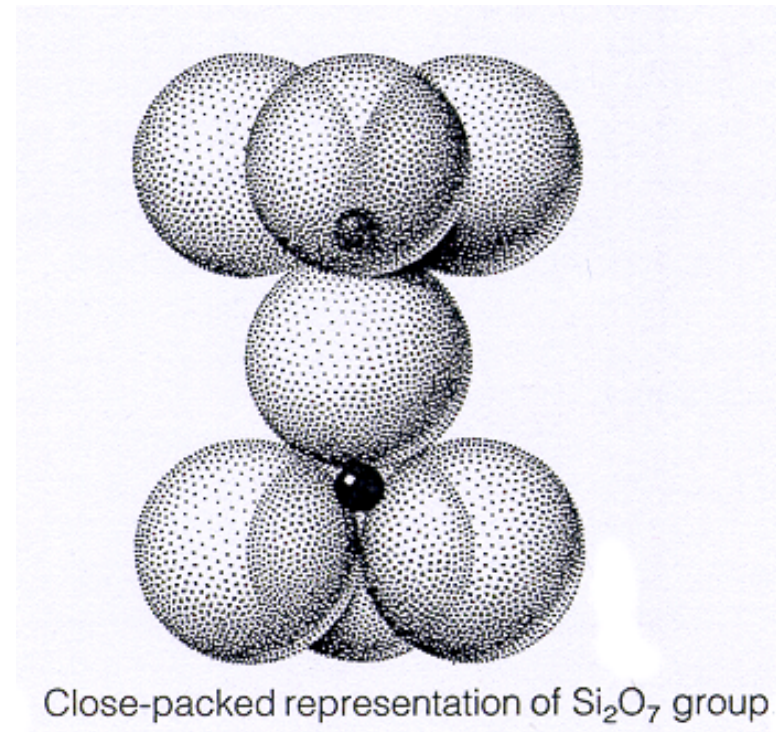





# Sorosilicate minerals

# Sorosilicate

- Sorosilicates are characterised by isolated, double tetrahedral groups formed by two  $\text{SiO}_4$  tetrahedra sharing corners with Si:O ratio of 2:7
- Over 70 minerals known in this group, but rare.

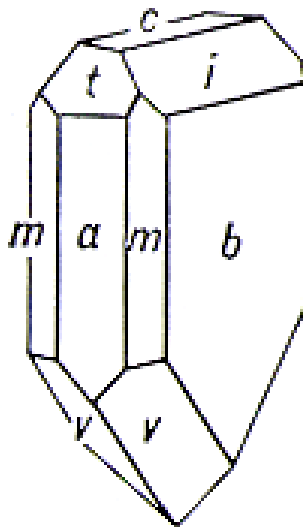


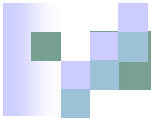


# Hemimorphite: $\text{Zn}_4(\text{Si}_2\text{O}_7)(\text{OH})_2 \cdot \text{H}_2\text{O}$

- Orthorhombic, tabular // to  $\{010\}$ , show prism faces with one end terminated by combination forms of pedian and domes, while other end by pyramid causing polar xtal. Divergent xtal, coxcomb masses, stalactitic, mammillary, massive and granular
- Structure contains  $\text{Si}_2\text{O}_7$  groups joined by  $\text{ZnO}_3(\text{OH})$  tetrahedra.  $\text{Si}_2\text{O}_7$  tetrahedra have their base // to  $\{001\}$  and their apices point to the same direction along C-axis. This orientation causes polar character of the structure. Each (OH) group bound to two  $\text{Zn}^{2+}$  ions.  $\text{H}_2\text{O}$  lie in holes between tetrahedra. If hemimorphite is heated up to  $500^\circ \text{C}$ , all  $\text{H}_2\text{O}$  molecules are driven off remaining only (OH) groups. They can be driven off at much higher T and will destroy xtal structure

- Recognised by grouping of crystals. Similar to prehnite, but higher SG (3.4-3.5)
- Found as secondary mineral in oxidised zones of Zn deposits, associated with smithsonite, sphalerite, cerussite, anglesite, & galena
- Use as ore of zinc





Mina Ojuela, Level 7, Mapimí, Municipio de Mapimí, Durango Mexico



<http://www.fabreminerals.com/specimens/MEC-north-america-mineral-specimens.php#TM76L3>





