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The geo-ecological rehabilitation capabilities of dolomite on a pollution plume derived from a gold tailings storage facility - a myth or reality?

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In recent decades there has been a great deal of controversy surrounding the construction of new gold tailings storage facilities (TSF's) on dolomitic formations in South Africa. TSF's are considered as a fatal flaw by means of increased pollution impacts.

Dolomites consist of specific structural features such as fractures, joints and large cavities. These tend to make it one of the most vulnerable aquifer systems due to its ability to transmit large amounts of water and pollutants, and also with the risk of sinkhole formations.

The old Stilfontein Gold Mine TSF's located in the North West Province, approximately 30 km west-south-west of Potchefstroom and north of the N12 highway, can be considered as a "rule breaker" in this regard. The mining started in the early 1950's and ceased in 1992. Re-mining of the No. 2 TSF started in 2003 and was re-deposited on the No. 5 TSF.

The geology of the area is dominated by the dark-coloured chert poor dolomites of the Oaktree Formation with only a small outcrop of the lightly-coloured chert rich dolomites of the Monte Christo Formation in the south east of No. 2 footprint. Both these formations are subdivisions of the Malmani Subgroup of the Chuniespoort Group, which belongs to the Transvaal Supergroup. For a period of approximately 56 years the solid waste from the gold extraction plant was deposited on the TSF's on these dolomitic formations.

Long term monitoring studies which included soil, vegetation and groundwater investigations were conducted on a pollution plume derived from the No. 5 TSF on the land north of the TSF. The study revealed that the pollution plume diminished without any rehabilitation within a year after deposition was stopped. There was no evidence that suggested the formation of sinkholes in this area even though the area is dominated by dolomites. The study also revealed that the dolomitic soils have a high capacity to buffer and neutralise acid mine drainage. It therefore can be concluded that in some cases it is more viable to build gold TSF's on dolomites due to the natural rehabilitation capabilities of the dolomites and therefore reduce the long-term liability of these TSF's.

