

IV.—On the Nepalese Method of Refining Gold. By Dr. A. CLARKE
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Gold dust to the amount of two lakhs of rupees or more is annually imported from Tibet into Nepal. It is not reckoned pure, and is bought from the Bhooteahs by the dealers in Katmandu for about 15 rupees per tola. The greater part of this gold is required for consumption in Nepal. A small portion of it for the Government mint, and the remainder for making female ornaments†, as well as chains and lace for the officers of the Gorkha army, who ornament their turbans with handsome and massive chains, embroider their regimental jackets most richly, and mount their swords and *kukries* with the precious metal, to a degree highly detrimental to the purse, but eminently advantageous in making a display of splendour so grateful to this enthusiastically military people. The process of refining is tedious, but not expensive, nor attended with much loss of the metal: it forms a separate occupation for a few individuals, but is for the most part performed by the purchasers themselves—and is, although rude, supposed to be very effectual, as gold can be purified through its means to an extent that raises its price from 15 to 24 rupees per sicca weight or tola.

The first step of the process is the melting of the dust, when it is cast into uniform plates about the thickness of writing-paper, and a little larger than playing-cards; in this state it is as impure as when in the original form, unless as is sometimes the case, insoluble and insulated particles of sand are mixed with it, which of course become separated during the melting. The plates, if cast too thick, are beat out to

* Nepal currency, about 13 Sa. Rs.

† Every Newar woman who can afford it wears a bar of plain gold suspended by a ribbon from the neck; it is of a lozenge shape; and weighs generally from two to four tolas. Besides this, the most favorite ornament is a massive gold ear-ring, not suspended from the lobe, but worn in the upper part (helix) of each ear; it is shaped like two cones with a connecting bar. One of the cones unscrews, and when the bar is passed through the perforation in the side, it is screwed on again. These ear-rings cost generally from 30 to 50 rupees.

‡ Short sword, peculiar to the hills, and worn constantly by every Parbatiah, great or small.

§ Every commissioned officer has his turban nearly covered with gold chains, tastefully arranged; added to this he wears the distinguishing mark of his regiment, which is a small plate of gold worn in the front of the turban. Some corps wear a crescent to represent their "moon-born lineage," others carry the "Lion of England" above their brows. And every soldier of the Katmandu force wears the same of silver alone or gilded. The embroidery so thickly laid on the officers' coats comes mostly from Benares.

the requisite degree of thinness, and treated in the following manner:—The refiner having selected from some ancient ruined building the oldest bricks he can find, and pounding them into fine dust, proceeds to make up his masala or flux, which is of two kinds: in both the old brick dust predominates, and is considered indispensable to the efficacy of the process. One of the mixtures consists merely of brick dust two parts, of common salt one part, intimately mixed up, and pounded together: the other and best one is composed of brick dust two parts, muriate of soda (salt) one part, borax $\frac{1}{2}$ part. The plates of gold being previously smeared over with mustard seed oil, are piled upon one another to the number of 80 or more, between each pair a thin layer of the above cement being placed. Thus treated, the pile of plates is laid on a smooth and hard earthen floor, and covered with a heap of dry cow-dung (*gobar*), which being set fire to, is allowed to burn slowly to ashes, care being taken that but a limited supply of air has access to the fire; to insure this necessary measure, the process is always carried on in a close room—by which means the fire is so slow and weak, so that fusion of the metal cannot possibly take place. The usual time occupied by the burning of the heap of cow-dung is about 20 minutes, after which, when cold, the plates are removed, and examined. The colour, softness, and shade of yellow left on the touchstone being the guides to their degree of purity.

The process is generally repeated three or four times only, when the ore operated on is tolerably pure, or where only inferior gold is wanted; but is repeated as often as 20 times, when the dust has been of the white* or worst kind, or where good dust is under operation, and the purest gold called *kundan* is required. The plates purified as above described are melted, and cast into small bars, in which form the metal is bought for making ornaments, &c. The dealers have acquired a wonderful degree of correctness in estimating the value of gold through the tests resorted to by them for this purpose. The touch-stone† is the chief one employed, but they rely mainly on the appearance and weight of the metal. They do not use scales, but by merely taking a bar in the hand, experience enables them to give from its weight, a wonderfully correct estimate of its value; and he who would expect from using a hydrostatic balance to outwit the native dealer, will find himself fairly and equally matched by the trained fingers and experienced ken of the Katmandu merchant.

* Most probably having a considerable portion of Tellurium (silver?) in combination with the gold.

† The sacred Saligram is the one most used here; they are very common, which may account for their being employed for profane purposes.

The natives are in total ignorance of the rationale of this process, and I regret that I can only conjecture it, being unacquainted with the matters most commonly combined with the gold of Siam, or forming its matrices.

Note to the above paper. By J. P.