## Lawsonite: $\text{CaAl}_2(\text{Si}_2\text{O}_7)(\text{OH})_2 \cdot \text{H}_2\text{O}$

- Orthorhombic, tabular to prismatic xtal, frequently polysynthetic twinned on {110}.
- Structure similar to that of anorthite,  $\text{CaAl}_2\text{Si}_2\text{O}_8 + \text{H}_2\text{O}$ , consists of (AlO, OH) octahedra linked by  $\text{Si}_2\text{O}_7$  groups.  $\text{Ca}^{2+}$  and  $\text{H}_2\text{O}$  molecules are located between these polyhedra
- Recognised by great hardness ~8
- Found typically in glaucophane schist facies associated with chlorite, epidote, titanite, glaucophane, garnet & quartz. Common mineral in gneisses and schists formed under low T and high P

Schist with lawsonite crystals of blue to cream colour



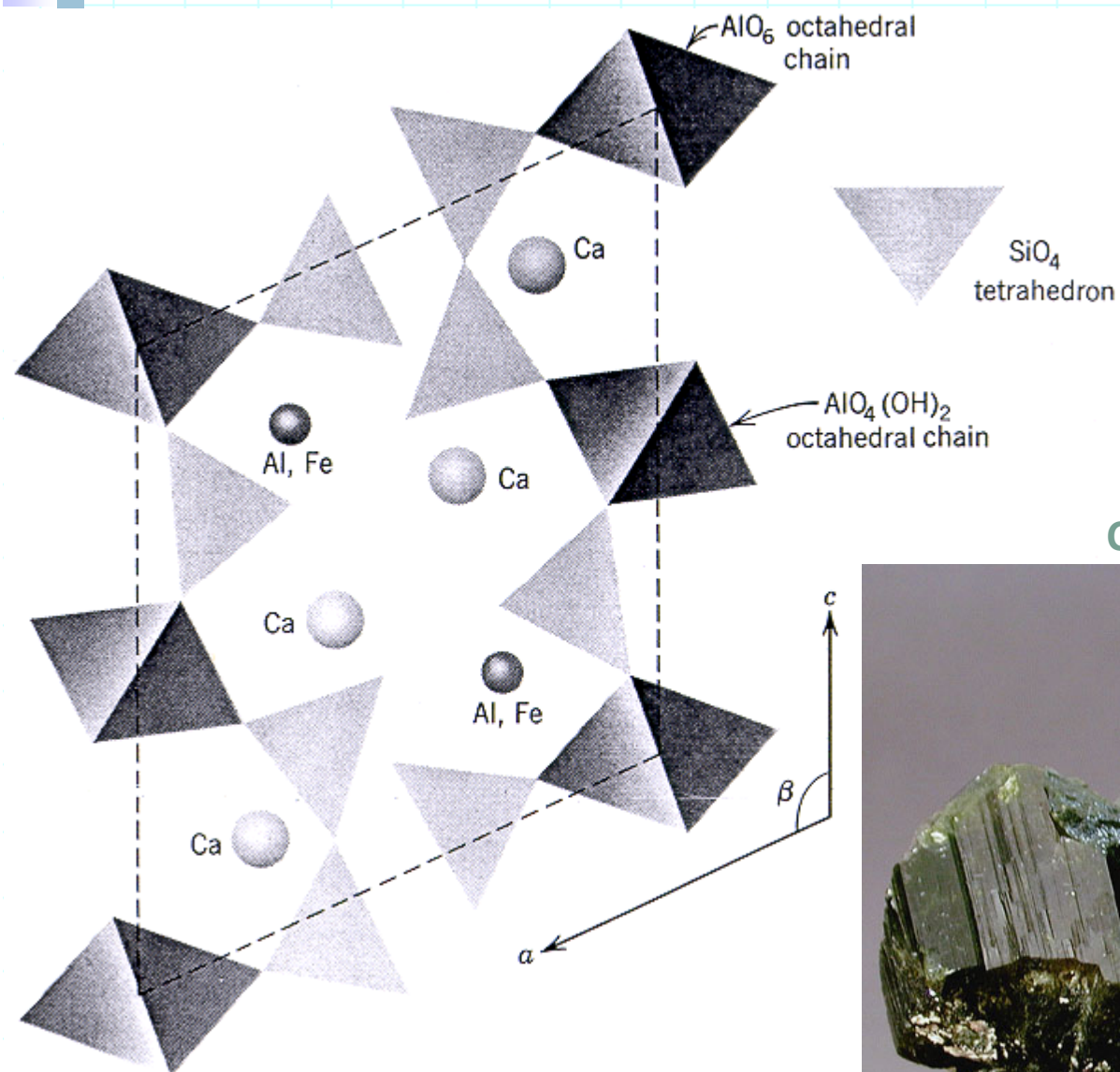
<http://www.mineralatlas.com/mineral%20photos/L/lawsonitecp5.htm>



