**Material Name:** Wollastonite

**Etymology:**

Named after William Hyde Wollaston, a British scientist.
(Britannica, “William Hyde Wollaston”)

**Uses in studio ceramics:**

**Ceramics**: Wollastonite can be used in a variety of ceramic applications including ceramic glazes and bodies, enamels, frits, fluxes and in sanitary-ware. This industrial mineral is a source of CaO to alkaline glaze formulations to improve the strength of the glaze. Wollastonite also has a low LOI (< 1%) which gives minimal gas evolution during firing resulting in a smooth surface with diminished pinholing. Due to its acicular structure, wollastonite improves green strength and reduces crazing and checking especially during rapid heating and cooling. It has a low sintering temperature (approximately 991-1196°C) which is comparable to that of most natural frits.
(Industrial Minerals Association, “What Is Wollastonite?”)

A white nonmetallic, natural mineral identified chemically as calcium metasilicate, $CaSiO_3$. It is the only commercially available pure white mineral that is wholly acicular (needle-like crystals). Wollastonite is available in fine particle size powders as well as fibrous 'high aspect ratio' products (20:1). This material has a very unusual texture, it does not flow at all (a hand full can be picked up with fingers downward). Wollastonite's unique qualities were first recognized in 1822 by an English scientist, Sir William Wollaston. However as a commercially available raw material wollastonite has only been available since the 1950s. Explosive market growth took place during the 1980s and 90s and major industrial sectors have adopted the material.

Deposits are mined mainly in US, China, India, Mexico, Canada, and Finland. They vary in purity; some require almost no beneficiation; others may require removal of up to 80% impurities such as garnet, diopside, limestone, and dolomite (e.g. by magnetic separation, froth flotation, optical sorting). Synthetic wollastonite is also made by combining quicklime with quartz, calcium carbonate and calcium hydrate.
(DigitalFire, “Wollastonite”)

In ceramics, wollastonite reduces warping and cracking during firing and increases strength. Being a calcium silicate mineral, wollastonite contributes calcium in ceramic glaze mixes.
(USGS, “Wollastonite-A Versatile Industrial Mineral”)

**Other Uses:**

Wollastonite has been mined in the U.S. for more than 70 years. The industry first started in California, where production continued until 1970. Production was only a few thousand metric tons per year for decorative stone, ceramics, mineral wool, and paint. Today, wollastonite is

mined only in Essex and Lewis Counties, N.Y. Wollastonite has been produced in New York for more than 40 years.

Until the late 1970's, the primary use of wollastonite was as a decorative stone. Since the early 1980's, one of the uses has been as a replacement for asbestos in products, including insulating board and panels, paint, plastics, roofing tiles, and in friction devices such as brakes and clutches….Wollastonite is widely used as a flux in the casting of steel and in the production of paints and coatings. In paints, wollastonite provides reinforcement, hardening, low oil absorption, and other benefits. In textured coatings, like stucco, wollastonite provides crack resistance, reinforcement, and high brightness. Wollastonite is also used in the manufacture of adhesives, joint compounds, refractories, and rubber. All grades of wollastonite are used in the production of plastics, including nylons, phenolic molding compounds, polyesters, and polyurethanes and polyureas.

Ceramic and paint markets traditionally were the mainstay of the wollastonite industry. With the recognition in the 1970's of health issues associated with asbestos, wollastonite became a substitute for short-fiber asbestos in many applications, and the U.S. and worldwide markets have grown ever since. Another boost to the industry came with the increase in demand for wollastonite as a filler and extender for the rapidly growing plastics market. Today, plastics and ceramics are the leading markets, followed by paint and asbestos substitutes.
(USGS, “Wollastonite-A Versatile Industrial Mineral”)

**Source Location and Extraction Process/Conditions:**

Vanderbilt Minerals, LLC: VANSIL W-30

> From their website: “VANSIL® Wollastonite is a high brightness, white calcium metasilicate mineral mined and processed in Upstate New York by Vanderbilt Minerals, LLC.”

