^{36}Cl: Tracer of perchlorate origin?

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Perchlorate is nearly ubiquitous in the environment, and occurs at trace concentrations in precipitation, surface water, groundwater, and seawater. It is enriched in the vadose zone of arid regions. Because perchlorate ingestion can have a negative impact on human health, there has been much attention given recently to perchlorate in public water supplies. The ability to trace the origin of perchlorate is important for prevention of further contamination, for developing remediation strategies, and, in some cases, for legal purposes. Stable isotope ratios of O and Cl point to multiple sources, including (1) synthetic perchlorate manufactured for industrial and military use, (2) natural perchlorate-rich nitrate fertilizer imported from Chile, and (3) background-level perchlorate from atmospheric deposition. Production mechanisms for natural perchlorate are not yet fully understood, but mass-independent variations in O isotope ratios that some fraction of natural perchlorate may be produced by reaction of stratospheric ozone with volatile Cl species [1]. We investigated the ^{36}Cl content of perchlorate as a tracer of its origin. This was measured by accelerator mass spectrometry in synthetic and natural perchlorate samples. The range in ^{36}Cl/Cl ratio measured in synthetic perchlorates is 0.0 to 40×10^{-15} and may reflect the sources of NaCl brines used in electrochemical perchlorate synthesis, whereas that in natural perchlorates is 22 to 291×10^{-15} and thus may reflect cosmogenic ^{36}Cl. Comparison of ^{36}Cl data with stable isotope data for O and Cl indicates that stable isotope ratios provide better indication of perchlorate origin. In addition, stable isotope ratios are significantly fractionated by biodegradation [2], which yields a diagnostic tool for investigating the fate of perchlorate in the environment.

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Location, location, location: Does surface deformation (both elastic and inelastic) affect microbial attachment?

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Previous work [1, 2] has opened up the possibility that bacteria (e.g., *Shewanella oneidensis* MR-1) may be sensitive to the distribution of stress on the surfaces where they attach. We investigate this possibility by mapping the attachment of bacteria on the surface of a cantilever beam under stress using vertical scanning interferometry (VSI). VSI measurements have nanometer vertical precision and sub-micron lateral resolution. Before the cantilever is immersed in an inoculated fluid cell, its surface in both unstressed and stressed states is measured by VSI. By registering the two images and then calculating the difference between the two, a detailed map of surface deformation is obtained. These deformation surfaces may be made to show entirely elastic deformation or elastic deformation with the addition of micro-cracks by increasing or decreasing the amount of deflection applied to the end of the cantilever. After the stressed beam has been immersed in a fluid cell inoculated with MR-1, a third measurement is taken showing the locations of the bacteria. This third measurement is then compared to the map of surface deformation so that any correlations can be made.

[1] Lower SK *et al.* (2001) *Science* **292**, 1360. [2] Luttge A Conrad PG (2004) *Appl Env Microbio* **70**, 1627.