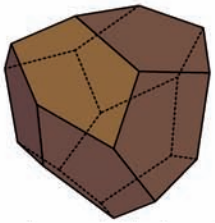
{111}	{110}	{100}
		
Tetraeder	Rhombendodekaeder	Würfel/ Hexaeder

Mineral-Bsp.:
Langbeinit $K_2Mg_2[(SO_4)_3]$
Ullmannit NiSbS
Gersdorffit NiAsS

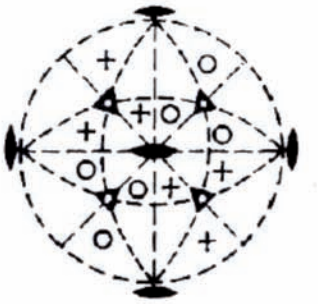
Sistema Cristalino Isométrico

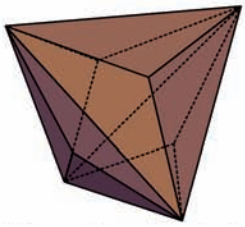
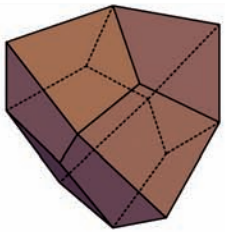
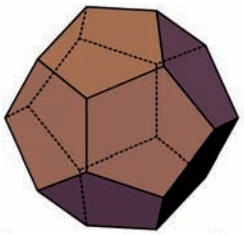
Tetartoedro Cúbico
Classe pentagontritetraedrica Símbolo: 23 ou T

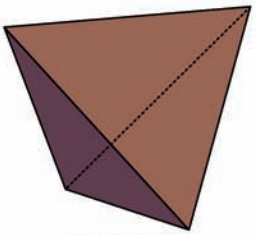
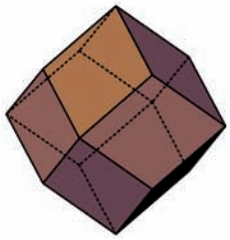
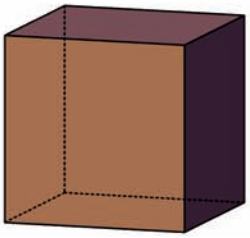
Forma geral:
{hkl}



Pentagontritetraedro



{hll}	{hhl}	{hk0}
		
Tetraedro piramital	**Deltoidodecaedro**	**Pentagonododecaedro**

{111}	{110}	{100}
		
Tetraedro	**Rombododecaedro**	**Cubo**

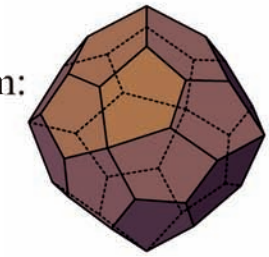
Exemplos de minerais:

Langbeinita $K_2Mg_2[(SO_4)_3]$
Ullmanita NiSbS
Gersdorffita NiAsS

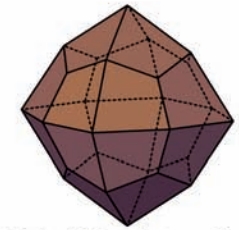
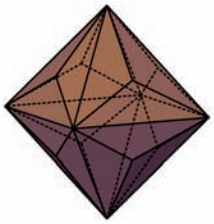
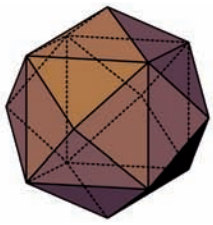
Kubisches Kristallsystem

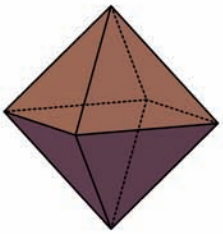
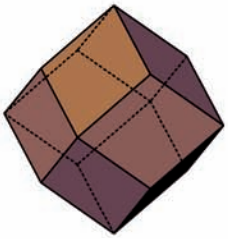
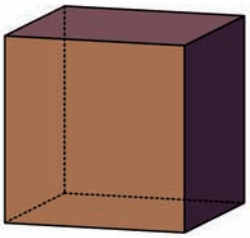
Gyroedrische Hemiedrie Symbol: 432 oder O
Pentagonikositetraedrische Klasse

Allgemeine Form:
{hkl}



Pentagonikositetraeder

{hll}	{hhl}	{hk0}
		
Deltoidikositetraeder	Pyramidenoktaeder	Pyramidenwürfel

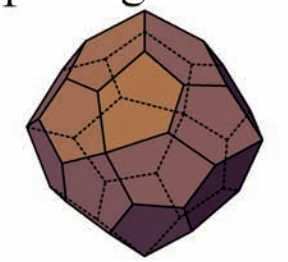
{111}	{110}	{100}
		
Oktaeder	Rhombendodekaeder	Würfel/ Hexaeder

Mineral-Bsp.:
Maghemit Gamma-Fe_2O_3
Choloalit $CuPb[(TeO_3)_2]$
Petzit Ag_3AuTe_2

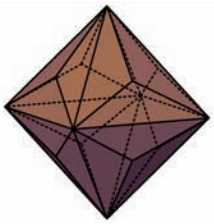
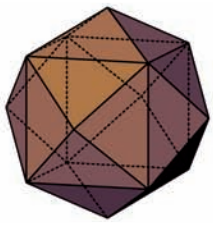
Sistema Cristalino Isométrico

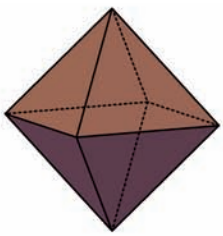
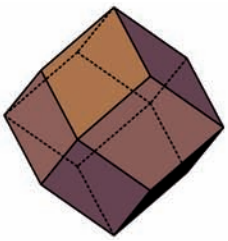
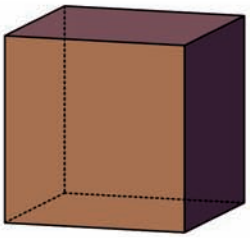
Hemiedro Girodedral — Símbolo: 432 ou O
Classe tetraedro pentagonal

Forma geral:
{hkl}



Pentagonicositetraedro

{hll}	{hhl}	{hk0}
		
Deltoideicositetraedro	**Trisoctaedro**	**Tetrahexaedro**

{111}	{110}	{100}
		
Oktaedro	**Rombododecaedro**	**Ou Hexaedro**

Exemplos de minerais:

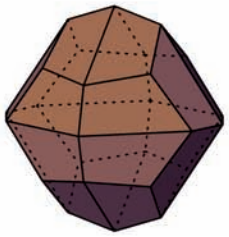
Maghemita Gamma-Fe_2O_3
Choloalita $CuPb[(TeO_3)_2]$
Petzita Ag_3AuTe_2

Kubisches Kristallsystem

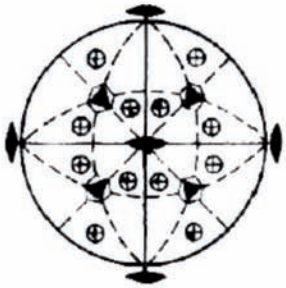
Parallelflächige Hemiedrie
Disdodekaedrische Klasse

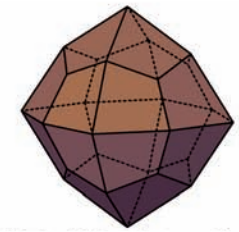
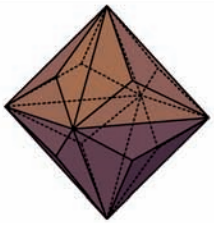
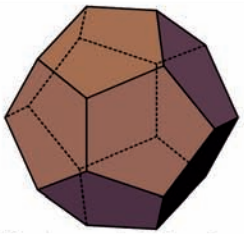
Symbol: 2/m $\bar{3}$ oder T_h
(m3)

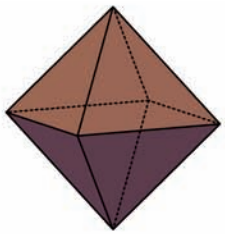
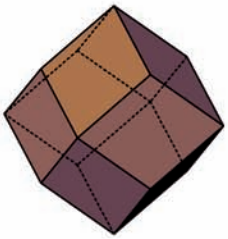
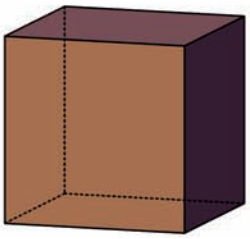
Allgemeine Form:
{hkl}



Disdodekaeder



{hll}	{hhl}	{hk0}
		
Deltoidikositetraeder	Pyramidenoktaeder	Pentagondodekaeder

{111}	{110}	{100}
		
Oktaeder	Rhombendodekaeder	Würfel/Hexaeder

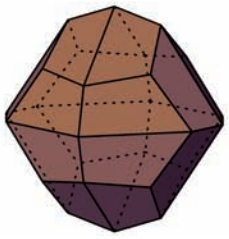
Mineral-Bsp.:
Pyrit FeS_2
Cobaltin CoAsS
Alaune, z.B. $KAl[SO_4]_2*12H_2O$
Bixbyit $(Mn,Fe)_2O_3$

Sistema Cristalino Ou Isométrico

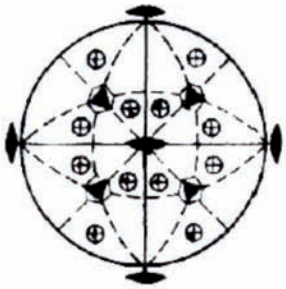
Hemiedro planer-paralelo
Classe disdodecaédrica

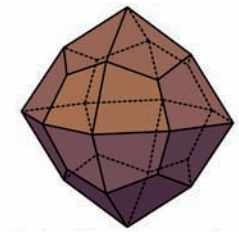
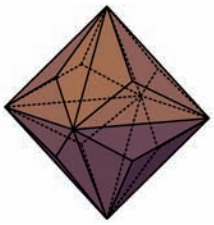
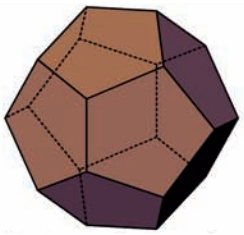
Símbolo: 2/m $\overline{3}$ ou T_h
(m3)

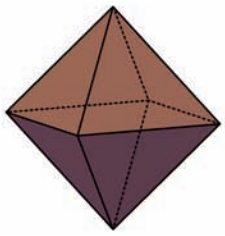
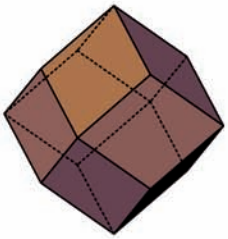
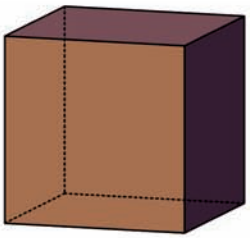
Forma geral:
{hkl}



Disdodecaedro



{hll}	{hhl}	{hk0}
		
Deltoidicositetraedro	**Trisoctaedro**	**Pentagondodecaedro**

{111}	{110}	{100}
		
Octaedro	**Rombododecaedro**	**Ou hexaedro**

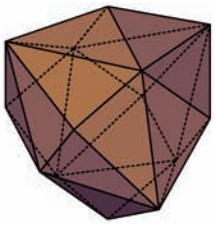
Exemplos de minerais:

Pirita FeS_2
Cobaltita CoAsS
Alunita, z.B. $KAl[SO_4]_2*12H_2O$
Bisbyita $(Mn,Fe)_2O_3$

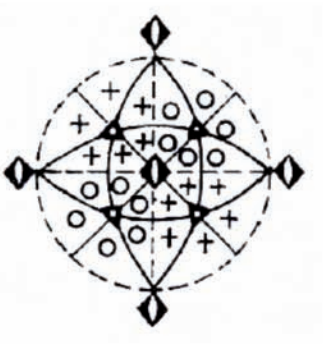
Kubisches Kristallsystem

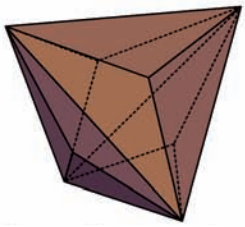
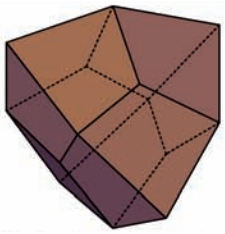
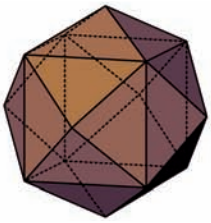
Geneigtflächige Hemiedrie Symbol: $\bar{4}3m$ oder T_d
Hexakistetraedrische Klasse

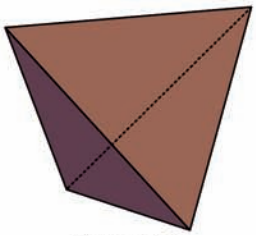
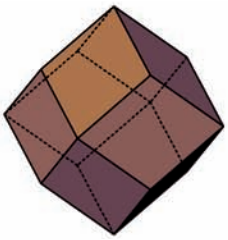
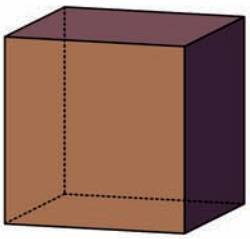
Allgemeine Form:
{hkl}



Hexakistetraeder



{hll}	{hhl}	{hk0}
		
Pyramidentetraeder	Deltoiddodekaeder	Pyramidenwürfel

{111}	{110}	{100}
		
Tetraeder	Rhombendodekaeder	Würfel/ Hexaeder

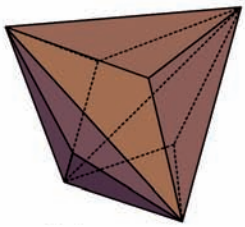
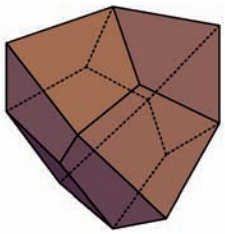
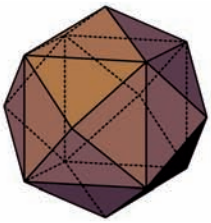
Mineral-Bsp.:
Sphalerit/Zinkblende ZnS
Tetraedrit $(Cu,Fe)_{12}[Sb_4S_{13}]$
Sodalith $Na_8[(Cl)_2(AlSiO_4)_6]$
Mayenit $Ca_{12}Al_{14}O_{33}$

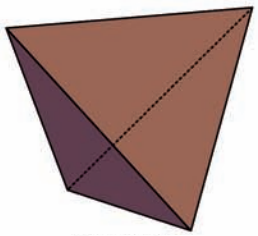
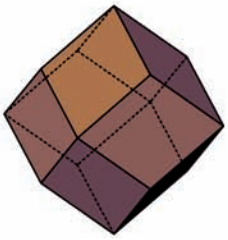
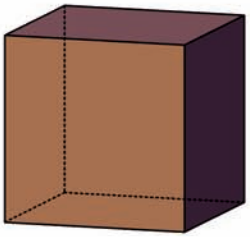
Sistema Cristalino Ou isométrico

Hemiedria de fácie inclinada Símbolo: $\bar{4}3m$ ou T_d
Classe hexatetraédrica

Forma geral:
{hkl}

Hexatetraedro

{hll}	{hhl}	{hk0}
		
Tristetraedro	**Tetraedro deltoide**	**Tetrahexaedro**

{111}	{110}	{100}
		
Tetraedro	**Rombododecaedro**	**Ou hexaedro**

Exemplos de minerais:

Esfalerita ou blenda ZnS
Tetraedrota $(Cu,Fe)_{12}[Sb_4S_{13}]$
Sodalita $Na_8[(Cl)_2(AlSiO_4)_6]$
Mayenita $Ca_{12}Al_{14}O_{33}$

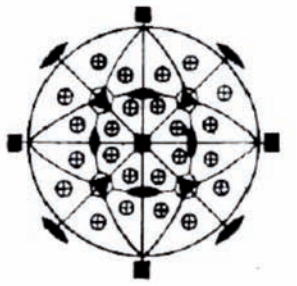
Kubisches Kristallsystem

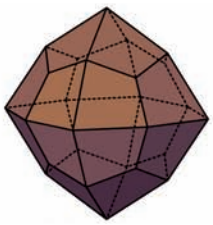
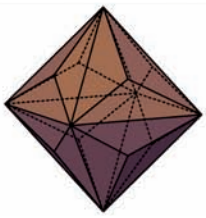
Kubische Holoedrie
Hexakisoktaedrische Klasse

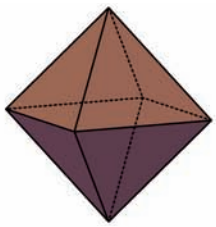
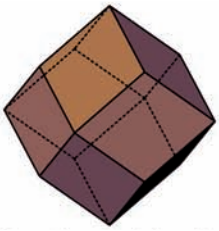
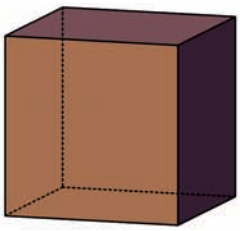
Symbol: 4/m $\bar{3}$ 2/m oder O_h
(m3m)

Allgemeine Form:
{hkl}

Hexakisoktaeder



{hll}	{hhl}	{hk0}
		
Deltoidikositetraeder	**Pyramidenoktaeder**	**Pyramidenwürfel**

{111}	{110}	{100}
		
Oktaeder	**Rhombendodekaeder**	**Würfel/Hexaeder**

Mineral-Bsp.:
Elemente: Au, Ag, Cu, Pt, Pb, Fe, W, Si, C(Diamant)
Halit/Steinsalz NaCl
Galenit/Bleiglanz PbS
Fluorit/Flußspat CaF_2
Spinelle, z.B. $MgAl_2O_4$
Granate $Me^{II}_3Me^{III}_2[SiO_4]_3$

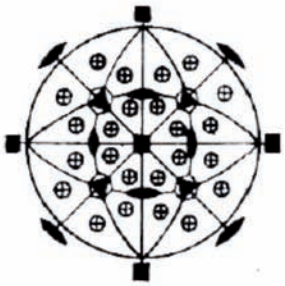
Sistema Cristalino Cúbico

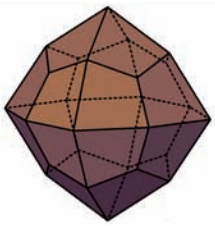
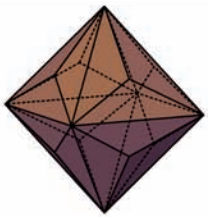
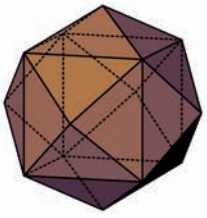
Holoedria Cubica
Classe Hexaoctaédrica

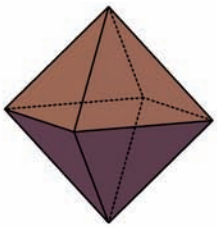
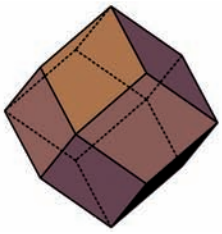
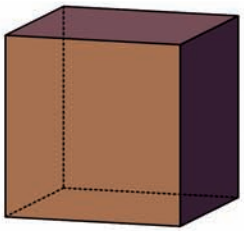
Símbolo: 4/m $\bar{3}$ 2/m ou O_h
(m3m)

Forma geral:
{hkl}

Hexaoctaedro



{hll}	{hhl}	{hk0}
		
Octaedro deltóide	Trisoctaedro	Tetrahexaedro

{111}	{110}	{100}
		
Oktaedro	Rombododecaedro	Ou hexaedro

Exemplos de minerais:
Elementos nativos: Au, Ag, Cu, Pt, Pb, Fe, W, Si, diamante C
Halita NaCl
Galena/Galenita PbS
Fluorita CaF_2
Espinélio $MgAl_2O_4$
Granada $Me^{II}_3Me^{III}_2[SiO_4]_3$

Beispiele für korrelate Kristallformen

Formenausbildung

Positiv – Negativ

Rechts – Links

Oben – Unten

Vorn - Hinten

Exemplos de formas cristalográficas correlatas

Descrição de Formas

Positiva – Negativa

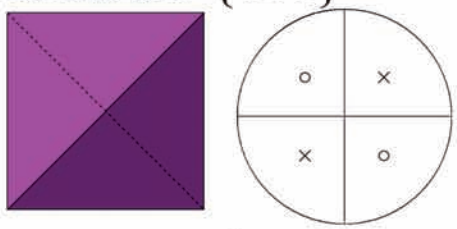
Direita – Esquerda

Acima – Abaixo

A Frente - Atrás

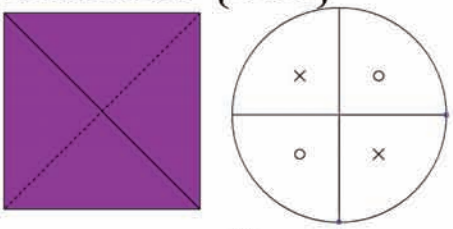
Kubisches Kristallsystem

Tetraeder $\{\overline{111}\}$



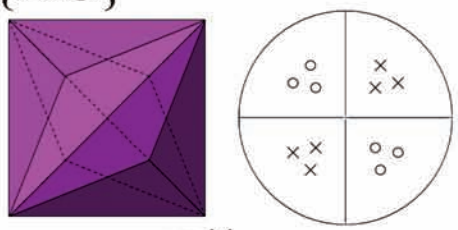
negativ

Tetraeder $\{111\}$



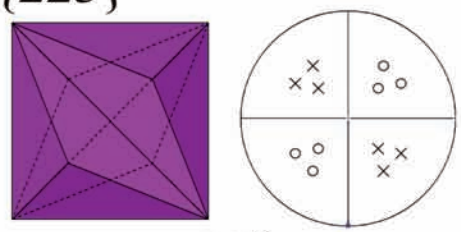
positiv

Pyramidentetraeder $\{223\}$



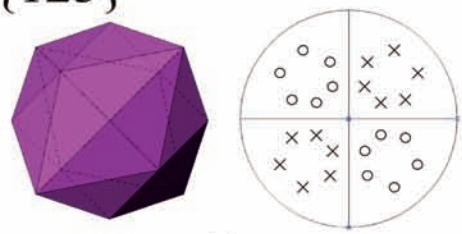
positiv

Pyramidentetraeder $\{\overline{223}\}$



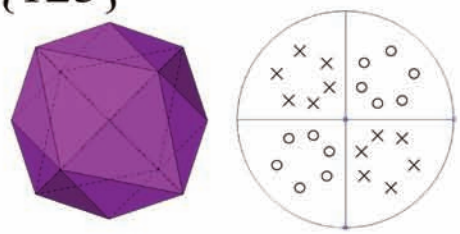
negativ

Hexakistetraeder $\{123\}$



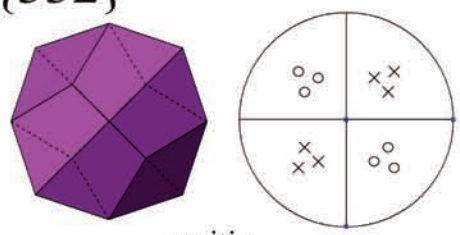
positiv

Hexakistetraeder $\{\overline{1}23\}$



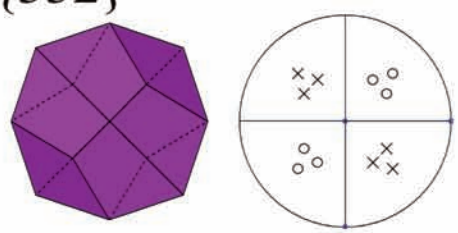
negativ

Deltoiddodekaeder $\{332\}$



positiv

Deltoiddodekaeder $\{\overline{332}\}$

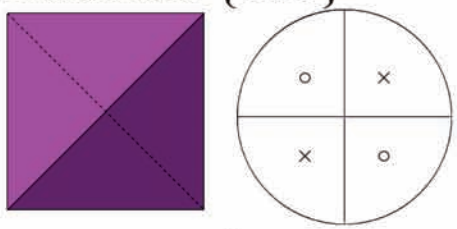


negativ

Diese stereographischen Projektionen beinhalten keinerlei Symmetrieelemente, es handelt sich hier lediglich um Bezugslinien

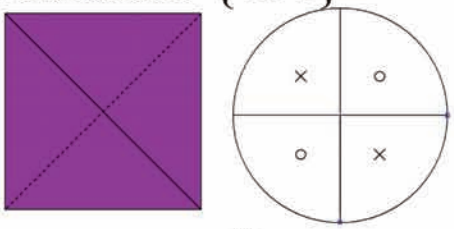
Sistema Cristalino Cúbico

Tetraedro $\{\overline{111}\}$



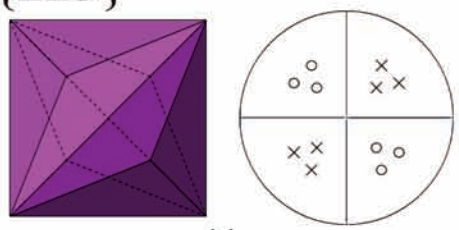
negativo

Tetraedro {111}



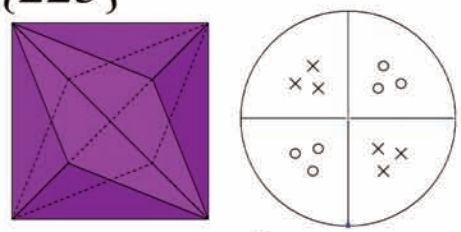
positivo

Pirâmide Tetraedro {223}



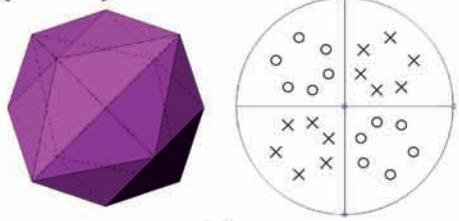
positivo

Pirâmide Tetraedro $\{\overline{223}\}$



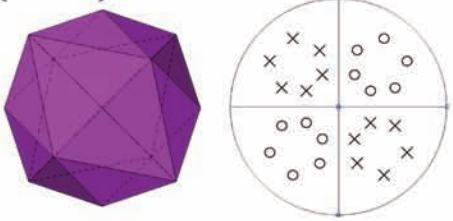
negativo

Hexatetraedro {123}



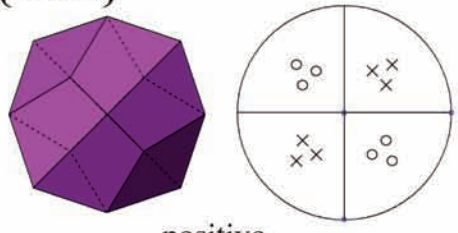
positivo

Hexatetraedro $\{\overline{1}23\}$



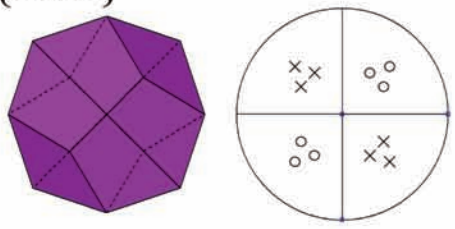
negativo

Dodecaedro deltóide {332}



positivo

Dodecaedro deltóide $\{\overline{332}\}$

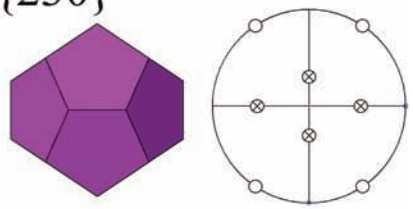


negativo

Essas projeções estereográficas não envolvem elementos de simetria, estão aqui apenas para linha de preferência