Vanderbilt Warehouse: 1837 NY-812, Gouverneur, NY 13642

Mine: off NY-3 between Harrisville, NY and Natural Bridge, NY approx. 1 mile south of Lake Bonaparte at 44° 07’ 22” N, 75° 22’ 51” W

> August 22, 2018 story in the Adirondack Explorer about NYCO Minerals’ wollastonite mine and Imerys, who owns NYCO, straining the local economy and upsetting local residents; Vanderbilt is mentioned as a comparison:
> “Since Imerys assumed control of the company, plant safety violations and fines have soared, according to public records. In 2007 there were ten citations by the U.S. Mine Safety and Health Administration and $1,140 in fines. That grew to fifty citations and $59,155 in fines in 2016, fifty-three citations and $20,033 in fines last year, and twelve citations and $5,597 in fines based on first-quarter 2018 records. Employment has dropped, according to the agency’s records. They show that the number of workers from ninety-three in 2013 to seventy in the first quarter of this year.

By comparison, the RT Vanderbilt Minerals wollastonite mining operation in Gouverneur has never had more than ten citations or more than $3,900 in fines in any year dating to 2007. Vanderbilt may be picking up some of NYCO's traditional customers. Vanderbilt President Ian Begley said changes under Imerys have "not been to our disadvantage, let me put it that way." He thinks Imerys may be trying to extend the life of its New York mines by pushing business to its Mexican operation."

**Refinement Process:**

VANSIL products are made by crushing, drying and milling the wollastonite ore. The same ore is used for all grades, which differ only in particle size distribution. VANSIL wollastonite is not contacted by flotation chemicals or chemical treatments of any kind. Because it is milled natural ore, elemental analysis can show natural minor variations.
("VANSIL Wollastonite")

To be useful for many different applications, wollastonite must be processed; the processing should produce concentrates that are 97–99 percent pure wollastonite. After drilling, blasting, and partial crushing at the mine site, the ore goes to a production plant for further crushing, beneficiation, and milling. Crushing and milling must produce a range of particle sizes having a range of aspect ratios. The commonly associated minerals garnet and diopside are removed by high-intensity magnetic separators.
(USGS, "Wollastonite-A Versatile Industrial Mineral")

**Distribution Journey:**

Wollastonite is mined in northern Lewis County, NY and processed at 1837 NY-812, Gouverneur, NY 13642 (13 miles). From there it is trucked to Rocky Mountain Clay in Denver (1,872 miles) and then to CSU (70 miles). Total 1,955 miles.

**Geologic Origins:**

Some twenty million years ago, for reasons which remain obscure to geologists, a dome about 150 miles across – later to become the Adirondack Mountains – began to rise. Erosion ensued, creating a system of parallel valleys, wearing away the sediments on the surface, and exposing the billion-years-old rocks below. The Adirondacks are continuing to rise at an estimated rate of about a foot per century, assuming that the current rate continues.
(Adirondacks Forever Wild, "Adirondacks Geology")

Wollastonite forms as a result of the contact metamorphism of limestones and in igneous rocks that are contaminated by carbon-rich inclusions. It can be accompanied by other calcium containing silicates, such as diopside, tremolite, epidote, and grossular garnet. Wollastonite also appears in regionally metamorphosed rocks in schists, slates, and phyllites. It forms when

impure limestone or dolomite is subjected to high temperature and pressure, which sometimes occurs in the presence of silica-bearing fluids as in skarns or in contact with metamorphic rocks. (GeologyScience.com, “Wollastonite”)

The other currently commercial wollastonite deposit is mined by the R.T. Vanderbilt Co. in the Gouverneur District, Lewis County, N.Y. The deposit was formed by the recrystallization of siliceous Precambrian carbonate rocks by the contact metamorphism and metasomatism accompanying an igneous intrusion. The ore bodies consist of large pods of wollastonite, calcite, and graphite with accessory prehnite, magnetite, and diopside.
(USGS, “Wollastonite-A Versatile Industrial Mineral”)

**Land Acknowledgement:**

Iroquois Confederacy or Haudenosaunee Confederacy
-specifically Oneida or Mohawk who call themselves “Kahniakenhaka”

**Synopsis:**

Wollastonite, also known as calcium metasilicate and composed of calcium, silicon, and oxygen, was named after the British scientist William Hyde Wollaston who lived in the late 18th and early 19th centuries. It’s a versatile mineral with diverse applications. In ceramics, wollastonite improves green strength and reduces crazing thanks to its unique acicular or needle-like crystal structure. It can be found in ceramic glazes and bodies, enamels, frits, and fluxes, and it reduces warping and cracking during firing.

