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## SILVER MINING IN MASSACHUSETTS.

Early in 1873, considerable public interest was awakened and some speculative excitement aroused by the announcement in local journals of the discovery of mines in the vicinity of Newburyport, Massachusetts, which were yielding even at the surface ores rich in silver, and in some cases containing appreciable amounts of gold. The reports were, as is usually the case under like circumstances, greatly exaggerated, and those who expected to find gold in nuggets and silver in the native state were considerably disappointed to encounter both metals only in the form of sulphurets, the one occasionally in auriferous pyrites, the other in argentiferous galena and in gray copper (tetrahedrite). The first assay of the new found galena showed that one ton of the ore represented a value of $179, lead and silver together, the latter existing in the proportion of 68 ounces to the ton, and as other trials resulted in even more promising data measures were at once set afoot to develop the mineral resources thus brought to light. With the speculative mania which ensued, whereby land hitherto deemed little more than a rocky desert suddenly became exceedingly valuable, and with the vicissitudes of the numerous concerns which were started to mine the precious metals, it is not our purpose here to deal; especially as at the present time the era of speculation seems to have gone by, and several mining experts of long experience in the silver mines of the West have entered (though in a limited way) upon the systematic development of certain veins, which offer, we are informed, every indication of large and valuable yields.

The region where the ores abundantly exist (for it is scarcely possible to break an outcropping rock without finding traces or even a good showing of galena) is a barren and forbidding tract, located about two miles to the southwest of the town of Newburyport. Over how large an area the metalliferous deposit extends no two estimates seem to agree. The geological formation, or rather lack of formation, almost defies classification, for it is evident that great natural forces have here been at work both to roughen the face of the country and inextricably to intermingle the strata. The metal bearing veins are known to ramify over an area of five by two miles, for a shaft sunk almost anywhere within these limits is reasonably certain to strike ore, and it is reported that in reality the metalliferous beds underlie a much more extended region. There is hardly a farmer in the vicinity who has not dug down and found ore, and mere well digging has brought to light some remarkably fine deposits. These little shafts, however, can hardly be counted, but beside nearly every one, and most of them appear to be abandoned, there is a heap of ore from which rich specimens of galena can easily be picked out. Occasionally this shallow excavation demonstrates the existence of a large vein, as in the case of the so-called "Big Quartz Vein," which, though prospected only to the depth of 30 feet, is found to be 18 feet wide on the surface, with outcroppings at a distance of some 2,500 feet. It lies between a wall of feldspathic trap or greenstone on one side, and a talcose slate on the other, and surface assays yield gold and silver in about equal value to over $20 per ton.

It may be said of all the mining operations thus far conducted in the vicinity that they are little more than surface prospecting, a fact clearly apparent from the details of some of the principal mines given further on; and we are assured by experts, who have made special examinations, that deeper mining offers every prospect of substantial success. The difficulty, however, is lack of capital to put up the necessary works for treating the ores on the spot. Owners and parties interested in different mines all agree in stating to us that a mill, capable of handling the 200 tons (rough estimate) per day taken from the principal shafts, would probably prove remunerative to whoever would establish it; but where there were so many small disunited interests it was useless to expect the same result through co-operation. The fact seems to be that the mines that are still worked require all the available resources of the owners to keep them free from water, and the ore that is taken out simply lies in heaps in the sheds.

The mine known as the Merrimac is the largest, and besides has the most extensive plant. It is under the superintendence of Mr. Edgar Shaw, who informs us that one pocket of gray copper that was encountered in it yielded 8 tons of ore, which was sold at $2,150 per ton in Liverpool. The pay streak of galena now being worked is 2 feet wide, and thus far 312 feet long, yielding about $70 per ton. The shaft has a depth of 200 feet. This mine has been open about five years, and has paid 12 dividends, showing a net profit of about $80,000. Owing to a defalcation and loss of funds its operations are at a standstill, although a new milling plant for concentrating the ore by the Hooper process has just been erected.

The China mine was opened in last September, and has a shaft 90 feet deep. The vein being worked is about 4 feet in width. About 300 tons of ore have been taken out, averaging in value $200 per ton. Gray copper assaying as high as $1,000 per ton, a few specimens of ruby silver, and considerable zinc are also reported to have been found. Of the other mines, the richest bonanza is believed to exist on the so-called Noyes property, where gold in the proportion of over 20 dollars' worth per ton is found in auriferous pyrites, besides a rich showing of silver in the gray copper and galena. In the Newhall mine, gold has been found in patches in the gray copper, and the ore has assayed at $26 per ton.

