Goldschmidt 2000
September 3rd–8th, 2000
Oxford, UK.

Journal of Conference Abstracts
Volume 5(2), 746

Microbes in the Hyper Alkaline Springs of Maqarin, Jordan, a Natural Analogue for Water/Cement Interaction

Emma Larsdotter Nilsson (emma.nilsson@gmm.gu.se)

Göteborg Universitet, CMB-Microbiology, Box 462, 405 30 Göteborg, Sweden

Cement and concrete will be major components in underground repositories for radioactive wastes. The presence of microbes can not be avoided in an underground repository since they will be introduced during its construction, as well as being associated with the stored waste material. Since both cement and concrete provide good surfaces for microbes to attach to, any microbes in a repository may attach to these materials and form biofilms. Due to the presence of cement and concrete in the repository environment the pH produced by water/cement interaction will be extremely high. Whether or not microbes are able to survive and grow in high pH repository environments is of great significance due to their influence on gas production, as geochemical mediators or catalysts, as potential retardation factors, or as transporters of radionuclides in advecting waters.

Maqarin, situated in northern Jordan, offers a unique opportunity to study the presence of microbes in hyper alkaline water up to pH 12.7. In earlier studies it has been established that some of the microbes found in Maqarin are tolerant up to pH 11 (West et al. 1992). Gene sequencing studies showed that the diversity and total number of bacteria are within the range of other subterranean sites, though none of the sequences found were typical for known alkaliophilic microbes (Pedersen et al. 1998).

During earlier studies no proof for microbial activity at pH 12-13 has actually been presented, neither has it been demonstrated that the microbes are *in situ* viable and growing. A hypothesis that some groundwaters at Maqarin were too extreme for active life, even for the most adaptable microbes, was proposed in by Pedersen et al. (1998). Through uptake experiments with ^{14}C and ^{3}H labelled organic carbon sources it would be possible to prove or overturn this hypothesis. The uptake experiments might be performed both with microbes in water and on introduced surfaces at pH above 12. Enrichment cultures with different carbon and energy sources would also give an idea about what kinds of microbes that are able to grow at these high pH's.

The first sampling campaign in Maqarin in November 1999 showed some indication of active uptake of carbon sources, especially glucose, at pH above 12 for both microbes in water an on surfaces. Enrichment cultures performed in Maqarin ground water from the same sampling campaign indicated presence of aerobic bacteria as well as anaerobic manganese, iron and sulfate reducers at pH above 12. A second sampling campaign is currently on-going (May 2000).

Pedersen, K, Arlinger, J, Erlandsson, A-Cand Hallbeck, L, *In: Maqarin natural analogue study: Phase III. Editor: J. A. T. Smellie. SKB Technical Report, TR-98-04*, **1**, 367-387, (1998).

West, JM, Deguelder, C, Allen, M, Breuetsch, R, Gardner, S, Ince, Sand Milodowski, AE, *In: A natural analogue study of the Maqarin hyper-alkaline groundwaters. I. Source term description and thermodynamic database testing. NAGRA Technical Report, 91-10*, (1992).