Exploration Geomicrobiology – Developing bio-indicator technology for mineral exploration

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Abstract

Geomicrobiology is a relatively new approach for mineral exploration research; it shows promise as a means of enabling researchers to cheaply and quickly categorising microbes based on specific factors (geochemistry, underlying geology, regolith landforms, land-use, sample depth, geophysics (magnetic survey) and mineralisation). The research site is located at the Hillside IOCG-style deposit, Yorke Peninsula in South Australia. Above the zone of mineralisation and from background areas, DNA was extracted from the surface (0.03 m) and sub-surface (0.03 – 0.5 m) soils. Terminal restriction fragment length polymorphism (tRFLP) and multivariate statistical methods (nmMDS, CAP, Permanova, RELATE) were employed to analyse the relative similarities between soil communities of bacteria, fungi and archaea. The results of the experiment demonstrate that microbial community composition of the Hillside site can be linked to site relevant factors such as geochemistry, underlying geology, regolith landforms, land-use, sample depth, geophysics and mineralisation. Primarily, land-use and depth stand out as being the major factors driving microbial communities of bacteria and fungi ($P < 0.05$), with archaea showing no significant effect. Genetic richness was highest in bacteria and fungi surface soil samples. Significant differences ($P < 0.05$) were found in microbial communities between the different factors. Geochemistry and biological data sets can be linked together (RELATE). Non-metric multidimensional scaling was not sufficient to elucidate difference in factors between populations. However, using constrained canonical analysis of principal co-ordinates differences become evident. Geophysics, mineralisation and geology displayed some promising results but further research is

needed to gain a better understanding of the interaction of these factors with microbes.

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