The other mines are sinking shallow shafts, and are worked in a spasmodic manner, as the owners have funds to devote to them.

So far as our superficial inspection of the mining region, and as the statements of those familiar with the operations extended, there seems to be no reasonable doubt as to the existence of the large metal bearing deposits alleged to exist. Nor in view of the general prevalence of rich looking ore already on the surface, and the results of apparently well authenticated assays, does it seem improbable that the value of the deposits is in any degree less than the experts on the spot allege. As to whether the refractory ores can practically be manipulated on the spot, so as to pay, and whether the products of the mines will hold out in uniform richness, these, besides many others, are questions for the mining engineer to answer after proper examination of the present status of the field. It is but right to say that the value of the mines has been disputed, and there seems to be a lack of exact information relative to them which suggests the idea that it might be to the interest of mining experts, as well as of public importance, to have more extended surveys and investigations made at an early day. Assays of specimens of galena, collected at random from numerous ore heaps at the mines, yield an average of $27.96 per ton in gold and silver.

## COUNTERFEIT COIN.

It would hardly be supposed that so large an amount as two million dollars in counterfeit silver and gold coin is now afloat in this country, but such, according to the estimate of Treasury experts, is the fact, and, moreover, the total is constantly increasing. This spurious money passes through thousands of innocent hands, until finally it is caught in the meshes of the nets laid by the Secret Service or is recognized by a lynx eyed expert in some large bank. Then the unfortunate holder becomes the victim of the counterfeiter's skillful rascality.

In order to imitate a coin successfully—that is, so that it will deceive, not the general public, because probably most persons never take a second look at the coin they receive, provided its appearance seems right, but the clerk or cashier moderately well accustomed to handling money—the counterfeiter must regard both execution, size, and weight. The last is most important in gold coin, because the least current weight of the latter is established, whereas in silver a coin of light weight, so long as the reduction is not manifestly too great, will pass. The standard weights and least current weights of gold coin are as follows:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20 dollar piece—Standard, | 516 | grains; | least current weight, | 513·42 |
| 10 | " | " | " | 258 | " | " | " | 256·71 |
| 5 | " | " | " | 129 | " | " | " | 128·36 |
| 2½ | " | " | " | 64·5 | " | " | " | 64·18 |

Any decrease in weight below the latter figures subjects the holder to a loss equivalent to the difference. This decrease may occur by wear, or, as is very often the case, through sundry nefarious processes, which, though not properly counterfeiting, nevertheless belong to that species of crime.

These operations are perhaps the most dangerous to the community, because as a rule the coin preserves its appearance, is apparently genuine under the acid test, and in fact is genuine except in weight. It is impossible, for example, to tell whether a coin has been "sweated" or not without weighing it, and by sweating is meant the use of the coin as the anode in the electroplating bath, the gold being abstracted from it and deposited on another surface. Of course a uniform quantity is removed from the entire surface, and the imprint retains its original sharpness. As much as two dollars' worth of gold is sometimes taken from the double eagle in this way. A less scientific plan is one too commonly adopted by conscienceless jewelers, who when they want a little gold, instead of buying the precious metal, purchase a twenty dollar piece, file off with a dead smooth file a sufficient quantity, reburnish the place, and pass off the coin at full value. The most extensive fraud perpetrated on gold coinage is "splitting." The operator uses a fine saw to split the coin neatly in two. Then he gouges the gold out of the center until only a thin outside shell is left, and substitutes a silver and platinum alloy for the metal thus abstracted. The two parts are then joined with gold solder, and the edge is remilled. In this way, we are informed, gold to the value of $15.50 has been taken from a single piece. The operation, however, generally destroys the ring or tone of the coin, leaving it, besides, either too light or too thick. Another swindle is to bore into the edge, and it is said that John Chinaman favors this game, buying up the pieces, sending them to China, so that his dexterous compatriots may there manipulate them in safety, and subsequently reimporting them to set them adrift upon the unsuspecting American public. The holes whence the gold is taken are refilled with silver, covered with gold solder, and the edges are neatly finished; but the light weight reveals the theft. From 5 to 7½ dollars' worth of gold has thus been taken from one coin, and the pieces of course have every appearance of being genuine. Real counterfeits—that is, coin wholly spurious because made of base metal—are almost invariably below weight. An exception to this, however, exists in a $5 piece which is of the exact standard weight of 129 grains. It is composed of an alloy of gold and silver, and is worth from $2.70 to $3.40. Its appearance and tone are excellent, but it is thicker than the genuine coin, and hence may be detected by the gauge. Still it is one of the most dangerous counterfeits in existence.