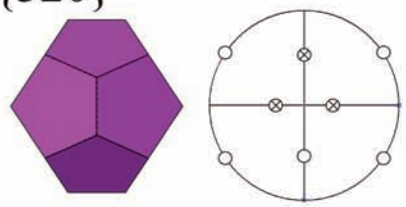
Kubisches Kristallsystem

Pentagondodekaeder {230}



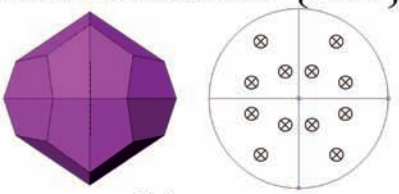
rechts (positiv)

Pentagondodekaeder {320}



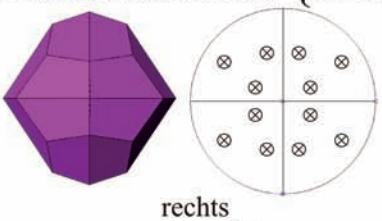
links (negativ)

Disdodekaeder {213}



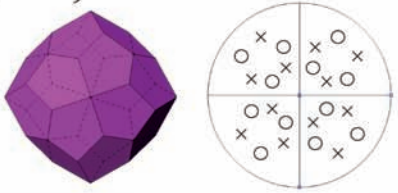
links (positiv)

Disdodekaeder {123}

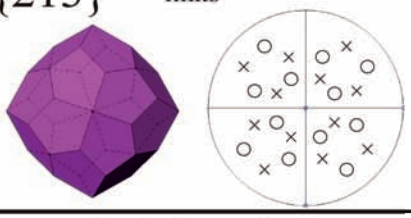


rechts (negativ)

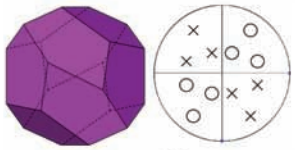
Pentagonikositetraeder {123} rechts



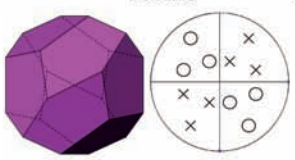
Pentagonikositetraeder {213} links



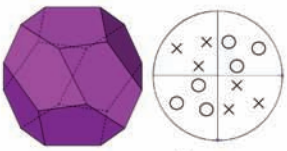
Tetraedrischer Pentagondodekaeder



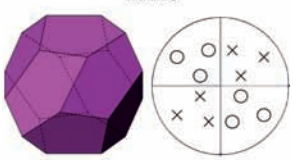
{123} positiv rechts



{$\bar{1}$23} negativ rechts



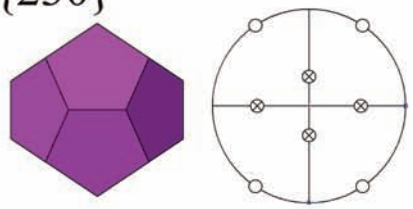
{213} positiv links



{$\bar{2}$13} negativ links

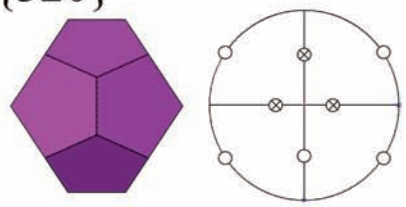
Sistema Cristalino Ou Isométrico

Pentadodecaedro {230}



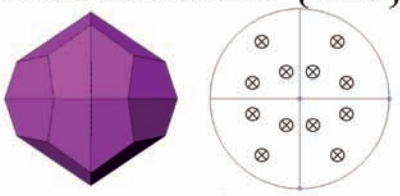
direito (positivo)

Pentadodecaedro {320}



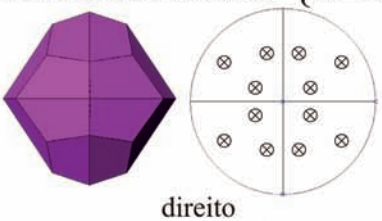
esquerdo (negativo)

Disdodecaedro {213}



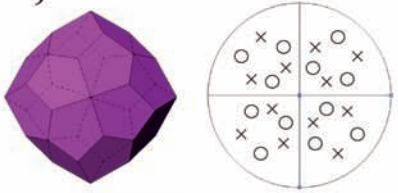
esquerdo (positivo)

Disdodecaedro {123}

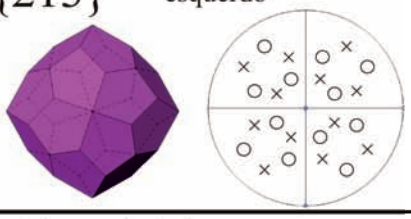


direito (negativo)

Icositetraedro pentagonal {123} direito

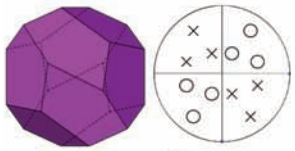


Icositetraedro pentagonal {213} esquerdo



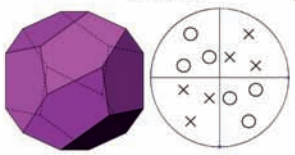
Essas projeções estereográfikas nào envolvem elementos de simetria, estão aqui apenas para linha de preferência

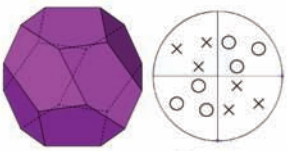
Pentadodecaedro Tetraédrico



{123} positivo direito

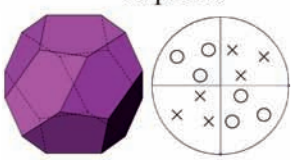
{$\bar{1}$23} negativo direito





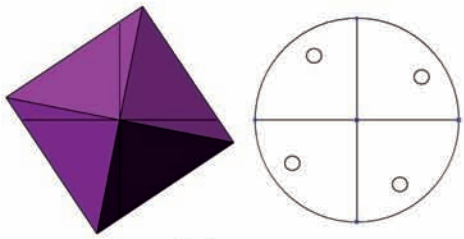
{213} positivo esquerdo

{$\bar{2}$13} negativo esquerdo



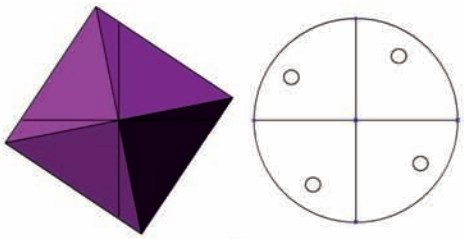
Tetragonales Kristallsystem

Pyramide {321}



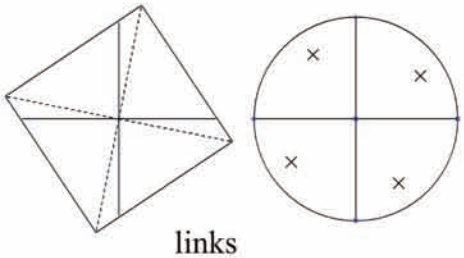
links
oben

Pyramide {231}



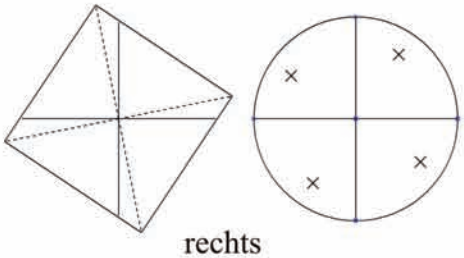
rechts
oben

Pyramide {32$\bar{1}$}



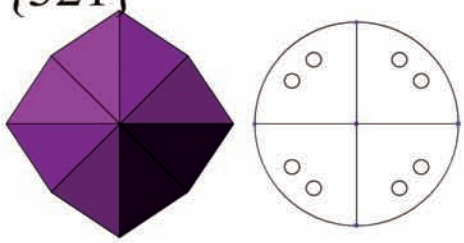
links
unten

Pyramide {23$\bar{1}$}



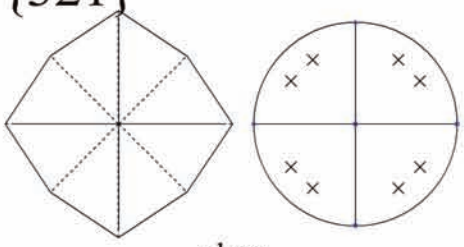
rechts
unten

Ditetrag. Pyramide {321}



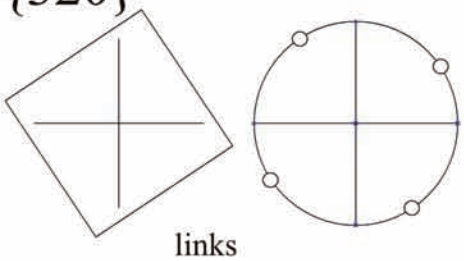
unten

Ditetrag. Pyramide {32$\bar{1}$}



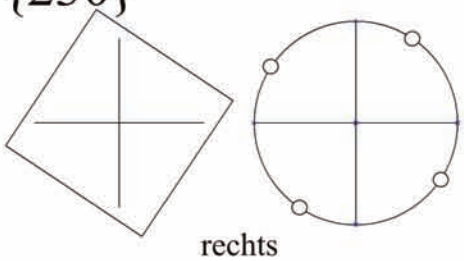
oben

Prisma III.Stellung {320}



links

Prisma III.Stellung {230}



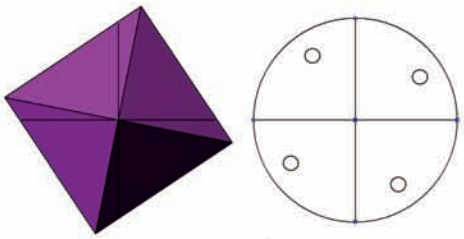
rechts

Diese stereographischen Projektionen beinhalten keinerlei Symmetrieelemente, es handelt sich hier lediglich um Bezugslinien

Sistema Cristalino Tetragonal

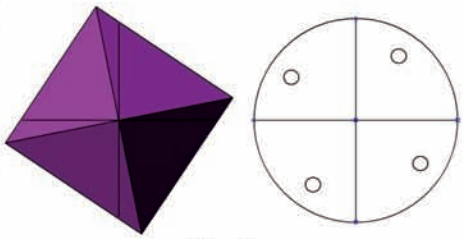
Essas projeções estereográfikas não envolvem elementos de simetria, estão aqui apenas para linha de preferência

Pirâmide {321}



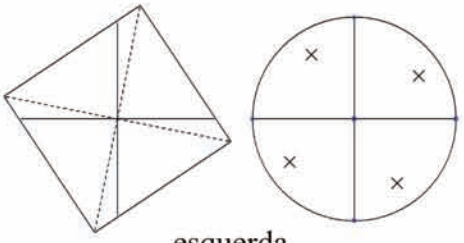
esquerda
acima

Pirâmide {231}



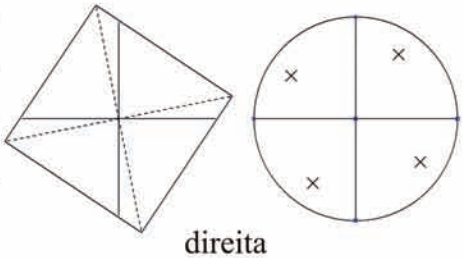
direita
acima

Pirâmide {32$\bar{1}$}



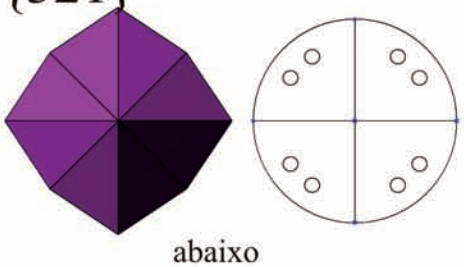
esquerda
abaixo

Pirâmide {23$\bar{1}$}



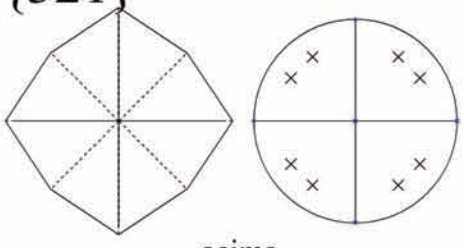
direita
acima

Pirâmide Ditetragonal {321}



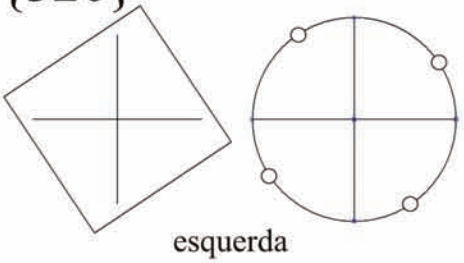
abaixo

Pirâmide Ditetragonal {32$\bar{1}$}



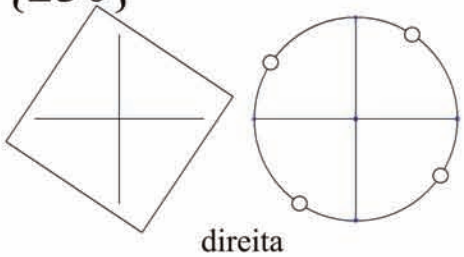
acima

Posição III Prisma {320}



esquerda

Posição III Prisma {230}

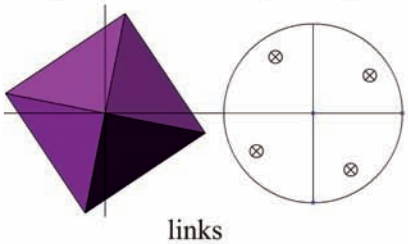


direita

Tetragonales Kristallsystem

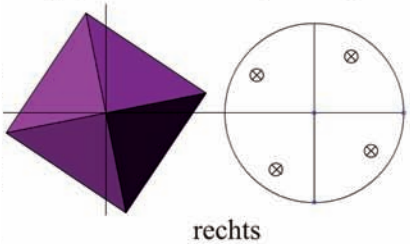
Diese stereographischen Projektionen beinhalten keinerlei Symmetrieelemente, es handelt sich hier lediglich um Bezugslinien

Dipyramide {321}



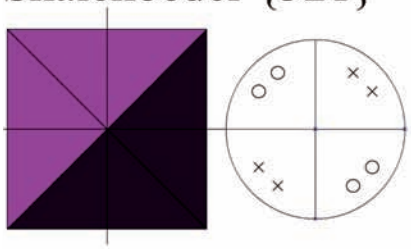
links

Dipyramide {231}



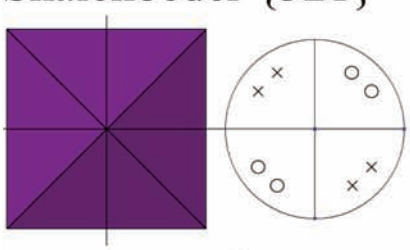
rechts

Skalenoeder {321}



positiv

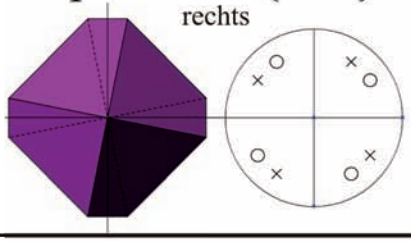
Skalenoeder {$\bar{3}$21}



negativ

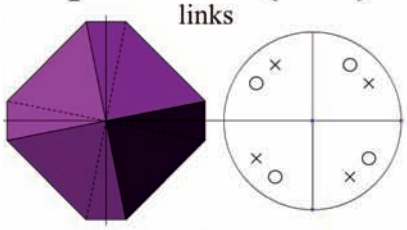
Trapezoeder {321}

rechts

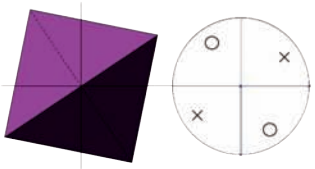


Trapezoeder {231}

links



Tetragonales Disphenoid

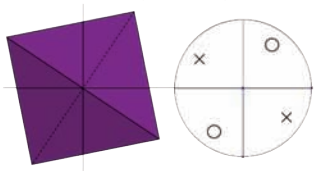


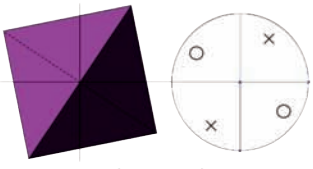
{321}

links
positiv

links
negativ

{$\bar{3}$21}



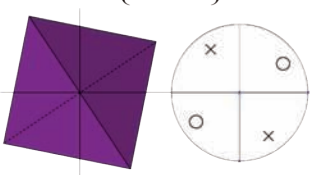


{231}

rechts
positiv

rechts
negativ

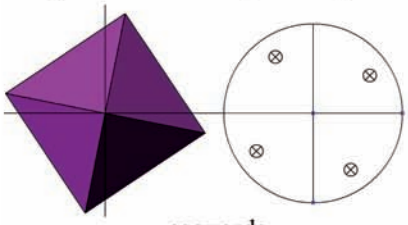
{$\bar{2}$31}



Sistema Cristalino Tetragonal

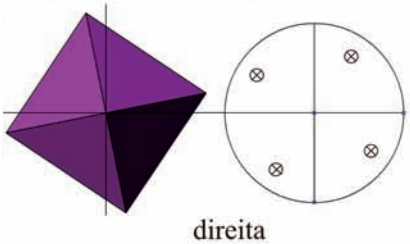
Essas projeções estereográfikas nào envolvem elementos de simetria, estão aqui apenas para linha de preferência

Dipirâmide {321}



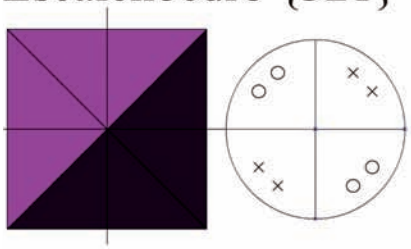
esquerda

Dipirâmide {231}



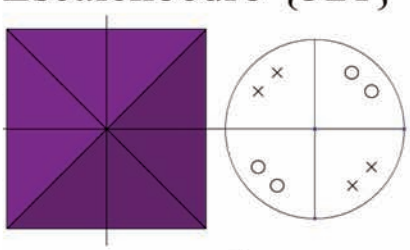
direita

Escalenoedro {321}



positivo

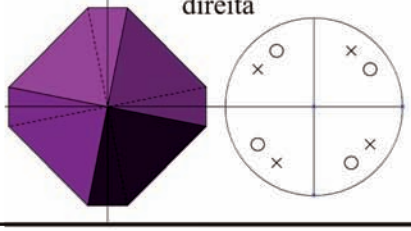
Escalenoedro {$\bar{3}$21}



negativo

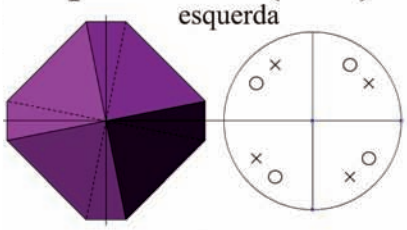
Trapezoedro {321}

direita

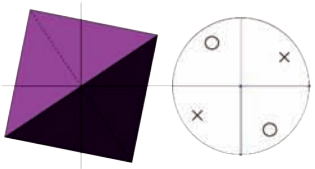


Trapezoedro {231}

esquerda



Difenoide tetragonal

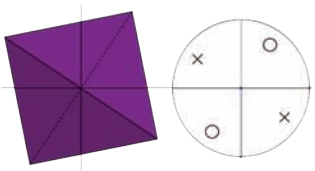


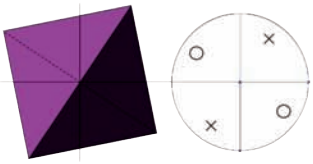
{321}

esquerda
positiva

esquerda
negativa

{$\bar{3}$21}



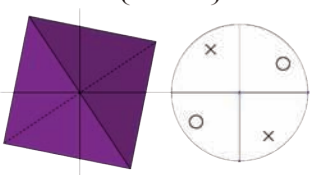


{231}

direita
positiva

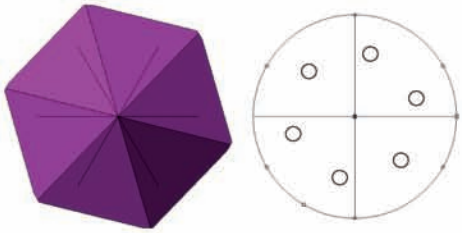
direita
negativa

{$\bar{2}$31}



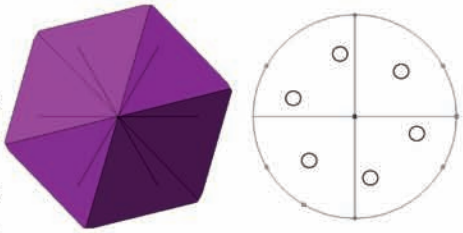
Hexagonales Kristallsystem

Pyramide {132}



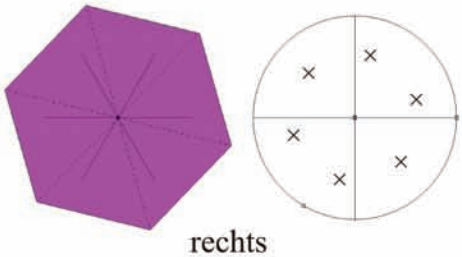
rechts
oben

Pyramide {312}



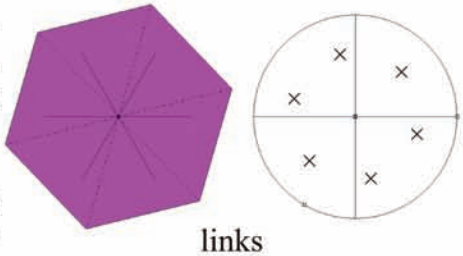
links
oben

Pyramide {13$\bar{2}$}



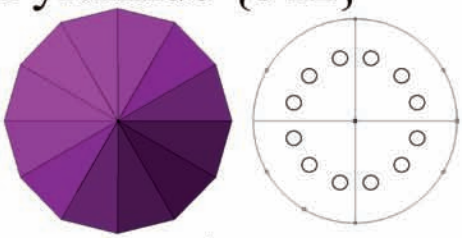
rechts
unten

Pyramide {31$\bar{2}$}



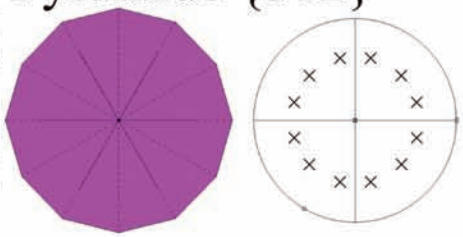
links
unten

Dihexagonale Pyramide {312}



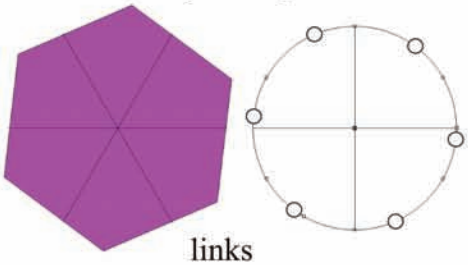
oben

Dihexagonale Pyramide {31$\bar{2}$}



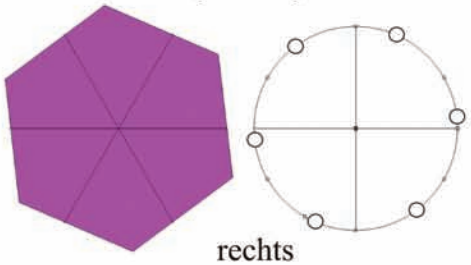
unten

Prisma {320}



links

Prisma {230}

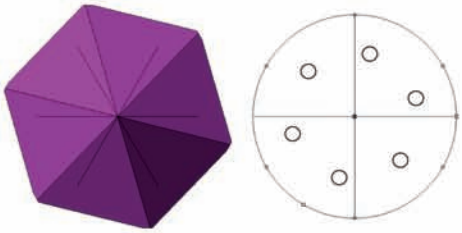


rechts

Diese stereographischen Projektionen beinhalten keinerlei Symmetrieelemente, es handelt sich hier lediglich um Bezugslinien

