Overview of stevensite mineral: classification, history, uses

Science, Chemistry

Stevensite is a complex mineral compound with the chemical formula (Ca, Na)xMg3-x(Si4O10)(OH)2. Ranging from white to pale pink, brown or yellow, this unique naturally occurring geological substance is a member of the Smectite group of minerals. Found in relative abundance, limited research has been compiled regarding Stevensite. However, it has been recorded that Stevensite can be found throughout Western Australia, Egypt, Greece, Italy, Japan, Scotland, Sweden, and parts of the United States. Moreover, Stevensite possesses many unique properties regarding beauty products, filtration, and cellular life foundations, which will be discussed in detail in later paragraphs; potentially imposing ramifications on science, technology and sustainable development.

Classification

Stevensite is recognized as belonging the Smectite group of minerals along with several other minerals. This was determined by X-ray pattern examination determined by Faust and collogues (1953) & (1959); recognizing the similarities Stevensite shares with other class minerals (i. e. Aliettite, Beidelite, Calcium Montmorillonite, etc.) In contrast, Stevensite differs from other minerals in this group due to the differences in low layer charge stems being octahedral vacancies rather than substitutions in structure, and for having higher thermal properties. Since Stevensite is found on nearly every continent, interesting allusions can be drawn, connecting foreign research and amalgamating data; Stevensite is thus synonymous with Greek terms Aphrodite and Aphrodite. Providing nuance, Greek literature further reviles that Stevensite is commonly found in two forms; the more abundant Mg-rich, Ni- poor and scarce Ni-rich Stevensite. Additionally,

Dana, supported by the National Museum of Natural History (Washington D. C.) reported that Stevensite has associated properties with other mineral compounds such as Quartz, Talc and Pectolite (1899).

Physical & Chemical Properties

Formula: Ca, Na)xMg3-x(Si4O10)(OH)2

Color: White, Pale Yellow, Pale Brown, Pale Pink, Pink, Amber, Grey, Brown

Lustre: Waxy, Earthy, Dull, Resinous, Streak White

Transparency: Translucent

Hardness: 2 ½ (Mohs Scale)

Isotypes

There is limited research regarding isotope occurrence of Stevensite. Leeds, recognizes that like any substance in nature the potential for naturally occurring variances is high (1873). Moreover, naturally occurring Stevensite is rarely pure, but rather found within clay beds and mixed with other minerals.

History

Discovered in 1873, with the help of American engineer, inventor, and entrepreneur Edwin Augustus Stevens in the New Jersey region, Stevensite was named to pay homage to its detector. Of 11 children, Mr. E. A. Stevens was a lucrative businessman, and successor of the Stevens estate in Hoboken at the age of 26. As a successful inventor, Edwin was responsible for the design of various farming and steamboat equipment. Later teamed

with his brother, further diversifying his career, Mr. Stevens worked for the United States government and navy. As the founder of the Stevens Institute of Technology, which opened in 1870, Mr. Stevens' legacy protrudes into a wide array of scientific research and technological development. Although, Edwin Augustus Stevens died in 1868 at the age of 73, he is accredited for the discovery of the mineral Stevensite. Research also suggest ancient origins of Stevensite. Egyptian women are claimed to have used Stevensite and other talc-carbonates as a form of makeup, believing that it would preserve their youth while enhancing their beauty. Similarly, analysis of pottery, hieroglyphics and other ancient structures, elucidates that Stevensite was a common resource for the Egyptians. With this knowledge, inferences about trading of this mineral raise curiosity and open avenues for future investigation.

Occurrence and Production

As mentioned in the introduction, Stevensite is a common mineral compound that is found in abundance throughout the world. The formation of this and other Smectite group minerals are believed to result from the explosive volcanic activity during the early formation of earth. Synthetic recreations of Stevensite are in existence and are popular for research purposes due to the purity and ease of production. Güven and Carney, conducted research out of the University of Texas, concluding that synthetic Stevensite most easily converts from sepiolite in the presence of fresh water, an abundance of calcium and sodium, and with the appropriate temperature (1979). Reports additionally speculate that there may be a presence of Stevensite on our

neighboring planet, Mars. Providing little evidence, this nuance alludes to predictions of potential life on the red planet; past or present.

Uses

Stevensite is an important mineral for the foundation of cellular life. Burne et al explain that anaerobic microbialites, the earliest form of macroscopic life, are extremely important for the evolution of aquatic ecosystems because they provide the structural backbone for species that make up the coral reefs (2014). This claim is alluring due to the evidence out of Lake Clifton, Western Australia, claiming that Stevensite is one of the foundational minerals for organomineralization; quite literally being the key component for the initial structure of modern thrombolytic microbialites. Furthermore, Stevensite possesses geo-filtration properties. This inexpensive mineral expresses the capacity to filter out substances like chloridazon from aqueous solutions at rates that far exceed that of other geo-filters. Moreover, with the ever-increasing use of antibiotics which “ is considered a contaminant of emerging concern due to its presence in wastewater effluents, surface waters and groundwaters”, Stevensite appears to be able to filter antibiotic tetracycline approximately three times more effectively than previously used filtration devices.

Lastly, Stevensite geo-filters are efficient absorbers of polycyclic aromatic hydrocarbons found in incomplete combustion of fossil fuels and oil spill disasters. Stevensite as a geo-filter is also easily able to release substances and regenerate for future uses making it a unique, sustainable option for water management.