Saponite

\((\text{Ca}_{0.5}, \text{Na}_{0.3})(\text{Mg}, \text{Fe}^{2+})_3(\text{Si}, \text{Al})_4\text{O}_{10}(\text{OH})_2 \cdot 4\text{H}_2\text{O}\)  

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Crystal Data: Monoclinic.  
Point Group: n.d.  
Crystals minute, pseudo-hexagonal, tabular \(\{001\}\); bladed, fibrous, flaky, or subparallel aggregates; nodular, fine-grained, massive.

Physical Properties:  
Cleavage: \{001\}, perfect.  
Tenacity: Plastic when hydrated, brittle when dry.  
Hardness = < 1–2  
\(D\) (meas.) = 2.24–2.30  
\(D\) (calc.) = n.d.  
Positive identification of minerals in the smectite group may need data from DTA curves, dehydration curves, and X-ray powder patterns before and after treatment by heating and with organic liquids.

Optical Properties:  
Translucent.  
Color: White, yellow, gray, blue, green, reddish, brown.  
Luster: Greasy.

Optical Class: Biaxial (–).  
Pleochroism: \(X = \) colorless, light yellow to green-brown; \(Y = Z = \) colorless, greenish brown to dark brown.  
Orientation: \(X \perp \{001\}; Z \parallel \) elongation.  
Absorption: \(Y \cong Z > X. \) \(\alpha = 1.48–1.54 \quad \beta = 1.50–1.58 \quad \gamma = 1.50–1.58 \)  
\(2V\) (meas.) = 0°–40°

Cell Data:  
Space Group: n.d.  
\(a = 5.3 \quad b = 9.14 \quad c = 16.9 \quad \beta = \sim 97^\circ \quad Z = n.d.\)

X-ray Powder Pattern:  
Synthetic \(\text{Na}_{0.33}\text{Mg}_{3.00}(\text{Si}_{0.67}\text{Al}_{0.37})_\Sigma=4.00\text{O}_{10}(\text{OH})_2\); glycolated; very close to stevensite.  
17.0 (100), 3.37 (80), 1.535 (70), 8.5 (50), 4.58 (50), 5.69 (40), 2.58 (40)

Chemistry:  
\[
\begin{array}{ccc}
\text{SiO}_2 & 40.46 & 51.26 \\
\text{TiO}_2 & 0.09 & \text{CaO} \\
\text{Al}_2\text{O}_3 & 10.15 & 4.42 \\
\text{Fe}_2\text{O}_3 & 3.56 & 1.14 \\
\text{FeO} & 4.89 & \text{H}_2\text{O}^+ \\
\text{MnO} & 0.24 & 0.03 \\
\text{NiO} & 0.04 & \text{P}_2\text{O}_5 \\
\hline
\text{Total} & 100.23 & 99.75
\end{array}
\]

(1) \(\text{Časlav}, \) Czech Republic; corresponds to \((\text{Ca}_{0.16}\text{Mg}_{0.05}\text{Na}_{0.04}\text{K}_{0.03})_\Sigma=0.29(\text{Mg}_{0.37}\text{Fe}^{2+}_{0.32}\text{Fe}^{3+}_{0.21}\text{Al}_{0.10})_\Sigma=3.00(\text{Si}_{3.16}\text{Al}_{0.84})_\Sigma=4.00\text{O}_{10}(\text{OH})_2 \cdot 0.98\text{H}_2\text{O}.\)  
(2) \(\text{Ballarat}, \) California, USA; by XRF; Na by AA, \(\text{H}_2\text{O}\) by TGA; corresponds to \((\text{Ca}_{0.10}\text{Na}_{0.16}\text{K}_{0.02})_\Sigma=0.37(\text{Mg}_{0.61}\text{Al}_{0.15}\text{Fe}_{0.05})_\Sigma=2.82(\text{Si}_{3.77}\text{Al}_{0.23})_\Sigma=4.00\text{O}_{10}(\text{OH})_2 \cdot 4\text{H}_2\text{O}.\)

Mineral Group: Smectite group.

Occurrence:  
Hydrothermally deposited in mineralized veins and in vesicles in basalt. Formed in fissures cutting calc-silicates, iron-rich skarns, amphiboliths, and serpentinites.

Association:  
Celadonite, chlorite, copper, epidote, orthoclase, dolomite, calcite, quartz.

Distribution:  
Many localities; a few for well-studied material follow. At \(\text{The Lizard}, \) Cornwall, England. From \(\text{Allt Ribhein}, \) Fiskavaig Bay, Isle of Skye, Scotland. At \(\text{Svärdsjö}, \) Kopparberg, Sweden. From \(\text{Časlav}, \) Czech Republic. In Poland, at \(\text{Frankenstein}, \) Silesia. At \(\text{Krugersdorp}, \) Transvaal, South Africa. In the USA, in the \(\text{Kearsarge} \) and \(\text{Ahmek} \) mines, Keweenaw Peninsula, Houghton Co., Michigan; between \(\text{Pigeon Point} \) and \(\text{Fond du Lac}, \) north shore of Lake Superior, Cook Co., Minnesota; from near \(\text{Milford}, \) Beaver Co., Utah; at \(\text{Ballarat}, \) Inyo Co., California; in the \(\text{Toughnut} \) mine, Tombstone, Cochise Co., Arizona. From \(\text{Thunder Bay}, \) Ontario, Canada.

Name:  
From the Latin for soap, which it resembles.

Type Material:  
\(\text{Mining Academy}, \) Freiberg, Germany, 44591.

References:  
(1) \(\text{Dana, E.S.} \) (1892) Dana’s system of mineralogy, (6th edition), 682–683.  
(3) \(\text{Ames, L.L. and L.B. Sands} \) (1958) Factors affecting maximum hydrothermal stability in montmorillonites. \(\text{Amer. Mineral.}, \) 43, 641–648.  

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