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Gold dredging in Mongolia - scope for less impacts and more profits

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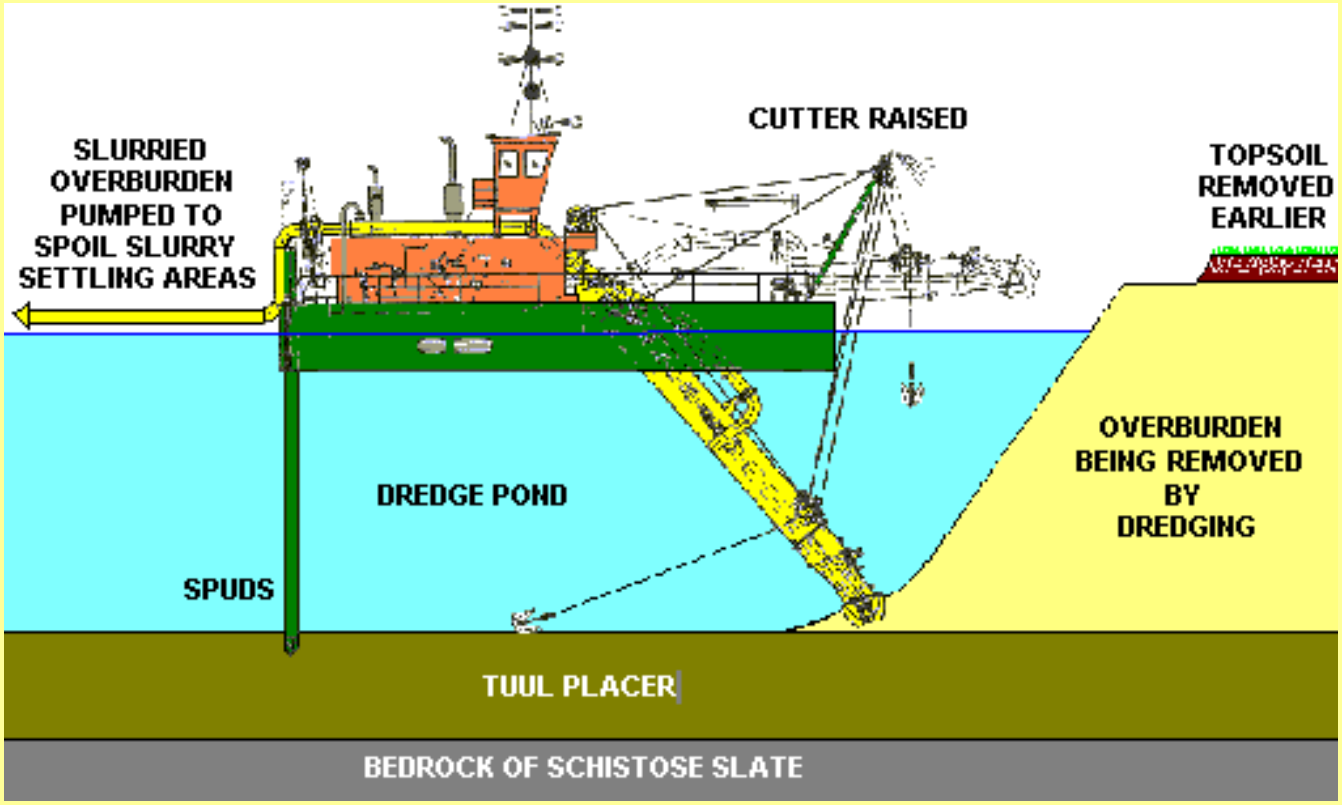

LOW-COST REMOVAL OF OVERBURDEN...

A Cutter-Suction Dredge, such as the IHC Beaver 4510 model shown above, is considered to be the best way of quickly removing thick overburden at low-cost. The Cutter-Suction Dredge turns the overburden into a slurry and pumps it a long distance to prepared spoil settling areas, with NO SPOIL MOUNDS created. In contrast, a Dragline creates steep spoil mounds, cannot excavate properly below water, and is 'stuck' on land.

