

Coordination Number (C N)
Radius Ratio
Silicate Structures

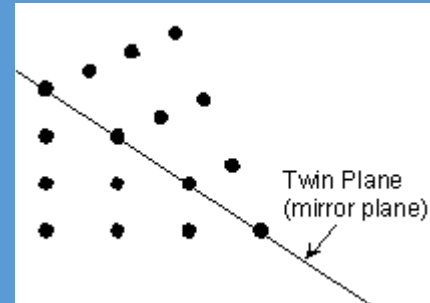
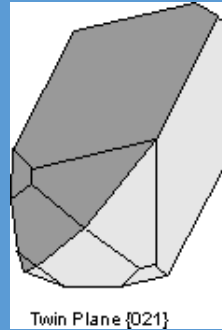
Twinning



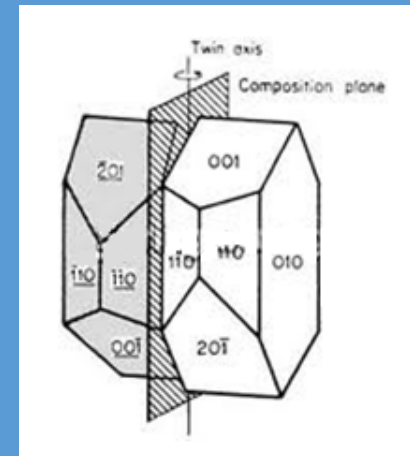
- If a crystal is subjected to stress during growth
- or temperature/pressure conditions different from those under which it originally formed
- two or more intergrown crystals are formed in a symmetrical fashion.
- These symmetrical intergrowths of crystals are called twinned crystals.

Twinning defined by symmetry

twin plane reflection across a mirror plane.



twin axis rotation about an axis or line in the crystal.



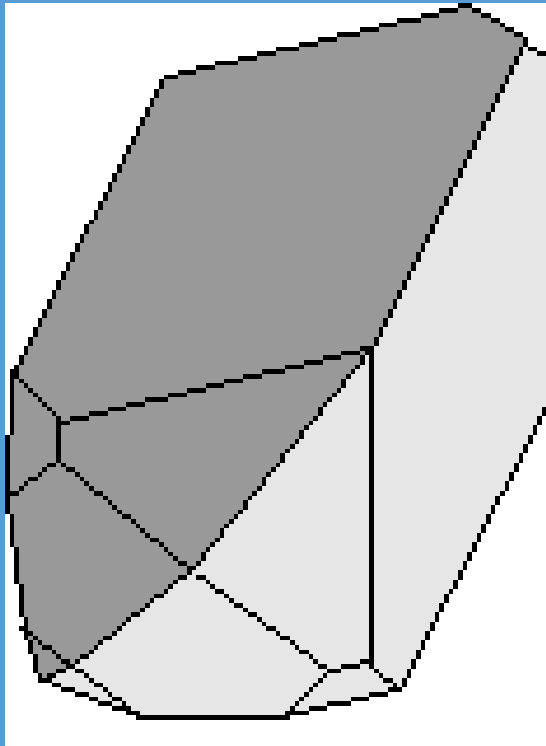
twin center inversion through a point.

