

Organic carbon turnover due to sulfate reduction in Peru margin sediments

JENS KALLMEYER, TIMOTHY G. FERDELMAN AND
BO B. JØRGENSEN

Max Planck Institute for Marine Microbiology, Celsiusstr. 1,
28357 Bremen, Germany.
jkallmey@mpi-bremen.de, tferdelm@mpi-bremen.de,
bjoergen@mpi-bremen.de

During ODP Leg 201 and RV SONNE Leg 147 several sites along the Peru Continental Margin were sampled at high depth resolution from the sediment-water interface up to depths of 200 meters below seafloor (mbsf) for the determination of biological sulfate reduction rates. We used an improved, highly sensitive radiotracer technique for experimental rate measurements. Based on porewater concentration profiles of sulfate and methane we also modeled rates of consumption and production. The measured and modeled rates were compared and zones of high microbial sulphate reducing activity were identified. Buried organic matter was used as a carbon source at all depths where sulphate was present in the Peru Margin sediments. Methane as a carbon source was important only in relatively narrow depth intervals and its quantitative contribution to the total sulfate reduction was small. Although measured sulfate reduction rates ranged over three to four orders of magnitude at any given depth, an overall trend of decreasing sulfate reducing activity with depth of 7 orders of magnitude was clear. In contrast, the total number of bacterial cells (based on a fit of all censused acridine orange direct cell counts) decreased only three to four orders of magnitude over the same depth. This apparent mismatch between cell abundances and activities could be explained either through a change in community structure and/or per cell sulfate reduction rates. Assuming that the percent composition of sulfate reducing bacteria to the total cell counts remains constant over depth, we calculated per-cell sulfate reduction rates. Compared with per cell rates found in other ecosystems and in pure culture our calculations suggested that per-cell sulfate reduction rates in the Peru Margin are at the lower limit of what has been described previously.

Dependence of acidity of liquid media on the mechanochemically generated hydrogen

JUN KAMEDA¹, KAZUKO SARUWATARI² AND
HIDEMI TANAKA³

¹Department of Earth & Planetary Science, The University of
Tokyo, Japan (kameda@solid.eps.s.u-tokyo.ac.jp)
²(kazuko@solid.eps.s.u-tokyo.ac.jp)
³(tanaka@solid.eps.s.u-tokyo.ac.jp)

Since hydrogen gas anomaly was observed along active faults (Wakita et al., 1980; Sugisaki et al., 1980), it has been extensively discussed about the relation between fault /seismic activities and hydrogen gas behaviors (Sugisaki et al. 1983; Sato et al., 1986; Ito et al., 1998). The origin of hydrogen along an active fault is usually attributed to chemical reactions between crushed rocks and water. Although the dependence of temperature or rock species on hydrogen generation was experimentally evaluated (Kita et al., 1982; Sugisaki et al., 1983), no attention has been paid on the chemical feature of water. For the purpose of precise understanding of hydrogen behavior along an active fault, we especially focus on acidity of water and conduct wet grinding experiment under controlled pH conditions. In case of quartz, the amount of hydrogen rapidly decreased in acidic pH region below pH 5 while it was almost constant over pH 5. On the other hand, when biotite and muscovite was ground, pH dependence was negligible but quite large amount of hydrogen was generated. This is likely related with the existence of hydroxyls within their crystal structures. Based on the experimental results we discuss about natural examples of the relationship between the reported hydrogen concentrations and acidity of spring water near active faults.

References

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