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The use of fractal analysis for gold exploration in the Manica-Mutare-Odzi greenstone belt

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The Manica-Mutare-Odzi greenstone belt is a Late Archean linear feature that was formed at ca. 2.74 Ga. The ENE-trending belt is roughly synformal, with ultramafic metavolcanics along the margins and coarse clastic metasediments in the core. Shear zones separate individual lithological packages, which are intensely folded and have regional penetrative foliation.

The Manica-Mutare-Odzi greenstone belt has produced approximately 84 tonnes of Au. Gold has been produced mainly from shear zone-hosted deposits (12.36 g/t), fault-hosted deposits (23.51 g/t), and quartz vein deposits (10.07 g/t). Most of these deposits are steeply dipping and strike E-W to NE-SW.

Generally gold mineralization is controlled by multiple factors at a variety of scales. This complexity is due to the interaction of all factors in an area where each factor controls a specific type of deposit in a particular geological setting. The distribution of gold deposits can be explained by statistical-mathematical methods, such as fractal analysis that was applied in the the Manica-Mutare-Odzi greenstone belt. The approach in this study combines graphical, spatial, and statistical analyses for a description of the distribution patterns of gold mineralization. The results suggest that all gold deposits in the Manica-Mutare-Odzi belt can be treated as fractal dust and can be compared with results from similar study elsewhere in the Zimbabwe Craton. The values of the minimum fractal limits are interpreted as evidence of the spatial distribution or clustering of all deposits in the greenstone belt and can be explained by a single mineralizing process and small variations resulting from the different degrees of exploration and mining. There is also geological evidence that supports a structural control, where gold was transported by hydrothermal fluids and deposited in suitable sites.

