1.1 Introduction. Feldspars are the most abundant mineral species in both the oceanic and continental crust, making up 50-60% by volume. They are framework aluminosilicates with the general formula A[SiO₃]B[Al₂O₃]-[O]-C, where M is usually Ca²⁺, Na⁺ or K⁺, and T is Al³⁺ or Si⁴⁺, with Al and Si. They have either monoclinic or triclinic symmetry and exhibit considerable solid solution at high T, but very little at low T, when almost all natural feldspars are intergrowths of two or more feldspar phases.

1.2 Components and phases. Common feldspars are tectosilicate solid solutions of two components: CaSi₂O₆ (anorthite), NaAlSi₃O₈ (albite), and KAlSi₃O₈ (orthoclase). Feldspars may also contain minor amounts of other elements, such as Mg, Fe, and Ti. At room temperature, all feldspars are monoclinic, but at high T, they become triclinic.

1.3 Intergrowths. An Or-rich phase and an Ab-rich phase, known as orthoclase feldspar (Fig. 1.3), form by exsolution during cooling of homogeneous Al₂O₃-SiO₂ feldspar. They are called cryptoperthite when sub-optical microliths are visible in a petrographic microscope and macroperthite when visible to the naked eye. This is an extremely light-sensitive phenomenon. Orthoclase and albite feldspars are most common, but plagioclase and anorthoclase are also present. Feldspar crystals in contact with an alkali-rich melt composition, such as basaltic andesite, exhibit clinopyroxene, olivine, and orthopyroxene. Orthoclase and albite feldspars are less stable and form at high T, while clinopyroxene and olivine are more stable at low T. The relationships between these minerals and the phase relationships are complex and depend on the specific composition of the melt.

1.4 Crystal structure and symmetry. All feldspar structures are based on the feldspar framework. In triclinic feldspars, the unit cell is divided into a right- or left-handed sense relative to the mirror plane, and the symmetry is lost. The maximum departure of the cell edges from the ideal Euclidean cube is 0.4% and 8.7% in low albite.

1.5 Phase equilibrium. Phase changes in feldspar compositions are strongly influenced by the amount of water present. At high T, all feldspars are monoclinic, but at low T, they become triclinic. In plagioclase feldspars, the unit cell is divided into a right- or left-handed sense relative to the mirror plane, and the symmetry is lost. The maximum departure of the cell edges from the ideal Euclidean cube is 0.4% and 8.7% in low albite.

1.6 Metasomatic phase diagram for An-free plagioclase feldspars at P = 500 MPa. Two feldspars are in equilibrium with liquid at the eutectic E. All feldspars are discarded.

1.7 Phase diagram for Or plagioclase feldspars, showing liquids and solidus curves at atmospheric P and probable subsolidus relationships in feldspars with equilibrium conditions.