Types of Twinning

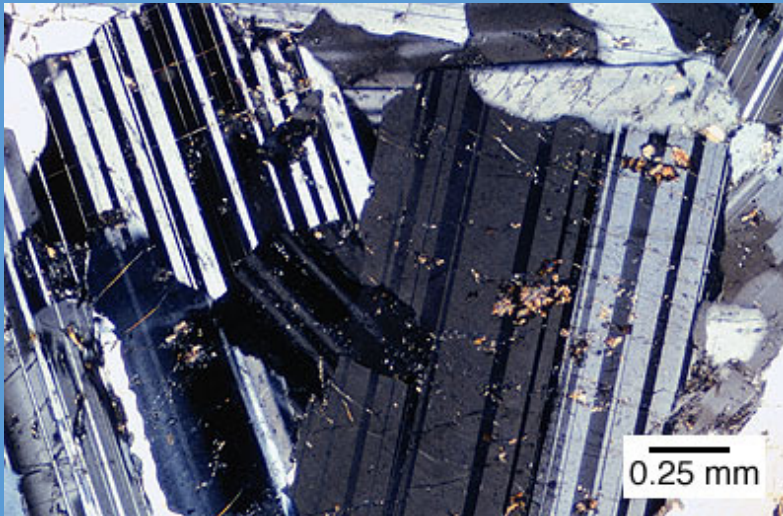
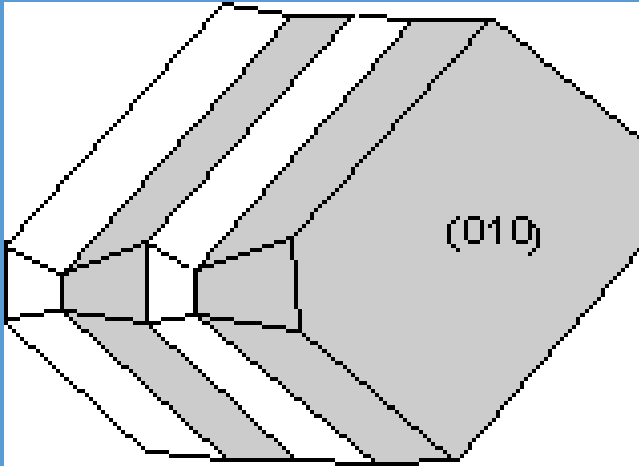
There are two basic types of twin

- Contact twins
- Penetration twins

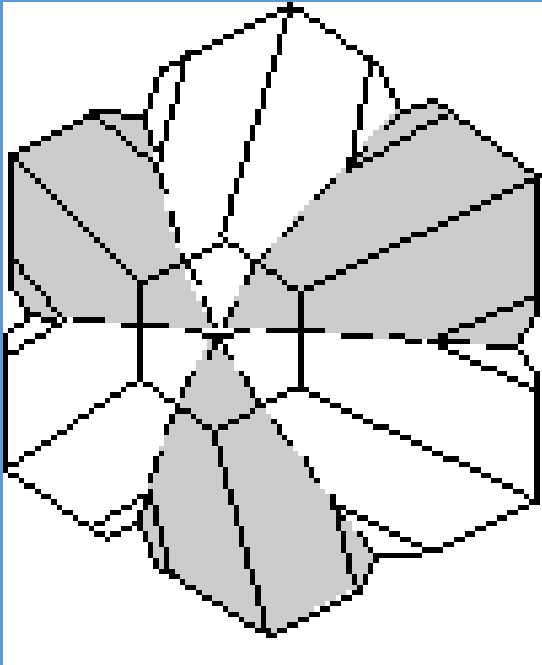
Contact Twinning: Have a planar composition surface separating two individual crystals that one part is the mirror image of the other,
Example- Orthoclase



Polysynthetic Twinning



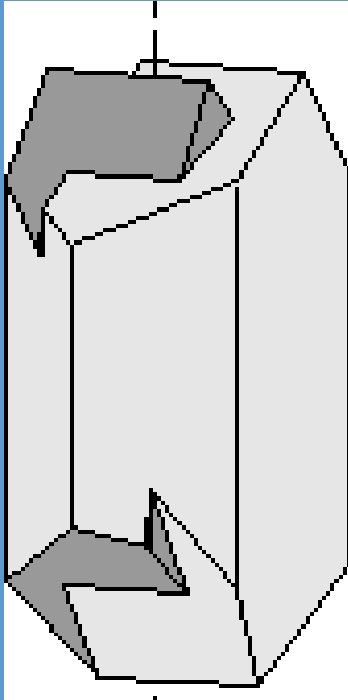
- A type of multiple contact twinning is called polysynthetic
- The compositions surfaces are parallel to one another, they are called *polysynthetic*
- Plagioclase commonly shows this type of twinning, called the Albite Twin
- Such twinning is one of the most diagnostic features of plagioclase