Industrially, wollastonite has only been a major raw material for a few decades. Wollastonite production started in the U.S. in California, where only a few metric tons were mined per year, primarily for use as decorative stone. Since the late 1970s, however, this material has expanded into several industries and has been used as a replacement for asbestos in products like insulation, roofing tiles, paints, and fire-resistant construction materials. Wollastonite provides crack resistance, reinforcement, and high brightness in textured coatings like stucco, and all grades of wollastonite are used in the production of plastics. Wollastonite is an important ingredient in the production of steel and also in the manufacturing of friction devices such as brakes.

Vanderbilt Minerals mines wollastonite in northern Lewis County in New York state, and it is currently the only company producing the material in the U.S. NYCO Minerals, the only other company that mined wollastonite in this area, has ceased mining after selling its operations to the multinational conglomerate Imerys. In 2013, a statewide vote allowed NYCO to mine two-hundred acres of the Jay Mountain Wilderness. The proposal was supposed to save local jobs, but since Imerys’ acquisition of NYCO, the project hasn’t moved forward and former NYCO miners have expressed frustration towards Imerys.

Northern New York state is historically the territory of the Haudenosaunee, otherwise known as the Iroquois Confederacy, and Vanderbilt’s mines are located in what was likely the

territory of the Oneida or Mohawk tribes. Geologically, wollastonite occurs when limestones come into metamorphic contact within igneous rocks that are contaminated by carbon-rich intrusions. It can also occur when impure limestone or dolomite is subjected to high heat and pressure. Besides a billion-year-old history of continental collision and rifting, Northern New York state is characterized by the Adirondack Mountains, which are the result of a twenty-million-year-old dome of earth rising up at roughly a foot per year. Scientists have only just begun to understand this phenomenon. The wollastonite available in this region is likely related to this strange geologic activity.

Vanderbilt mines their wollastonite off New York Highway 3 between Harrisville and Natural Bridge, approximately 1 mile south of Lake Bonaparte. From there, it is trucked north to their warehouse where it is processed into their copyrighted product VANSIL W-30. The material is then trucked cross-country to Rocky Mountain Clay in Denver, and finally ends up at Colorado State University. This material travels a total of 1,955 miles from mine to studio.

**Research Process:**

This was a straightforward material to research. Credible sources have written a lot about wollastonite, so I was never wanting for more information. I started by digging into wollastonite's etymology, and from there familiarized myself with its ceramic and industrial applications. Once I had a good grasp on that, I looked into where RMC's wollastonite comes from, discovered that they buy it from Vanderbilt Minerals, and then browsed Vanderbilt's website for information on their wollastonite product. Fortunately, Vanderbilt is very generous with the information they make available, and this helped me understand how their wollastonite is mined and refined. Their website also pointed me to where their mine is located, and I was able to pinpoint one precise location by cross-referencing their website information with the USGS's database of registered mine locations. After I understood wollastonite's distribution network, I dug into its particular geology as well as the geologic history of northern New York state where the mine is located. This is where I spent a lot of my time, since the geology of this region is fascinating. During this research I also stumbled on an interesting news story about mining in this area that involves the multinational corporation Imerys and a local mining company NYCO. I decided to include this in my report since it represented an intriguing intersection of the economics of material extraction, the politics of that economy, and the cultural implications of those interactions. The final piece of information I looked into was northern New York state's Indigenous history, which led me to the fascinating and controversial history of the Haudenosaunee Confederacy, otherwise known as the Iroquois Confederacy.

**Bibliography/Sources:**

https://www.britannica.com/biography/William-Hyde-Wollaston

https://www.ima-na.org/page/what_is_wollastonite#:~:text=Wollastonite%20is%20an%20industrial%20mineral,%25%20CaO%20and%2051.72%25%20SiO2.

https://digitalfire.com/material/wollastonite

https://pubs.usgs.gov/fs/fs-0002-01/fs-0002-01textonly.pdf

https://www.vanderbiltminerals.com/markets/cc-vansil-wollastonite

https://mrdata.usgs.gov/mrds/show-mrds.php?dep_id=10297337

https://www.adirondackexplorer.org/stories/nyco-land-swap-has-failed-to-save-jobs

https://wildadirondacks.org/adirondack-geology.html

https://geologyscience.com/minerals/wollastonite/

https://www.haudenosauneeconfederacy.com/who-we-are/

https://oneida-nsn.gov/

https://web.archive.org/web/20140811190057/http://www.mohawknation.org/index.php?option=com_content&view=article&id=47&Itemid=56