# Epidote group

- Clinozoisite  $\text{Ca}_2\text{Al}_3\text{O}(\text{SiO}_4)(\text{Si}_2\text{O}_7)(\text{OH})$   
Epidote  $\text{Ca}_2(\text{Fe}^{3+}, \text{Al})\text{Al}_2\text{O}(\text{SiO}_4)(\text{Si}_2\text{O}_7)(\text{OH})$
- Monoclinic, elongated // b-axis with striation // to b-axis. Coarse to fine granular, also fibrous
- Complete solid solution ranges from clinozoisite ( $\text{Al}:\text{Fe}^{3+}=3:0$ ) to epidote ( $\text{Al}:\text{Fe}^{3+}=2:1$ ). Epidote consists of both  $\text{SiO}_4$  tetrahedra and  $\text{Si}_2\text{O}_7$  groups. Chains of  $\text{AlO}$  and  $\text{AlO}_4(\text{OH})_2$  octahedra, which share edges, form // to b-axis. Additional octahedra position occurs outside the chains; and occupied by Al in clinozoisite and by  $\text{Fe}^{3+}$  in epidote. Chains are linked by independent  $\text{SiO}_4$  and  $\text{Si}_2\text{O}_7$  groups. Ca is in distorted 8-coordination whereas sometimes partly filled by  $\text{Na}^+$ . Octahedral site outside the chains may host  $\text{Fe}^{3+}$ ,  $\text{Mn}^{3+}$ , and rarely  $\text{Mn}^{2+}$ .





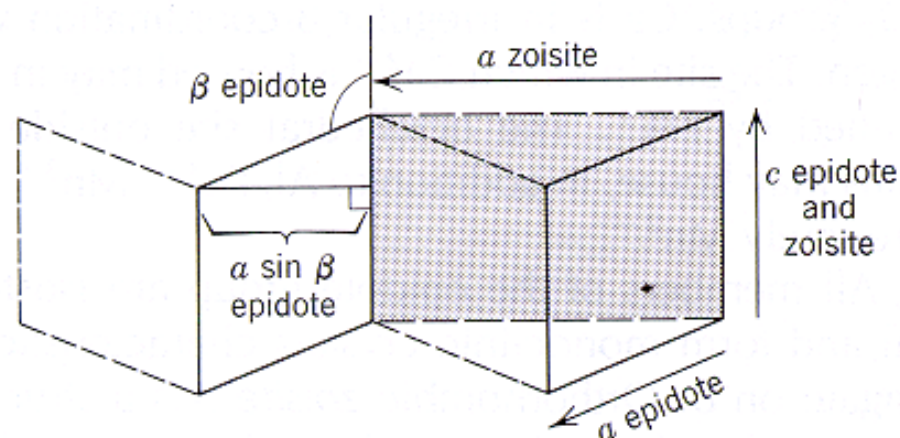
**Dark green, blocky epidote &  
transparent quartz**  
**Copper Mt., Prince of Wales, Alaska**



<http://webmineral.com/specimens/picshow.php?id=364>



	Ions in Ca Site	Ions in Al Site Outside Chains
Clinozoisite	$\text{Ca}^{2+}$	$\text{Al}^{3+}$
Epidote	$\text{Ca}^{2+}$	$\text{Fe}^{3+}, \text{Al}^{3+}$
Piemontite	$\text{Ca}^{2+}$	$\text{Mn}^{3+}, \text{Fe}^{3+}, \text{Al}^{3+}$
Allanite	$\text{Ca}^{2+}, \text{Ce}^{3+}, \text{La}^{3+},$ $\text{Na}^{+}$	$\text{Fe}^{3+}, \text{Fe}^{2+}, \text{Mg}^{2+},$ $\text{Al}^{3+}$



Relation between unit cells of monoclinic epidote and orthorhombic zoisite, as projected on (010). The monoclinic unit cell outlined in solid can be related to its dashed equivalent by a mirror reflection (twinning). The orthorhombic unit cell is shown by shading.



- Epidote is recognised by its pistachio-green and one perfect cleavage {001}.
- Found in regional metamorphism of epidote-amphibolite facies. Also occurs in association with **actinolite-albite-epidote-chlorite** in upper part of greenschist facies. They form during retrograde metamorphism and form as reaction product of plagioclase, pyroxene, and amphibole. Epidote is common in metamorphosed limestone with Ca-rich garnets, diopside, vesuvianite, and calcite.
- Epidotisation is low-temperature metasomatism and found in veins & joint filling in granitic rocks.
- Sometimes cut as gem




## Unakite:

granite rich in green epidote

Epidotization pegmatite







# Allanite: $X_2Y_3O(SiO_4)(Si_2O_7)(OH)$

- Monoclinic, elongated // b-axis with striation // to b-axis. Commonly massive and in embedded grains.
- Allanite has the same structure as in epidote group, but it often found as metamict state results from 'self-irradiation'. Destruction of xtal structure causes glassy product that absorbs considerable  $H_2O$
- Recognised by its black colour, pitchy lustre, and associated with granitic rocks.
- Occur as minor accessory mineral in many igneous rocks, such as granite, syenite, diorite, and pegmatites. Frequently associate with epidote.



