

10: Borax – early smelting of gold



Figure 25. BORAX SMELTING
Smelting concentrate to recover gold in the Philippines. (photo: Peter Appel of GEUS, Geological Survey of Denmark and Greenland)

‘Early smelting’ is possible on unclean concentrate to recover fine gold that might be lost if upgrading were to be attempted by amalgamation or gravitational means.

The ‘early smelting’ method of recreational miners is described at www.nuggethunters.org [46,47]. The ore is screened or milled at 2mm and the black sand soaked in acidic acid for couple of days to help break down sulphides, then carefully dried. The flux is of anhydrous borax $\text{Na}_2\text{B}_4\text{O}_7$ (5 parts), #70 silica sand SiO_2 (40 parts), soda ash Na_2CO_3 (10 parts) and sodium nitrate NaNO_3 (20 parts) as oxidizer. The ingredients are mixed and stored in a container and kept dry.

Flux (1-2 parts) is added to the concentrate (1 part) and mixed well. The mixture is spooned into the crucible and dampened with rubbing alcohol. The mixture is fired by the acetylene torch up to 1,100°C and the heat kept until the mixture is molten and a bright yellow white.

The molten material is poured into a cast-iron mould, requiring special clothes and care [46,47,48].

Operation

The artisanal method of ‘early smelting’ is reported by Peter Appel from the Philippines, and outlined below.

Hardrock ore is first crushed and milled. The milled ore is then subjected to gravitational separation to produce a black sand concentrate with visible gold.

The concentrate (one part) is dried carefully and then mixed in a very small plastic bag only a few centimetres in size with borax (three parts). After mixing, a few drops of water are added.

The plastic bag in put in a pottery bowl serving as a crucible, and positioned tilted on a few pieces of charcoal.

The mixture of borax and heavy mineral is heated by a blow torch. The blow torch is gasoline fuelled, is very cheap and already used by the artisanal miners for burning amalgam. The heating continues until first the borax melts and later the gold melts.

Borax depresses the melting point of gold. The molten gold is heavier than the other heavy minerals which float off as slag to leave a nice gold pellet.

The entire process only takes a few minutes.

Adoption by placer gold miners

‘Early smelting’ assisted by borax has been used for many years by small-scale gold miners in the Benguet area north of Manila in the Philippines as an alternative to mercury or cyanide. Elsewhere borax-assisted smelting is sometimes used by artisanal miners, but only after mercury amalgamation or cyanide leaching.

Smelting assisted by borax is common among recreational and industrial gold miners in North America, Russia and Mongolia upon concentrates that are clean. But ‘early smelting’ is advocated for recreational miners by www.nuggethunters.org [46,47] for recovering fine gold from concentrates that are not particularly clean.

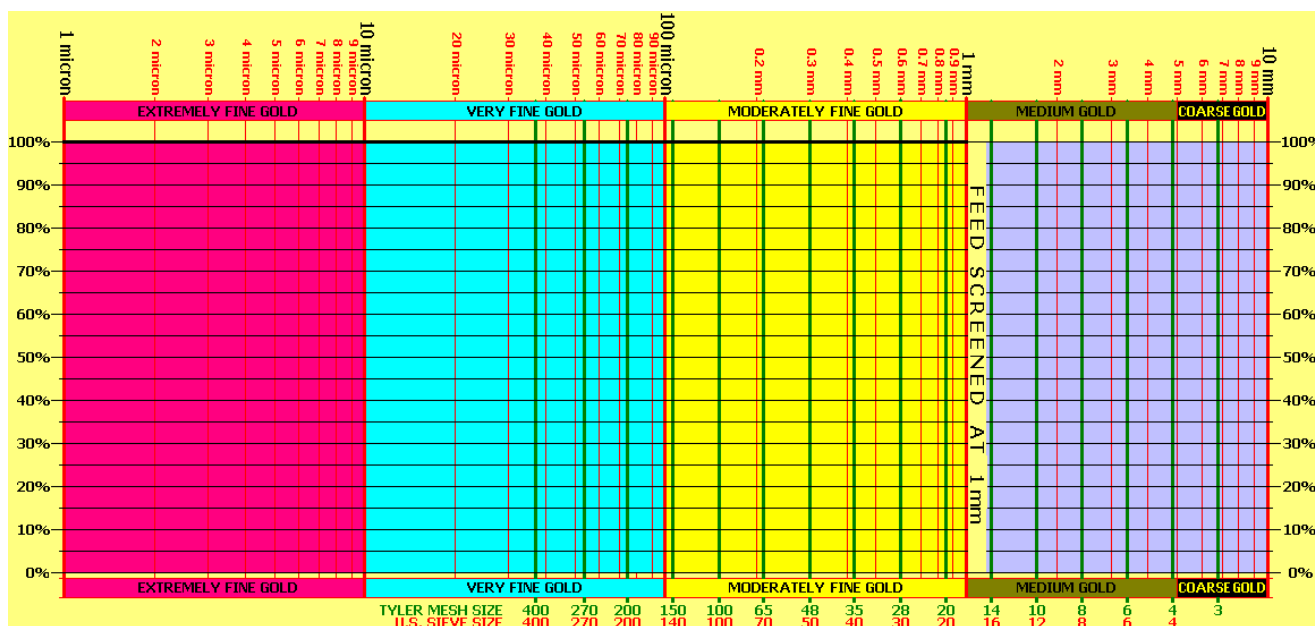


Figure 26. GOLD RECOVERY BY SMELTING WITH BORAX
Smelting with borax can recover fine gold, but usually only from a clean concentrate. (compiler: Robin Grayson)