As we have stated a silver piece passes current so long as the imprint is not badly defaced or weight greatly reduced. A hole through the coin, however, condemns it—a fact, we

believe, not generally known. The low value of silver prevents any such proceedings as in the case of gold, as the amount which could safely be abstracted will not pay for the trouble of doing it. Consequently all silver counterfeits are true imitations, and there is hardly a date of dollar, half dollar, or quarter which has not been copied with remarkable accuracy. The counterfeiter either makes a mould in plaster from the real coin and casts from it, or he stamps his imitation in dies. As this last process is the same as is in use in the mints, the counterfeits thus produced are more difficult to detect, because, besides being more accurately finished, the compression which the alloy receives brings it nearer to standard weight. A large number of counterfeit silver coins are made chiefly of type metal. A very dangerous half dollar is composed of silver, copper, and zinc, and is worth about 17 cents. It is from 7 to 10 grains too light. Spurious half dollars have appeared which constantly deceive bank tellers and other experts because they are of full weight. They are made of a compound similar to German silver, and are so well plated with genuine silver that the acid does not affect them. They are, however, too thick, and the gauge, as usual where the balance fails, shows the fact. Counterfeits of the quarter dollar, though very plenty, are less dangerous than those of larger pieces. They are composed of antimony, tin, and lead, and are both too light and too thick, although they have a good ring. A peculiar composition has been employed, to which powdered glass is added to give a clear sound; but this is but a clumsy expedient, as the coin is far below proper weight, a fact easily appreciable by mere handling.

It is a difficult matter to lay down any general rules for detecting counterfeit coins, as it will be seen from the foregoing that the closest ocular inspection may be wholly at fault. One of the most ingenious little mechanical contrivances for both measuring and weighing coin, and which has, we are informed, been adopted in the United States mints and Treasury and many banks, will be found illustrated in our last issue. In general the milling on the edge of the counterfeit coin is always poorly executed as compared with the genuine; but wear of the latter often renders the distinction difficult to draw.

Another point worth remembering is that absence of clear tone in a coin is not necessarily proof of its falsity, because it may and does happen that a crack or flaw is made in the metal during the rolling, and this, just as in a bell, will of course destroy the vibrations and make the sound dull and flat.

## ARTIFICIAL FUEL.

It is well known that owing to the brittleness of anthracite there is a large waste in mining it. The comminuted material being too fine to be merchantable has accumulated in immense heaps near the mines, cumbering the ground and at the same time standing as tangible evidence of the necessity of some means for its utilization. Processes for this purpose have not been wanting, and when they failed as many have it was frequently because the fuel in the heat of the furnace lost its form and choked up the grates, but more commonly because the cost of manufacture was such that competition could not be made with the lump coal. Inventors of artificial fuels based on anthracite culms too often overlook the fact that the success of their process necessarily includes an increase in value of the culm in proportion as the demand for it is augmented. Says Mr. Frederick Prime, in his report as a judge at the Centennial Exposition on "coals:" "As quickly as this value touches a certain point it then becomes impossible for the artificial fuels to compete with the lump anthracite. Nor can they do this even when the culm is obtained for a mere song when the price of anthracite is very low. Consequently it is very probable that the manufacture of artificial fuels will for many years be limited, both as to quality and the purposes for which they are used."

The principal processes introduced of late years are the Loiseau, the Newton, and the Endres. The first is the invention of Mr. E. F. Loiseau, and has achieved remarkable success both in this country and abroad. It is claimed to be the first ever used to make artificial fuel for domestic employment by mechanical processes on a commercial scale. We illustrated Mr. Loiseau's ingenious train of machinery some four years ago, and its operation can be briefly summed up. The anthracite dust, after being dumped on a covered platform, is received on a screen, which after screening the coal delivers it to an elevator which raises and discharges it into a bin. Meantime dry potter's clay is suitably ground, and in a separate tank a liquid mixture is made of lime, rye flour, and water; 95 per cent of coal dust and 5 per cent of clay are mechanically taken from the bins, delivered under a chain elevator, and there sprinkled through a perforated pipe with the liquid composition. The compound is conducted between rollers, in which are cavities which mould it in egg shaped form, thence passes to a drying oven, through which it passes five times to and fro on a belt, thence the lumps are carried through a waterproofing composition, and finally they pass through a drying oven, emerging perfectly dried and ready for the market. This fuel burns well, retains its form, and leaves as a residuum the clay and any other solid impurities besides the ash.