ABSTRACT

Large gold dredges are now successfully established in Mongolia, part of the ongoing placer gold boom. Soviet-designed **Bucket-Line Dredges** with **On-Board Wash-Plants**, with Russian **Draglines** clearing the overburden in their path, continue to be highly profitable. Three sets are actively mining the giant Tuul Placer and a fourth is currently being assembled on site. In spite of the ongoing success, the Bucket-Line Dredges have a number of operational and environmental limitations, as described by **Bazuin, Grayson, McBride & Barclay (2000)**. Designs are based on dredges of 50 years ago that used mercury, a discontinued technique. The designs cause coarse tailings to be discharged on top of fine tailings giving an unnatural restored profile. Retroengineering is affordable to create a more natural profile. The dredges use the 'spud' system for steerage so the discharged tailings tend to accumulate in mounds, and conversion is not realistic. An alternative would be the addition of a swinging stacker to spread the discharged tailings more evenly. In spite of their success, the Bucket-Line Dredges could perform even better, as all 3 dredges have inadequate on-board wash-plants to fully disaggregate the gold-rich red clayey Ulaan Placer of Neogene age that underlies the easy-to-wash gravelly Tuul Placer. Large red clay balls rich in gold are therefore ejected with the oversize at the rear of each dredge and some of the smaller clay lumps probably act as gold robbers in the gold recovery systems. Three of the 4 dredges use Russian sluices of improved type and one uses conventional jigs. Recovery of fine gold would be much higher with 'sawtooth' jigs, and the dredges might boost production by 1 ton of gold a year between them. This would give a fast payback, but requires investment.

The overburden is stripped from the dredge path by a land-based **Dragline** but this creates severe environmental impacts, notably steep-sided high mounds of overburden. A second problem is that the draglines are unable to strip the overburden from below the water-table and expensive pumping still only allows a few metres below the water table to be stripped. Therefore there is no alternative but for the Bucket-Line Dredges to mine all the remaining overburden as well as the underlying placer. This exposes a weakness of the Bucket-Line Dredges in that the wash-plants are on-board and cannot be "switched off". i.e. all material dredged has to go through the wash-plants. In itself this is not a problem, but the rate of progress of the dredge is therefore reduced and the gold output less than it needs be. Barren overburden is washed, and the lack of operational flexibility prevents more intensive washing of the sticky red gold-rich paleoplacer.

The author presents a modern alternative, new to Mongolia, but common elsewhere.

In this alternative, the draglines are dispensed with entirely, and instead a **Cutter-Suction Dredge** is used to pump the overburden away as slurry to spoil settling areas. The settling areas can be up a kilometre or more from the dredge pond, and therefore the land-raising can abut the terraces and so the floodplain can later be rehabilitated as flushed water meadows and wetlands of considerable value to livestock and biodiversity. The alternative would be unsightly dragline mounds of overburden that, even if flattened later at considerable cost, would result in land raising of the floodplain due to the 'swell factor' that increases the volume of material after excavation by 30-50% initially and natural re-compaction is very slow and never fully achieved. The land-raised floodplain would therefore be of much-reduced value for livestock and biodiversity being an extra metre or more above the water level, and no longer flushed during floods. The reduction of flood storage capacity of the floodplain would alter the hydrology downstream and the overall channel behaviour. In contrast, the use of a Cutter-Suction Dredge offers the opportunity of creating significant stretches of open water and marshes to achieve substantial 'wildlife gain' if so desired.