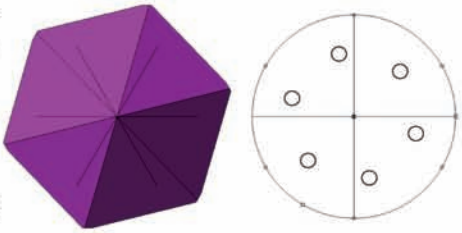
Sistema Cristalino Hexagonal

Pirâmide {132}



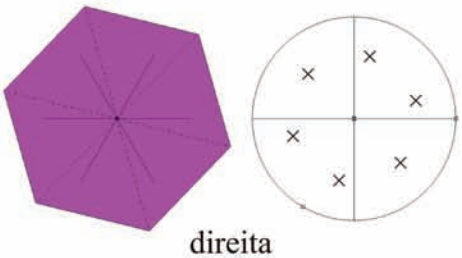
direita
superior

Pirâmide {312}



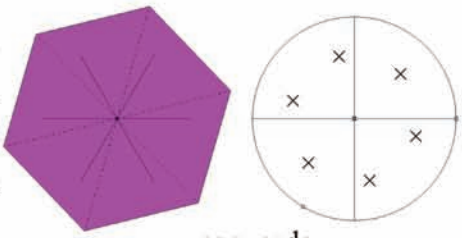
esquerda
superior

Pirâmide {13$\bar{2}$}



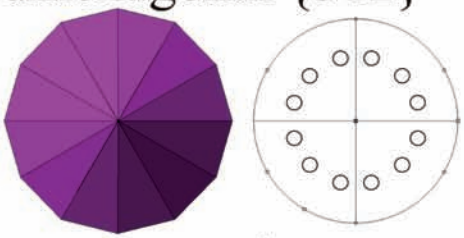
direita
inferior

Pirâmide {31$\bar{2}$}



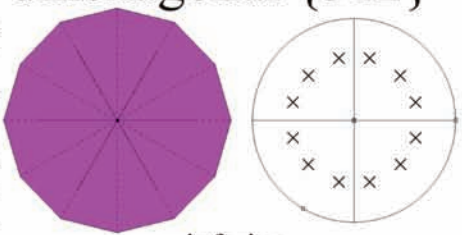
esquerda
inferior

Pirâmide
dihexagonal {312}



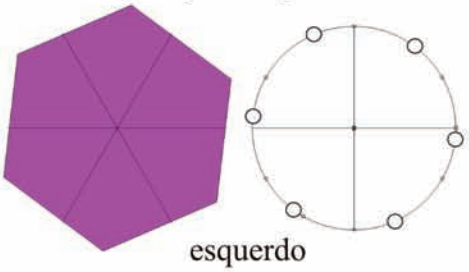
superior

Pirâmide
dihexagonal {31$\bar{2}$}



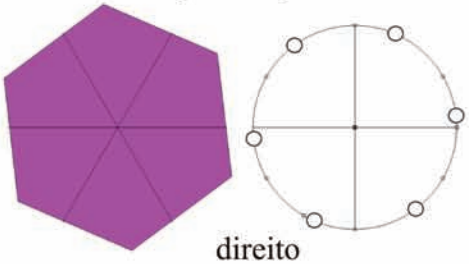
inferior

Prisma {320}



esquerdo

Prisma{230}

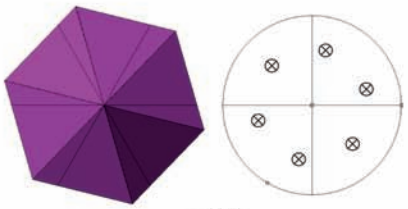


direito

Essas projeções estereográfikas não envolvem elementos de simetria, estão aqui apenas para linha de preferência

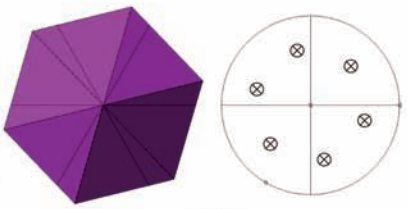
Hexagonales Kristallsystem

Dipyramide {132}



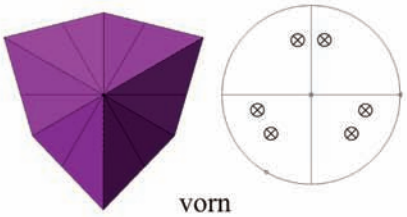
rechts

Dipyramide {312}



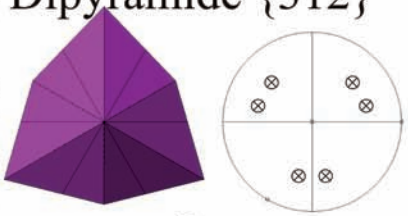
links

Ditrigonale Dipyramide {132}



vorn

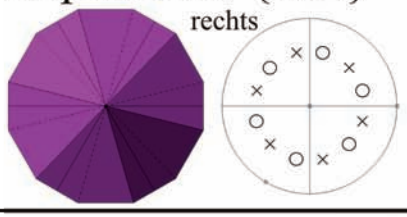
Ditrigonale Dipyramide {312}



hinten

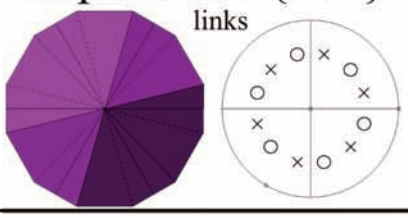
Trapezoeder {132}

rechts



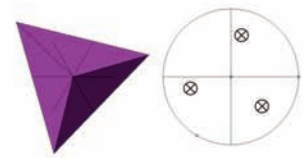
Trapezoeder {312}

links

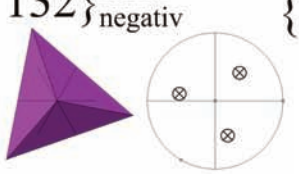


Diese stereographischen Projektionen beinhalten keinerlei Symmetrieelemente, es handelt sich hier lediglich um Bezugslinien

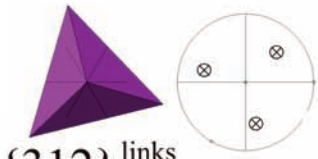
Trigonale Dipyramide



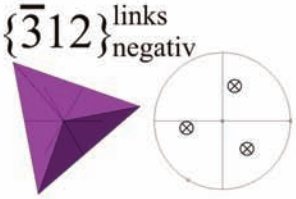
{132} rechts positiv



$1\bar{3}2\}$ rechts negativ



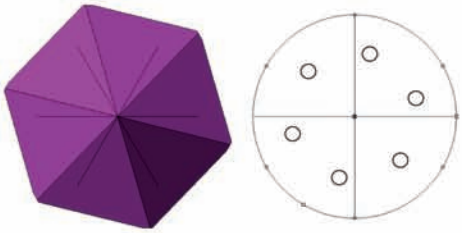
{312} links positiv



$\{\bar{3}12\}$ links negativ

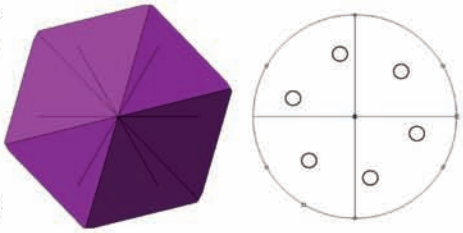
Sistema Cristalino Hexagonal

Pirâmide {132}



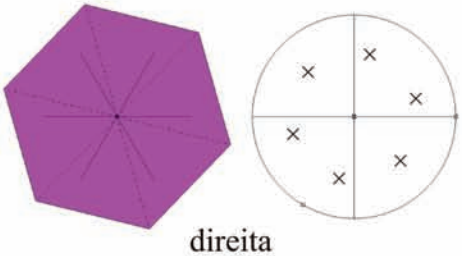
direita
superior

Pirâmide {312}



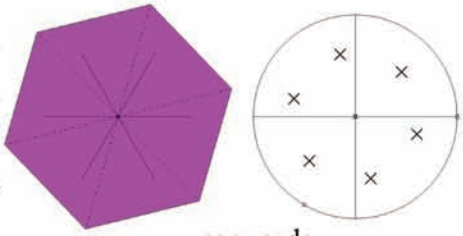
esquerda
superior

Pirâmide {13$\bar{2}$}



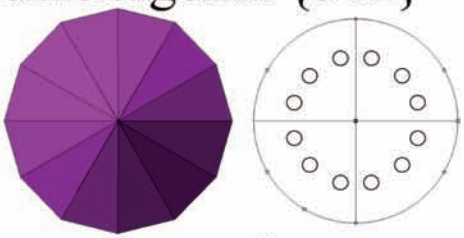
direita
inferior

Pirâmide {31$\bar{2}$}



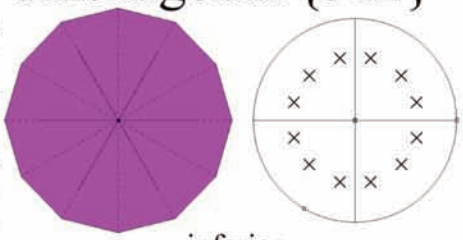
esquerda
inferior

Pirâmide
dihexagonal {312}



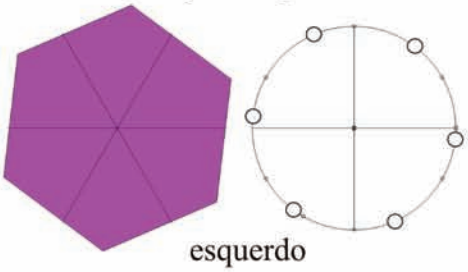
superior

Pirâmide
dihexagonal {31$\bar{2}$}



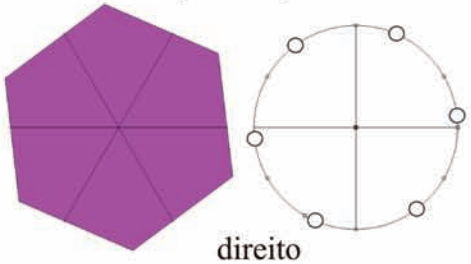
inferior

Prisma {320}



esquerdo

Prisma{230}

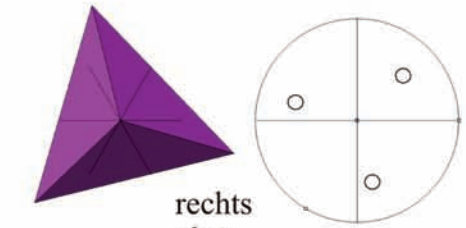


direito

Essas projeções estereográfikas não envolvem elementos de simetria, estão aqui apenas para linha de preferência

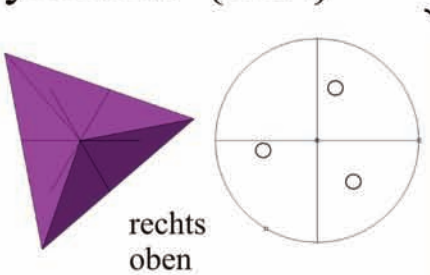
Trigonales Kristallsystem

Pyramide {312}



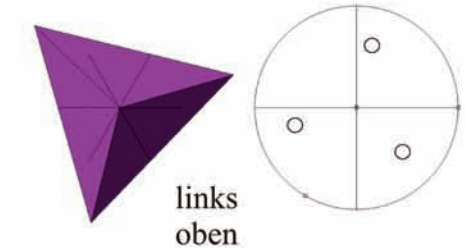
rechts
oben
vorn

Pyramide {$\bar{3}$12}



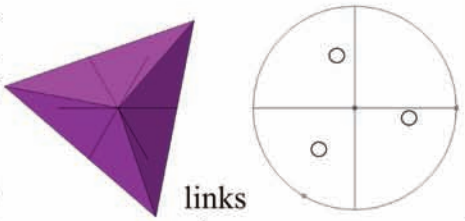
rechts
oben
hinten

Pyramide {132}



links
oben
vorn

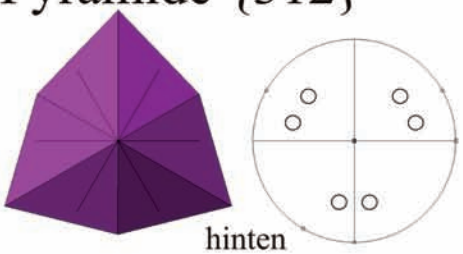
Pyramide {$\bar{1}$32}



links
oben
hinten

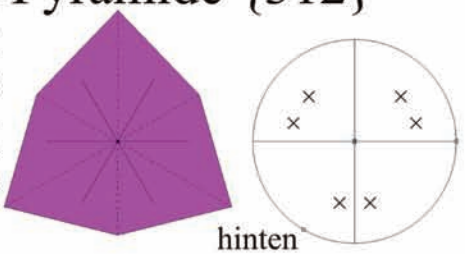
analog dazu “unten”

Ditrigonale Pyramide {312}



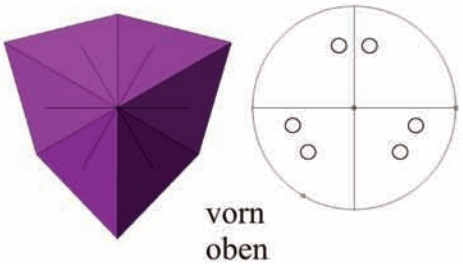
hinten
oben

Ditrigonale Pyramide {31$\bar{2}$}



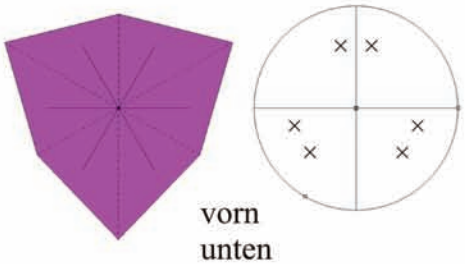
hinten
unten

Ditrigonale Pyramide {132}



vorn
oben

Ditrigonale Pyramide {13$\bar{2}$}

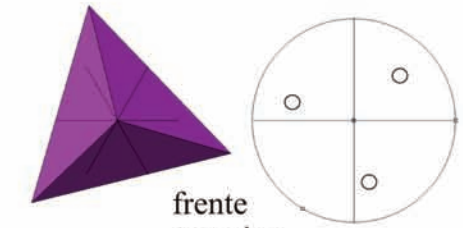


vorn
unten

Diese stereographischen Projektionen beinhalten keinerlei Symmetrieelemente, es handelt sich hier lediglich um Bezugslinien

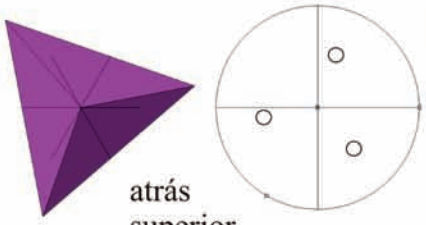
Sistema Cristalino Trigonal

Pirâmide {312}



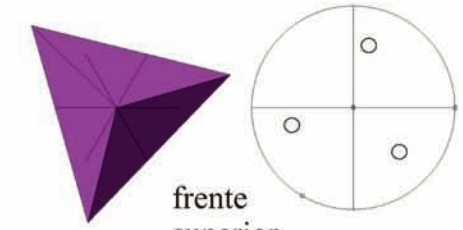
frente
superior
direita

Pirâmide {$\bar{3}$12}



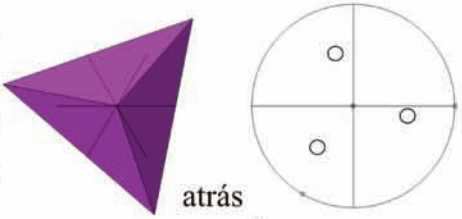
atrás
superior
direita

Pirâmide {132}



frente
superior
esquerda

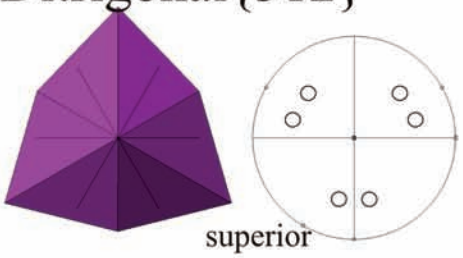
Pirâmide {$\bar{1}$32}



atrás
superior
esquerda

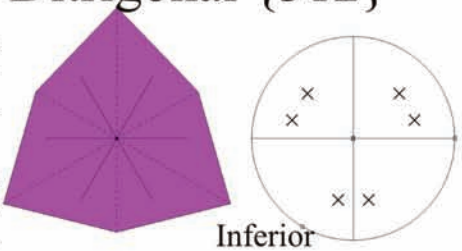
análogo
a parte
inferior

Pirâmide Ditrigonal{312}



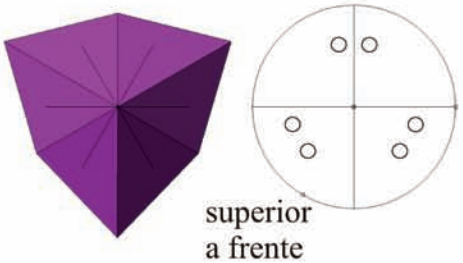
superior
atrás

Pirâmide Ditrigonal {31$\bar{2}$}



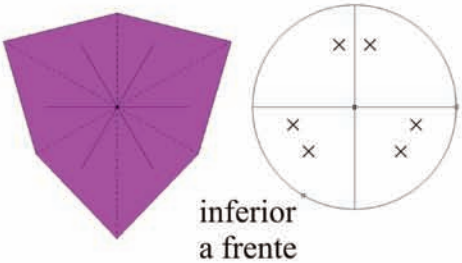
Inferior
atrás

Pirâmide ditrigonal{132}



superior
a frente

Pirâmide Ditrigonal{13$\bar{2}$}

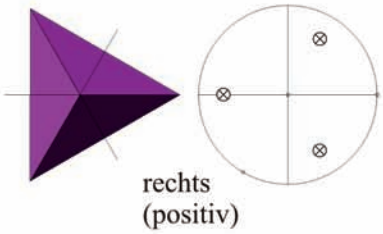


inferior
a frente

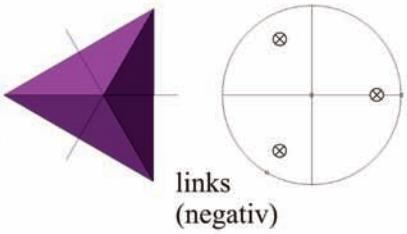
Essas projeções estereográfikas não envolvem elementos de simetria, estão aqui apenas para linha de preferência

Trigonales Kristallsystem

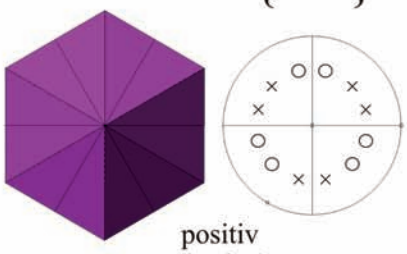
Dipyramide {332}



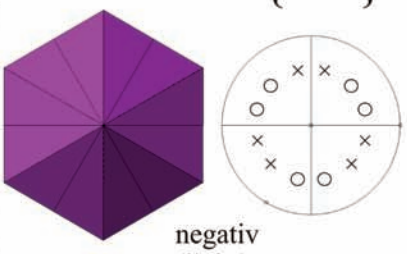
Dipyramide {$\overline{3}\overline{3}2$}



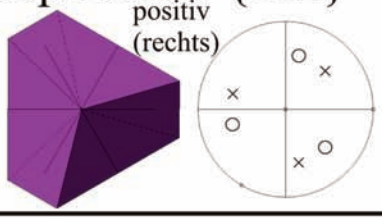
Ditrigonaler Skalenoeder {132}



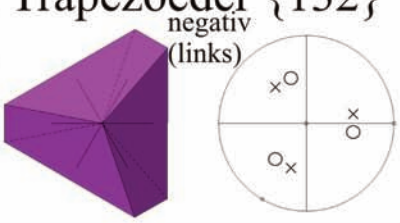
Ditrigonaler Skalenoeder {312}



Trapezoeder {132}

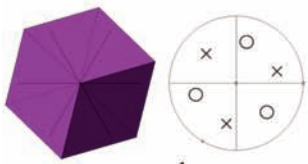


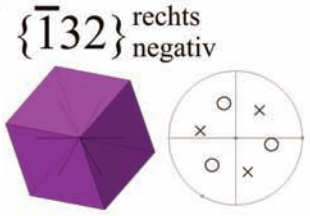
Trapezoeder {$\overline{1}32$}

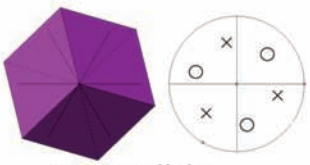


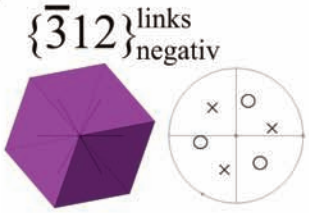
Diese stereographischen Projektionen beinhalten keinerlei Symmetrieelemente, es handelt sich hier lediglich um Bezugslinien

Trigonaler Rhomboeder



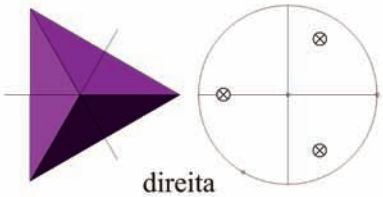






Sistema Cristalino Trigonal

Bipirâmide {332}

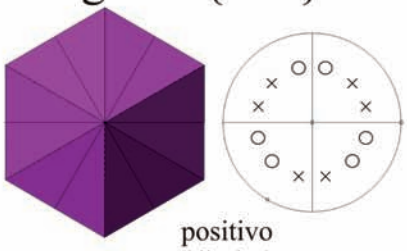


direita
(positiva)

Bipirâmide {$\overline{3}\overline{3}2$}

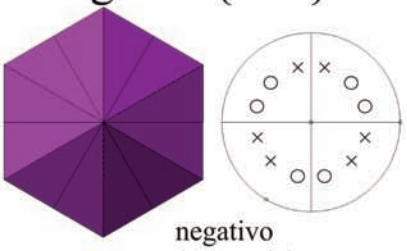
esquerda
(negativa)

Escalenoedro ditrigonal {132}



positivo
(direito)

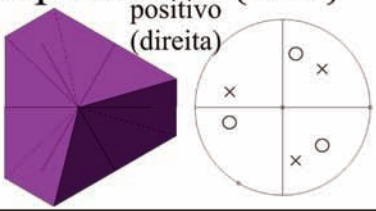
Escalenoedro ditrigonal {312}



negativo
(esquerdo)

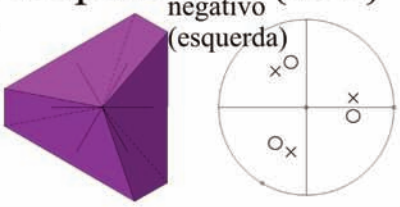
Trapezoedro {132}

positivo
(direita)



Trapezoedro {$\overline{1}32$}

negativo
(esquerda)



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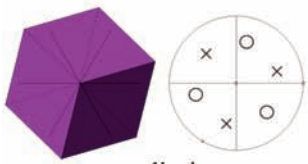
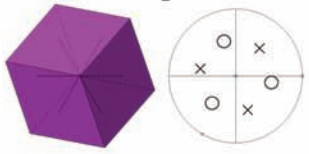
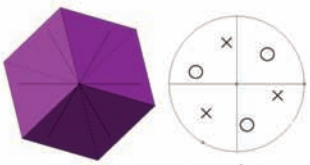
Romboedro Trigonal



{132} direito positivo

{$\overline{1}32$} direito negativo



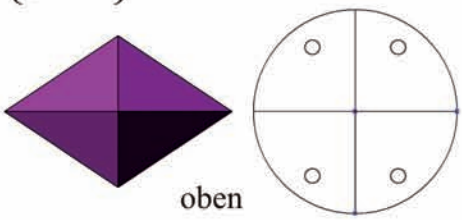


{312} esquerdo positivo

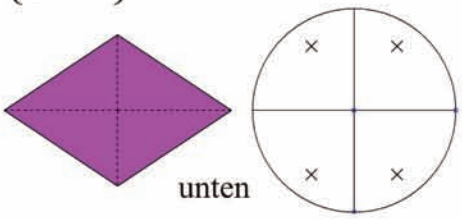
{$\overline{3}12$} esquerdo negativo

Orthorhombisches Kristallsystem

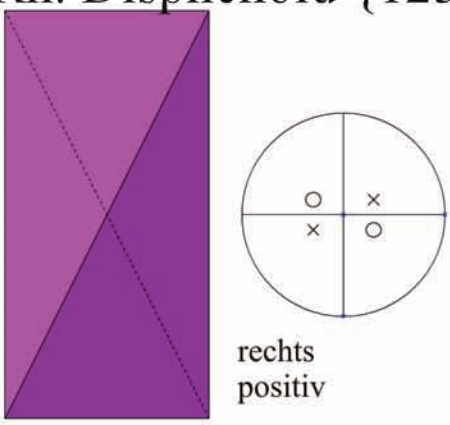
Rhombische Pyramide {321}



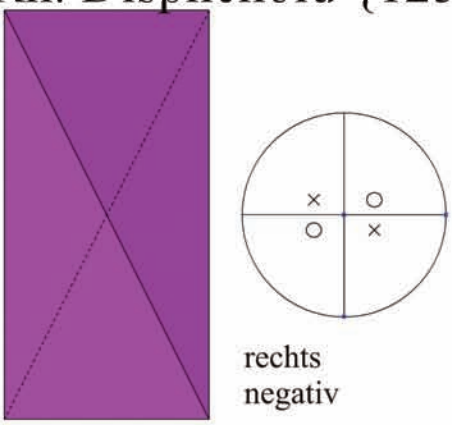
Rhombische Pyramide {321}



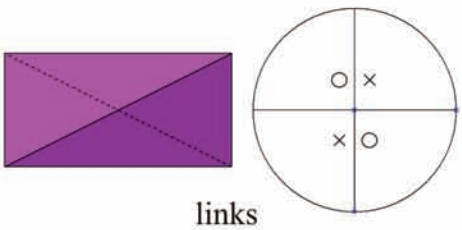
Rh. Disphenoid {123}



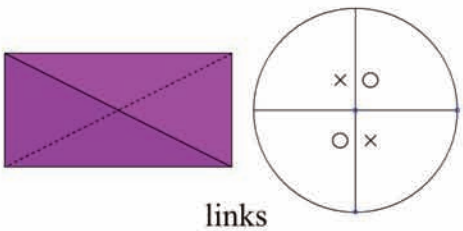
Rh. Disphenoid {$\bar{1}$23}



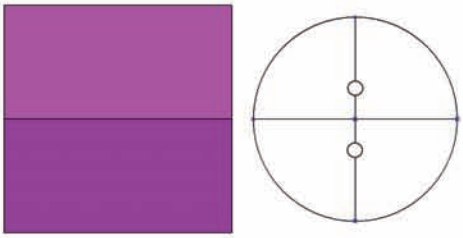
Rh. Disphenoid {213}



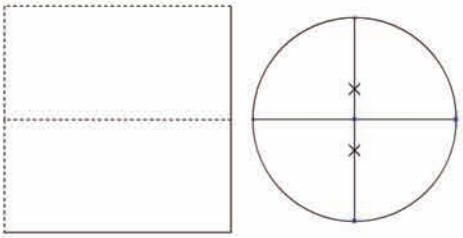
Rh. Disphenoid {$\bar{2}$13}



Doma II.Stellung {203}



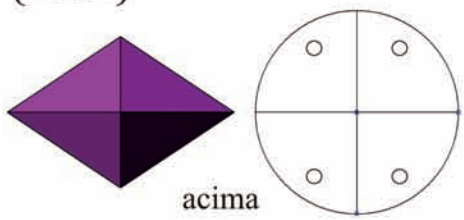
Doma II.Stellung {$\bar{2}$03}



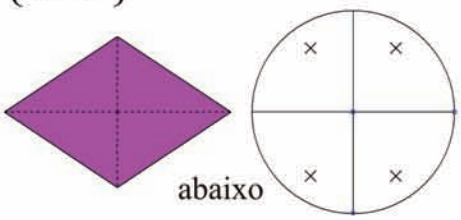
Diese stereographischen Projektionen beinhalten keinerlei Symmetrieelemente, es handelt sich hier lediglich um Bezugslinien