The process described by Dr. CAMPBELL is precisely that employed throughout India, and no where more frequently than in Calcutta. I took occasion myself to notice it in the Oriental Magazine for June 1827, for the purpose of pointing out a material error in many manuscript copies, as well as in the English translation, of AVON PARK'S description of the same operation. As the passage alluded is short, and the work containing it, now out of print, I venture to subjoin the passage:

"In GLADWIN'S translation of the Aysen Akbery, there is an account of the native process for refining gold, in which it is mentioned, that a composition of 'equal parts of saltpetre and brick-dust' is spread between the plates of gold, which are then heated red hot, &c.

"As it is well known to chemists, that the ignition of such a mixture would only disengage nitric acid, the very acid which is actually used in the European method of refining in the humid way, this passage is calculated to mislead even the scientific reader. The mixture really used by the native refiners is composed of equal parts of common salt (muriate of soda) and brick-dust, just in the same way as is practised in Europe, in what is termed the dry method of refining. The rationale of the process is, that muriatic acid has the power of dissolving silver and copper at a red heat, and the muriates, being volatile, quit the surface of the gold plate as soon as they are formed, giving place to a fresh action from further acid, until the gold is rendered perfectly pure. The muriate of silver is not decomposed, unless some free alkali be present. Now, nitric acid will quit all its bases at a red heat, and is itself incapable of acting upon silver at that temperature, although it will assist in oxidizing copper and other metals: saltpetre is indeed frequently used in purifying silver. There is then evidently some mistake, and if so, is it attributable to the translation, or to the original work, which is so accurate and particular in most of its details? For the purpose of deciding this question, several old manuscript copies of the Aysen Akbery were examined. In one the expression was simply *shorah*, which agreed with the translation. In another it was *shorah i khah khah*, the saltpetre of half-burnt bricks:—at last, in an older manuscript, the true original reading was discovered, which proved to be *simah shorah*, coarse bitter-sour, mon salt, such as is given to cattle. The ignorance of copyists had imagined perhaps that the word *simah* was redundant, mistaking *shorah* for a substantive, as though it were written "salt of saltpetre," and *simah* was therefore henceforward omitted. The ease with which the sense of passages in manuscripts may become varied is further evinced by the second example, where the original plain sentence of 'half of coarse salt, and half brick-dust,' has undergone two metamorphoses, and appears as merely 'the nitre of half-burned bricks.'

"Perhaps in this place, a brief account of the whole process will not be devoid of interest.

The gold to be refined, is beaten out into very thin leaves of $\frac{1}{2}$ inches square, each weighing about 100 grains. From 300 to 200 of these leaves are piled over one another, being first dipped in a mixture of oil and water, and then smeared over with a composition of three parts of fine old brick-dust, and one part of common salt.

A fire of cow-dung is made on the ground, upon which the pile of gold leaves is placed, and it is farther sprinkled with some more of the composition. Around the whole, a dome of cow-dung is raised, (see Pl. XXXV, fig. 5,) to which fire is applied; and the operator fans it with precaution, that the fire may not become too fierce, and melt the gold. The firing is repeated three times, after which the plates are separated and thoroughly washed. If the purification is to be carried further, another charge of the composition is interstratified with the leaves, and three more fires applied. Sometimes even the whole process is repeated three times. Bullion of 22 carats pure, is refined to 23 carats, by the first three heats. After six fires, it become 23 carats, $2\frac{1}{2}$ grains pure. The expence of the process is very trifling, and every part of the residue is saleable to the tender refiners, who extract the silver and copper.

"The heat employed, measured by a pyrometric alloy cupel, was below the melting point of silver."

In publishing Dr. CAMPBELL'S account, I have with permission omitted his reasoning on the rationale of the Nepal process, to make way for a brief notice of some recent observations by the celebrated French chemist BOUSSINGAULT*, whose experiments have led to a more accurate knowledge of the subject than was before to be met with even in the best works. This chemist had an opportunity of witnessing the art, now so completely exploded and obsolete among Europeans, in the mint of New Granada: "Certes c'était," he writes, "une circonstance des plus piquantes, que de me trouver au milieu de cette métallurgie du 16ème siècle, non-seulement d'observer ces fourneaux compliqués qui rappelaient la philosophie hermétique, mais encore de les rencontrer, scientifiquement parlant, avec des hommes de cette époque. On croyait voir des chimistes qui venaient de se réveiller après avoir dormi pendant trois siècles."

Instead of beating the gold into fine leaves, as in India, the practice at Santa Fé is to granulate it, and dispose the grains in porous earthen vessels, in alternate layers with a cement made of two parts of brick and one part of sea salt. The layers of cement are an inch thick; each pot holds 10 or 15 lbs. of gold; and the cementation continues from 24 to 36 hours at a cherry-red heat.

To decompose or reduce the silver, which is retained as a chloride in the brick-dust, the cement is triturated with mercury and one-tenth of fresh common salt, in a humid state. The muriate of mercury is tumbled off and an amalgam of silver and mercury left behind, which yields a very pure silver, (known in the Calcutta market as *plata fina*.)

* In the *Annales de Chimie et de Physique*, vol. Lrv. 1833, page 263.