Cyclic Twinning

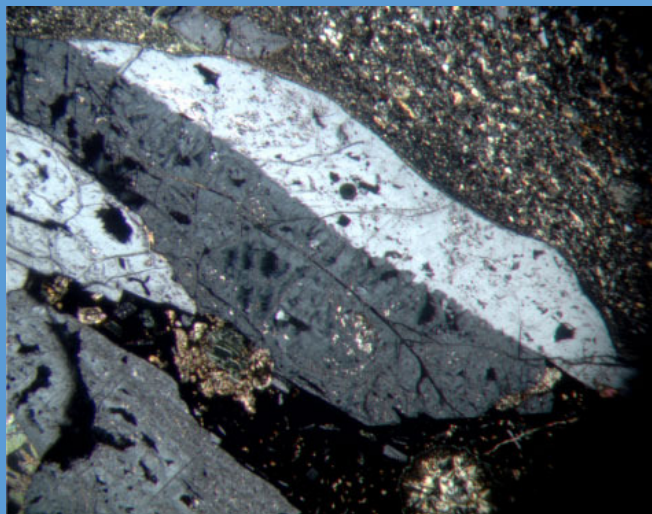
- Another type of contact twinning
- If the composition surfaces are not parallel to one another, they are called *cyclical twins*
- cyclical twin occurs in chrysoberyl





Penetration Twins

- Have an irregular composition surface separating 2 individual crystals
- Are defined by a twin center or twin axis

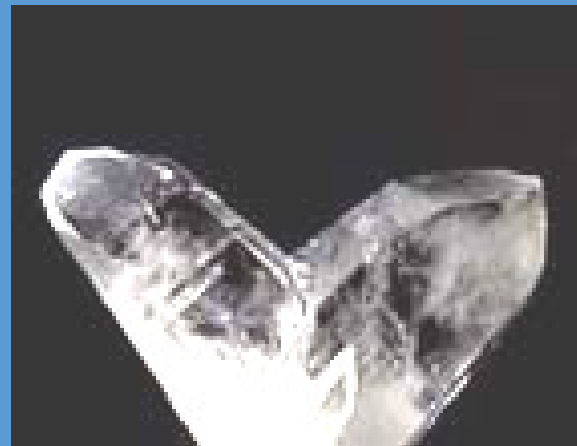


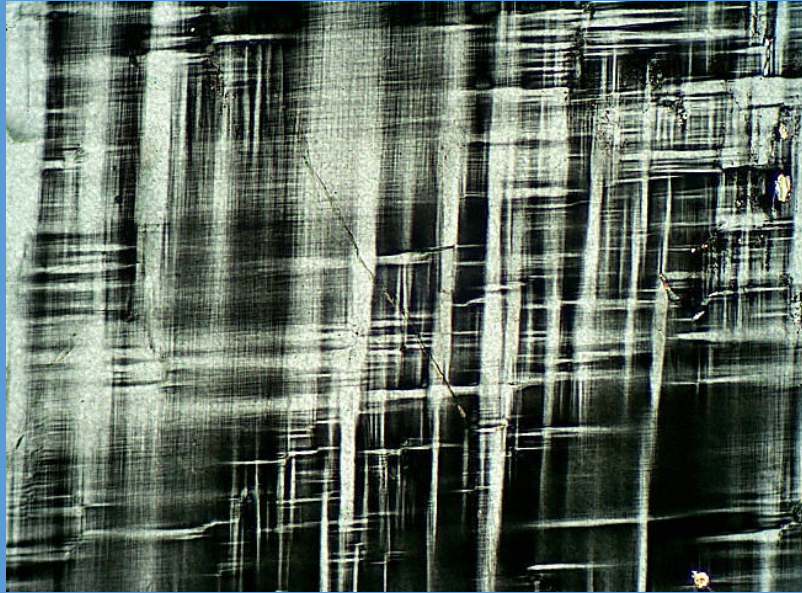
Some other types of twinning



Brazil Twin

- *Dauphiné, Brazil and Japanese* twinning in quartz commonly forms during a decrease in temperature





Tartan Twinning

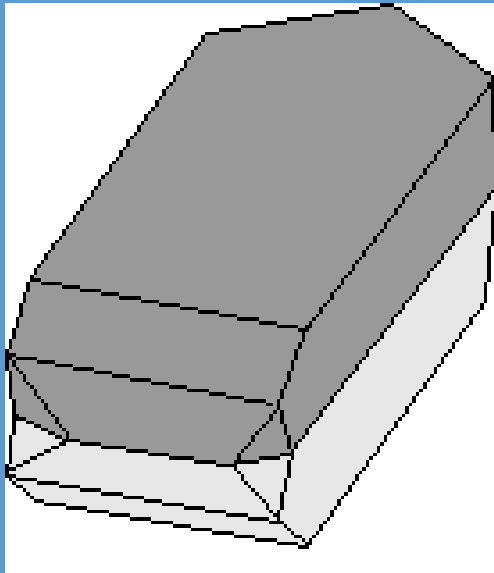
- Combination of albite twinning and pericline twinning in alkali feldspar results when high temperature sanidine (monoclinic) transforms to low temperature microcline (triclinic) is known as "tartan", or "cross-hatch" twinning pattern
- One of the most characteristic diagnostic properties for the identification of microcline