Sistema Cristalino Ortorrômbico

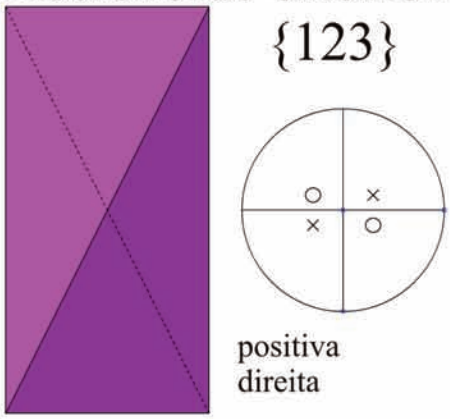
Pirâmide ortorrômbica {321}



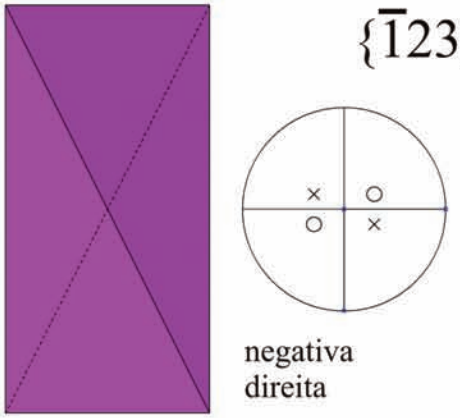
Pirâmide ortorrômbica {321}



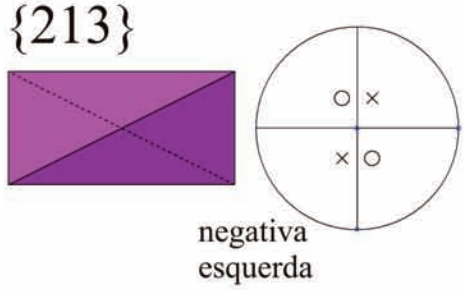
Diesfenóide ortorrômbica {123}



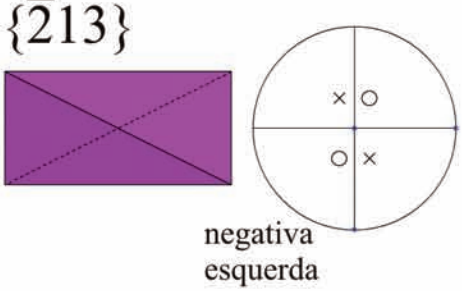
Diesfenóide ortorrômbica {$\bar{1}$23}



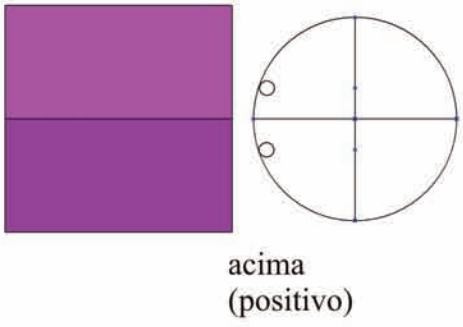
Diesfenóide ortorrômbica {213}



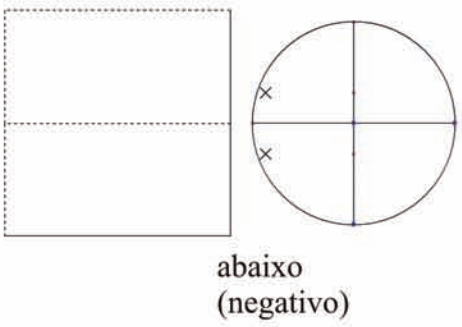
Diesfenóide ortorrômbica {$\bar{2}$13}



Posição II Domo {203}



Posição II Domao {$\bar{2}$03}



Essas projeções estereográficas não envolvem elementos de simetria, estão aqui apenas para linha de preferência

System	Klasse	Symmetrieelement	polare Richtungen im Kristall	nichtpolare Richtungen im Kristall
	I62m	1⬢ +3↑⬬ + 3m	alle ⬮	a_1, a_2, a_3 und alle Zonen ⍰ auf ⬮ die da-

Weitere azentrische Klassen mit polaren Richtungen: 222, 4, 422, 42m, 622, 432

*= Klassen mit einzigartigen polaren Achsen, zu denen keine äquivalenten Achsen existieren: ferroelektrische Stoffe

Sistemas	Classes	Elemenetos de Si-	Direções polares no cristal	Direções apolaes no cristal
monoclínico				
tetragonal				
trigonal				
hexagonal				
	2m	1 +3 + 3m	todas	a_1, a_2, a_3 e todas zonas que se situam
Cúbico ou isométrico				

Outras classes sem centro de simetria mas com direções polares: 222, 4, 422, 42m, 622, 432

*= Classes com eixos de simetria polar único, para as quais não existe um único eixo equivalente: materiais ferroelétricos

Die Kombination von Formen

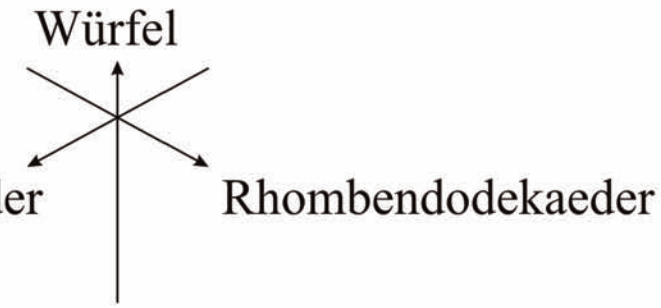
Zwei Formen: Würfel ↔ Oktaeder

Rhombendodekaeder → Würfel, Oktaeder

Tetraeder → Würfel, Rhombendodekaeder

positiver Tetraeder ↔ negativer Tetraeder

Drei Formen:



Kombinationen von Flachen und Steilen Rhomboedern

As Combinações de Formas

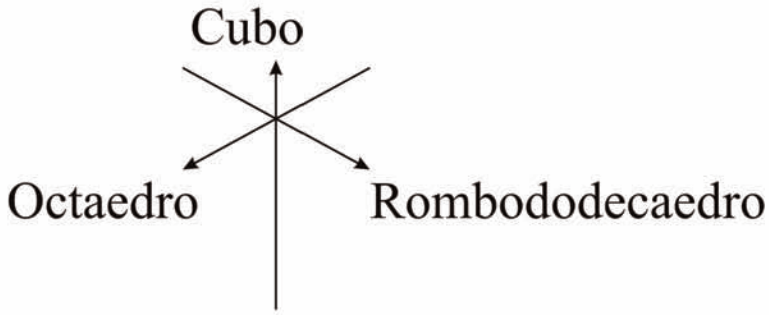
Duas Formas: Cubo ↔ Octaedro

Rombododecaedro → cubo, octaedro

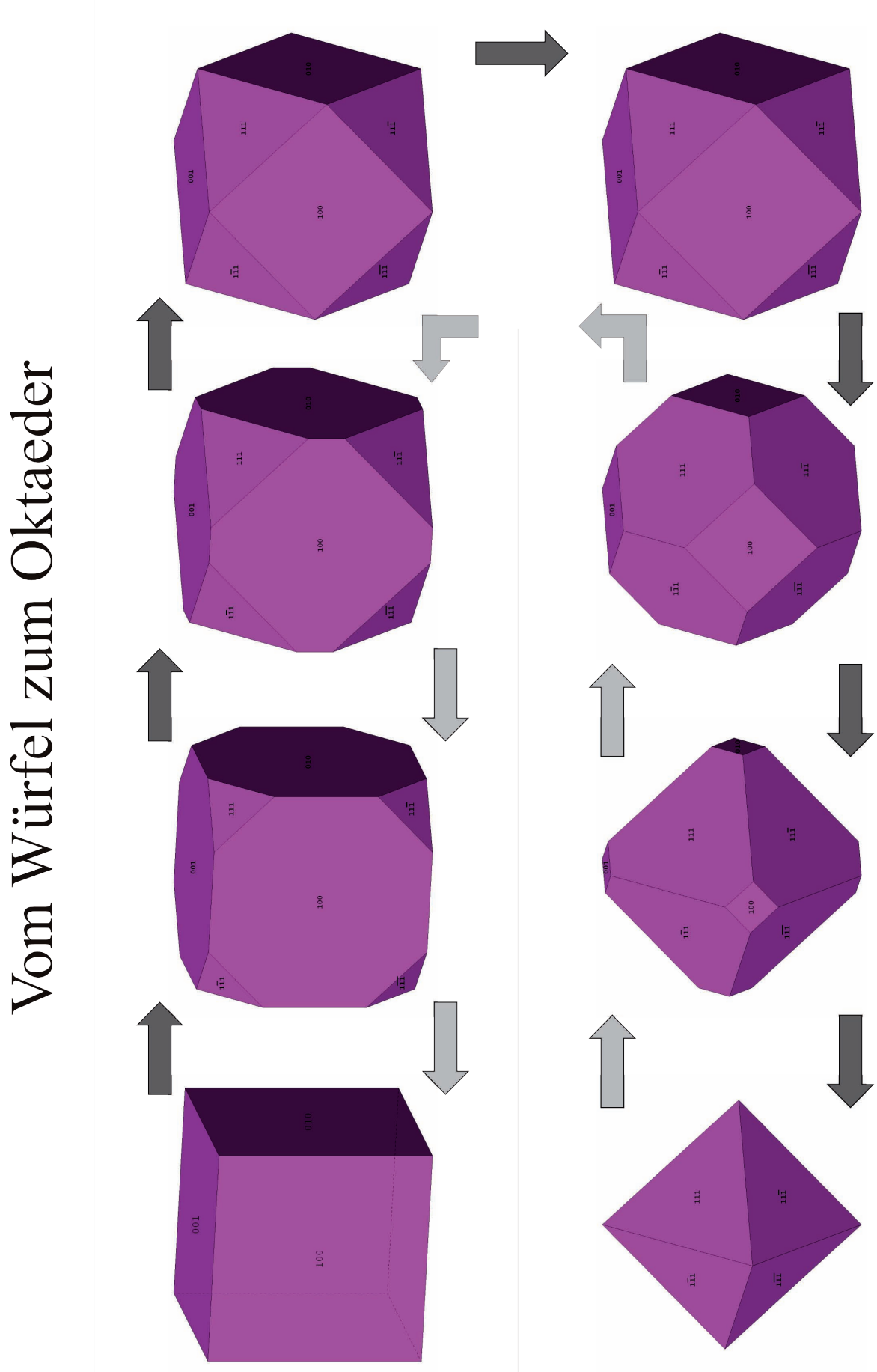
Tetraedro → cubo, rombododecaedro

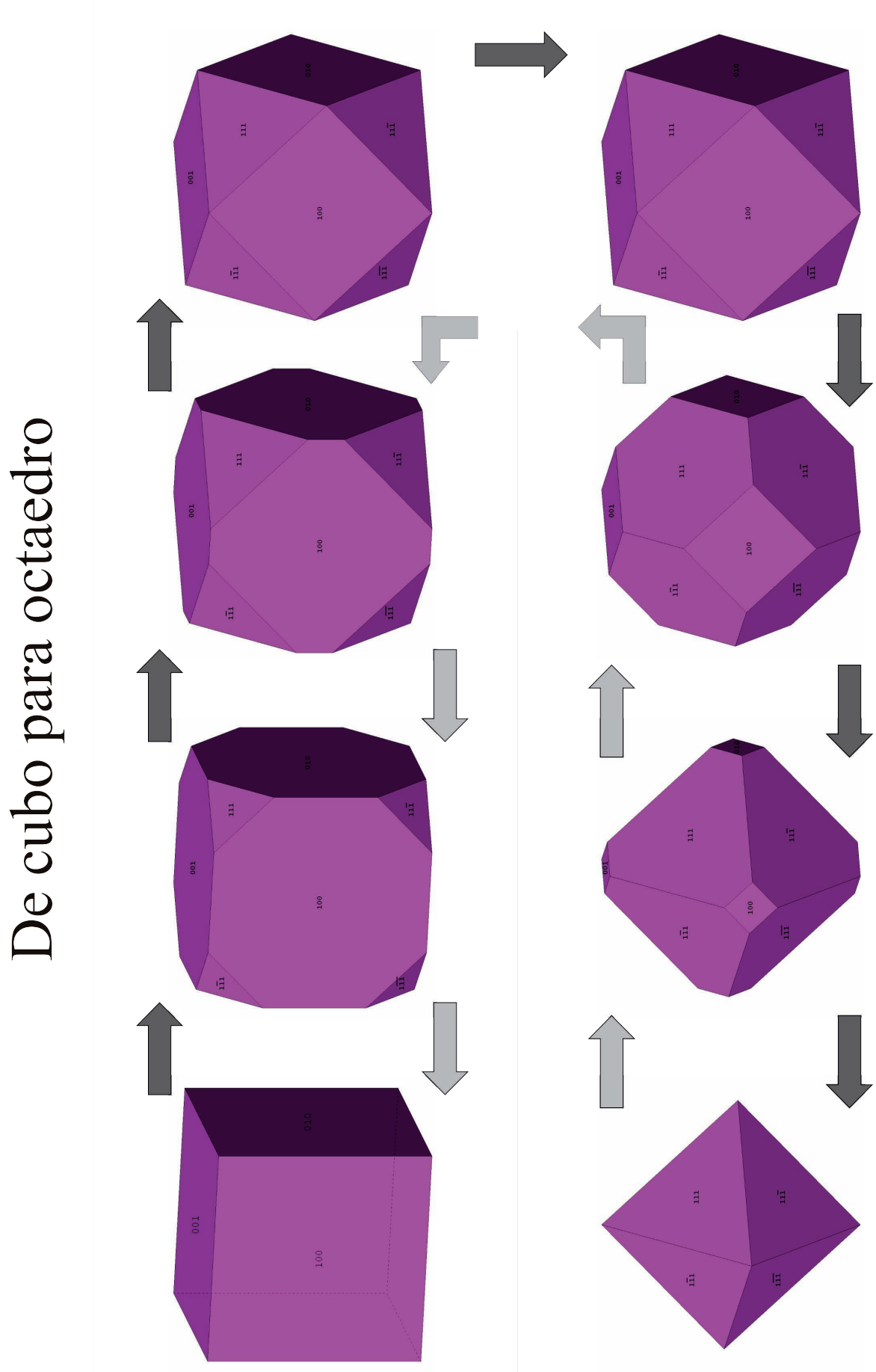
tetraedro positivo ↔ tetraedro negativo

Três Formas:

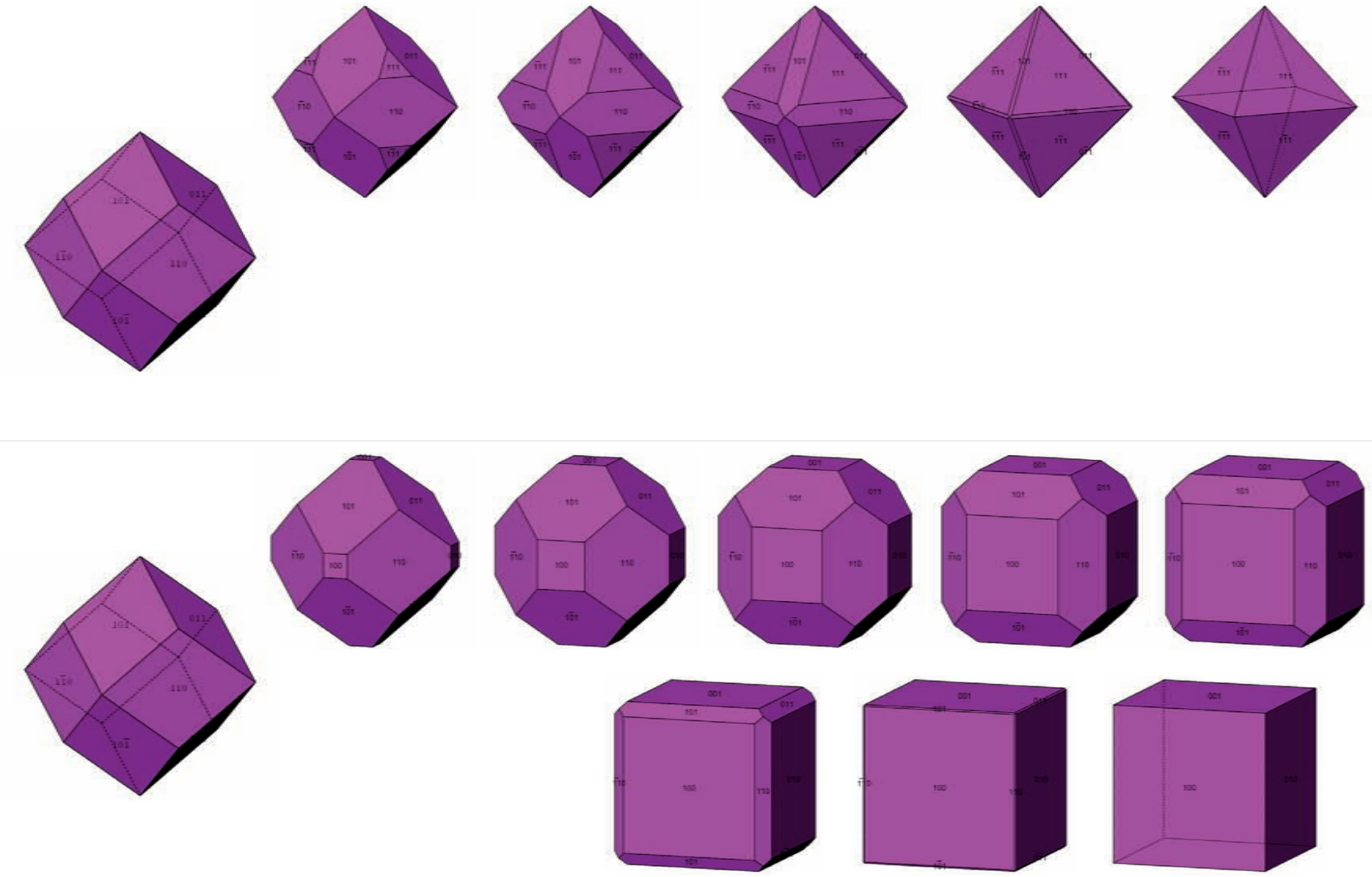


Combinação de romboedros achatados e alongados

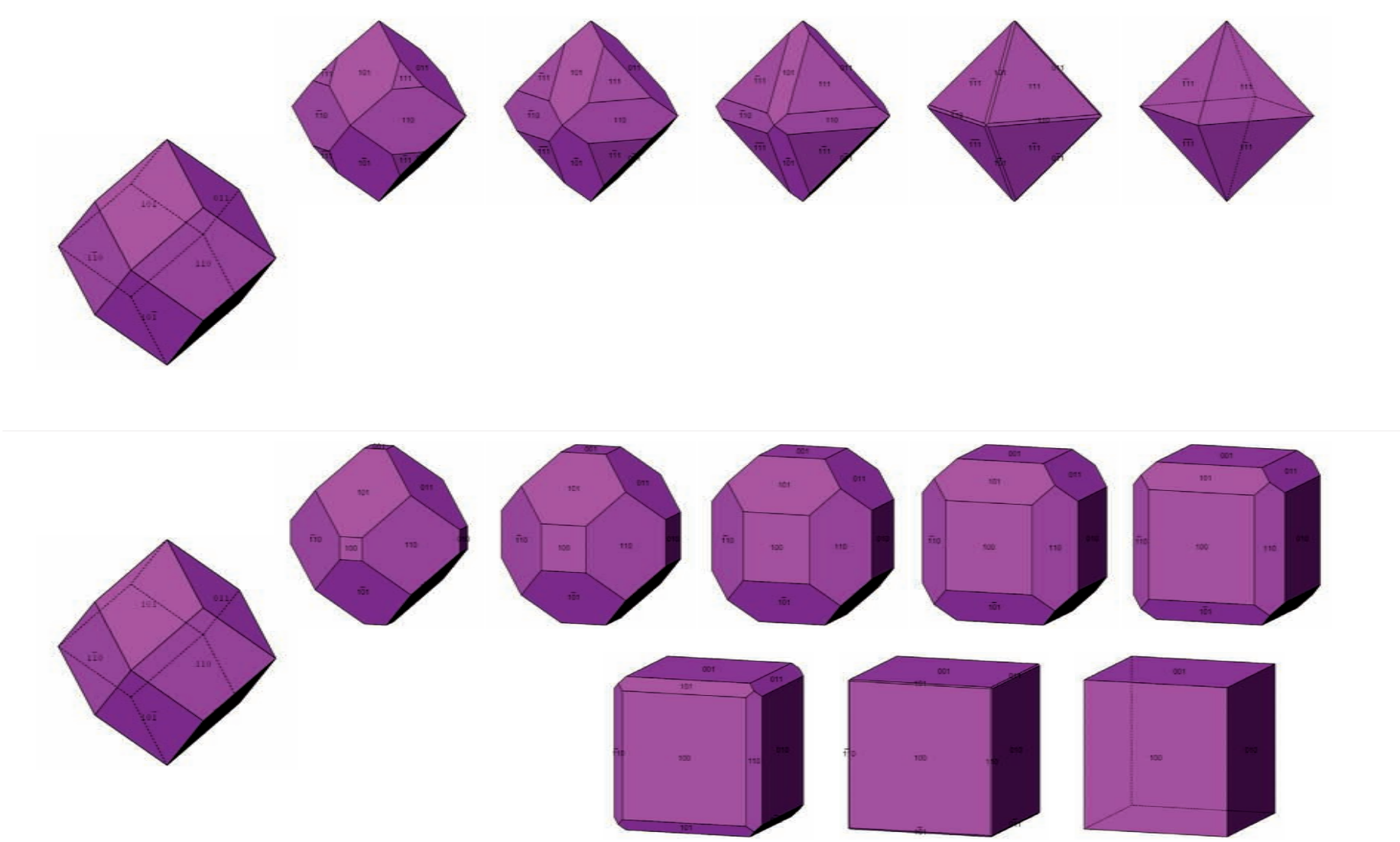

Vom Würfel zum Oktaeder


De cubo para octaedro

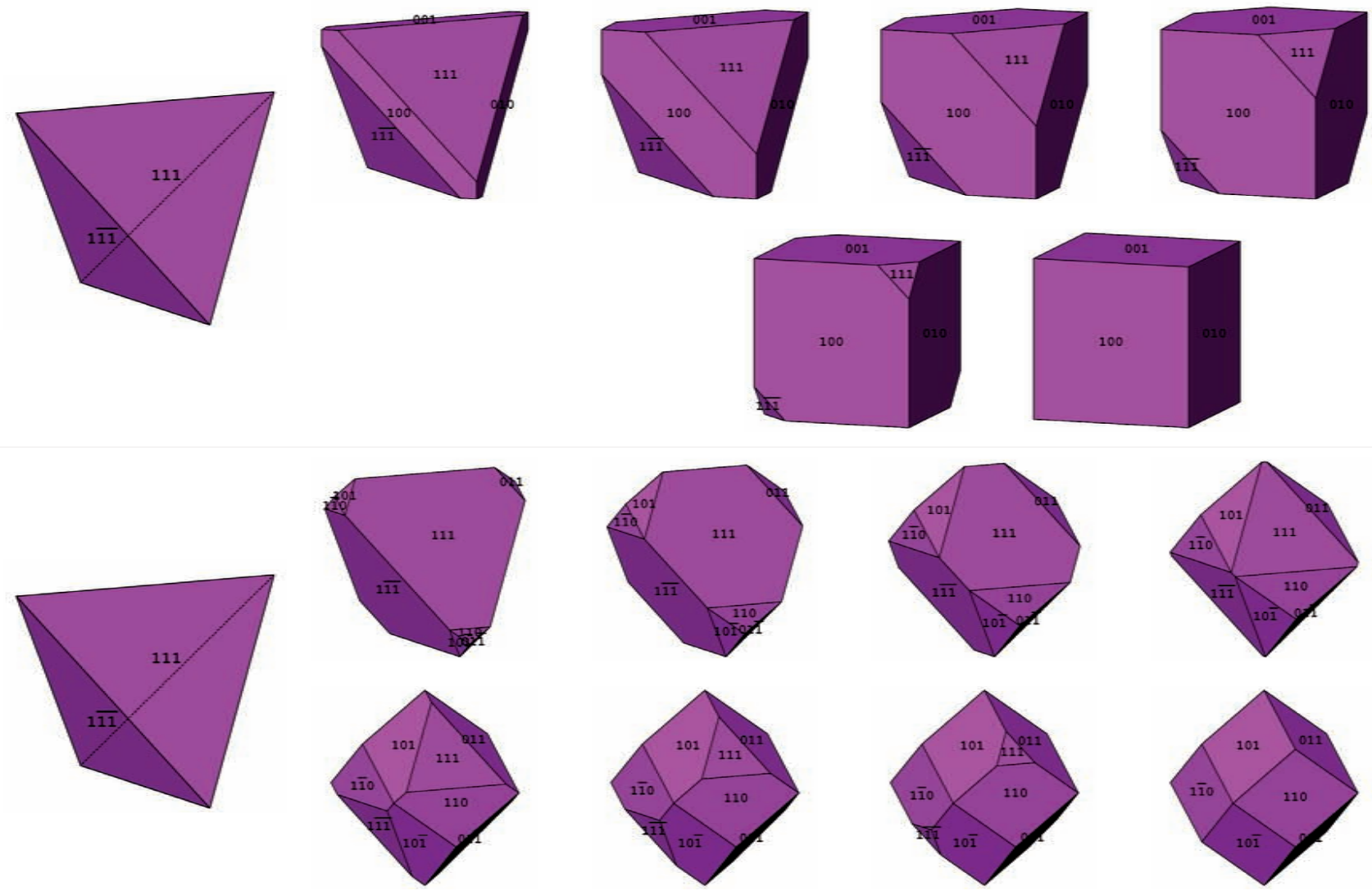
Kombination des Rhombendodekaeder mit Oktaeder und Würfel



