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What can DNA tell us about microbial colonization of rock surfaces?

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The application of molecular biological techniques to characterise microbial populations that colonize rock and mineral surfaces is a new approach developed in our laboratory. Previously, Gleeson et al [2, 3] found significant correlations between certain species of bacteria and fungi and whole-rock geochemistry within a pegmatitic granite. Little is known however about the microbial populations associated with particular silicate minerals, or the extent to which the chemistry of the mineral and the surrounding micro-environment influences the structure of microbial populations. In this study we exploit the contrasting major element chemistry of three different minerals: muscovite, feldspar and quartz from several sampling points on a 10 metre scale pegmatitic granite outcrop to investigate the influence of mineral types on microbial and fungal diversity. Soils from directly above the rock outcrop were also analysed to understand possible links between the microbial communities that develop in soils and the underlying bedrocks. A DNA-based community fingerprinting approach (automated ribosomal intergenic spacer analysis) was used to assess the nature and extent of bacterial diversity. This molecular method discriminates to species or even to strain level, and offers geomicrobiologists the potential to match uncultivated microorganisms to particular biogeochemical reactions. The molecular biology approach was combined with major element chemical analysis and multivariate statistics: multidimensional scaling (MDS), canonical correspondence analysis (CCA), and analysis of variance (ANOVA) to identify the main geochemical factors influencing microbial community structure *in situ*. We found that the bacterial and fungal community structure is strongly influenced by mineral type, with many bacterial and fungal pop-

ulations limited to a single type, and to a much lesser extent by the sampling location within the outcrop. The length scales over which mineral type exerted a strong selection varied from a few cms to several metres. Thus adjacent minerals of different types from within individual rock samples were colonised by very different communities, whereas particular mineral types taken from widely separated parts of the outcrop exhibited similar populations.

References

[2] Gleeson, D.B., Clipson, N., Melville, K., Gadd, G.M., and McDermott, F. (2005) *Microb. Ecol.* **50(3)**, 360-368.

[3] Gleeson, D.B., McDermott, F., and Clipson, N. (2006). *Environ. Microbiol*. in press