

40: Hydraulic riffles – 1980s research in New Zealand and Canada



**Figure 88. HYDRAULIC METAL RIFFLES**  
*A set of hydraulic metal riffles showing the manifold supplying the elutriation water under pressure. This set was manufactured by PAuSE Ltd in New Zealand. (photo: Robin Grayson)*

Hydraulic riffles appeared over a century ago. In their modern form they began in New Zealand in the 1970-80s. Lindsay Guy Herron of Queenstown invented compact hydraulic riffles patented in New Zealand (NZ #216,327, filed 1986, lapsed 1997) and the United States (US #4,863,588, awarded 1989, lapsed 1993).

A typical sluice box for hydraulic riffles is short and wide, contrasting with the long and narrow sluice box for conventional riffles. Hydraulic riffles inject pressurised clean water into the black sand from below. This keeps the bed loose and fluidised indefinitely, so gold particles continue to fall into the black sand and accumulate.

Randy Clarkson noted "...unlike conventional riffles that rely on the formation of vortices, hydraulic riffles rely primarily on the settling velocity of gold" [86-90]. In the Yukon tests, hydraulic riffles performed well at "extremely low feed rates" and "low water flows" but at high feed rates are "only suitable for coarse gold recovery (nugget traps)". The Yukon tests on hydraulic riffles were limited and the author is unaware of any other tests. They are unlikely to be as efficient as tuned conventional sluices in recovering fine gold, but have the overriding advantage of compactness for ease of low-cost mobile mining.

**Operation**

Washed pay gravel screened at 25mm is fed into the sluice box at a rate of about 25m<sup>3</sup>/hour of solids. Higher throughput is by two or more sluices in parallel.

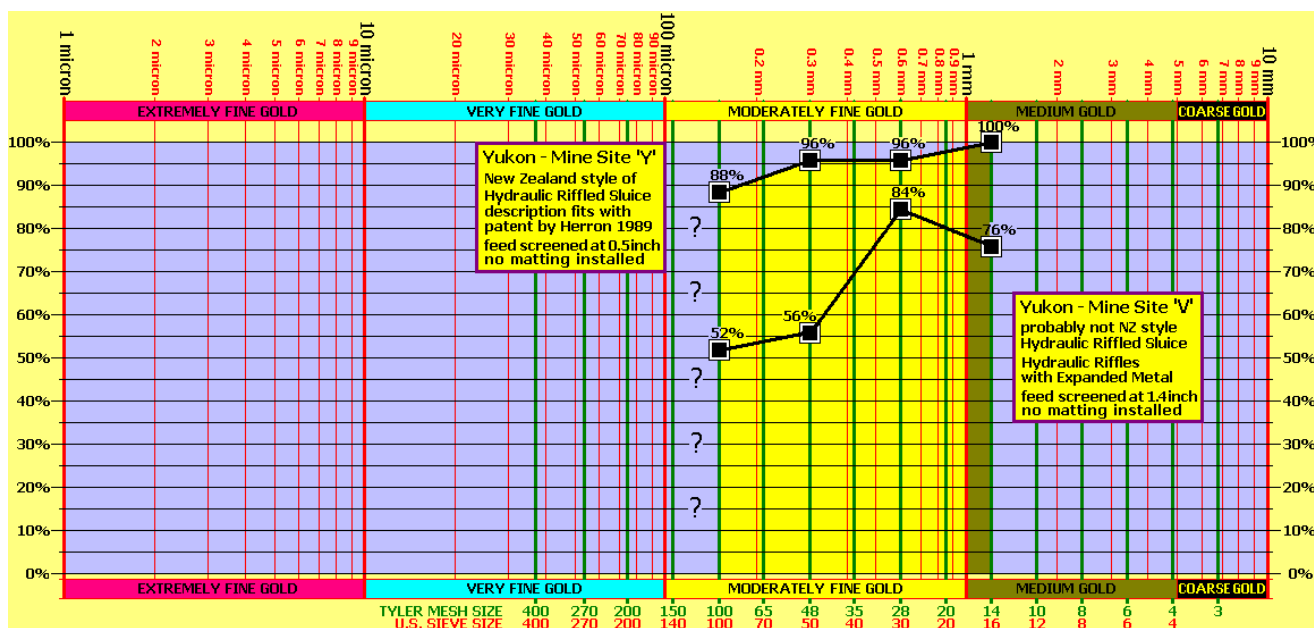
The slurry first enters a boil box that serves as a nugget trap, where the trap shape ensures turbulence to prevent clogging with fines, assisted by 9-13.5m<sup>3</sup>/hour of clean water injected at 15-35kpa pressure from a manifold. Exiting the boil box, the slurry passes over a slick plate to calm the slurry and engender laminar flow to allow the slurry to stratify with heavies concentrating near the bottom. After the slick plate the stratified slurry crosses the first set of hydraulic riffles where 32-48 m<sup>3</sup>/hour of clean water is injected 15-35kpa pressure from a manifold into the black sand to maintain a fluidised bed that traps the gold. The hydraulic riffles rest on unbacked Nomad™ matting to assist capture of gold.

The slurry continues over a second slick plate that encourages more density stratification and passes over the second set of hydraulic riffles to recover more gold.

Finally the slurry passes over an end section of raised expanded metal mesh that catches gold from the tails and helps to verify that the system is functioning properly.

**Adoption by placer gold miners**

Hydraulic riffles are popular in New Zealand, and have spread to the Yukon (Canada), Alaska (USA), Mongolia, South America, Australia and doubtless elsewhere. In Mongolia, the adoption of hydraulic riffles has been slow, but of the 200 or so wash-plants more than a dozen now have hydraulic riffles including: Cold Gold Mongolia Ltd (New Zealand); Ochir LG Ltd (British-Dutch-Mongolian [www.ochirlg.com](http://www.ochirlg.com)); Gatshuurt Ltd; Jump Ltd; Gazar Holdings Ltd; G&U Gold Ltd, and Barmash JSC.



**Figure 89. GOLD RECOVERY BY HYDRAULIC RIFFLES WITHOUT MATTING – Yukon tests**  
*Recovery of placer gold by hydraulic riffles one of NZ-style, the other unknown. (compiler: Robin Grayson from Clarkson 1989 [86])*