Anaerobic oxidation of methane by sulfate in hypersaline groundwater at the Dead Sea aquifer

N. AVRAHAMOV[1]*, G. ANTLER[1,2], Y. YECHIELI[3,4],
I. GAVRIELI[3], S. JOYE [5] AND O. SIVAN[1]

[1]Department of Geological and Environmental Sciences, Ben Gurion University of the Negev, Beer-Sheva
[2]Department of Earth Sciences, University of Cambridge
[3]The Geological Survey of Israel, Jerusalem
[4]Department of Environmental Hydrology & Microbiology, Zuckerberg Institute for Water Research, Blaustein Institutes for Desert Studies, Ben Gurion University of the Negev, Sede Boqer, Israel
[5]Department of Marine Sciences, University of Georgia, Athens, GA (*correspondence: katzavn@bgu.ac.il)

Anaerobic oxidation of methane (AOM) with sulfate as an electron acceptor is not a process that is expected to occur in salt-stressed environments, since the energy yield is extremely low. Still, AOM appears to function even in hypersaline cold seeps sediments in marine environment. Here, we document geochemical evidences for AOM process in the continental hypersaline environment of the Dead Sea aquifer. We explored this process through chemical and isotope measurements of sulfate and methane in groundwater with salinity range of 40-225 Cl $g \cdot L^{-1}$ along the Arugot alluvial fan next to the DS. Oxygen values of this groundwater vary from absence to very low (0 to 0.16 $mg \cdot L^{-1}$). Sulfate concentrations and isotopes indicates BSR. Mass balance of carbon system parameters as well as the association between methane concentrations to the apparent net sulfate reduction show that methane serves as the main electron-donor. The calculated sulfur isotope enrichment factor might hint high reduction rates of sulfate when methane is used as asubstrate.

Comparison of ^{2}H, ^{18}O, ^{3}H and radionuclides migration in groundwater near the liquid waste injection site (Tomsk-7, Russia)

I.A. AVRAMENKO[1], I.V. BLAZHENNIKOVA[2]
AND I.V. TOKAREV [3]

[1](i.a.avramenko@gmail.com)
[2](blazhennikova@mail.ru)
[3]((okarevigor@gmail.com)

Groundwater near the site injection of the liquid radioactive waste of the Siberian Chemical Combine (former Tomsk-7, Russia) was studied. There are six (from I to VI) sandy aquifers (the numbers are follow from the crystalline basement to the Earth surface) in this multilayer hydrogeological system. Radioactive solutes (including a high activity waste) are injected into the II and III aquifers on the depth of 270–350 m. Total activity of the buried waste is about 800 millions Curie. The nitrates, gamma radiation, temperature were used for monitoring of the radioactive waste distribution in aquifers for 1963-2000.

Natural water of II and III aquifers has no tritium, because their age is several thousand years according to the helium and radiocarbon dating. The tritium (^{3}H) concentration in radioactive waste is very high, and also the stable isotopes composition (^{2}H and ^{18}O) of natural and man-made water is very different. These isotopes are the best tracers of water, as they form its molecule, whereas the radionuclides of waste are the reactive components, which decay with time and adsorb on the clayey part of sediments. Therefore comparison the behavior of conservative and non-conservative tracers allow to estimate of the retardation factor *in situ*. More than 200 wells have been tested for localization of the boundary between the natural water and man-made solutes. We used the ^{3}H, ^{2}H and ^{18}O monitoring to improve the safety prediction of the waste disposal and also for verification and calibration of the numerical model.

DOI:10.1180/minmag.2013.077.5.1