Archean metasedimental rock and mafic/ultramafic altered intrusives in non-meteoric hypersaline brine environment at 3 km depth in South African gold mines.

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It is very critical for geo-microbiology to search for a biomarker of deep life or early life in Archean rock formations and in non-meteoric environments at great depths. We will introduce a crucial research spot in a deep gold mine in South Africa with the ever greater advantages.

South Africa has gold mines in Archean metasedimental rock formations at great depths, which provide very rich geological information obtained in-situ underground. Onstott and his team have focused on this and have been conducting groundwater and geo-microbiological studies at a number of South African gold mines since 1996 (e.g., Onstott 2016 "Deep Life").

Supported by ICDP, at the Moab Khotsong mine, South Africa, a total of 1.6 km of full-core drilling was carried out in 2017-2018 from 2.9 km depth below the ground surface (Ogasawara et al., 2007 Afrirock, 2019 Deep Mining; ICDP 2019, "The Thrill to Drill").

Drilling penetrated Archean felsic metasedimental rock formations (dipping at about 20 degrees to the southeast), and when the upper margin of the aftershock zone was reached, our Drilling intersected by an ultramafic altered dyke less than a few meters thick, followed by a core loss zone less than a few meters thick (where a small amount of altered clay or breccia was recovered). In addition to this altered dyke, the DSeis drilling also intersected the intrusives associated with the igneous activities in several generations, including the Ventersdorp Large Igneous Province (2.7 Ga) Super plume activity. One of them is roughly parallel to the ultramafic dyke hosting the aftershocks; instead, a non-meteoric hypersaline brine vein was found (Rusley et al. 2019 AGU). It was also rich in dissolved organic material of abiogenic origin (Rusley et al. 2018 AGU; Nisson et al. AGU 2019; Onstott et al. 2019). This hypersalinee brine was unique in its salinity and composition compared to any other brine that Onstott et al. had collected from other gold mines throughout South Africa since 1996. The microbiology team was about to begin studying it in detail. However, the microbiology team leader, T.C. Onstott, sadly passed away on October 19, 2021, and the DSeis team decided to name the dyke Onstott Dyke to honor him.

In JpGU 2022, there will be six reports apart from this talk, including an overview of the DSeis project (Session M-GI32) and a report on the differences in material between the ultramafic dyke hosting the aftershock zone and the Onstott Dyke (S-CG46 Oman Ophiolite session). Based on the latest outcomes reported in these sessions, I would like to talk about the advantage in geomicrobiological research in the South African gold mines, especially the holes and the recovered core of the aftershock zone and the Onstott Dyke (the core of which is currently being temporarily stored at the Kochi Core Center).

The DSeis team consists of seismologists, geologists, geomicrobiologisits, rock mechanists, mining engineers from Japan, South Africa USA, Switzerland, Germany, India, and Australia. The DSeis project is build on JST-JICA SATREPS project and Kakenhi (21224012) and is supported by ICDP, JSPS Core-to-Core Program, Ritsumeikan University, MEXT 2nd Earthquake and Volcano Hazard Reduction

Research, and Kochi Core Center.

Keywords: Archean metasedimental rock formations, Mafic/ulstramafic altered intrusives, At great depths, South African gold mines, Seismogenic zones

