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Stibnite: Humanity’s Fuel

When you look at this stibnite, you see ambition. This beautiful yet unassuming specimen in the Orma J. Smith Museum of Natural History, all the way from Iyo, Shikouku, Japan, would not convey this at first glance. The slender, varying crystals jut upwards in many different directions, the entire formation no larger than a man’s fist, with their midnight black façade revealing nothing of their deep history. It is a history of materialism, exploitation, and consumption all for the furtherance of human goals in an ongoing quest for one of the two chemical constituents of stibnite: the element antimony. Stibnite is thus a mineral often unwanted in its natural state, yet intrinsically valuable for its component. Since ancient times, humans have found a tremendous number of uses and ways to benefit from this mineral. Stibnite thus represents humanity’s ambition thanks to this role in fueling our goals.

Humans tend to find value in the chemical components of stibnite. Stibnite’s chemical formula is Sb2S3, meaning each molecule of the mineral consists of two Sb atoms, with Sb being the chemical symbol of antimony, and two S, or sulfur, atoms. The mineral forms orthorhombic crystals which range from slender to stout shapes. Well-formed crystals found in nature usually develop in clusters radiating out from a central point, similar to a nest-like formation, but stibnite can also occur as a simply massive formation with no official crystal shape (Anthony 1). In color, stibnite is often lead grey with a metallic luster and leaves a grey to black streak. It tarnishes to a blackish color, as the Orma J. Smith Museum’s specific specimen has done, and often features some iridescence. The mineral’s formations are somewhat brittle and only have a hardness of two on the Mohs scale, meaning it is a rather soft mineral comparable to that of gypsum (Liu 1043). Stibnite’s gorgeous black to lead grey coloring is ultimately useless as the mineral is too soft to be used in jewelry, and thus human demand for stibnite relies on its containing antimony, a very useful element in many aspects of human life. In fact, stibnite is “the most abundant ore of antimony” and is thus mined whenever there is a demand for antimony and its uses in manufacturing, military technology, art, and so much more (Spring 101). In this way, even the very composition of stibnite contributes to its value as a tool for humans.

Because stibnite is a naturally occurring mineral, it can be found in many places around the world that have used it in varying ways. Even though large deposits of the mineral are rather rare, exceptional crystal formations have been produced in the United States, Bolivia, Germany, Slovakia, the Czech Republic, Romania, France, Malaysia, New Zealand, Iran, Kyrgyzstan, and China. However, perhaps the most famous mines, known for their magnificent crystal groupings, are found in Japan, most notably in the Ichinokawa mine located in the Ehime Prefecture, or the Iyo Province (Anthony 1-2). This very same area produced the crystal specimen located in the Orma J. Smith Museum. Obviously, these areas of the world differ greatly in their cultures, practices, and societies, and these differences have produced a vast variety of uses for stibnite as humans use it to fuel their culturally significant yet differing ambitions.

Humans are often forced to access stibnite, in order to use it in art, industry, beauty, and more, through mining practices because of its formation underground. The mineral occurs of a hydrothermal origin, and forms in veins across many temperatures (Anthony 1). The specific ore deposits at the Japanese Ichinokawa mine were developed due to hydrothermal activity related to volcanic activity. The rocks in which the ore is deposited at this location include Mesozoic Sambagawa metamorphic rock and Ichinokawa conglomerate stone, which includes breccia, schist, and sandstone (Sano 150-151). The stibnite forms veins in these rocks after precipitating in the hydrothermal fluid, and these veins travel vertically and horizontally through the stone. The shortest at Ichinokawa are just two hundred meters, but the longest are up to one thousand (Miura 10-11). While these formations are specific to Ichinokawa, they form similarly all across the world and have inspired vast numbers of mining operations to access stibnite’s wealth of antimony—antimony which is then put to use in all sorts of ways to further people’s ambitions.

Humans have used stibnite in order to create or further beauty since ancient times. Of the many uses of stibnite, one of its earliest recorded uses was as an element of glassware. In ancient Mesopotamian civilizations, a compound called antimonate was used to opacify and color glass. Lead antimonate, added to glass in the form of roasted stibnite, was used to produce a yellow color. However, it was not easy to work with as this yellow pigment was rather unstable and dissolved at high temperatures, simply resulting in a creamy white color. Thus, the pigment “was either carefully folded to the melted glass at relatively low temperatures, or was processed extremely quickly to avoid high temperatures for too long” (Schmidt 141). Because lead antimonate’s yellow coloration was hard to handle, it was often only used for feather decoration, handles, or rims since the base color required refiring while secondary colors did not. This antimonate was acquired through extraction after firing stibnite ore, and at the time of ancient Mesopotamia, was likely acquired from regions like the eastern Mediterranean or the Near East (Schmidt 141). In this way, stibnite found its use central to humanity’s ambitious search for beauty and the creation of beautiful objects. This has always been and will continue to be a recurring goal of mankind as humanity is innately drawn to beauty.