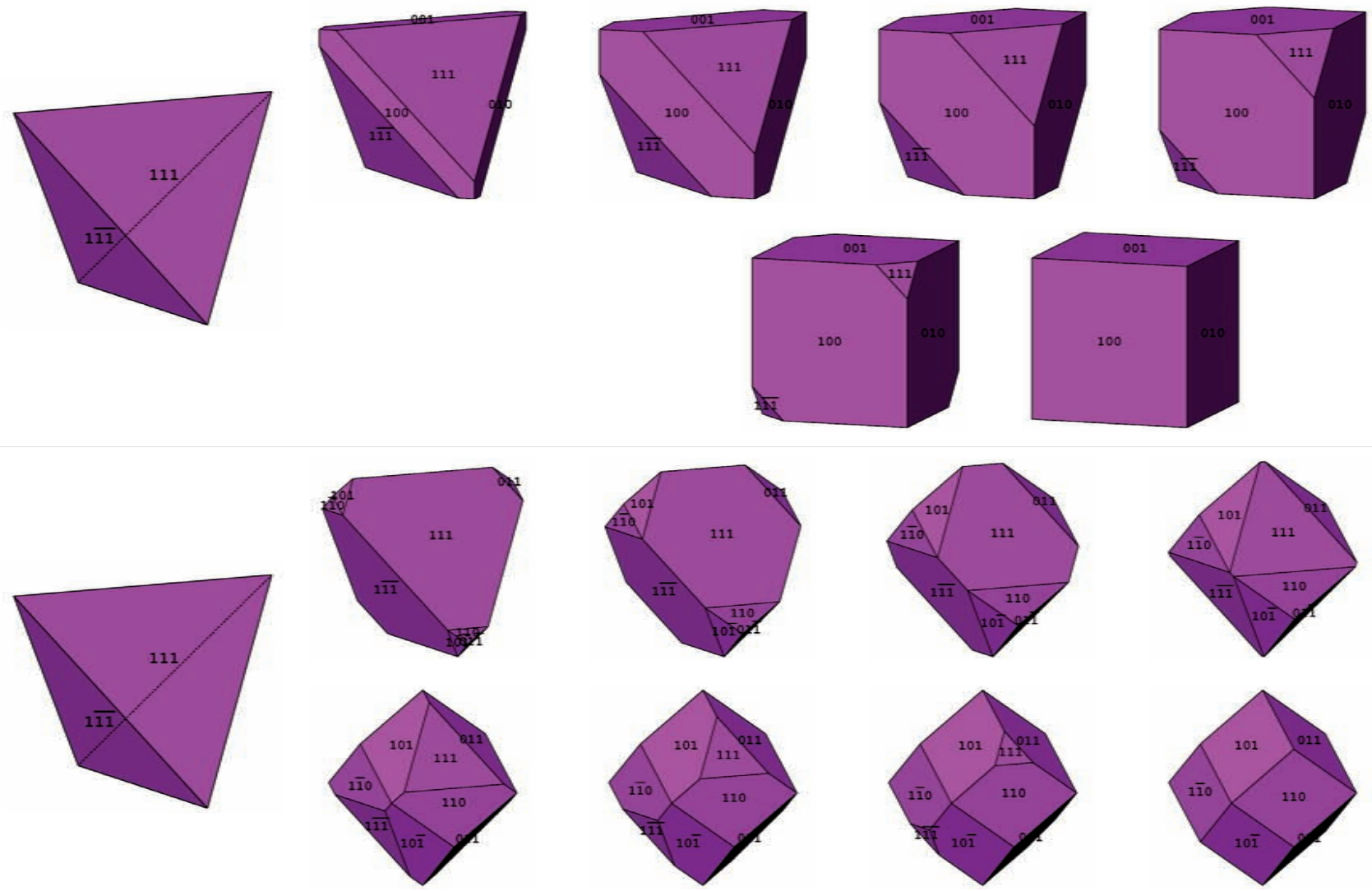
Combinação de rombododecaedro com octaedro e cubo



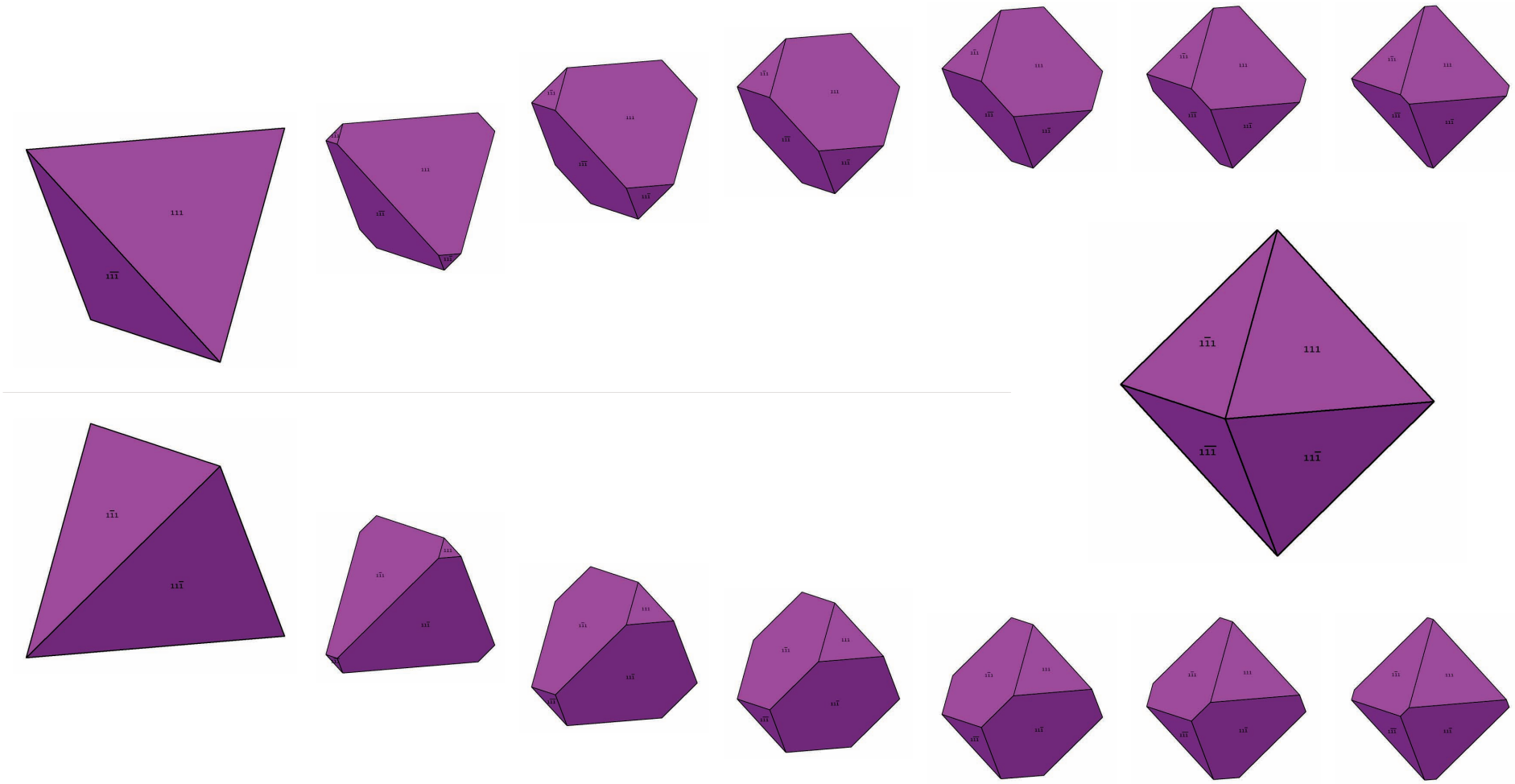
Kombination des Tetraeder mit Würfel und Rhombendodekaeder



Combinações de tetraedros com cubos e rombododecaedro

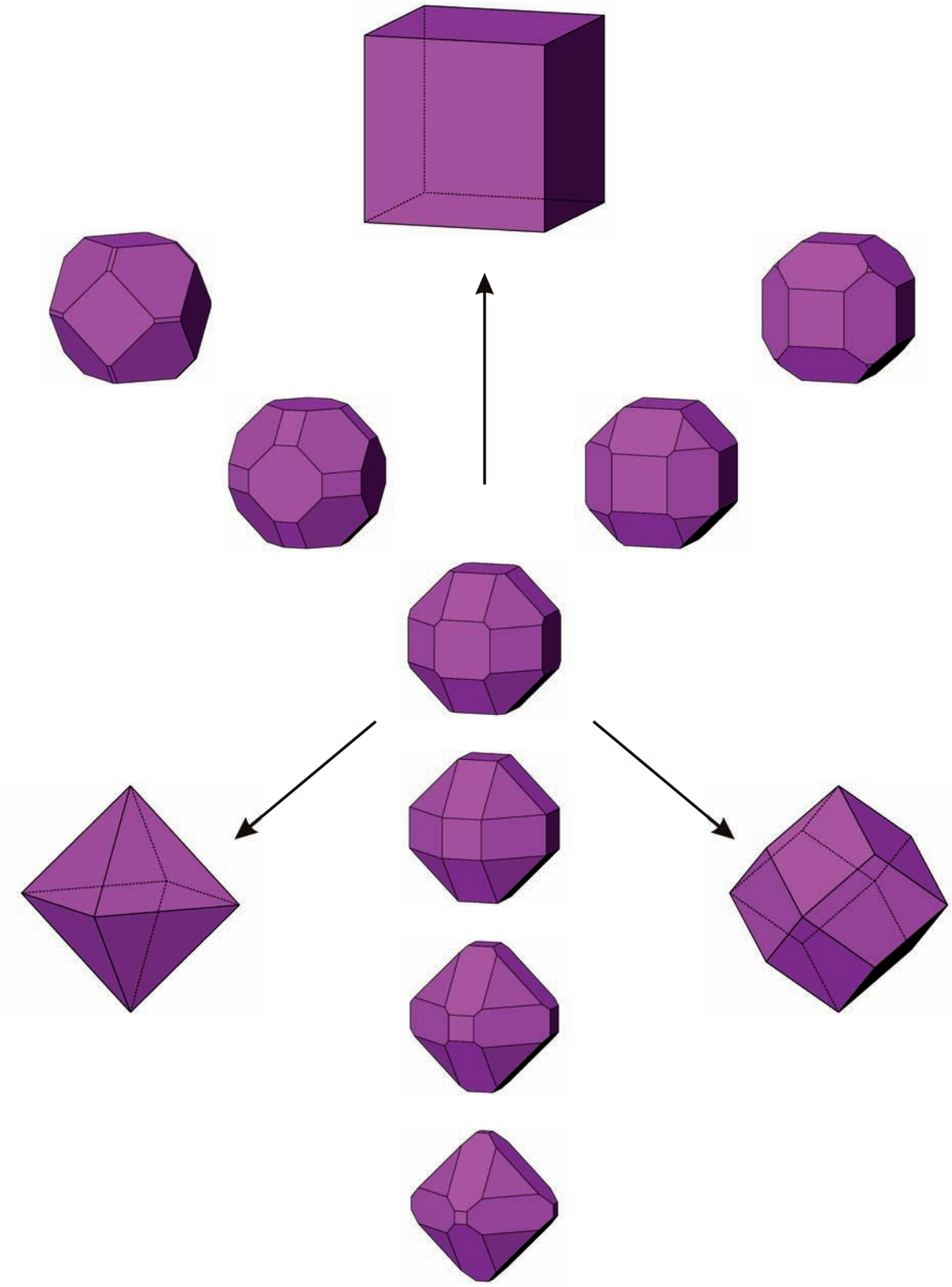


Kombination von positivem und negativem Tetraeder

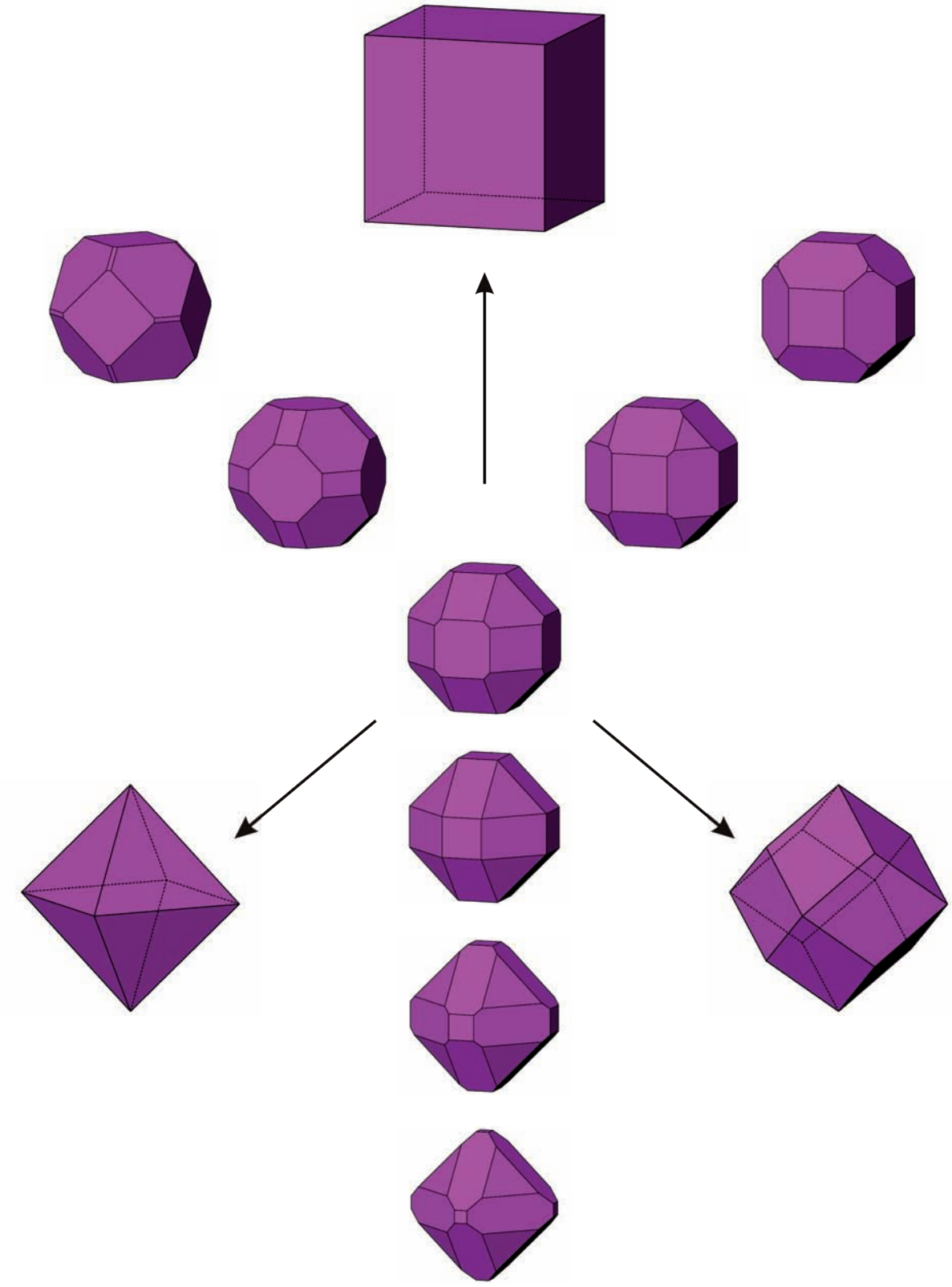


Combinações de tetraedros positivos e negativos

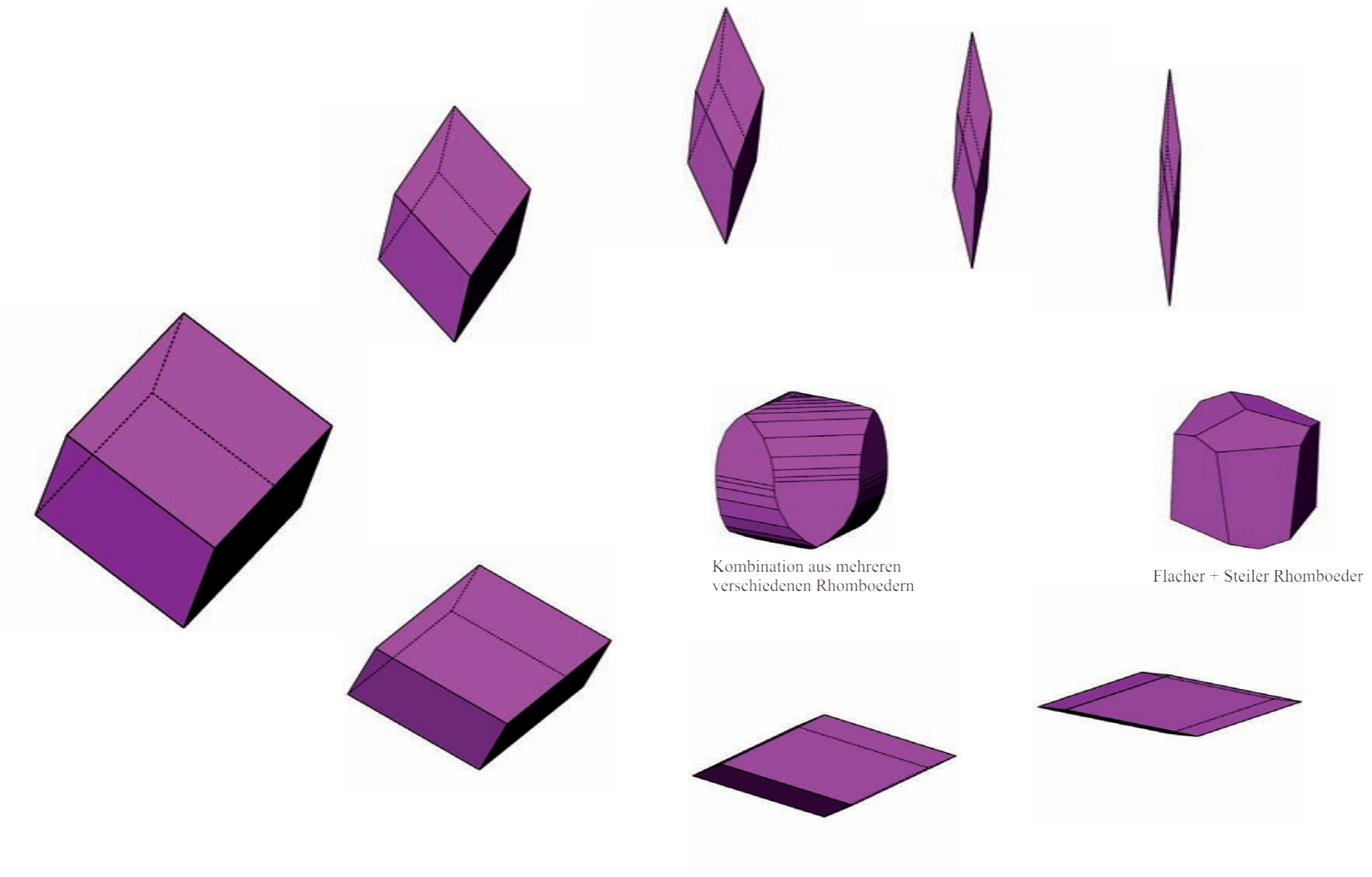
Kombinationen aus Würfel, Oktaeder
und Rhombendodekaeder



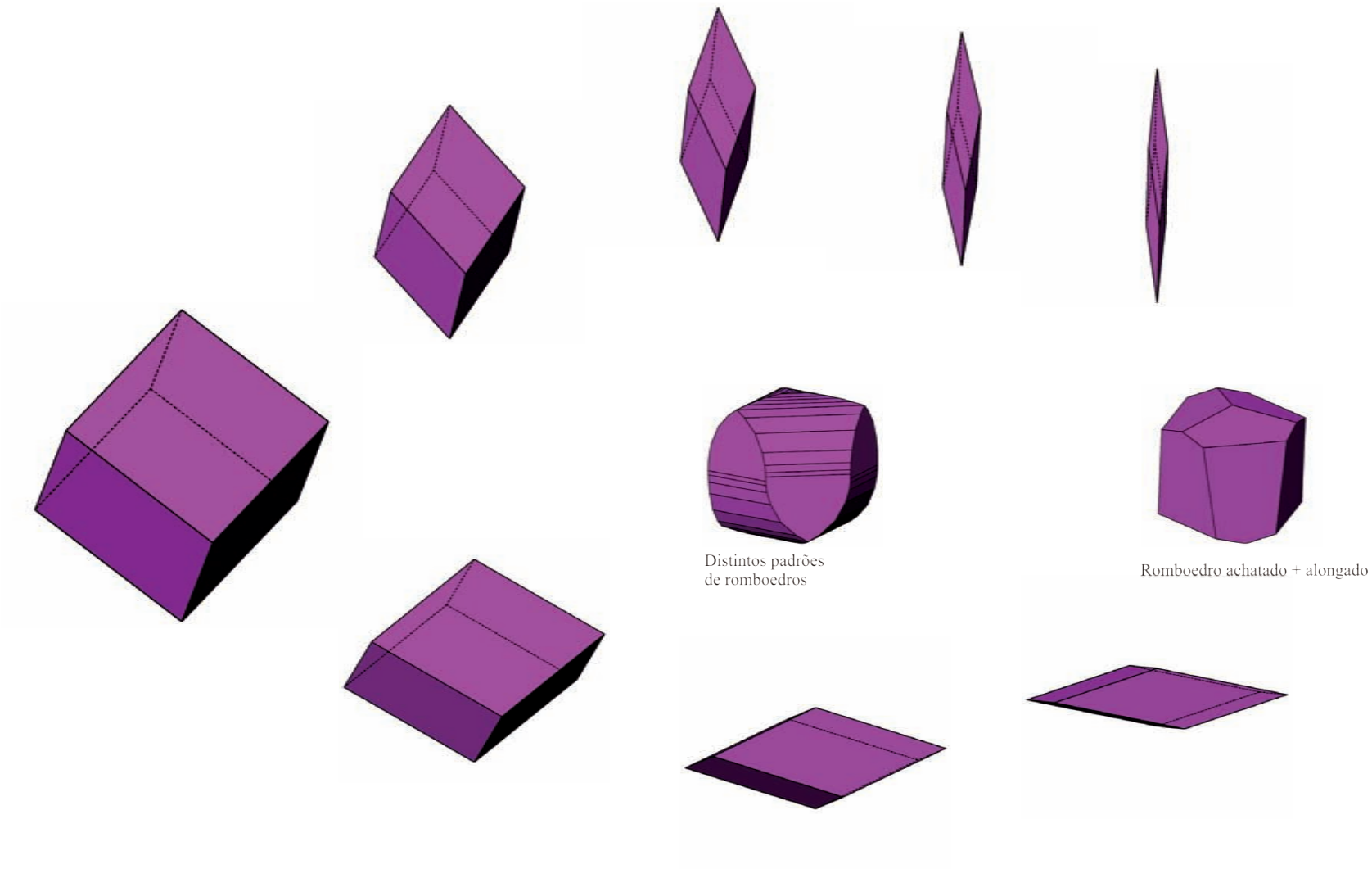
Combinações de cubo, octaedro
e rombododecaedro



Verschieden steile und flache Rhomboeder



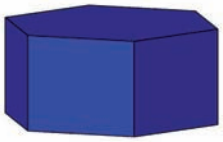
Combinações de distintos estilos de romboedros achatados e alongados



Einige ausgewählte Formen und Kombinationen nach Mineralbeispielen

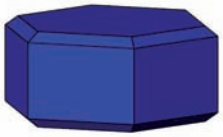
Alguns exemplos selecionados de combinações de formas entre os minerais

Apatit:



Hexagonales Prisma
Basispinakoid

Hexagonales Prisma
Hex. Dipyramide I. St.
Hex. Dipyramide II. St.



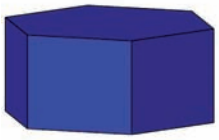
Hexagonales Prisma
Basispinakoid
Hex. Dipyramide I. St.

Hexagonales Prisma
Hex. Dipyramide I. St.
Hex. Dipyramide II. St.

Hexagonales Prisma
Hex. Dipyramide I. St.
Hex. Dipyramide II. St.

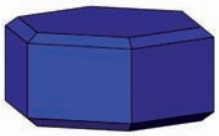
Chemische Zusammensetzung	: $Ca_5[(PO_4)_3(F,Cl,OH]$
Kristallsystem	: Hexagonal, 6/m
Elementarzelle	: a_o=9.38 Å, c_o=6.89 Å
Raumgruppe	: P 6_3/m
Ausbildung	: Derb, eingewachsen, körnig, kryptokristallin, krustenartig, xx säulig, dicktafelig, nadelig

Apatita:



Prisma hexagonal
Base pinacoidal

Prisma hexagonal
Dipirâmide hexagonal I. pos.
Dipirâmide II. Posição



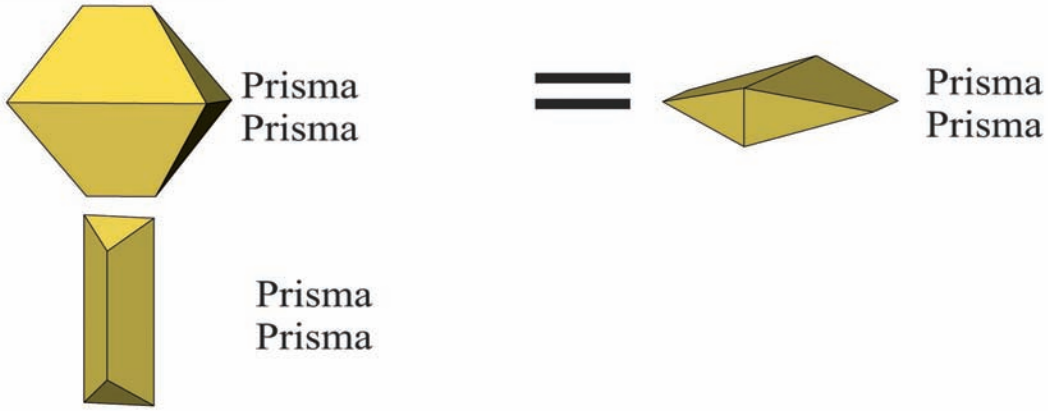
Prisma hexagonal
Base pinacoidal
Dipirâmide dihexagonal
I. pos.

