



**GEUS**

## Borax replacing mercury in small-scale mining

Millions of small-scale miners all over the world use mercury to extract gold. Every year thousands of tonnes of mercury are released into the environment where it causes serious and long lasting damage to health and environment.

Small scale miners often use whole ore amalgamation or repeatedly mill the already processed gold ore in order to increase recovery. Milling the mercury produce mercury flour which cannot coalesce and neither mercury nor the gold captured by the mercury flour can be recovered. Analyses of tailings from Tanzania and the Philippines did indeed show gold contents in discarded tailing up to 20 g per ton and 400 g of mercury per ton.



Mercury flour in tailing - scale 2 cm.

### Are there alternatives to mercury?

Several alternative methods to extract gold have been experimented. For instance, recycling devices have been invented some of which actually do reduce the release of mercury.

One method – however - makes the use of mercury totally redundant! The so-called bo-

rax method has been used by thousands of small-scale miners for more than thirty years in the Benguet area north of Manila in the Philippines.

### Win-win for small scale miners and nature

The method is simple, inexpensive and does not require advanced technical equipment. Borax ( $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ ) is a component of many detergents. Its use in gold extraction is environmental benign.

The basic principle behind the method is that borax reduces the melting point of all minerals, including gold. The melting point of gold is  $1063^\circ\text{C}$ , which is a much higher temperature than can be obtained by inexpensive burners. By adding borax to the heavy mineral concentrate the melting point temperature decreases permitting small-scale miners to melt gold out of their concentrate. By using borax no mercury flour is produced, hence gold recovery increases.

### The borax method - step by step

*Grinding.* Gold ore is crushed, milled and sluiced.

*Washing.* The milled ore is “washed” in a traditional gold digger’s pan in order to concentrate the heavy minerals including gold. The final concentrate shall have a high proportion of gold.

*Mixing.* The mineral concentrate is mixed with three times (by volume) as much of borax. The borax-heavy mineral concentrate is thoroughly mixed in a small plastic bag with a few drops of water.



Mineral concentrate in a plastic bag is mixed with borax and a few drops of water.



Melting is finished: The shining gold pellet in red glowing molten borax.

*Heating.* The plastic bag is placed in a pre-heated ceramic bowl. The heating can be done in two different ways:

- Charcoal is ignited and burning is increased with a hand held blower.
- Heating can be done by means of an acetylene flame in which case charcoal is not necessary.

*Extraction.* After a short while the borax melts and further heating for a few minutes will melt the heavy mineral concentrate. The molten gold drops concentrate in the bottom of the bowl. Heating is stopped and the shining gold pellet can be removed by the tip of a knife.



The plastic bag is placed in a ceramic bowl with charcoal and heated. Heating increased with hand powered blower.



The final result: A pure gold pellet produced without use of mercury.

#### **Advantages of using borax to extract gold**

The main advantage is that borax is environmentally benign. A second advantage is that it recovers much more gold. The reason for reduced gold recovery by using mercury is formation of mercury flour as described above.

The borax process is described in detail in an educational video which can be viewed at:

<http://youtu.be/X6Sawj0HyF0>

#### **Further information**

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