Feldspar Twinning:

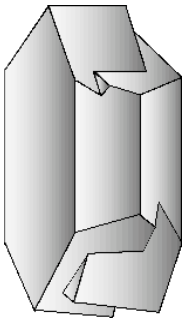
@ least 7 types of twinning are exhibited by feldspars

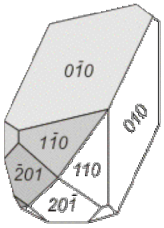
Feldspar frequently exhibits phase changes in what may appear externally as a single crystal but actually represents two or more individuals. The individuals show differences in birefringence between crossed polars when examined in thin section.

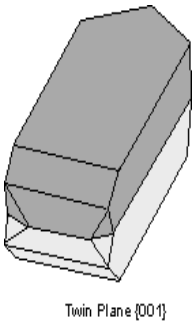
Several stages of growth in plagioclase may be shown by zonal structure. Complexity of growth may produce unusual development as a central crystal core of plagioclase enclosed in an envelope of orthoclase.

Twins are described with reference to directions in the feldspar crystal. Description is given in terms of the exes around which twinning takes place, and the composition planes along which the twin individuals meet.

Twin crystals formed by simple repetition are represented by the Carlsbad, Baveno, and Manebach twin laws.



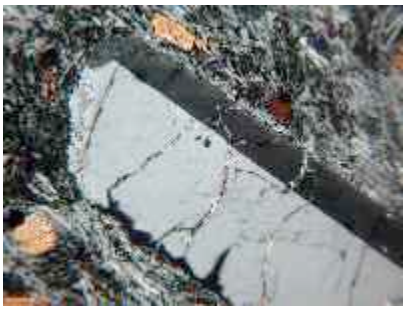




Carlsbad Twin Baveno Twin Manebach Twin

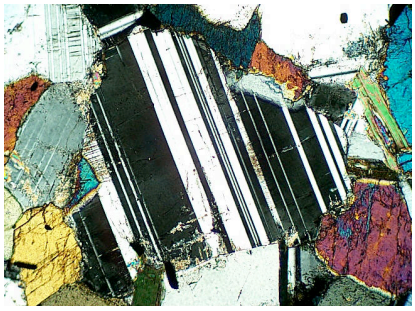
Carlsbad twins are common in **orthoclase**, only occasionally observe Baveno and Manebach in orthoclase. Carlsbad twins may also be present in plagioclase.

Carlsbad twins often exhibit 2 elongate individuals separated by a single composition plane:

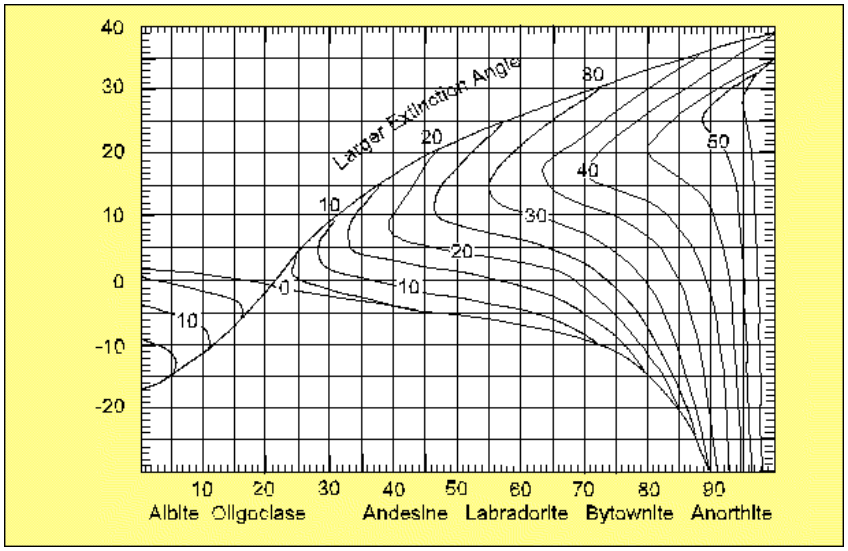


The individuals differ in extinction between crossed polars. Baveno twins may be separated by a diagonal plane.

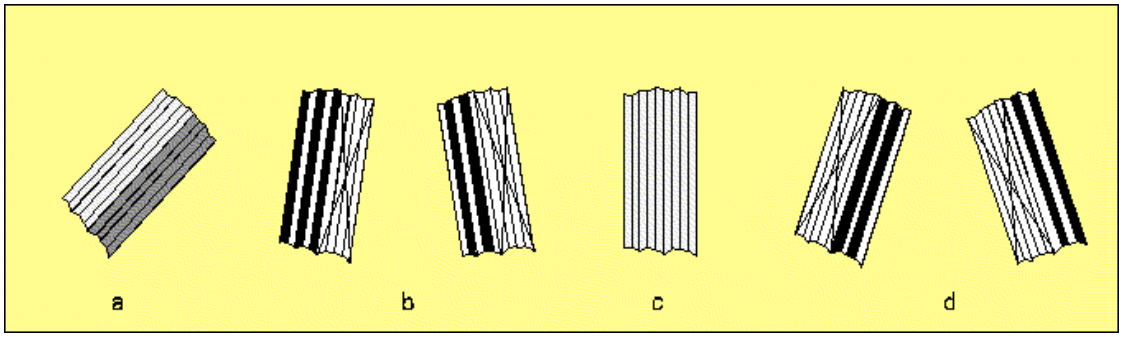
Polysynthetic or multiple twinning is abundant in **plagioclase** (Fig 13-23a). **Albite twinning** is widespread. It is recognized by the parallelism between the composition planes and the (010) cleavage (Fig 13-23b). Fragments showing albite twinning are useful in plagioclase identification.