Prisma hexagonal
Dipirâmide hexagonal I. pos.
Dipirâmide II. Posição

Prisma hexagonal
Dipirâmide hexagonal I. pos.
Dipirâmide II. Posição

Fórmula química	: $Ca_5[(PO_4)_3(F,Cl,OH]$
Sistema cristalino	: Hexagonal, 6/m
Célula unitária	: a_o=9.38 Å, c_o=6.89 Å
Grupo espacial	: P 6_3/m
Características	: maciço, granular, criptocristalino, com intercrescimento, xx colunar, tabular, acicular

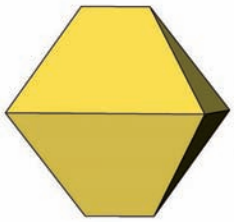
Arsenopyrit:



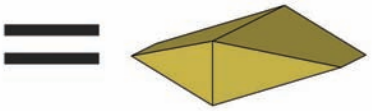
„Arsenkies“

Chemische Zusammensetzung	: FeAsS
Kristallsystem	: Monoklin, pseudorhombisch
Elementarzelle	: a_o= 5.74 Å, b_o= 5.68 Å, c_o= 5.79 Å, ß = 112.17 °
Raumgruppe	: P 2_1/c
Ausbildung	: idiomorphe Kristalle, körnig

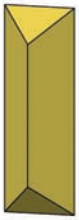
Arsenopirita:



Prisma
Prisma



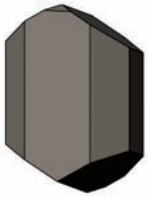
Prisma
Prisma



Prisma
Prisma

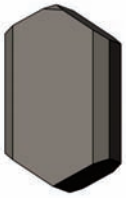
Fórmula química	: FeAsS
Sistema cristalino	: Monoclínico, pseudorômbico
Célula unitária	: a_o= 5.74 Å, b_o= 5.68 Å, c_o= 5.79 Å, ß = 112.17 °
Grupo espacial	: P 2_1/c
Características	: cristais idiomorfos, granular

Augit:



Pinakoid
Prisma
Pinakoid
Pinakoid
Prisma

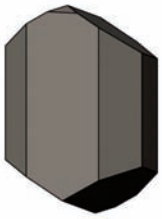
=



Pinakoid
Prisma
Pinakoid
Pinakoid
Prisma

Chemische Zusammensetzung	: $(Ca, Mg, Fe, Al, Ti)\,[(Si, Al)_2O_6]$
Kristallsystem	: Monoklin
Elementarzelle	: $a_o = 9.69$ Å, $b_o = 8{,}84$ Å, $c_o = 5.28$ Å, $\beta = 106.3^\circ$
Raumgruppe	: C 2/c
Ausbildung	: Kurzprismatische bis tafelige xx, achteckiger Querschnitt, oft zonar aufgebaut

Augita:



Pinacóide
Prisma
Pinacóide
Pinacóide
Prisma

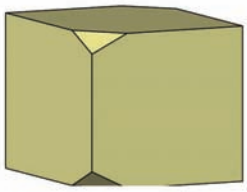
=

Pinacóide
Prisma
Pinacóide
Pinacóide
Prisma

Fórmula química	: $(Ca, Mg, Fe, Al, Ti)[(Si, Al)_2O_6]$
Sistema cristalino	: Monoclínico
Célula unitária	: a_o= 9.69 Å, b_o= 8,84 Å, c_o= 5.28 Å, ß = 106.3°
Grupo espacial	: C 2/c
Características	: de pequenos prismas até tabular xx; seções octógonas, geralmente zonado.

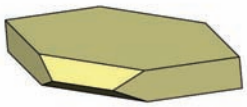
Baryt:

Basispinakoid
Prisma

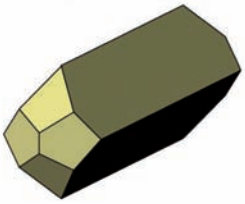


Basispinakoid
Prisma
Prisma

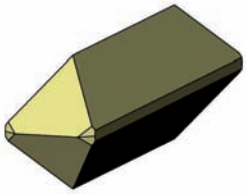
=



Basispinakoid
Prisma
Prisma



Prisma
Prisma
Prisma

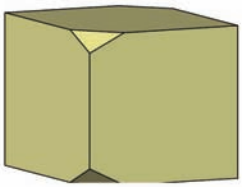


Prisma
Prisma
Pinakoid
Dipyramide

Chemische Zusammensetzung	: $BaSO_4$
Kristallsystem	: Rhombisch, 2/m 2/m 2/m
Elementarzelle	: a_o= 8.88Å, b_o= 5.45Å, c_o= 7.15Å
Raumgruppe	: P b n m
Ausbildung	: Dicht, feinkristallin, grobspätig, blättrig, xx meist tafelig oder meißelförmig

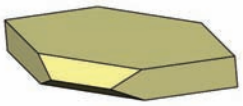
Barita:

Pinacóide basal
Prisma

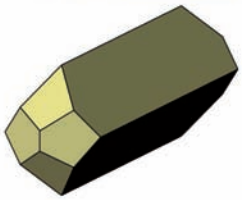


Pinacóide basal
Prisma
Prisma

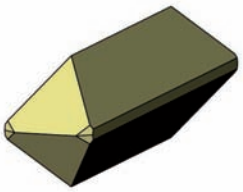
=



Pinacóide basal
Prisma
Prisma



Prisma
Prisma
Prisma

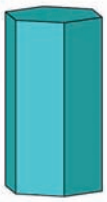


Prisma
Prisma
Pinacóide
Dipirâmide

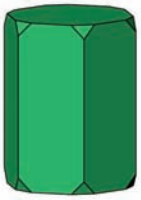
Fórmula química	: $BaSO_4$
Sistema cristalino	: Rômbico, 2/m 2/m 2/m
Célula unitária	: a_o= 8.88Å, b_o= 5.45Å, c_o= 7.15Å
Grupo espacial	: P b n m
Características	: denso, fino, prismático, laminar, xx principalmente tabular ou miceliforme (bastonete)

Beryll:

Hexagonales Prisma
Basispinakoid



Hexagonales Prisma
Basispinakoid



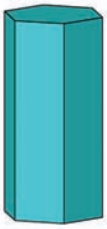
Hexagonales Prisma
Basispinakoid
Hex. Dipyramide II. St.

Hexagonales Prisma
Basispinakoid
Hex. Dipyramide I. St.
Hex. Dipyramide II. St.

Chemische Zusammensetzung	: $Be_3Al_2[Si_6O_{18}]$
Kristallsystem	: hexagonal
Elementarzelle	: a_o= 9.22Å, c_o= 9.19Å
Raumgruppe	: P 6/m m c
Ausbildung	: säulig, stengelig, dominierend Prisma (1 0 – 1 0) und Pinakoid (0 0 0 1)

Berilo:

Prisma hexagonal
Pinacóide basal



Prisma hexagonal
Pinacóide basal

Prisma hexagonal
Pinacóide basal
Dipirâmide hexagonal
II. Posição

Prisma hexagonal
Pinacóide basal
Dipriâmide hexagonal I. pos.
Dipirâmide hexagonal II.pos.

Fórmula química	: $Be_3Al_2[Si_6O_{18}]$
Sistema cristalino	: hexagonal
Célula unitária	: $a_o = 9.22Å$, $c_o = 9.19Å$
Grupo espacial	: P 6/m m c
Características	: colunar, fibroso, dominantemente prismático (1 0 – 1 0) e pinacoidal (0 0 0 1)

Biotit:

Basispinakoid
Prisma
Pinakoid

=

Basispinakoid
Prisma
Pinakoid

Basispinakoid
Prisma
Pinakoid
Prisma

Chemische Zusammensetzung	: $K(Mg, Fe)_3[(OH)_2/AlSi_3O_{10}]$
Kristallsystem	: Monoklin, trioktaedrisches Dreischichtsilikat
Elementarzelle	: a_o= 5.35 Å, b_o= 9.26 Å, c_o= 10.23 Å, ß = 100.3°
Raumgruppe	: C 2/m
Ausbildung	: Tafelig, plattig, schuppig

Biotita:

Pinacóide basal
Prisma
Pinacóide

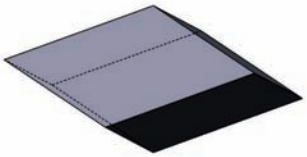
=

Pinacóide basal
Prisma
Pinacóide

Pinacóide basal
Prisma Pinacóide
Prisma

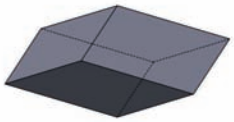
Fórmula química	: $K(Mg, Fe)_3[(OH)_2 / AlSi_3O_{10}]$
Sistema cristalino	: Monoclínico, três folhas de silicatos tri-octaédricos
Célula unitária	: a_o= 5.35 Å, b_o= 9.26 Å, c_o= 10.23 Å, ß = 100.3°
Grupo espacial	: C 2/m
Características	: tabular, micáceo, liso, laminar

Calcit:

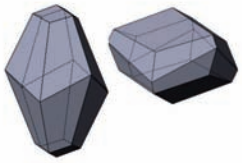


positiver Rhomboeder

Skalenoeder

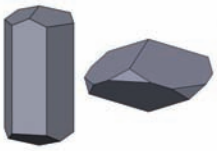


negativer
Rhomboeder



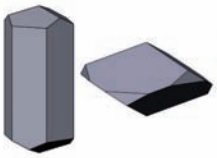
Skalenoeder
(+) Rhomboeder

negativer Rhomboeder



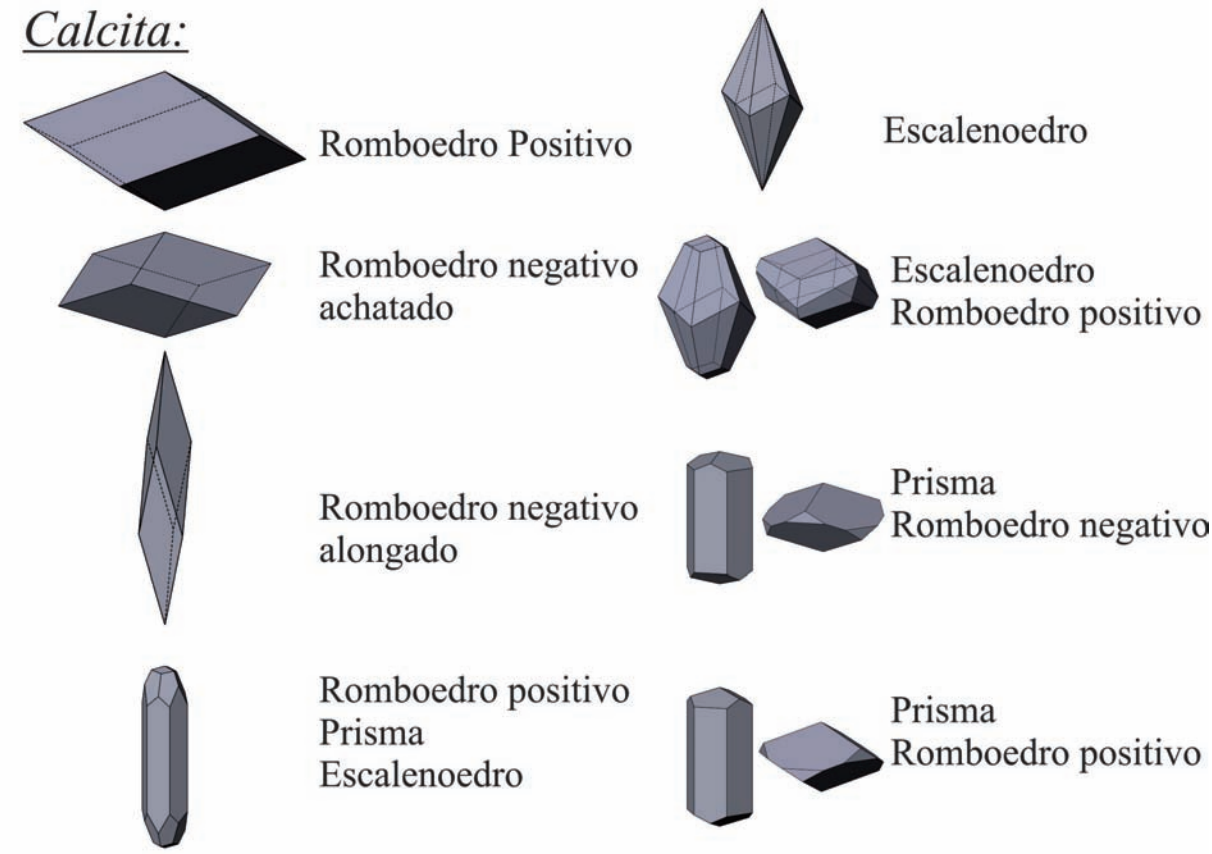
Prisma
(-) Rhomboeder

pos. Rhomboeder
Prisma
Skalenoeder



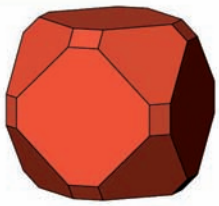
Prisma
(+) Rhomboeder

Chemische Zusammensetzung	: $CaCO_3$
Kristallsystem	: Trigonal, -3m
Elementarzelle	: a_o= 4.99, c_o= 17.06
Raumgruppe	: R-3c
Ausbildung	: Gesteinsbildend, dicht, oolithisch, derb grobspätig, xx sehr verschieden (formenreiches Mineral!), z. B. Rhomboeder und Skalenoeder, säulige xx u.a.



Fórmula química	: $CaCO_3$
Sistema cristalino	: Trigonal, -3m
Célula unitária	: a_o= 4.99, c_o= 17.06
Grupo espacial	: R-3c
Características	: formador de rocha, denso, oolítico, maciço, colunar, xx muitas variações (mineral com vários hábitos possíveis!), p.ex.: romboédrico e escalenoédrico, xx e outros

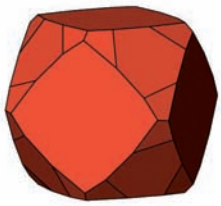
Cuprit:



Hexaeder
Oktaeder
Rhombendodekaeder

=

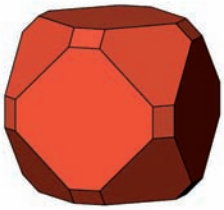
Hexaeder
Oktaeder
Rhombendodekaeder



Hexaeder
Oktaeder
Pentagonikositetraeder

Chemische Zusammensetzung	: Cu_2O
Kristallsystem	: Kubisch
Elementarzelle	: a_o=4.27 Å
Raumgruppe	: Pn3m
Ausbildung	: Derb, eingesprengt, Würfel, Oktaeder, nadelige x

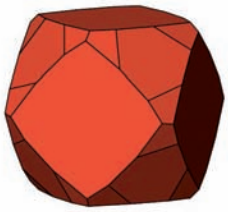
Cuprita:



Hexaedro (cubo)
Octaedro
Rombododecaedro

=

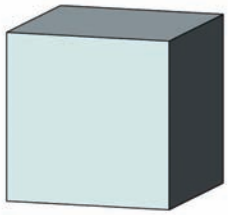
Hexaedro (cubo)
Octaedro
Rombododecaedro



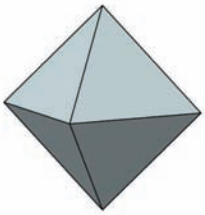
Hexaedro (cubo)
Octaedro
Pentagonicositetraedro

Fórmula química	: Cu_2O
Sistema cristalino	: Isométrico
Célula unitária	: a_o=4.27 Å
Grupo espacial	: Pn3m
Características	: maciço, disseminado, cúbico, octaédrico, acicular x

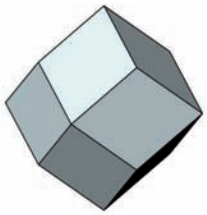
Diamant:



Hexaeder



Oktaeder



Rhombendodekaeder

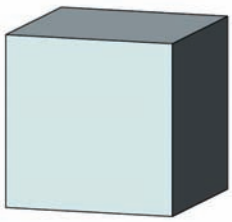
Tetrakishexaeder

Hexakisoktaeder

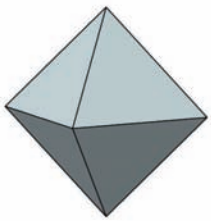
Oktaeder
Hexakisoktaeder

Chemische Zusammensetzung	: C
Kristallsystem	: Kubisch
Elementarzelle	: a_o= 3.559 Å
Raumgruppe	: F d3m
Ausbildung	: Oktaeder, Rhombendodekaeder, Würfel, xx meist abgerundet

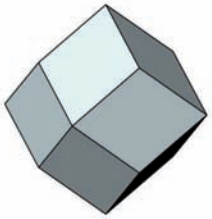
Diamante:



Hexaedro (cubo)



Octaedro



Rombododecaedro

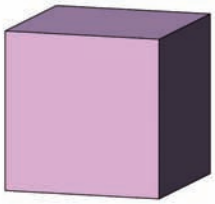
Tetrahexaedro

Hexaoctaedro

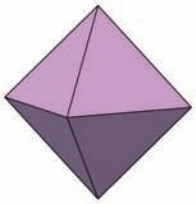
Octaedro
Hexaoctaedro

Fórmula química	: C
Sistema cristalino	: Isométrico
Célula unitária	: a_o= 3.559 Å
Grupo espacial	: F d3m
Características	: octaédrico, romboédrico, cubo, xx por vezes arredondado

Fluorit:



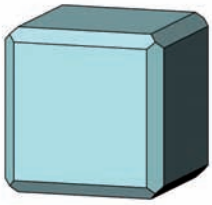
Hexaeder



Oktaeder

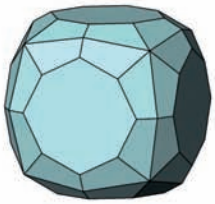
Hexaeder
Oktaeder

Oktaeder
Rhombendodekaeder



Hexaeder
Rhombendodekaeder

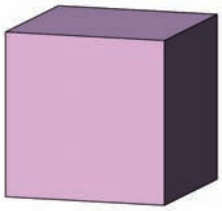
Tetrakishexaeder



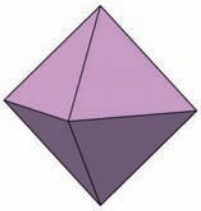
Hexaeder
Hexakisoktaeder

Chemische Zusammensetzung	: CaF_2
Kristallsystem	: Kubisch
Elementarzelle	: a_0= 5.46 Å
Raumgruppe	: F m3m
Ausbildung	: Derb, grobspätig, Würfel, Oktaeder, Rhombendodekaeder, oft grobkristallin,

Fluorita:



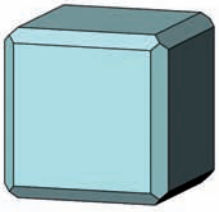
Hexaedro (cubo)



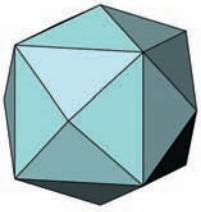
Octaedro

Hexaedro
Octaedro

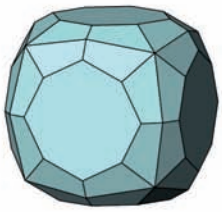
Octaedro
Rombododecaedro



Hexaedro
Rombododecaedro



Tetrahexaedro



Hexaedro
Hexaoctaedro

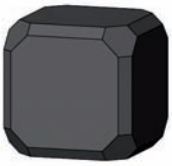
Fórmula química	: CaF_2
Sistema cristalino	: Isométrico
Célula unitária	: a_o= 5.46 Å
Grupo espacial	: F m3m
Características	: maciço, prismático, cúbico, octaédrico, rombododecaédrico; geralmente desenvolvecristais

Galenit:

Oktaeder

Würfel

div.
Kub-Oktaeder



Würfel
Oktaeder
Rhombendodekaeder

Chemische Zusammensetzung	: PbS
Kristallsystem	: Kubisch, NaCl-Gitter
Elementarzelle	: a_o= 5.94 Å
Raumgruppe	: F m 3 m
Ausbildung	: Derb, eingesprengt, Würfel, Oktaeder, Rhombendodekaeder, oft Kombinationen

Galena:

Octaedro

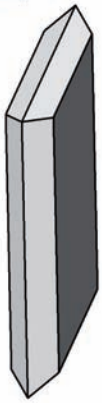
Cubo (hexaedro)

Distintas combinações
de hexaedro e octaedro

Cubo (hexaedro)
Octaedro
Rombododecaedro

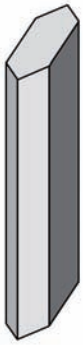
Fórmula química	: PbS
Sistema cristalino	: Isométrico, reticulados de NaCl
Célula unitária	: a_o= 5.94 Å
Grupo espacial	: F m 3 m
Características	: maciço, disseminado, cúbico, octaédrico, dodecaédrico rômbico, geralmente associado a outros minerais

Gips:



Prisma
Prisma
Pinakoid

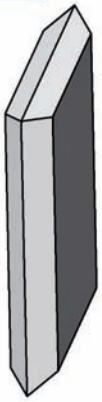
Prisma
Prisma
Prisma
Prisma
Pinakoid



Prisma
Basispinakoid
Pinakoid

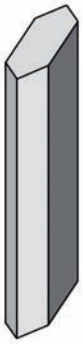
Chemische Zusammensetzung	: $CaSO_4 * 2H_2O$
Kristallsystem	: Monoklin, 2/m
Elementarzelle	: a_o= 5.68Å, b_o= 15.18Å, c_o= 6.89Å, ß =113.83
Raumgruppe	: A 2/a
Ausbildung	: Dicht, feinkörnig, faserig, xx nadelig, prismatisch, tafelig, oft Schwalbenschwanzzwillinge

Gipso:



Prisma
Prisma
Pinacóide

Prisma
Prisma
Prisma
Prisma
Pinacóide

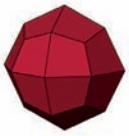


Prisma
Picanóide basal
Pinacóide

Fórmula química	: $CaSO_4 .2H_2O$
Sistema cristalino	: Monoclínico, 2/m
Célula unitária	: a_o= 5.68Å, b_o= 15.18Å, c_o= 6.89Å, ß =113.83
Grupo espacial	: A 2/a
Características	: denso, fino, fibroso, xx acicular, prismático, roseta, tabular; frequentemente com geminação do tipo ponta de flecha

Granat:

Rhombendodekaeder



Deltoidikositetraeder

Rhombendodekaeder
Deltoidikositetraeder

Rhombendodekaeder
Deltoidikositetraeder
Tetrakishexaeder
Hexakisoktaeder
Trisoktaeder

Chemische Zusammensetzung : $X_3Y_2[SiO_4]_3$
X: Mg, Fe^{2+}, Mn^{2+}, Ca (8er Koord.)
Y: Al, Fe^{3+}, Cr^{3+}, V^{3+} (6er Koord.)
Für (SiO_4) z. T. auch (AlO_4) oder (OH)

Kristallsystem : Kubisch

Ausbildung : Rhombendodekaeder (110),Deltoidikositetraeder (211)

„Pyralspite“

Pyrop $Mg_3Al_2[SiO_4]_3$

Almandin: $Fe_3Al_2[SiO_4]_3$

Spessartin: $Mn_3Al_2[SiO_4]_3$

“Ugrandite”

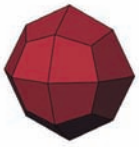
Uwarowit: $Ca_3Cr_2[SiO_4]_3$

Grossular: $Ca_3Al_2[SiO_4]_3$

Andradit: $Ca_3Fe_2[SiO_4]_3$

Granada:

Rombododecaedro



Icositetraedro deltóide

Rombododecaedro
Icositetraedro deltóide

Rombododecaedro
Icositetraedro deltóide
Tetrahexaedro
Hexaoctaedro
Trioctaedro

Fórmula química	: $X_3Y_2[SiO_4]_3$ X: Mg, Fe^{2+}, Mn^{2+}, Ca (8º coord.) Y: Al, Fe^{3+}, Cr^{3+}, V^{3+} (6º coord.) Para (SiO_4) por vezes também (AlO_4) ou (OH)
Sistema cristalino	: Isométrico (cúbico)
Características	: rombododecaédrico (110), icositetraedro deltoidal (211)

Piralspita

Piropo $Mg_3Al_2[SiO_4]_3$

Almandina: $Fe_3Al_2[SiO_4]_3$

Espessartita: $Mn_3Al_2[SiO_4]_3$

Ugrandita

Uvarovita: $Ca_3Cr_2[SiO_4]_3$

Grossulária: $Ca_3Al_2[SiO_4]_3$

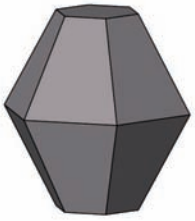
Andradita: $Ca_3Fe_2[SiO_4]_3$

Hämatit:

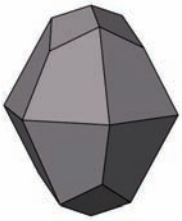
Rhomboeder
Basispinakoid

=

Rhomboeder
Basispinakoid



Dipyramide
Basispinakoid



Rhomboeder
Dipyramide

Rhomboeder
Dipyramide
Rhomboeder

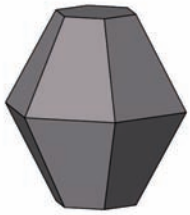
Chemische Zusammensetzung	: Fe_2O_3
Kristallsystem	: Trigonal
Elementarzelle	: a_o= 5.03Å, c_o=13.74Å
Raumgruppe	: R -3c
Ausbildung	: Erdig, schuppig, radialstrahlig, knollig, nierig, xx tafelig, plattig

Hematita:

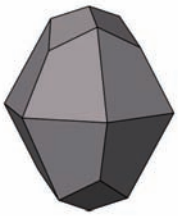
Romboedro
Pinacóide basal

=

Romboedro
Pinacóide basal



Dipirâmide
Pinaóide basal



Romboedro
Dipirâmide

Romboedro
Dipirâmide
Romboedro

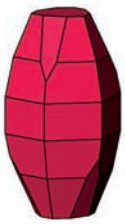
“diamante-negro”

Fórmula química	: Fe_2O_3
Sistema cristalino	: Trigonal
Célula unitáriaunitária	: a_o= 5.03Å, c_o=13.74Å
Grupo espacial	: R -3c
Características	:terroso, radial (dendrítico), nodular, reniforme, xx tabular, laminar

Korund:

Prisma
Basispinakoid

Prisma
Basispinakoid
Dipyramide



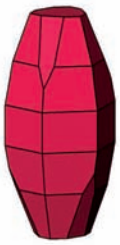
Prisma
Basispinakoid
Dipyramide
Dipyramide
Rhomboeder

Chemische Zusammensetzung	: Al_2O_3
Kristallsystem	: Trigonal
Elementarzelle	: a_o=4.75 Å, c_o= 12.98 Å
Raumgruppe	: R-3c
Ausbildung	: Eingesprengt, säulige bis tonnenförmige xx, meist mit Flächenstreifung