Newton's fuel has not yet been produced on a manufacturing scale. It is composed of coal dust and coal tar, placed in a retort, which distills out the volatile products, the residue of the coal tar, some 2·5 per cent, remaining behind as a binding medium. Mr. Prime in the report before us says that the product seemed too friable to stand much handling without particles of the coal wearing off from the lumps, but it burns freely, without smoke or sulphurous fumes, and if left untouched retains its form until consumed. It is more friable than the Loiseau fuel, but leaves less ash.

The Endres process is worked by the Anthracite Fuel company of Rondout, in this State. It uses 100 parts anthracite culm to 10 parts "fuel pitch" or bitumen of coal tar. This pitch is previously prepared by passage through crushing rollers, and it is mechanically combined with the coal in exact proportions. The mixture is then heated, the pitch melting, and it is afterward moulded under heavy pressure into bricks weighing about 15 pounds each. This fuel Mr. Prime states to be a steaming coal of uniformly high average. During 1876 it was supplied to six railroads in New York and Connecticut, eliciting favorable reports from all. On the Hudson River Railroad the economy in its favor was estimated at about 15 per cent.

## SILVER IN ART.

In a short but interesting article on this subject in the *International Review*, Mr. Edwin C. Taylor has described a few of the more novel methods of ornamentation of silver that have not yet become generally familiar. And, by the way, the author expresses it as his opinion that in view of the fact that the yield of this metal in our own country is destined, for years to come, to be greatly in excess of the natural demand, it would be far better to divert it to the uses of art than to make it the means of striking a blow at our national credit. In view of the late action of Congress, however, it would seem that our legislators are uot disposed to regard metallurgy from an æsthetical standpoint.

Conspicuous among the newer methods of ornamentation of silver is that of inlaying with niello, somewhat after the manner of the *Champlevé* enamel, and similar to the much admired Russian work at our Centennial Exhibition. The art of applying this enamel was for a long time regarded as a Russian secret, although the metallic oxides, of which it is composed, were well known to our metallurgists, and it has lately been successfully employed by craftsmen of Paris and London. This valuable ornamental agent was developed in America only last year, and its use in connection with silver offers the greatest advantages, from the fact that it can be worked with equal facility in mass or in the most delicate lines. Niello, unlike the vitrified enamels used in *Cloisonné* ware, will bend with the body in which it is inserted, and is therefore not liable to destruction through fracture or abrasion. In connection with this very flexible composition, pure metals, such as copper, iron, and gold, are also inlaid by an ingenious process, so that it is possible to obtain a durable surface possessing the beautiful polychromatic effects that were but lately produced only by superficial methods of decoration, such as electro-plating and oxidation.

Another method of silver ornamentation, which has proved to be susceptible of rare delicacy of treatment, is that styled *Appliqué* work.

In this process each ornament is first separately wrought in the same manner as a piece of jewelry, laid upon the surface to be embellished, and held in place by ligatures of fine wire, while a careful blast from a blow-pipe directed upon it secures perfect fusion between it and the original body. In this way Japanese figures of birds, fishes, foliage, and Persian ornamentations of floral and other decorations may be admirably treated. By this process of applying raised ornament, too, another feature of decoration is introduced, which, until the current year, has never been known outside of the curious workshops of the jealous Japanese, into whose precincts the foot of the "barbarian" is never allowed to enter, nor his eye to peer.

The material used in this process may be call "Japanese alloy," and it is applied in the manner described in regard to raised ornaments of silver. This alloy is composed of certain metallic substances that are capable of receiving and retaining various shades of color, such as blue-black, gray, yellow, brown, violet, and vermilion, used separately or together, or mixed with gold. "The opportunities for metallic decoration which this wonderful and highly valuable compound affords are vast indeed, and render it easy to present the gorgeous plumage of birds, and all the beautiful hues which the wealth of nature yields, in the durable form of metal objects." The discovery of this secret in metallurgy is the result of a long series of patient experiments, and its development will be watched with great interest by those who are accustomed to follow the progress of American industrial art. It is said that the use of this alloy, yet in its infancy here, "is likely to result in the production of rarer and costlier art objects of silver than modern art has known, and the chryselephantine treasures of archaic times will doubtless be rivaled by the many-colored products of American workshops."