Dual views of the same 0.8 cm jet  
black allanite-(Ce) on quartz  
Tiro Estrella Mine, El Capitan Mts.,  
Lincoln Co., New Mexico, USA

© [John Veevaert](#)



<http://webmineral.com/specimens/picshow.php?id=24>

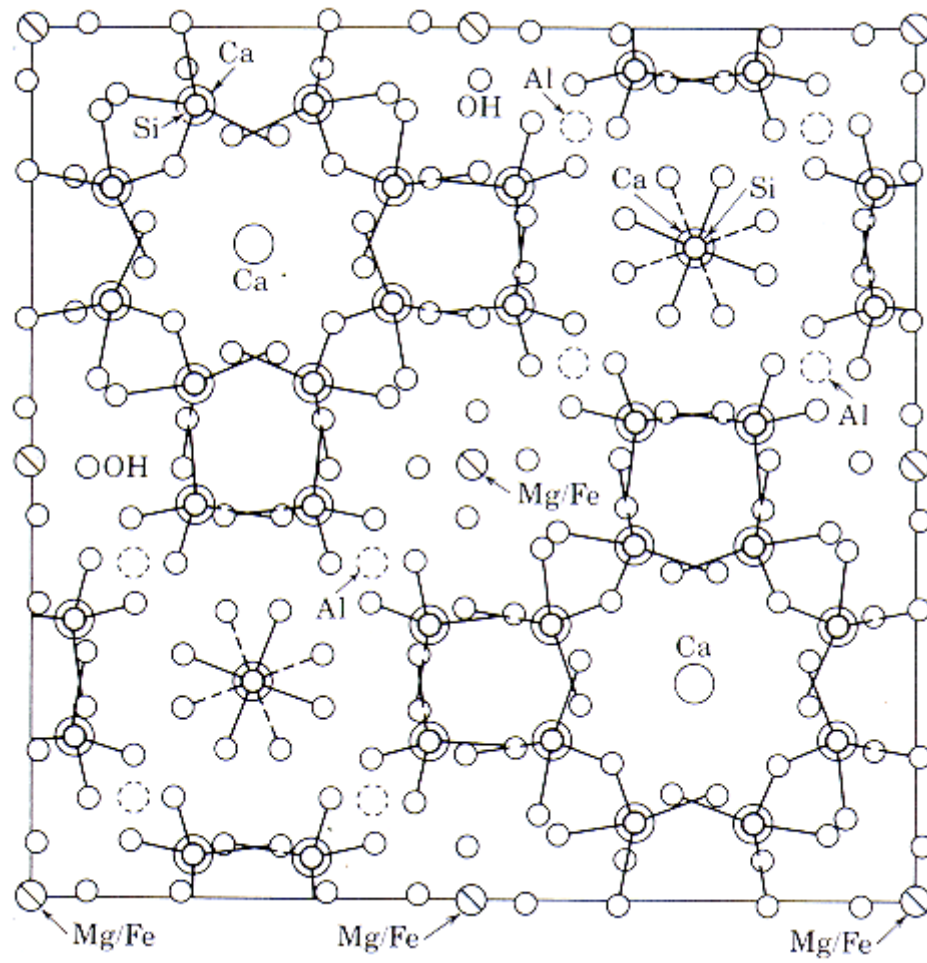
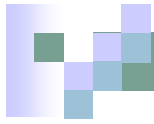




# Vesuvianite (Idocrase)



- Tetragonal, prismatic often vertically striated. Commonly form striated columnar aggregate, also isolated xtal, granular and massive.
- Vesuvianite has structure similar to grossular garnet. Isolated  $\text{SiO}_4$  and  $\text{Si}_2\text{O}_7$  occur in structure.  $\frac{3}{4}$  of Ca is in 8-coordination and  $\frac{1}{4}$  in 6-coordination with oxygen. Al and Fe (and Mg) in octahedral coordination. Substitution occur among Na for Ca;  $\text{Mn}^{2+}$  for Mg;  $\text{Fe}^{3+}$  and Ti for Al; F for (OH). B and Be substitution also reported.
- Recognised by brown tetragonal prisms and striated columnar masses
- Found associated with other contact metamorphism like grossular and andradite garnet, wollastonite, and diopside.
- Use as gem



© [Fabre Minerals](#)



**Blocky, tan-colored vesuvianite  
with white grossular (garnet)  
Sierra de la Cruz, Lago Jaco,  
Coahuila, Mexico**

<http://webmineral.com/specimens/picshow.php?id=1196&target=Vesuvianite>