Corindum:

Prisma
Pinacóide basal

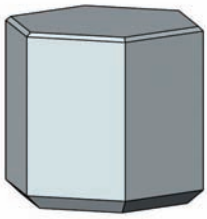
Prisma
Pinacóide basal
Dipirâmide



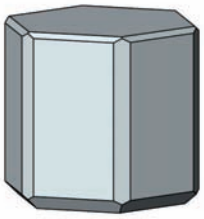
Prisma
Pinacóide basal
Dipirâmide
Dipirâmide
Romboedro

Fórmula química	: Al_2O_3
Sistema cristalino	: Trigonal
Célula unitáriaunitária	: a_o=4.75 Å, c_o= 12.98 Å
Grupo espacial	: R-3c
Características	: disseminado, colunar até oval, geralmente com estrias

Nephelin:



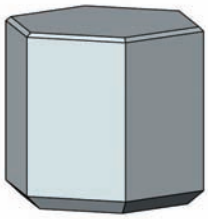
Prisma
Basispedion
Basispedion
Pyramide
Pyramide



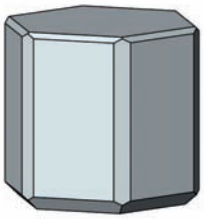
Prisma
Basispedion
Basispedion
Pyramide
Pyramide
Prisma

Chemische Zusammensetzung	: $KNa_3[Al\,SiO_4]_4$
Kristallsystem	: Hexagonal
Elementarzelle	: a_o= 9.99 Å, c_o= 8.37 Å
Raumgruppe	: P 6_3
Ausbildung	: Derb, selten säulige xx

Nefelina:



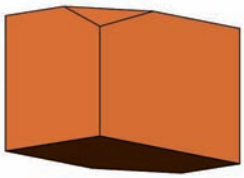
Prisma
Pédio basal
Pédio basal
Pirâmide
Pirâmide



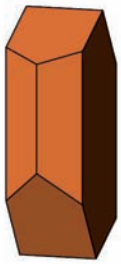
Prisma
Pédio basal
Pédio basal
Pirâmide
Pirâmide
Prisma

Fórmula química	: $KNa_3[Al\,SiO_4]_4$
Sistema cristalino	: Hexagonal
Célula unitária	: a_o= 9.99 Å, c_o= 8.37 Å
Grupo espacial	: P 6_3
Características	: maciço, raramente colunar xx

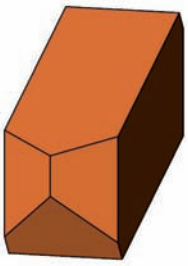
Orthoklas:



Prisma
Pinakoid
Pinakoid



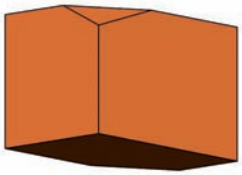
Prisma
Basispinakoid
Pinakoid
Pinakoid



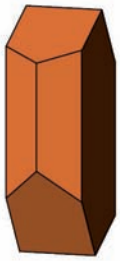
Prisma
Pinakoid
Basispinakoid
Pinakoid

Chemische Zusammensetzung	: $K[Al\,Si_3O_8]$ „Kalifeldspat“
Kristallsystem	: Monoklin
Elementarzelle	: a_o= 8.62 Å, b_o= 12.99 Å, c_o= 7.19 Å, ß =116.02 °
Raumgruppe	: C 2/m
Ausbildung	: Gesteinsbildend, xx tafelig, prismatisch, häufig

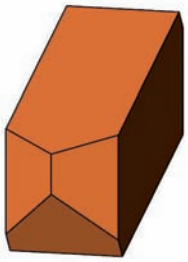
Ortoclásio:



Prisma
Pinacóide
Pinacóide



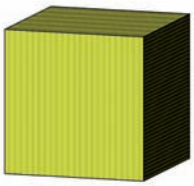
Prisma
Pinacóide basal
Pinacóide
Pinacóide



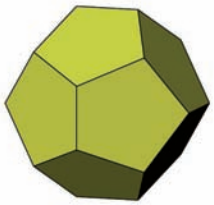
Prisma
Pinacóide
Pinacóide basal
Pinacóide

Fórmula química	: $K[Al\,Si_3O_8]$ k-Feldspato (Feldspato potássico)
Sistema cristalino	: Monoclínico
Célula unitária	: a_o= 8.62 Å, b_o= 12.99 Å, c_o= 7.19 Å, ß =116.02 °
Grupo espacial	: C 2/m
Características	:formador de rochas, xx tabular, prismático, frequentemente com geminações (Karlsbar, Manebach, Baveno)

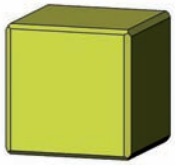
Pyrit:



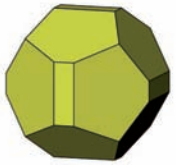
Würfel mit
Flächenstreifung



Pentagondodekaeder

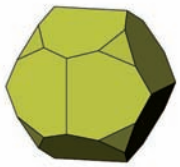


Pentagondodekaeder
Würfel



Pentagondodekaeder
Würfel

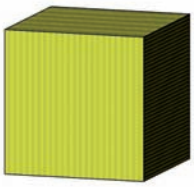
Pentagondodekaeder
Oktaeder
= “Pseudo-Ikosaeder”



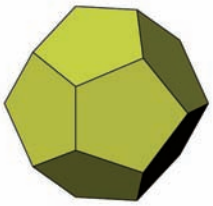
Pentagondodekaeder
Oktaeder

Chemische Zusammensetzung	: FeS_2
Kristallsystem	: Kubisch: Struktur: ähnlich NaCl, S_2-Hanteln liegen parallel (1 1 1)
Elementarzelle	: a_o= 5.42 Å
Raumgruppe	: P a 3
Ausbildung	: Derb, eingesprengt, Würfel (oft mit Flächenstreifung), Oktaeder, Pentagondodekaeder

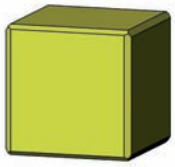
Pirita:



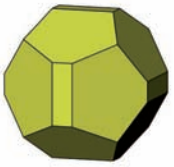
Cubo (hexaedro) com estrias nas faces



Pentagondodecaedro

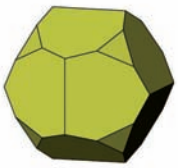


Pentagondodecaedro
Cubo (hexaedro)



Pentagondodecaedro
Cubo (hexaedro)

Pentagondodecaedro
Octaedro
= Pseuo-isosaedro

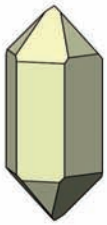


Pentagondodecaedro
Octaedro

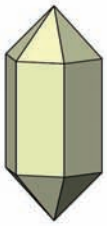
“Ouro de Tolo“

Fórmula química	: FeS_2
Sistema cristalino	: Isométrico (estrutura cúbica similar NaCl, com ligações S_2 paralelas (1 1 1)
Célula unitária	: a_o = 5.42 Å
Grupo espacial	: P a 3
Características	: maciço, disseminado, cúbico (geralmente estriado), octaédrico, pentadodecaédrico

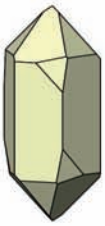
Quarz:



Hexagonales Prisma
pos. Rhomboeder
neg. Rhomboeder

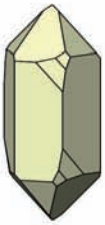


Hexagonales Prisma
Hex. Dipyramide
Hochquarz!
(andere Symetrie)



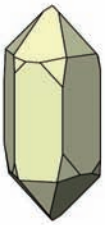
Hexagonales Prisma
pos. Rhomboeder
neg. Rhomboeder
rechter Trapezoeder

Hexagonales Prisma
pos. Rhomboeder
neg. Rhomboeder
linker Trapezoeder



Hexagonales Prisma
pos. Rhomboeder
neg. Rhomboeder
rechter Trapezoeder
rechte Dipyramide

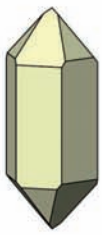
Hexagonales Prisma
pos. Rhomboeder
neg. Rhomboeder
linker Trapezoeder
linke Dipyramide



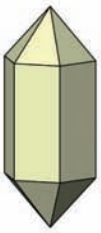
Hexagonales Prisma
pos. Rhomboeder
neg. Rhomboeder
“linker”
“rechter” Trapezoeder

Chemische Zusammensetzung	: SiO_2
Kristallsystem	: Trigonal
Elementarzelle	: a_o= 4.91 Å, c_o= 5.40 Å
Raumgruppe	: P 3_1 2 1 , P 3_2 2 1
Ausbildung	: derb, schöne Kristalle, z.T. wasserklar

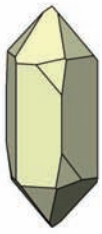
Quartzo



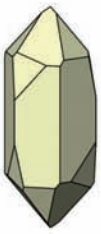
Prisma hexagonal
Romboedro positivo
Romboedro negativo



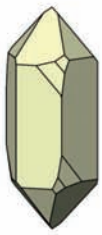
Prisma hexagonal
Dipirâmide hexagonal
Quartzo alta temperatura
(Outra simetria)



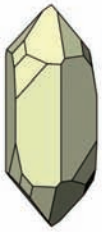
Prisma hexagonal
Romboedro positivo
Romboedro negativo
Trapezoedro direito



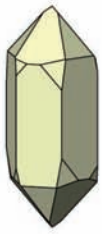
Prisma hexagonal
Romboedro positivo
Romboedro negativo
Trapezoedro esquerdo



Prisma hexagonal
Romboedro positivo
Romboedro negativo
Trapezoedro direito
Dipirâmide direita



Prisma hexagonal
Romboedro positivo
Romboedro negativo
Trapezoedro direito
Dipirâmide esquerda

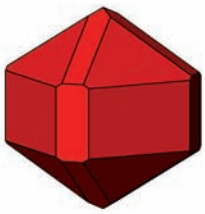


Prisma hexagonal
Romboedro positivo
Romboedro negativo
Trapezoedro esquerdo
direito

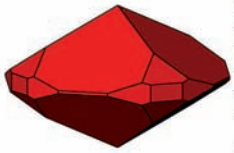
Fórmula química	: SiO_2
Sistema crsitalino	: Trigonal
Célula unitária	: a_o= 4.91 Å, c_o= 5.40 Å
Grupo espacial	: P 3_1 2 1 , P 3_2 2 1
Características	: granular; bem cristalizado, por vezes incolor

Rutil:

Prisma
Prisma
Dipyramide



Prisma
Prisma
Dipyramide
Dipyramide

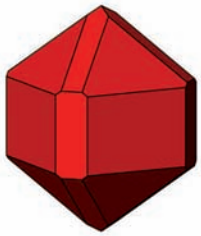


Prisma
Prisma
Dipyramide
Dipyramide
ditetragonales Prisma

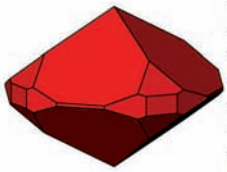
Chemische Zusammensetzung	: TiO_2
Kristallsystem	: Tetragonal
Elementarzelle	: a_o=4.594Å, c_o=2.958Å
Raumgruppe	: P 4/ m n m
Ausbildung	: Derb, nadelige, stengelig, häufig Verzwilligung

Rutilo:

Prisma
Prisma
Dipirâmide



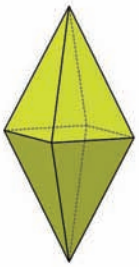
Prisma
Prisma
Dipirâmide
Dipirâmide



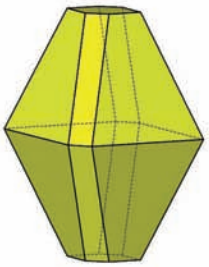
Prisma
Prisma
Dipirâmide
Dipirâmide
Prisma ditetragonal

Fórmula química	: TiO_2
Sistema cristalino	: Tetragonal
Célula unitária	: a_o=4.594Å, c_o=2.958Å
Grupo espacial	: P 4/ m n m
Características	: granular, acicular, fibroso, geralmente geminado (ângulo 120°), com agregados reticulados

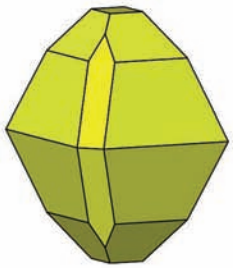
Schwefel:



Dipyramide



Dipyramide
Basispinakoid
Prisma



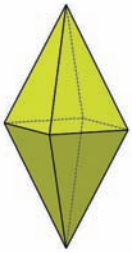
Dipyramide
Dipyramide
Basispinakoid
Prisma

=

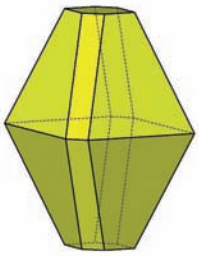
Kopfbild
Dipyramide
Dipyramide
Basispinakoid
Prisma

Chemische Zusammensetzung:	S	
Kristallsystem	:	orthorhombisch
Elementarzelle	:	a_o= 10.45 Å, bo= 12.85 Å, c_o= 24.46 Å
Raumgruppe	:	F ddd
Besonderheiten	:	bis 95° orthorhombisch, ab 95° monoklin, Schmelzpunkt 119,2 °C Ringförmige S_8-Moleküle, zwischen den Molekülen nur Van-der-Waalsche Bindung
Ausbildung	:	Derbe, dichte, erdige Aggregate, pyramidale und sphenoidische xx

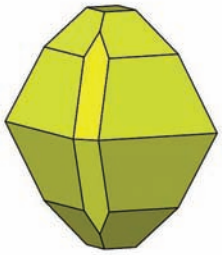
Enxofre:



Dipirâmide



Dipirâmide
Pinacóide basal
Prisma



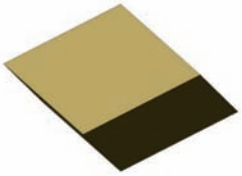
Dipirâmide
Dipirâmide
Pinacóide basal
Prisma

=

Imagem de cima
Dipirâmide
Dipirâmide
Pinacóide basal
Prisma

Fórmula química	: S
Sistema cristalino	: ortorrômbico
Célula unitária	: a_o= 10.45 Å, bo= 12.85 Å, c_o= 24.46 Å
Grupo espacial	: F ddd
Particularidades	: até 95°C ortorrômbico, a partir de 95°C monoclínico, ponto de fusão 119,2 °C Moléculas S8 anelares; entre as moléculas apenas ligações do tipo Van-der-Waal
Características	: maciço, denso, agregados terrosos, piramidal e esfenóide xx

Siderit:



Rhomboeder

Rhomboeder
Skalenoeder

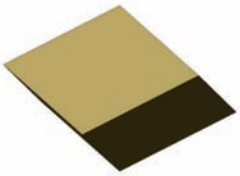
Rhomboeder
Skalenoeder
Skalenoeder
Rhomboeder

Rhomboeder
Basispinakoid

Rhomboeder
Basispinakoid
Rhomboeder
Skalenoeder

Chemische Zusammensetzung	: $FeCO_3$
Kristallsystem	: Trigonal, -3m
Elementarzelle	: a_o= 4.72, c_o= 15.46
Raumgruppe	: R -3c
Ausbildung	: Feinkörnig bis grobspätig, rhomboedrische xx

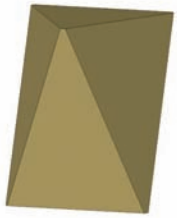
Siderita:



Romboedro

Romboedro
Escalenoedro

Romboedro
Escalenoedro
Escalenoedro
Romboedro

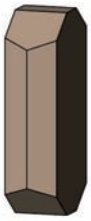


Romboedro
Pinacóide basal

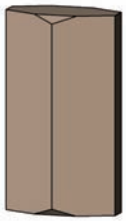
Romboedro
Pinacóide basal
Romboedro
Escalenoedro

Fórmula química	: $FeCO_3$
Sistema cristalino	: Trigonal, -3m
Célula unitáriaunitária	: a_o= 4.72, c_o= 15.46
Grupo espacial	: R -3c
Características	: fino até colunar, romboédrico xx

Staurolith:

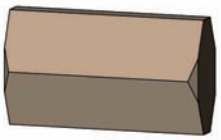


Prisma
Basispinakoid
Pinakoid
Prisma



Prisma
Basispinakoid
Pinakoid
Prisma

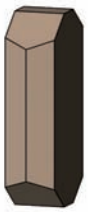
=



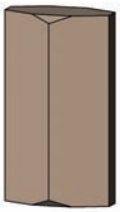
Prisma
Basispinakoid
Pinakoid
Prisma

Chemische Zusammensetzung	: $(Fe,Mg)_2Al_9(Si,Al)_4O_{20}(O,OH)_2$
Kristallsystem	: Monoklin
Elementarzelle	: a_o= 7.863 Å, b_o= 16.61 Å, c_o= 5.65 Å, ß =90-93 °
Raumgruppe	: C 2/m
Ausbildung	: Gesteinsbildend, xx tafelig, prismatisch, häufig

Estaurolita:



Prisma
Pinacóide basal
Pinacóide
Prisma



Prisma
Pinacóide basal
Pinacóide
Prisma

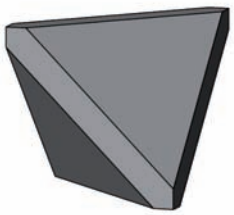
=

Prisma
Pinacóide basal
Pinacóide
Prisma

Fórmula química	: $(Fe,Mg)_2Al_9(Si,Al)_4O_{20}(O,OH)_2$
Sistema cristalino	: Monoclínico
Célula unitária	: a_o= 7.863 Å, b_o= 16.61 Å, c_o= 5.65 Å, ß =90-93 °
Grupo espacial	: C 2/m
Características	: formador de rocha, xx tabular, prismática, mineral frequente

Tetraedrit:

Tetraeder



Tetraeder
Hexaeder

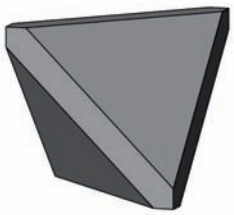
Tetraeder
Tristetraeder

Tetraeder
Tristetraeder
Rhomboeder

Chemische Zusammensetzung	: $Cu_{12}Sb_4S_{13}$, z. T. mit Ag-, Hg, Zn-Gehalten
Kristallsystem	: kubisch
Elementarzelle	: a_o=10.36 Å
Raumgruppe	: I -4 3 m
Ausbildung	: derb, tetraedr. Ausbildung, mit Calcit, Quarz verwachsen

Tetraedrita:

Tetraedro



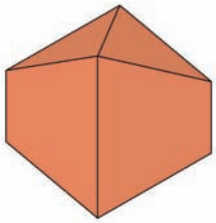
Tetraedro
Hexaedro

Tetraedro
Tristetraedro

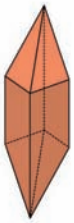
Tetraedro
Tristetraedro
Romboedro

Fórmula química	: $Cu_{12}Sb_4S_{13}$, por vezes com contribuições de Ag, Hg, Zn
Sistema cristalino	: Isométrico (cúbico)
Célula unitária	: a_o=10.36 Å
Grupo espacial	: I -4 3 m
Características	: maciço; formação tetraédrica alternada com calcita e quartzo

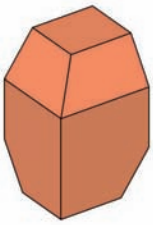
Titanit:



Prisma
Prisma



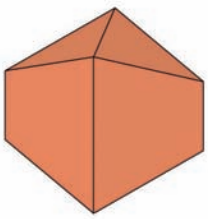
Prisma
Prisma



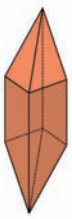
Prisma
Basispinakoid
Prisma

Chemische Zusammensetzung	: $CaTi[O/SiO_4]$
Kristallsystem	: Monoklin
Elementarzelle	: a_o=7.06Å, b_o=8,71 Å, c_o=6.56Å, ß =113.8 °
Raumgruppe	: $P2_1/a$
Ausbildung	: Eingesprengter, xx oft Briefkuvertförmig, stengelig, tafelig

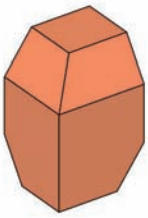
Titanita:



Prisma
Prisma



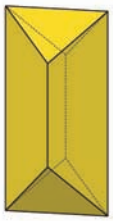
Prisma
Prisma



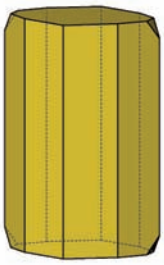
Prisma
Pinacóide basal
Prisma

Fórmula química	: $CaTi[O/SiO_4]$
Sistema cristalino	: Monoclínico
Célula unitária	: a_o=7.06Å, b_o=8,71 Å, c_o=6.56Å, ß =113.8 °
Grupo espacial	: $P2_1/a$
Características	: disseminado, xx geralmente losangular e com terminações em cunha, compacto, tabular

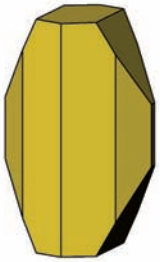
Topas:



Hexagonales Prisma
Basispinakoid

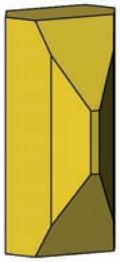


Prisma
Prisma
Basispinakoid
Prisma



Prisma
Prisma
Basispinakoid
Prisma
Pinakoid

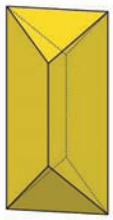
=



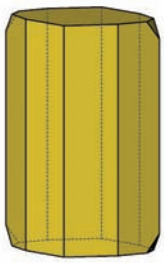
Prisma
Prisma
Basispinakoid
Prisma
Pinakoid

Chemische Zusammensetzung	: CaTi [O / SiO_4]
Kristallsystem	: Monoklin
Elementarzelle	: a_o=7.06Å, b_o=8,71 Å, c_o=6.56Å, ß =113.8 °
Raumgruppe	: $P2_1/a$
Ausbildung	: Eingesprengter, xx oft Briefkuvertförmig, stengelig, tafelig

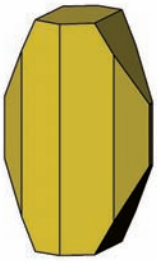
Topázio:



Prisma
Pinacóide basal

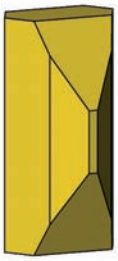


Prisma
Prisma
Pinacóide basal
Prisma



Prisma
Prisma
Pinacóide basal
Prisma
Pinacóide

=



Prisma
Prisma
Pinacóide basal
Prisma
Pinacóide

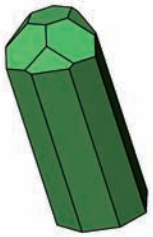
Fórmula química	: $Al_2[F_2/SiO_4]$
Sistema cristalino	: ortorrômbico
Célula unitária	: a_o= 4.65Å, b_o= 8.8Å, c_o= 8.4Å
Grupo espacial	: P b n m
Características	: granular, fibroso, prismático, miceliforme (bastonete)

Turmalin

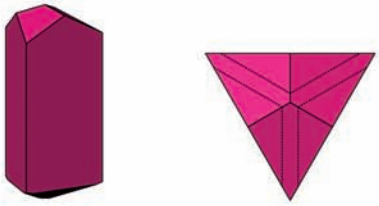
versch. Köpfe:

Basispedion
Trigonales Prisma
Hexagonales Prisma

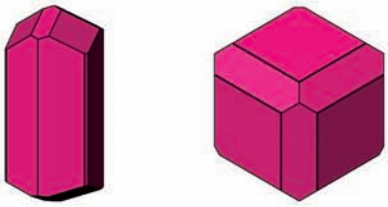
Pyramide
Pyramide
Trigonales Prisma
Hexagonales Prisma



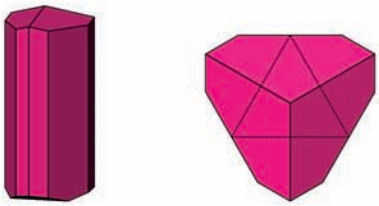
Pyramide
Pyramide
Trigonales Prisma
Hexagonales Prisma



Pyramide
Trigonales Prisma
Pyramide
Pyramide



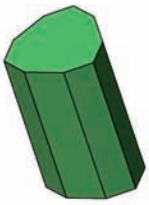
Pyramide
Pyramide
Trigonales Prisma
Pyramide
Pyramide



Pyramide
Trigonales Prisma
Hexagonales Prisma
Pyramide
Basispedion

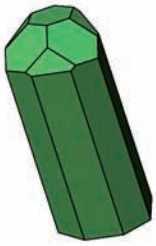
Turmalina

Terminações Diferentes:



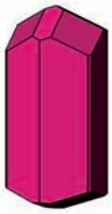
Pédio basal
Prisma trigonal
Prisma hexagonal

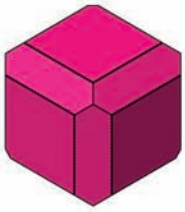
Pirâmide
Pirâmide
Prisma trigonal
Prisma hexagonal



Pirâmide
Pirâmide
Prisma trigonal
Prisma hexagonal

Pirâmide
Prisma trigonal
Pirâmide
Pirâmide

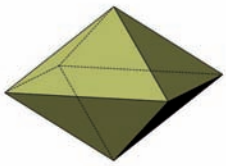




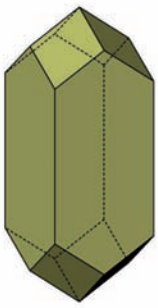
Pirâmide
Pirâmide
Prisma trigonal
Pirâmide
Pirâmide

Pirâmide
Prisma trigonal
Prisma hexagonal
Pirâmide
Pédio basal

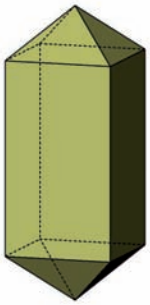
Zirkon:



Dipyramide



Dipyramide
und Prisma
I. Stellung

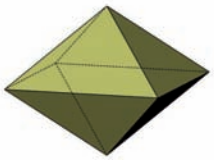


Dipyramide
und Prisma
II. Stellung

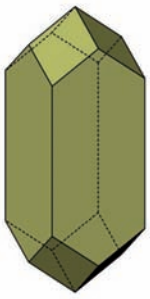
Dipyramide
Prisma I. St.
Prisma II. St.

