The microbial diversity, chemical and physical properties in fissure water of the deep terrestrial subsurface of the Witwatersrand Basin, South Africa.

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While the atmosphere was still young (allowing high levels of ultraviolet radiation)[1] and the terrestrial surface was regularly under impact events, the deep terrestrial subsurface could have been the only niche for live.

During the last decade research has shown that the biosphere reaches at least 2.8km beneath the surface [2]. The research is primarily based on water bodies with a very low H2O activity, meaning that there is very little or no meteorological water flux into these systems [3]. There are numerous reports of bacterial activity in these environments and the development of appropriate aseptic sampling techniques proved the existence of microbes contained in the deep terrestrial subsurface. These investigations revealed the presence of intact cells and DNA in fissures incased in a 2.9 Ga impermeable rock strata at a depth of 3.3 km below the subsurface [4]. This suggests that these types of water bodies are self-contained and also that an autotrophic biotic system is sustained in these environments. These ecosystems are dependent upon chemical energy sources possibly derived from gas, water and rock interactions [4].

Investigations previously performed on the gold mines in the Witwatersrand Basin have raised some questions as to where the abundance of H2 [5] came from and what caused the persistence of acetate [3,6] in the fissure waters. There is still no conclusive explanation for this, but some hypotheses on this subject indicate that the presence of microbial activity is responsible for the acetate levels. Lin *et al* 2003, showed that the radiolytic cleavage of water is the most probable explanation for the high concentrations of H2 in these environments.

16S rDNA analyses are used to probe these microbial communities, since many of these organisms are unculturable. This 16S data together with the data from geochemical analyses are then correlated to determine the most viable metabolism for these organisms to conserve energy in the form of ATP.

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