In conjunction with the various kinds of ornamentation, a very peculiar and quaint effect is sometimes produced by leaving the entire surface of the object impressed with the dints of the hammer. This finish imparts an appearance not unlike that seen in the Chinese "crackle" pottery. Sometimes the objects are indented with an edged hammer horizontally, so that the lines appear like waves of water. And in connection with this, a very novel and pleasing effect is produced by the introduction of raised figures of fishes and marine plants.

In noting these novelties in connection with the development of metallurgy in our country, it is gratifying to feel that we possess artisans of such skill that no foreign secret processes are beyond their power of grasping, and that our people have the taste and the will to encourage their efforts.

## FORMATION OF PLANETARY RINGS AND SATELLITES.

According to the great nebular hypothesis of Laplace, the planets owe their formation to the abandonment of zones of vapors which the primitive solar nebula left at the limits of its atmosphere, when, through the effect of cooling and contraction, the velocity of rotation of the mass progressively increased. These rings of vaporous matter ultimately condensed into separate nuclei, constituting the planets, which consequently at the beginning had the same constitution as the solar nebula. "In this state," says Laplace "the planets perfectly resembled the sun in nebulous condition," and they became rings and satellites circulating around their primary in the same direction as the movement of rotation of the latter, and turning on their own axis also in similar direction. All bodies which circulate around a planet having under this hypothesis been similarly formed by zones which its atmosphere has successively abandoned, and its movement of rotation having become more and more rapid, the duration of this movement should be less than that of the revolution of these different bodies, as in the case of the sun as compared with the planets. All this is confirmed by observation."

This at the time when Laplace wrote was true. The movement of the moon, for example, is 28 times less considerable than that of the earth's rotation; the first satellite of Jupiter, nearest to the planet, revolves in 1¾ days, and its movement is four times less rapid than the rotation of Jupiter, which occurs in 9 hours and 55 minutes. Mimas, the satellite of Saturn, having the shortest period of revolution, about 23 hours, moves in more than double the time required for the rotation of the primary, and even the nearest brilliant Saturnian ring turns about $\frac{1}{10}$ of a day less rapidly than the planet itself. All this accords with Laplace's law.

The newly discovered satellites of Mars render the system of that planet analogous to that of Jupiter, Saturn, or Uranus. But the first satellite of Mars, the distance of which from the center is 2·7, or less than three times the radius of the planet, makes its siderial revolution in a period of about 7½ hours only, three times less rapidly than the rotation of the primary is accomplished.

M. Edouard Roche has recently published an essay wherein he advances a new theory to account for this remarkable anomaly. He considers that during the contraction of a nebula there is not merely, as Laplace suggests, an abandonment of exterior rings, condensing at the equatorial limit where the central attraction equilibrates the centrifugal force. The portion of the nebula, he says, which becomes free at each new stage of cooling comes from a fluid layer which extends to the poles, and which is diverted on both sides, to meet finally outside by the equatorial line as by a sort of opening. It results that in flowing to the equator, one part of this nebulous matter arrives there with too low a velocity to allow of its circulating internally. The result of this is, that instead of separating from the nebula to form exterior rings and later satellites analogous to those known, this matter, re-entering the atmosphere of the nebula, forms there interior rings, which, at first describing more or less elongated ellipses, end by being transformed into circular rings. One part of Saturn's rings appears to be due to this mode of formation, and the same theory is advanced as accounting for the anomaly observed in the first satellite of Mars.

### The Lighthouse Board.

The decease of the distinguished Professor Henry left a vacancy in the United States Lighthouse Board, which has lately been filled by the appointment of Professor Henry Morton. This gentleman is well known in the scientific world for his experimental researches and discoveries in connection with light and the appliances for its production. His appointment will give very great satisfaction.

As President of the Stevens Institute of Technology, Hoboken, N. J., he has conducted the affairs of that institution with judicious skill, and has evinced the possession of executive abilities of a high order. He was, in fact, the organizer of the institution, which under his auspices has come to be widely celebrated for excellence.

The lighthouse system of the United States is under the control of a board of seven persons, consisting of two naval officers, two army officers, two civilian scientists, and a naval secretary. The Secretary of the Treasury is the President of the Board and controls all its decisions. But we cannot doubt that the influence of Professor Morton will prove useful to the Board, by helping to renew its vigor, and perhaps by assisting to increase the luminosity of some of our lighthouses.

### American Society of Engineers.

The tenth annual convention of the American Society of Civil Engineers will be held at Boston, beginning Tuesday, June 18, 1878. The list of topics to be considered is a long and interesting one, and the programme includes a number of excursions to points of professional interest in and about Boston. The meetings of the convention will be held in the hall of the Massachusetts Institute of Technology.