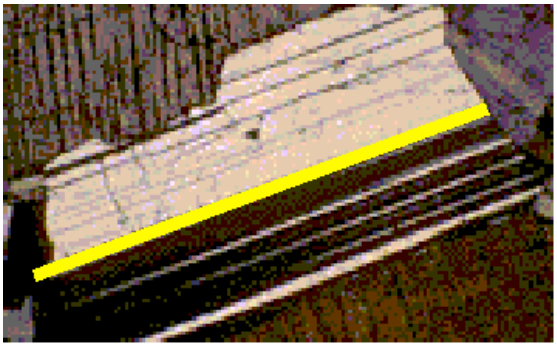


The most common method of identification is the use of extinction curves. To use this method, crystals cut normal to (010) are sought. This is recognizable by 3 factors: (1) the sharpness of the composition planes with a slight change in focus, (2) uniformity of illumination of all lamellae, (3) and equality of the extinction angles for twin sets rotated to the left or right.



You can also get a combination of more than one type of twinning. When **Carlsbad and albite twinning** are both present (Fig 13-27 and 13-28), there will be four extinction positions for the crystal. Both kinds of twins will be recognized in the 45º position. Sometimes the albite twinning disappears, and the crystal appears to be a simple Carlsbad twin. In the 0º position, both the albite and Carlsbad twinning will practically disappear.



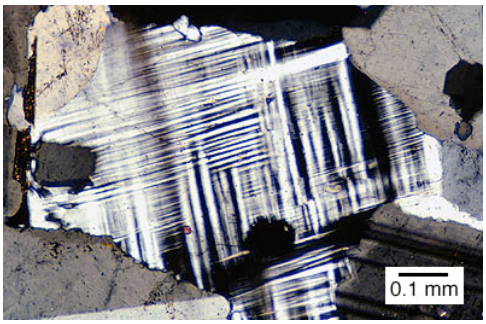


Pericline twinning is polysynthetic and results in lathlike individuals which may resemble albite twins as observed with the microscope. Pericline twin planes may be almost normal to the direction of the albite composition plane. They are recognized by their inclination with reference to the (001),(010) edge (the angle of the rhombic section).

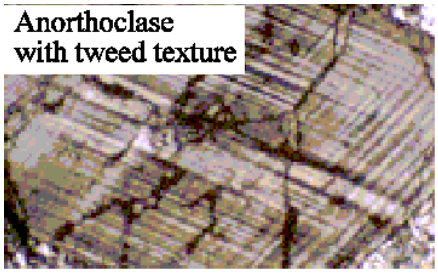
Combinations of albite and pericline twinning frequently appear in alkali feldspar – particularly in **microcline.** The combination produces a distinctinve grid pattern between crossed nicols. Tongues of albite often penetrate the grid structure at more or less regular intervals (the intergrowth forms the pattern known as **perthite**. (See Microcline picture below)

Alkali Feldspar Group

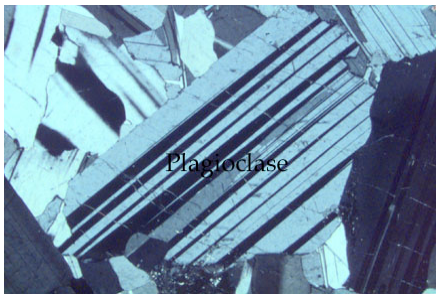
Orthoclase: Twinning according to Carlsbad law (C axis {001} = twin-axis). These are simple twins consisting of 2 individuals. (Also forms spherulites in obsidian)
Sanidine: Usually twins according to the Carlsbad law (C axis {001} = twin-axis). Twins are simple twins of two individuals and are rarely polysynthetic.
Microcline: Polysynthetic twinning is almost universal in microcline. The twinning is in two directions, one according to the albite law ({010} = twin plane), and the other according to the pericline law (b axis [010] = twin axis. This gives a gridiron or quadrille structure, the two sets of lamellae being at right angles.

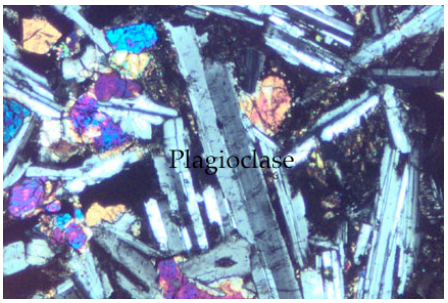


Anorthoclase: (soda microcline) Polysynthetic twinning in two directions like that of microcline, but the lamellae are finer. It may be necessary to have an unusually thin section to detect the twinning.



Plagioclase Group:





Albite: Polysynthetic twinning according to the albite law ({010} = twin plane) is rarely absent. There may also be twinning according to the Carlsbad law (c axis or [001] = twin axis) either alone or combined with albite twinning. Pericline twinning (b axis or [010] = twin axis) is sometimes present. The angle of the rhombic section is +15º to +37º.

Oligoclase: As in albite.

Andesine: As in albite. The angle of the rhombic section varies from +3º to -2º in andesine.

Labradorite: As in albite.

Bytownite: As in albite.

Quartz: