

1: Mercury – amalgamation of gold



Figure 13. MERCURY-GOLD AMALGAM
Soft bead of HgAu amalgam ready for firing off the mercury to leave gold. (photo: Peter Appel of GEUS)

Until 50 years ago, mercury (Hg) was the method-of-choice for industrial-scale recovery of hardrock gold, and to a lesser degree for recovery of placer gold also.

Since then, with the increased recognition of the harmful impact of mercury on human health and ecosystems, mercury use by companies and recreational miners has become strictly controlled and in some regions banned and eliminated. Mercury has been virtually eliminated in industrial placer gold mines in the USA, Canada, New Zealand, Australia, Russian Federation, Kazakhstan, Kyrgyzstan and Mongolia. Yet mercury is prevalent in large placer gold mines in South/Central America, Africa and China.

Companies shun mercury for six interlocking reasons:

- ✘ human health of employees and local people;
- ✘ environmental protection;
- ✘ insurance risks and liabilities;
- ✘ legal prohibition;
- ✘ viable alternatives to mercury now exist; and
- ✘ mercury is ineffective at recovering gold < 70µ [12].

Operation

Mercury is sourced from on-site recycling of waste plus mercury from traders from Hg mines (e.g. China and Kyrgyzstan) and Hg waste exporters (e.g. Spain and USA) [20]. In Mongolia some is sold by panners recovering mercury [29,30,31]. Mercury is added in four situations:

- ✘ adding Hg to a milling device (e.g. Muller mill = edge mill) to capture gold and leave amalgam in the milled residue;
- ✘ adding Hg to a pan, sluice, centrifuge, Hg-centrifuge (forced amalgamator) or other device to assist the capture of gold;
- ✘ adding Hg to concentrate to recover gold without the time and trouble of upgrading the concentrate further; and
- ✘ adding Hg to devices to recover gold lost to the tailings.

Mercury amalgamation typically recovers in excess of 90% of the gold content of a placer gravel or placer concentrate. Mercury amalgamation is effective only for gold particles larger than 60-70µ [12]. For mercury amalgamation to be effective, preconditions apply:

- ✘ the gold particle must have a clean surface available;
- ✘ mercury must be put in direct contact with the gold particle;
- ✘ mercury must be clean enough;
- ✘ the gold must be already liberated from the matrix, OR
- ✘ the gold has its surface exposed to adhere to the mercury.

After amalgamation, the resulting lumps of amalgam are retrieved by squeezing out excess mercury through a fine fabric or chamois leather. The amalgam paste is retrieved by hand and the mercury driven off by heating to leave a residue of impure gold containing traces of mercury.

Adoption by placer gold miners

Mercury amalgamation is entrenched as the 'global norm' for gold recovery from concentrates by artisanal placer gold miners. Mercury has been eliminated amongst placer mining companies in the former Soviet Union and is highly restricted, strictly controlled and virtually eliminated in industrial and recreational placer mining in the west.

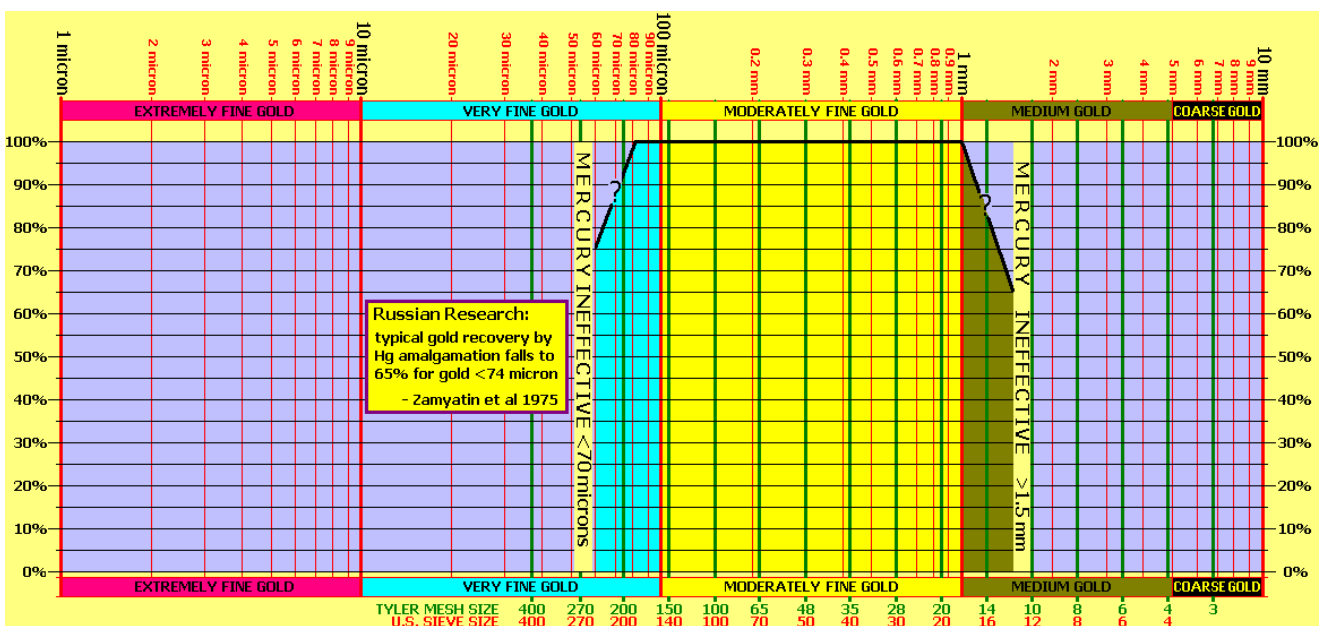


Figure 14. GOLD RECOVERY BY MERCURY AMALGAMATION
Mercury is ineffective at amalgamating with gold smaller than 70µ or larger than 1.5mm [12]. (compiler: Robin Grayson)