Twinning in Calcite

- The mineral calcite can be easily twinned during deformation, producing polysynthetic twins



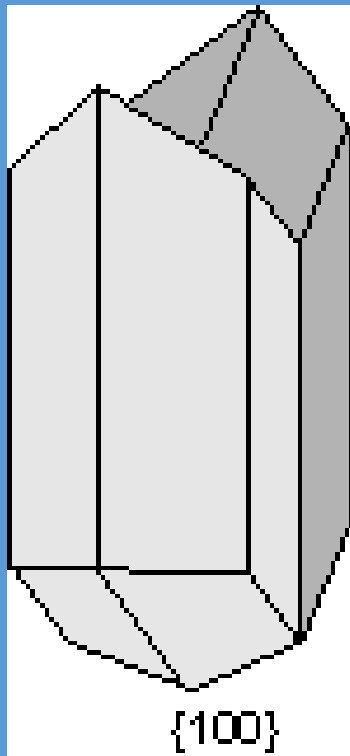
Manebach Twinning



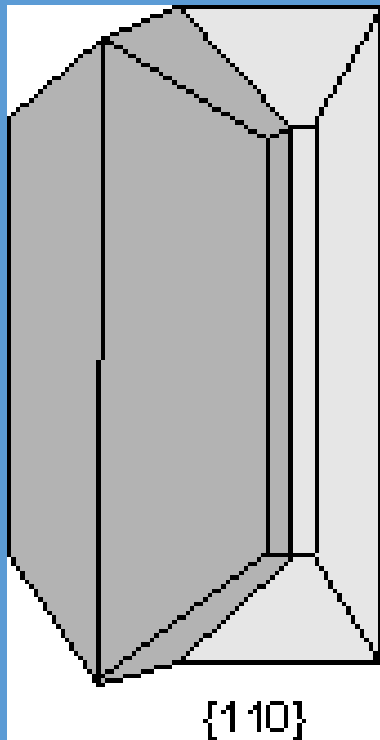
- A type of contact twinning seen in orthoclase on the $\{001\}$ plane
- Diagnostic of orthoclase
- Monoclinic system

Gypsum

- Swallow tail twins {100} are commonly observed in the mineral gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$)

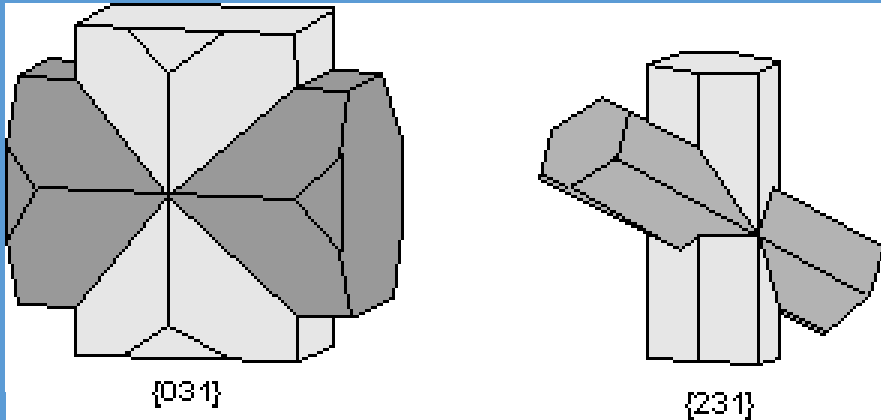


Orthorhombic Cyclic Twinning



- Cyclical Twins - The minerals aragonite (CaCO_3) and chrysoberyl (BeAl_2O_4), which results in a cyclical twin that gives these minerals a pseudo-hexagonal appearance

Twinning in Staurolite



“Fairy Cross” Twins
show staurolite
crystal



Spinel Law



- Twin plane clearly visible

Iron Cross Twin

- Iron Cross in Pyrite

