Phyllosilicates Encyclopedia Article

Phyllosilicates

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Phyllosilicates

Phyllosilicates are a group of minerals that are fundamentally composed of extended flat sheets of linked silicon-oxygen tetrahedra. Included in the phyllosilicate family are micas and clays. The name is derived from the Greek word *phyllos,* meaning leaf. As the name implies, phyllosilicates often display a platy or flaky crystal habit or perfect planar cleavage.

The phyllosilicate structure consists of sheets of hydrated SiO_4 rings (they are hydrated because there is one hydroxyl ion [OH^-] in the middle of each ring) and an octahedral sheet consisting of AlO or MgO. The simplest phyllosilicate is a sole octahedral layer: brucite in the case of MgO, gibbsite if the octahedral layer is AlO. However, most phyllosilicates are composed of interlocking tetrahedral and octahedral layers combined in the ratio of 1:1 or 2:1. One tetrahedral layer linked to one octahedral layer yields the 1:1 structure. This forms kaolinite when an AlO octahedral layer is used, antigorite if the octahedral layer consists of MgO. Other **clay** minerals such as talc and pyrophyllite are composed of a 2:1 structure: two tetrahedral layers sandwiching one octahedral layer. In both structures, 1:1 and 2:1, a weak residual interlayer charge exists. This interlayer charge is the source of the van der Waals forces that hold each interlocked layer to one another. These weak interlayer bonds are easily broken and allow the sheets to slip, resulting in the low hardness and greasy feel that is typical of clays.

Other phyllosilicate minerals are derived from further complications of the interlocking sheet system. For example, the micas are formed when atoms of **aluminum** substitute for **silicon** in the tetrahedral layer. Because these two elements carry different charges, the net charge of the 2:1 layers is increased. The result is an interlayer bond that is stronger than a van der Waals forces and produces the perfect planar cleavage and slightly higher hardness of micas.

See Also

Clay; Phyllite