Chemische Zusammensetzung	: $Zr[SiO_4]$, enthält diadoch Hf, SEE
Kristallsystem	: Tetragonal
Elementarzelle	: a_o= 6.60 Å, c_o= 5.98Å
Raumgruppe	: I 4_1/a m d
Ausbildung	: Körner, häufig idiomorphe xx, kurzsäulig, prismatisch

Zircão:

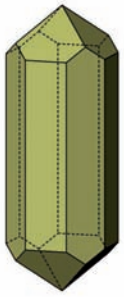


Dipirâmide



Dipirâmide
e Prisma Posição I

Dipirâmide
Prisma Posição II



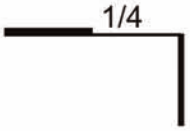
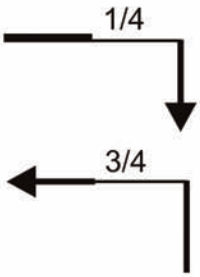
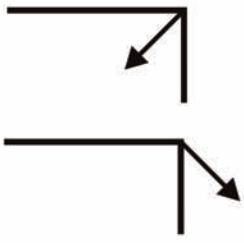
Dipirâmide
Prisma posição I
Prisma posição II

Fórmula química	: $Zr[SiO_4]$, contém Hf, ETR
Sistema cristalino	: Tetragonal
Célula unitária	: a_o= 6.60 Å, c_o= 5.98Å
Grupo espacial	: I 4_1/a m d
Características	: granular, geralmente idiomorfo xx, colunar, prismático

Quadratisches Netz
a = b
γ = 90°
Hexagonales Netz
a = b
γ = 60°
Rechtwinkliges Netz
a ≠ b
γ = 90°
Schiefes Netz
a ≠ b
γ ≠ 90°
a
b
γ
p4mm
p6mm
p2mm
p2

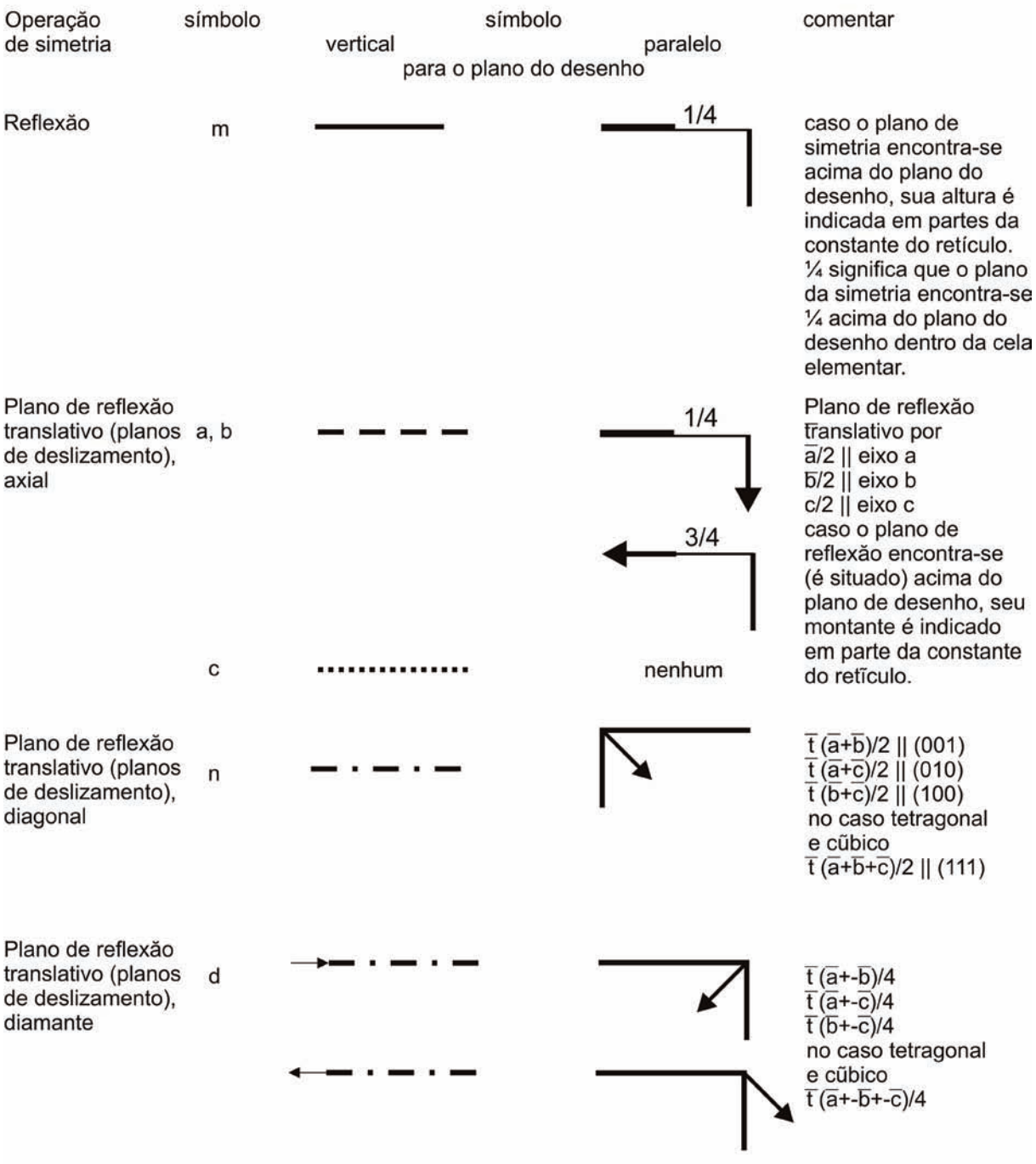
Rede quadrada
a = b
γ = 90°
b
γ
a
p4mm
Rede hexagonal
a = b
γ = 60°
b
γ
a
p6mm
Rede retângular
a ≠ b
γ = 90°
b
γ
a
p2mm
Rede angulada
a ≠ b
γ ≠ 90°
b
γ
a
p2

Symbolik der Symmetrieebenen

Symmetrie-operation	Symbol	Symbol zur Zeichenebene senkrecht	Symbol zur Zeichenebene parallel	Bemerkung
Spiegelung	m			falls die Spiegelebene über der Zeichenebene liegt, wird die Höhe in Bruchteilen der Gitterkonstante angegeben ¼ = Spiegelebene liegt um ¼ über der Zeichenebene in der Elementarzelle
Gleitspiegelung, achsial	a, b			Gleitspiegelung um $\bar{a}/2$ || a-Achse $\bar{b}/2$ || b-Achse $\bar{c}/2$ || c-Achse falls die Spiegelebene über d. Zeichenebene liegt, wird die Höhe in Bruchteilen der Gitterkonstante angegeben
	c		keines	
Gleitspiegelung, diagonal	n			$\bar{t}\,(\bar{a}+\bar{b})/2$ || (001) $\bar{t}\,(\bar{a}+\bar{c})/2$ || (010) $\bar{t}\,(\bar{b}+\bar{c})/2$ || (100) im tetragonalen und kubischen Fall $\bar{t}\,(\bar{a}+\bar{b}+\bar{c})/2$ || (111)
Diamantgleitspiegelung	d			$\bar{t}\,(\bar{a}+\bar{b})/4$ $\bar{t}\,(\bar{a}+\bar{c})/4$ $\bar{t}\,(\bar{b}+\bar{c})/4$ im tetragonalen und kubischen Fall $\bar{t}\,(\bar{a}+\bar{b}+\bar{c})/4$

Wirkung einer Spiegelebene ⊥ zur Projektionsebene:
Original- und Bildpunkt werden durch ein Komma voneinander unterschieden. Die Lage der Projektionsebene wird durch + (oberhalb) oder - (unterhalb) beschrieben.

Símbolos dos planos de simetria



Efeito de um plano de reflexão ⊥ ao plano de projeção:
conto original e de demonstração serão separados por vírgula.
A posição do plano da projeção estão sendo indicada
por + (acima) ou - (abaixo).

Symbolik der Symmetrieachsen

Symmetrieachse	Symbol	graphisches Symbol	Translation ll Symmetrieachse bei rechtshändiger Symmetrieoperation
Symmetrieachse	1		keine
Inversionszetrum	$\bar{1}$		keine
2-zählige Drehung	2		keine
2-zählige Schraubung	2_1		1/2
3-zählige Drehung	3		keine
3-zählige Schraubung	3_1		1/3
	3_2		2/3
3-zählige Inversionsdrehachse	$\bar{3}$		keine
4-zählige Drehung	4		keine
4-zählige Schraubung	4_1		1/4
	4_2		1/2
	4_3		3/4
4-zählige Inversionsdrehachse	$\bar{4}$		keine
6-zählige Drehung	6		keine
6-zählige Schraubung	6_1		1/6
	6_2		2/6
	6_3		3/6
	6_4		4/6
	6_5		5/6
6-zählige Inversionsdrehachse	$\bar{6}$		keine

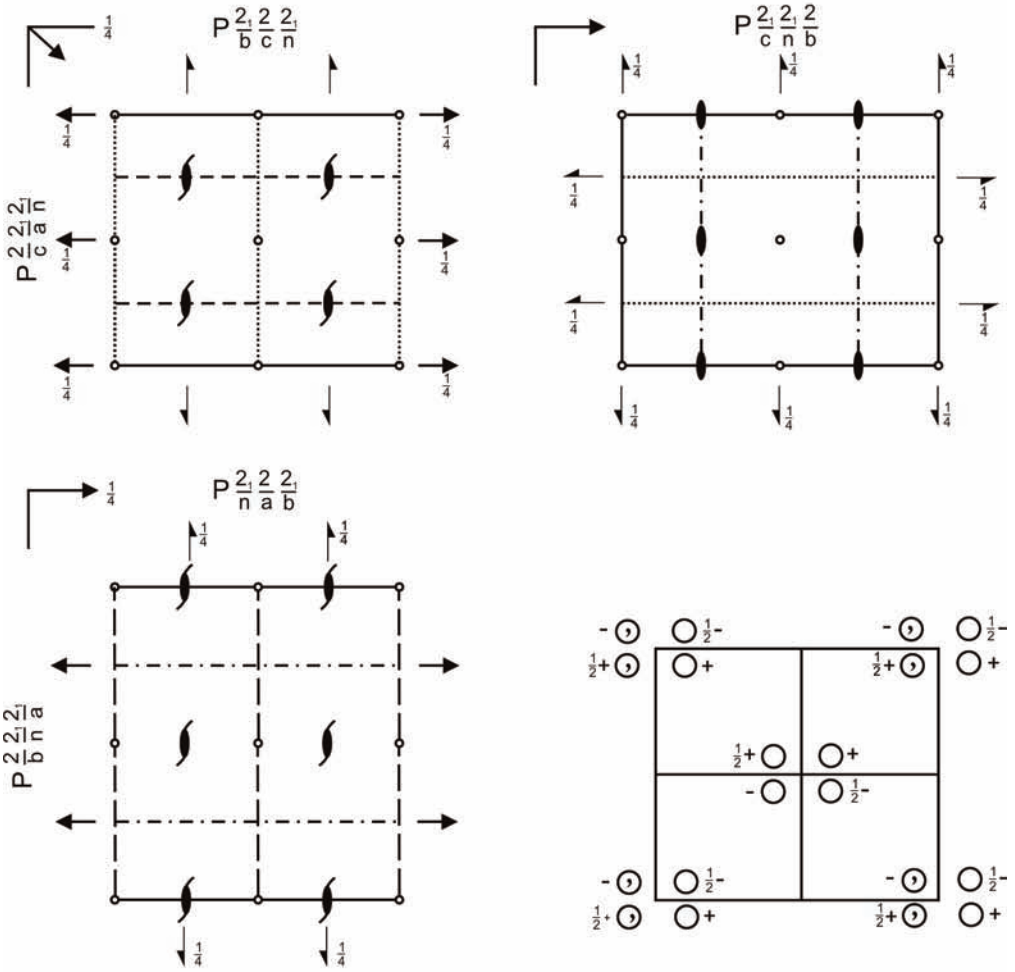
Símbolos dos eixos de simetria

Eixo de simetria	Símbolo	Símbolográfico	Translação II Eixo de simetria Operação de simetria no sontido direito
eixo de simetria	1		sem
centro de simetria	$\bar{1}$		sem
rotação (2)	2		sem
eixo de rotação com translação (2) (eixos parafuso)	2_1		1/2
rotação (3)	3		sem
eixo de rotação com translação (3) (eixos parafuso)	3_1		1/3
	3_2		2/3
centro de inversão rotativo (3)	$\bar{3}$		sem
rotação (4)	4		sem
eixo de rotação com translação (4) (eixos parafuso)	4_1		1/4
	4_2		1/2
	4_3		3/4
centro de inversão rotativo (4)	$\bar{4}$		sem
rotação (6)	6		sem
eixo de rotação com translação (6) (eixos parafuso)	6_1		1/6
	6_2		2/6
	6_3		3/6
	6_4		4/6
	6_5		5/6
centro de inversão rotativo (6)	$\bar{6}$		sem

Beispiel einer Raumgruppe **Pbcn**

Pbcn D_{2h}^{14} mmm Orthorhombisches Kristallsystem

P 2_1/b 2/c 2_1/n Patterson-Symmetrie Pmmm



Ursprung bei $\bar{1}$ in 1 c 1

Asymmetrische Einheit $0 \leq x \leq ½ \quad 0 \leq y \leq ½ \quad 0 \leq z \leq ½$

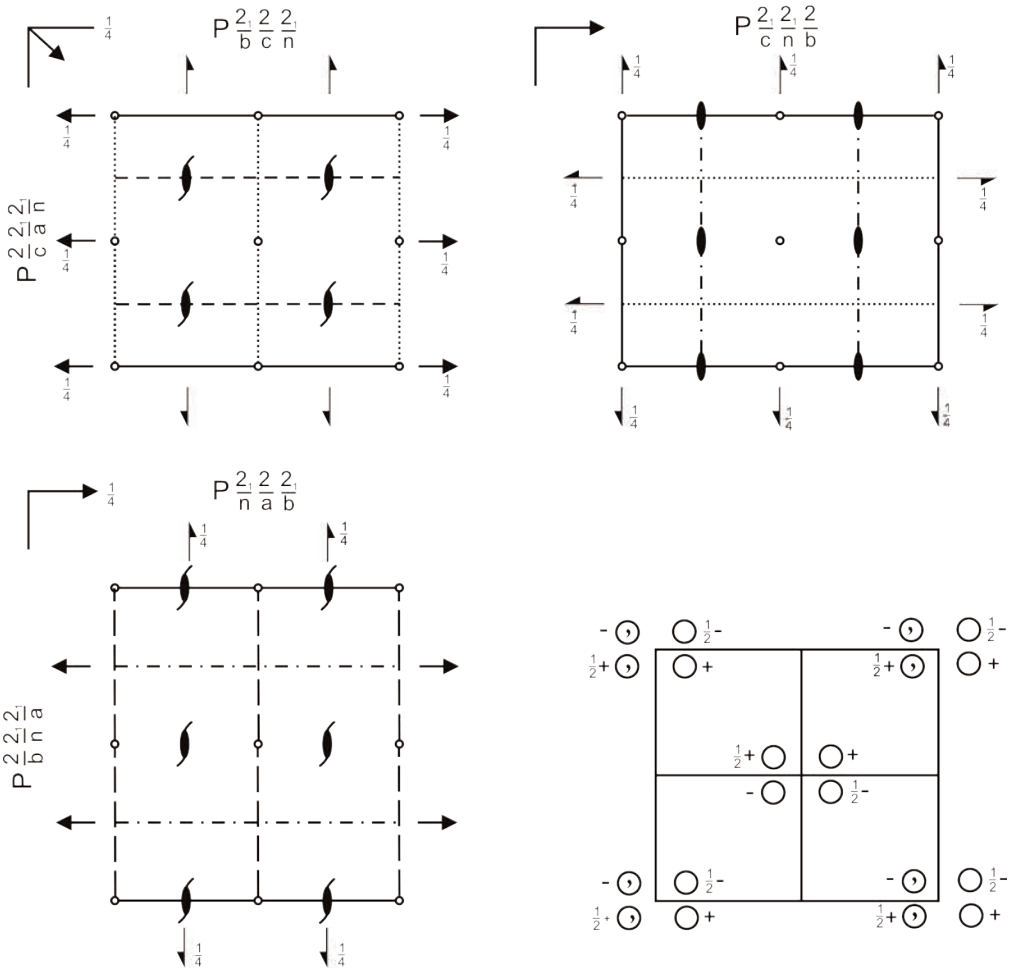
Symmetrie Operationen

(1) 1	(2) 2(0,0,½) ¼,¼,z	(3) 2 0,y,¼
(4) 2(½,0,0) x,¼,0	(5) $\bar{1}$ 0,0,0	(6) n(½,½,0) x,y,¼
(7) c x,0,z	(8) b ¼,y,z	

Exemplo grupo de espaço **Pbcn**

Pbcn D_{2h}^{14} mmm Sistema cristalino ortorrômbico

P 2_1/b 2/c 2_1/n Simetria Patterson Pmmm



Origem: $\overline{1}$ em 1 c 1

Unidade assimétrica $0 \leq x \leq ½ \quad 0 \leq y \leq ½ \quad 0 \leq z \leq ½$

Operação de simetria

(1) 1
(2) $\underline{2}$(0,0,½) ¼,¼,z
(3) 2 0,y,¼
(4) 2(½,0,0) x,¼,0
(5) $\overline{1}$ 0,0,0
(6) n(½,½,0) x,y,¼
(7) c x,0,z
(8) b ¼,y,z

Die 230 Raumgruppen

Kristallsystem	Punktgruppe	Raumgruppen			
Triklin	1	P1			
	-1	P$\bar{1}$			
Monoklin	2	P2	$P2_1$	C2	
	M	Pm	Pc	Cm	Cc
	2/m	P2/m	$P2_1/m$	C2/m	P2/c
		$P2_1/c$	C2/c		
Orthorhombisch	222	P222	$P222_1$	$P2_12_12$	$P2_12_12_1$
		$C222_1$	C222	F222	I222
		$I2_12_12_1$			
	mm2	Pmm2	$Pmc2_1$	Pcc2	Pma2
		$Pca2_1$	Pnc2	$Pmn2_1$	Pba2
		$Pna2_1$	Pnn2	Cmm2	$Cmc2_1$
		Ccc2	Amm2	Abm2	Ama2
		Aba2	Fmm2	Fdd2	Imm2
		Iba2	Ima2		
	mmm	Pmmm	Pnnn	Pccm	Pban
		Pmma	Pnna	Pmna	Pcca
		Pbam	Pwn	Pbcm	Pnnm
		Pmmn	Pbcn	Pbca	Pnma
		Cmcm	Cmca	Cmmm	Cccm
		Cmma	Ccca	Fmmm	Fddd
		Immm	Ibam	Ibca	Imma
Tetragonal	4	P4	$P4_1$	$P4_2$	$P4_3$
		I4	$I4_1$		
	-4	P-4	I-4		
	4/m	P4/m	$P4_2m$	P4/n	$P4_2/n$
		I4/m	$I4_1/a$		
	422	P422	$P42_12$	$P4_122$	$P4_12_12$
		$P4_222$	$P4_22_12$	$P4_322$	$P4_32_12$
		I422	$I4_122$		
	4mm	P4mm	P4bm	$P4_2cm$	$P4_2nm$
		P4cc	P4nc	$P4_2mc$	$P4_2bc$
		I4mm	I4cm	$I4_1md$	$I4_1cd$
	-42m	P-42m	P-42c	$P-42_1m$	$P-42_1c$
		P-4m2	P-4c2	P-4b2	P-4n2
		I-4m2	I-4c2	I-42m	I-42d
	4/mmm	P4/mmm	P4/mcc	P4/nbm	P4/nnc
		P4/mbm	P4/mnc	P4/nmm	P4/ncc
		$P4_2/mmc$	$P4_2/mcm$	$P4_2/nbc$	$P4_2/nnm$
		$P4_2/mbc$	$P4_2/mnm$	$P4_2/nmc$	$P4_2/ncm$
		I4/mmm	I4/mcm	$I4_1/amd$	$I4_1/acd$
Trigonal	3	P3	$P3_1$	$P3_2$	R3
	-3	P-3	R-3		
	32	P312	P321	$P3_112$	$P3_121$
		$P3_212$	$P3_221$	R32	
	3m	P3m1	P31m	P3c1	P31c
		R3m	R3c		
	-3m	P-31m	P-31c	P-3m1	P-3c1
		R-3m	R-3c		
Hexagonal	6	P6	$P6_1$	$P6_5$	$P6_2$
		$P6_4$	$P6_3$		
	-6	P-6			
	6/m	P6/m	$P6_3/m$		
	622	P622	$P6_122$	$P6_522$	$P6_222$
		$P6_422$	$P6_322$		
	6mm	P6mm	P6cc	$P6_3cm$	$P6_3mc$
	-6m2	P-6m2	P-6c2	P-62m	P-62c
	6/mmm	P6/mmm	P6/mcc	$P6_3/mm$	$P6_3/mmc$
Kubisch	23	P23	F23	I23	$P2_13$
		$I2_13$			
	m-3	Pm-3	Pn-3	Fm-3	Fd-3
		Im-3	Pa-3	Ia-3	
	432	P432	$P4_232$	F432	$F4_132$
		I432	$P4_332$	$P4_132$	$I4_132$
	-43m	P-43m	F-43m	I-43m	P-43n
		F-43c	I-43d		
	m-3m	Pm-3m	Pn-3n	Pm-3n	Pn-3m
		Fm-3m	Fm-3c	Fd-3m	Fd-3c
		Im-3m	Ia-3d		

230 grupos espaciais

Sistemas cristalinos	Grupo de pontos ou classes cristalinas	Grupo espaciais			
Triclínico	1	P1			
	-1	P$\bar{1}$			
Monoclínico	2	P2	$P2_1$	C2	
	M	Pm	Pc	Cm	Cc
	2/m	P2/m	$P2_1/m$	C2/m	P2/c
		$P2_1/c$	C2/c		
Ortorrômbico	222	P222	$P222_1$	$P2_12_12$	$P2_12_12_1$
		$C222_1$	C222	F222	I222
		$I2_12_12_1$			
	mm2	Pmm2	$Pmc2_1$	Pcc2	Pma2
		$Pca2_1$	Pnc2	$Pmn2_1$	Pba2
		$Pna2_1$	Pnn2	Cmm2	$Cmc2_1$
		Ccc2	Amm2	Abm2	Ama2
		Aba2	Fmm2	Fdd2	Imm2
		Iba2	Ima2		
	mmm	Pmmm	Pnnn	Pccm	Pban
		Pmma	Pnna	Pmna	Pcca
		Pbam	Pvvn	Pbcm	Pnnm
		Pmmn	Pbcn	Pbca	Pnma
		Cmcm	Cmca	Cmmm	Cccm
		Cmma	Ccca	Fmmm	Fddd
		Immm	Ibam	Ibca	Imma
Tetragonal	4	P4	$P4_1$	$P4_2$	$P4_3$
		I4	$I4_1$		
	-4	P$\bar{4}$	I$\bar{4}$		
	4/m	P4/m	$P4_2m$	P4/n	$P4_2/n$
		I4/m	$I4_1/a$		
	422	P422	$P42_12$	$P4_122$	$P4_12_12$
		$P4_222$	$P4_22_12$	$P4_322$	$P4_32_12$
		I422	$I4_122$		
	4mm	P4mm	P4bm	$P4_2cm$	$P4_2nm$
		P4cc	P4nc	$P4_2mc$	$P4_2bc$
		I4mm	I4cm	$I4_1md$	$I4_1cd$
	-42m	P$\bar{4}$2m	P$\bar{4}$2c	P$\bar{4}2_1$m	P$\bar{4}2_1$c
		P$\bar{4}$m2	P$\bar{4}$c2	P$\bar{4}$b2	P$\bar{4}$n2
		I$\bar{4}$m2	I$\bar{4}$c2	I$\bar{4}$2m	I$\bar{4}$2d
	4/mmm	P4/mmm	P4/mcc	P4/nbm	P4/nnc
		P4/mbm	P4/mnc	P4/nmm	P4/ncc
		$P4_2/mmc$	$P4_2/mcm$	$P4_2/nbc$	$P4_2/nnm$
		$P4_2/mbc$	$P4_2/mnm$	$P4_2/nmc$	$P4_2/ncm$
		I4/mmm	I4/mcm	$I4_1/amd$	$I4_1/acd$
Trigonal	3	P3	$P3_1$	$P3_2$	R3
	-3	P$\bar{3}$	R$\bar{3}$		
	32	P312	P321	$P3_112$	$P3_121$
		$P3_212$	$P3_221$	R32	
	3m	P3m1	P31m	P3c1	P31c
		R3m	R3c		
	-3m	P$\bar{3}$1m	P$\bar{3}$1c	P$\bar{3}$m1	P$\bar{3}$c1
		R$\bar{3}$m	R$\bar{3}$c		
Hexagonal	6	P6	$P6_1$	$P6_5$	$P6_2$
		$P6_4$	$P6_3$		
	-6	P$\bar{6}$			
	6/m	P6/m	$P6_3/m$		
	622	P622	$P6_122$	$P6_522$	$P6_222$
		$P6_422$	$P6_322$		
	6mm	P6mm	P6cc	$P6_3cm$	$P6_3mc$
	-6m2	P$\bar{6}$m2	P$\bar{6}$c2	P$\bar{6}$2m	P$\bar{6}$2c
	6/mmm	P6/mmm	P6/mcc	$P6_3/mm$	$P6_3/mmc$
Cúbico ou Isométrico	23	P23	F23	I23	$P2_13$
		$I2_13$			
	m-3	Pm$\bar{3}$	Pn$\bar{3}$	Fm$\bar{3}$	Fd$\bar{3}$
		Im$\bar{3}$	Pa$\bar{3}$	Ia$\bar{3}$	
	432	P432	$P4_232$	F432	$F4_132$
		I432	$P4_332$	$P4_132$	$I4_132$
	-43m	P$\bar{4}$3m	F$\bar{4}$3m	I$\bar{4}$3m	P$\bar{4}$3n
		F$\bar{4}$3c	I$\bar{4}$3d		
	m-3m	Pm$\bar{3}$m	Pn$\bar{3}$n	Pm$\bar{3}$n	Pn$\bar{3}$m
		Fm$\bar{3}$m	Fm$\bar{3}$c	Fd$\bar{3}$m	Fd$\bar{3}$c
		Im$\bar{3}$m	Ia$\bar{3}$d		

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