Stibnite has been further used as a method of creating beauty in a variety of products across time. For example, as early as 4000 BCE, stibnite was reportedly used in pottery decoration in ancient Egyptian civilizations (Miura 8). Across Europe, during the sixteenth and seventeenth centuries, antimony recovered from stibnite was used in recipes for “colored stars” in fireworks and was known to create the color of yellow, “or of an honey or box-colour,” as reported in the *Great Art of Artillery* published in 1650 by the Polish Casimir Siemienowicz (Werrett 466). Even today, antimony is utilized in making fireworks to produce a glitter effect. Back in the sixteenth and seventeenth centuries once more, antimony was used in yellow glazes for pottery by the French potter Bernard Palissy (Werrett 470). It was also utilized in many forms of Renaissance art, from many famous paintings by Correggio, among others, to German gothic sculptures. In both cases, stibnite was used to create a cool grey color which differed from the widely available carbon black (Spring 102-103). Clearly, antimony has always been utilized by humans, oftentimes for the creation of something beautiful, as in the case of glassware, pottery, and paintings, or for a spectacle of entertainment, as in the case of fireworks.

Stibnite was also used as a beauty product, which was employed to further women’s social ambitions. During the central period of Roman history, the era from roughly 200 BCE to 200 CE, women were known to line their eyelids, color their lashes, and darken their brows. This was done with the substance kohl, also known as stibium due to its association with stibnite, which “was composed of soot, lamp black mixed with grease, antimony, or ashes mixed with oil” and was applied using a thin stick or needle to line the woman’s eye (Olson 298). In another form, kohl was applied as a powder to the brows or eyelids, which entailed a woman dipping her thin stick into water or scented oil and then the powder. One of stibnite’s alternative names—“platyophtalmon”—comes from this practice of lining the eye with black in order to magnify them and quite literally means ‘that which enlarges the eye’ (Hibou). In Roman society during this time, however, makeup was a double-edged sword, especially the stark black of makeup products made using stibnite. Women were expected to be beautiful and to use makeup to make themselves so, yet men were allegedly repelled by the practice of actually applying makeup to the face. Thus, women were required to keep their beauty practices private even though they required presenting as a beautiful face to aid their sexual and social standing in Roman society (Olson 303-304). Again, while in a roundabout way, stibnite was used as a way for women to express their ambition to further themselves in their world.

Many ancient civilizations used stibnite as an eye product for medical and protective reasons in addition to its uses in beauty. In 77 CE, a Roman, Pliny the Elder, released an encyclopedic scientific work known as *Historia Naturalis*, or *The Natural History*, which has a significant account of the uses of stibnite in ancient Rome. Stibnite, referenced as “stimmi, stibi, alabastrum, larbasis, and platyophthalmon” in the encyclopedia, is referred to as “a stone made of concrete froth” which is found in the same mines as silver (Pliny, “Stimmi, Stibi”). Pliny the Elder presents stibnite as having many medical properties. When pounded into a powder with frankincense and gum, he asserts that it checks the fluxes and ulcerations of the eyes. He claims stibnite can stop the discharge of blood from the brain, powdered stibnite sprinkled on injuries can cure recent wounds and bites from dogs, and stibnite mixed with grease, litharge, ceruse, and wax can cure burns (Pliny, “Seven Remedies”). Pliny the Elder especially emphasizes stibnite’s importance as an eye salve and treatment for wateriness of the eye (Olson 306). The goal of living longer and healthier lives existed far before ancient Rome was even an idea, and there is no better encapsulation of human ambition than this. Medical advancement is simply a means for humans to achieve more than ever because they live longer than ever, so stibnite’s uses as a way to extend life or reduce medical discomfort is an obvious embodiment of ambition.

Stibnite’s history in medicine does not end with the Romans, though, as its component of antimony was a popular contributor to the later art of alchemy. During alchemy’s heyday, it was commonly used to purify gold. Alchemists mixed antimony and gold together and heated them in alcohol, often wine. This left a mixture in which antimony appears to have eaten the gold. Heat it again, however, and the antimony evaporates to reveal a nugget of pure gold, without any of the impurities it had prior. This fascination led alchemists to suspect that antimony could clean human bodies, just as it had cleaned gold (Curry 38). After all, alchemists were constantly searching for a substance called “potable gold,” thought to be the cure for all disease, and they believed their pursuit and study of antimony was the key to unlocking this goal (Medina). Today, antimony is known to be a powerful neurotoxin, but patients being treated with antimony were dying even into the 19th century because doctors were convinced that they had simply gotten the dosages wrong (Curry 38). Even so recent as in an 1883 edition of the British Medical Journal, a physician named Malcolm Morris, Surgeon to the Skin Department of St. Mary’s Hospital, recognized that antimony had dangerous symptoms with even moderate doses, yet asserted that “the same argument that applies to arsenic, and strychnia, and other drugs, applies with equal force to antimony—that the action depends entirely on the dose employed” (Morris 572). Both arsenic and strychnia, another name for strychnine, are very poisonous and deadly to humans, but nevertheless, Morris continued employing antimony as treatments for a variety of skin diseases, including eczema, erythema, prurigo, sycosis, urticaria, and psoriasis. Man’s drive in this case to satisfy their goals of extending life led to false certainties and deadly experiments, even after the danger of such antimony treatments was commonly known. Stibnite thus represents the dangerous, dark side of ambition just as much as it showcases the positives.

