Geophysical Research Abstracts,
Vol. 10, EGU2008-A-12408, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-12408
EGU General Assembly 2008

Microbial genomics, diversity, and biogeochemistry: describing the living Earth system

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The recent merger of advanced techniques in geology, geochemistry, molecular biology and microbial ecology is accelerating our understanding of the structure, function and dynamics of the living Earth System. New approaches in genomic technologies have allowed a more comprehensive assessment of the nature and distribution of genetic diversity, functional gene content, and biogeochemical pathways associated with natural microbial communities. Understanding the overlap between gene distributions, microbial distributions, and geochemical and environmental variation is providing unprecedented qualitative and quantitative insight into natural biogeochemical processes. Remote sensing, in situ geochemical techniques, isotopic analyses, genomic analyses, transcriptional analyses and proteomics combined are now poised to contribute new insights about global Earth system processes. As the quantitative impacts of man on biogeochemical cycling now rivals that of natural processes (that have evolved over billions of years), the need to understand the consequences of interacting anthropogenic and natural processes has never been greater.