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The occurrence of ammoniosulphate minerals in abandoned gold mines of the Vredefort Dome World Heritage site, South Africa

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The Vredefort Dome is a 2023 million year old meteorite impact structures which exposed gold-bearing reefs of the Witwatersrand Supergroup in the centre of the Witwatersrand Basin. Most mining activities were abandoned around 1910 resulting in several open mine adits left un-attended for almost a century. The formation of acid mine drainage (AMD) in the environment around Witwatersrand gold mines has been established by various studies [1]. These abandoned mine adits, however, provide the opportunity to study the formation of AMD inside the mine void. The formation of AMD through the leaching of groundwater into the mine and the subsequent oxidation of pyrite in the host rock created highly acidic conditions in the mine void. Secondary mineral salts formed through evaporation on the walls and floor of the walkways some distance from the mine entrances. These salts included rare secondary minerals such as ammonium jarosite as well as tschermigite and loncreekite, known to form under highly acidic conditions in cave environments [2]. Tschermigite and loncreekite have not previously been described in an AMD impacted mining environment in South Africa. Interactions of typical cave microorganisms and the mineral environments within the abandoned gold mines lead to the precipitation of these ammoniosulphate minerals on host rock walls and floors of the mine walkways. The abandoned mine adits are nutrient-limiting environments containing a variety of redox interfaces. Ammoniosulphate minerals formed due to the interaction of the leached sulphate salts and ammonia. The ammonium in these minerals is considered to be of biological origin and linked to the large amount of bat guano and baboon faeces which built-up due to occupation of the mine adits over an extended period of time. The geomicrobiological interactions between sulphate salts and animal excrement (bat guano and baboon faeces) in a humid environment of abandoned gold mines of the Vredefort Dome World Heritage site is the focus of this paper.

References

- [1] McCarthy TS (2011) S Afr J Sci 107: 5-6
- [2] Martini JEJ (1983) Ann Geol Surv S Africa 17: 29-34