Stibnite’s involvement in alchemy, born purely of human ambition, started even before its history in medicine. Most of the subject of alchemy revolves around the quest to create the “Philosopher’s Stone,” which is a legendary substance believed to give “unnatural longevity to anyone who drank it” and to “transmutate base metals such as lead, mercury, or copper, into alchemical gold” (Medina). This alchemical gold is not the same as genuine gold, but rather a result of a process which transmutated antimony and copper with the Philosopher’s Stone into a gold-antimonial bronze known as alchemical gold, which was highly prized. Alexandrian (Egyptian), Islamic, and European alchemists all studied this process, and decided that the three components necessary to produce the stone were gold, antimony, which occurs in nature as stibnite and is then purified to antimony, and flux, or the universal solvent which was supposed to be able to dissolve gold without corrosion (Medina). This search for a mythical stone that could grant longer life and provide prized alchemical gold was a massive goal of mankind and stemmed directly from people’s ambitions for wealth and living longer. Importantly, one of the core requirements to create the Philosopher’s Stone was none other than the acquisition of stibnite, making it once more central to humanity’s ambition.

In more recent times, demand for stibnite was greatly increased because of a demand for antimony, which was needed to win the Great War, or World War I. In a 1934 issue of *The Military Engineer*, a U.S. publication focusing on national security and military engineering, the many uses of antimony were explored. Similar to stibnite being used as a way to obtain antimony, however, antimony itself was fairly useless in military technology when unalloyed. According to the mining engineer H.P. Henderson, antimony’s “main uses depend on its properties, as a constituent of alloys, of giving greater hardness, stiffness, and strength to soft and fusible metals, especially lead and tin, and causing the alloy to expand on solidification, resulting in sharp castings” (Henderson 207). Basically, it was used to make other metals stronger, and these alloys were used in machinery bearings, storage batteries, electric cable sheathing, alloys and solders, ammunition, and more. Chemical compounds made of antimony, too, like antimony oxide, were used as pigments in paints and constituents of fused enamels, which were put to use in the coating iron of bathtubs, sinks, signs, and more (Henderson 207). In various Japanese conflicts, too, the Ichinokawa mine proved very useful in antimony production, which was then used mainly in the production of artillery shells and bullets as well as for its cooling properties in gun barrels (Miura 18). Military uses of antimony, and thus stibnite, are very clearly linked to a goal—a goal that has inspired a conflict so great it requires military strength to rectify it. Ambition is often the cause of this war, as nations vie for power, resources, safety, and more, and stibnite became central to that cause during WWI, especially in the United States.

Demand for antimony was worldwide, but the U.S. had so little access to antimony that it relied almost entirely on foreign imports at the time of WWI. In fact, from the five years between 1926 and 1930, the United States Bureau of Mines reported that, in its various forms, 49.3% of antimony supply comes from imported sources, and only 0.1% from domestic antimony ore, with the rest coming from antimonial lead and reworked scraps (Henderson 207). This dependence on foreign suppliers raised many concerns among the American people as they had just gone through World War I in which antimony was a very real requirement. A cut-off from this resource would spell disaster should another war break out, and thus the demand for local stibnite mines within the U.S. became increasingly high (Henderson 211). The ambition of the American people would not accept any loss well, so they wanted assurance that antimony, an essential wartime resource, would be available if another great war was to break out.

One such mine prompted by the war efforts in the United States is the Stibnite Mine District, a local mine collection here in Idaho. This district is rugged and remote with a long history of mineral exploration and extraction, most notably for gold and stibnite. It is located roughly fifteen miles east of Yellow Pine, Idaho and interferes greatly with the South Fork of the Salmon River. Mining in this area began in 1891 with the Meadow Creek Mine and interest quickly skyrocketed with the Thunder Mountain gold rush. In 1914, due to the WWI effort, interest was spurred again but for the other valuable element found in the area: antimony. This interest was pushed once more in 1939 with WWII on the horizon, and as the federal government saw the Stibnite Mine District as demonstrating the greatest potential, it invested in the project. The site grew quickly and became “the single most productive mine site for … antimony in the U.S.” from 1941 to 1945 (“The History”). After changing hands of ownership many times, the site was finally closed in 1997 and much restoration work was performed to help reverse the impacts of harmful gold and stibnite mining. However, this history of human ambition wreaking havoc on the environment is only the beginning as the mine is currently embroiled in debate with a new company—Perpetua Resources—attempting to reopen the mines.

