

## Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 34.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

### Metallurgy of Gold and Platinum among the Pre-Columbian Indians

WILLIAMS CURTIS FARABEE<sup>1</sup> refers to some finds of gold and platinum objects which come from La Tolita, Esmeraldas, Ecuador. During the washing process, in addition to the natural gold and platinum, a quantity of quite small gold objects were obtained, which bear witness to the surprising skill of the Indians, who used gold not only for ornaments, but also for many useful objects, which in the form of fishing-hooks, sewing needles, safety-pins, hooks and eyes demonstrate the existence of a true gold age. The use of gold extended even to nails, which, it is known<sup>2</sup>, are found but seldom in South America. In Antioquia, in Columbia, which lies to the north, objects are found made particularly of the gold alloy (copper 50, gold 33, silver 12 per cent) which is known as 'tumbago'<sup>2</sup>; but the La Tolita gold is of an essentially different composition, and the metal is often alloyed with platinum, obviously with the intention of producing white alloys.

There is a certain mystery about this find; what has especially aroused surprise is that the prehistoric Indians were able to prepare platinum in a compact state, so that they were able to use it not only for jewellery (nose rings) but also as a coating for gold; for small plates have been found with an upper side of platinum and a lower side of gold. Yet it is quite impossible to melt platinum by primitive means.

Some new finds which I have had the opportunity of studying very thoroughly seem meanwhile to throw light on these problems. It is to be observed first and foremost that, among the thousands of small objects, not a single one which has been cast is to be found; all are either wrought or made from plate or wire. Furthermore, it is remarkable that the use of solder cannot be demonstrated with any certainty; all joints were made by welding. Cold-hammering was used obviously for the sake of greater hardness, as Erland Nordenskiöld<sup>2</sup> has demonstrated for other pre-Columbian copper, bronze and gold tools. Investigation of the hardness is now in progress.

Silver does not seem to have been known at this place; the silver content of the alloys investigated does not exceed what can be assumed to occur naturally along with the gold. On the other hand, the gold is very often alloyed with copper; in one piece of gold which has been found, the melting was not altogether successful and a piece of copper which was added and has not quite been melted can be seen. What makes the new find so interesting is the presence of a quantity of work which has just been begun or is half-finished, which makes it possible to follow all the processes right from the mixing of the metals to the melting, forging and finishing. A number of round flat pieces of gold, of 1-20 gm. weight, are sharply distinguished from natural gold partly by their composition and partly by their

appearance, for their surface shows a number of crystals laid bare by liquation.

These articles have obviously been melted on wood charcoal with the help of a blowpipe; the use of this instrument is known from other places in South America<sup>3</sup>. On the lower side, they often have an impression of the grain in the charcoal. An equally large number of these pieces have been wrought, some into flat plates and some into small cubical pieces or into long bars. Three pieces have been used for wire-drawing; for they have been wrought in such a way that the ends could be clamped with the help of wedges, and then a wire could be made by drawing. The wire could be softened by heat and then drawn out further. Drawing through a hole could certainly not have been employed. The thickest wire found is 2 mm., the thinnest 0.1 mm.

Most interesting of all is the method by which the Indians were able to get the small platinum grains into a coherent form. Analysis showed that the platinum objects found do not consist of pure platinum, but that they contain about 30 per cent of gold in addition to the silver contained in the gold. Some of the small pieces of platinum ore more or less sintered together show the procedure to have been as follows: the grains of platinum were mixed with a little gold, which sealed them together during the melting. It is a well-known fact that during continued heating the molten metal diffuses into the unmelted, which partly dissolves again in the melted one. The result is a mass sintered together, which during subsequent alternate hammering and heating eventually becomes so homogeneous that it can be wrought into plates or other objects. Such plates can afterwards be welded on to a piece of gold, and the pieces welded together can finally be beaten out into quite thin plates.

These investigations are being continued, and further reports will be published shortly.

PAUL BERGSØE.

Copenhagen.

Nov. 27.

<sup>1</sup> *Museum J.*, Philadelphia, March 1921.

<sup>2</sup> Erland Nordenskiöld, "Comparative Ethnographical Studies", Gothenburg, vols. 4 and 9.

<sup>3</sup> P. Rivet, *J. Soc. des Americanistes*, 15, 185 (1923).

### Inhibition of Homogeneous Reactions by Small Quantities of Nitric Oxide

THERE is convincing evidence that some chemical changes take place by a mechanism involving reaction chains of considerable length, and equally convincing evidence that in other reactions no such long chains occur. Nearly every chemical reaction, however, starts by the activation of certain molecules, that is, by considerable highly localised thermodynamic fluctuations, and in principle it is possible