For the removal of the placer itself, the author argues in favour of 2 alternatives to a Bucket-Line Dredge:

a) a **Wheel-Dredge**, which converts the placer into a slurry that is then pumped by pipeline to a pair of pontoon-based **Floating Wash-Plants**. The author notes several advantages of a Wheel Dredge over a Bucket-Line Dredge for mining placers, especially placers of variable character. Equally important, the use of Floating Wash-Plants allows the best configuration of scrubbers and gold recovery systems, and ease of undertaking repairs and modifications, without having the constraint of limited space on board a dredge. The discharge of the tailings would be as slurry, pumped on top of the oversize in order to produce a better subsoil profile. The use of Floating Wash-Plants allows the dredge pond to be a little longer, as the discharge

of tailings and oversize is further to the rear of the dredging operations, so reducing the risk of such materials being re-circulated by the dredge.

b) a **Grab-Dredge** which, as the name suggests, grabs a large mass of placer material, which is hauled to the surface and released into either an **On-Board Wash-Plant** or piped into a **Floating Wash-Plant** as the situation requires. The Grab-Dredge operates at speed and modern models are very efficient in energy. This type of dredge is particularly good at raising large stones up to small boulders in size that present difficulties to other types of dredge.

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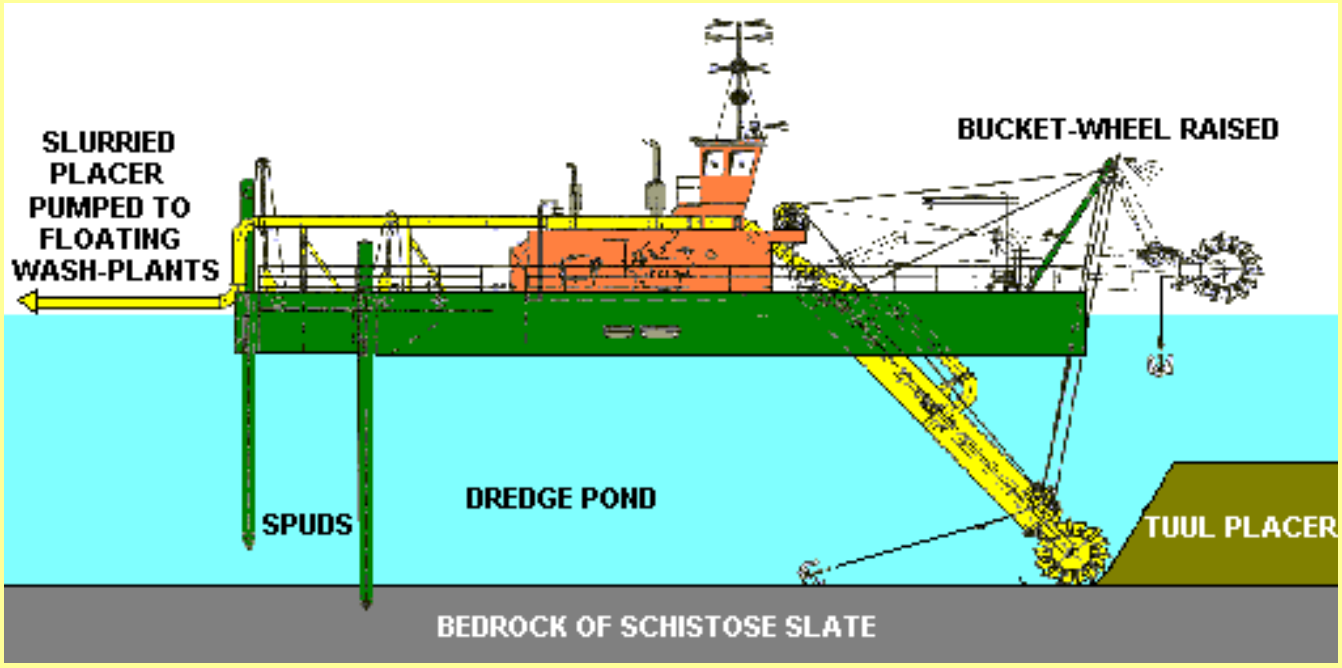

LOW-COST REMOVAL OF GOLD PLACER...

A Bucket-Wheel Dredge, such as the IHC Beaver model 4041W shown above, can remove a gold placer at great speed in spite of the small size of the dredge. The placer is turned into a slurry and pumped to distant Wash-Plants. A convenient option is to have a pair of Floating Wash-Plants on simple pontoons, some distance behind the Bucket-Wheel Dredge.

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