This Stibnite Mining Project is wildly controversial, because human ambition in this case is leading to environmental effects and further endangerment of fish species. Because the site had been mined for over one hundred years, the surrounding land and water was left with major disturbances and three open pit mines. There was significant loss of fish passages, water quality issues, and contaminated waste left at the site, commonly referred to as tailings. Due to concern regarding these issues, over seven million dollars have been spent on restoration efforts at the Stibnite Mine Area, through work done by the Environmental Protection Agency (EPA), the Idaho Department of Environmental Quality, and the U.S. Forest Service. This entailed extensive reclamation of wetland, streams, tailings, and waste rock in addition to the 35,000 cubic yards of tailings that were removed from the site. These efforts were still underway in 2007, when the Nez Perce tribe native to Idaho designed a project to restore a passage vital to spawning sites of the endangered Chinook salmon and bull trout but were halted by Perpetua Resources acquiring the site. Because this made the land private property which was no longer accessible, it eventually completely shut down government and tribal efforts to restore the Stibnite Mine District in 2012 (“The History”). And as if shutting down restoration efforts was not enough, the Environmental Impact Statement shows the project would entail destruction of 162.5 acres of wetlands, 630.3 acres of riparian areas, 20.8% of Chinook salmon critical habitat, and 27.5% of bull trout critical habitat. A total of 3,423 acres would be disturbed by this project, even though the company’s public campaign is hiding behind the slogan “Restore the Site” (“The Stibnite Project”). Again, ambition can poison just as much as it can motivate, and in the case of mining, stibnite embodies the negative impacts of human ambition.

This proposed mining project reveals another facet of stibnite’s uses, the rather dark underside of economic ambition and greed. The company proposing the Stibnite Mining Project, Perpetua Resources, knows exactly what they are planning to do to the natural environment of Idaho, which has already suffered so greatly. Nothing exposes this knowledge more than the change of their name from Midas Gold to Perpetua Resources, which occurred on just February 15 of 2021. The company’s own Plan of Restoration and Operations, in fact, states that “the purpose and need for the Project is for Midas Gold to economically develop and operate a modern mining operation at the Stibnite site to obtain financial return and benefits from its property rights and investment and supply extracted minerals for various uses” (“Stibnite Gold Project”). Obviously, as all companies are, Perpetua Resources is involved with mining stibnite for its financial benefits. Though they state that their plan will include restoring the site, this is wholeheartedly secondary to reaping the benefits of mining stibnite and gold, and will come much later, if at all, should the project actually be successful. And worse, should they decide to expand. Stibnite, and especially its mining, is in this way a means to an end—simply a route through which Perpetua Resources’ capitalist goals can be realized.

Further environmental concerns of stibnite and its mines are echoed all around the world, including in the area where this specific specimen was harvested, Shikouku Island in Japan. The island, home to the famed Ichinokawa mine, was the site of many stibnite harvesting projects intended to procure antimony. Antimony, however, is similar in chemical behavior and toxicity to arsenic, and is actually listed by the European Union (E.U.) and the EPA as primary pollutants (Sano 149). Because of this, the World Health Organization and E.U. define the upper limit of the concentration of antimony in drinking water as just five micrograms per Liter, or µg/L, while the EPA limits it as six µg/L. However, a 2010 study on the areas surrounding the Ichinokawa mine and the similar Tobe mine located in the same area, found the concentration in stream waters to be over two hundred µg/L. This means that there is a great possibility that any downstream areas, including the land and population, will be contaminated and is a great concern for human and environmental health (Sano 149-150). It is widely known that mining has negative impacts on the environment, and mining stibnite is no exception. The human ambition which fueled the pursuit of stibnite is responsible for many of these impacts today.

Looking at the beautiful, crystalized specimen of stibnite in the Orma J. Smith Museum of Natural History, you would never guess that the tiny sample has such an enormous wealth of history and uses for human advancements. Its history is most definitely one embroiled in human ambition, whether that be for the often-benign goal of creating beauty, the often-deadly goal of winning a war, or the goal of making a profit, which, in the case of stibnite, was especially harmful in its effects on the environment. Stibnite is essentially a mineral of controversy, then, as it both helps and hurts the human race in all of its advancements—advancements which are all fueled by the ambition that drives people to further themselves or the groups they are a part of, whether they be countries, companies, or communities of artists. Ultimately, the legacy of stibnite is much bigger than its presence as a pretty mineral—it has a long past and is still affecting our world today.

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