I-129 and I-127 in northern Germany

R. MICHEL[1], K. KLIPSCH[1], TH. ERNST[1], M. GORNY[1], D. JAKOB[1], J. VAHLBRUCH[1], H.-A. SYNAL[2] AND C. SCHNABEL[3]

[1]Zentrum für Strahlenschutz und Radiooekologie, Universitaet Hannover, Hannover, Germany (michel@zsr.uni-hannover.de)
[2]Paul Scherrer Institut, c/o Institut für Teilchenphysik, ETH Hoenggerberg, Zuerich, Switzerland (hans-arno.synal@ethz.ch)
[3]Scottish Universities Environmental Research Centre, East Kilbride, UK (c.schnabel@suerc.gla.ac.uk)

The abundances of ^{129}I and ^{127}I were investigated in sea-water, air, precipitation, surface and ground waters, soils, plants, animals, foodstuffs, total diet, and human and animal thyroid glands from Lower Saxony, Germany. The iodine isotopes are in severe disequilibrium in the different environmental compartments. The pre-nuclear equilibrium $^{129}I/^{127}I$ ratio in the biosphere was determined to be 2.0×10^{-13}. Today, the environmental isotope ratios range from 10^{-6} to 10^{-10}. The highest ratios were found in North Sea water, the lowest in deep soil samples and ground water. A differentiation by about a factor of ten between the iodine isotopes was observed for different air-borne iodine species. Time series for iodine in precipitation show a decade-long increase of ^{129}I fallout until the 1980ties and an ongoing constant input of ^{129}I with deposition densities of ~ 15 mBq m^{-2} per year. In surface waters, a dilution of the fall-out iodine takes place by stable iodine which is just weakly adsorbed in the soils. The isotope ratios in soils and ground waters demonstrate a high mobility and an accumulation of ^{129}I in the water unsaturated soil zones and an efficient migration into water saturated soil layers and ground water. The transfer into the food chain is ruled by the complex situation in the water-soil system. Given the environmental ^{129}I abundances, the relatively low $^{129}I/^{127}I$ ratios in human thyroid glands (2×10^{-9} - 3×10^{-8}) can only be explained by additional iodine sources with low isotope ratios in the diet.

Duration of microbial gas generation in Upper Cretaceous Reservoirs, Montana and Canada – Interpretation from $^{129}I/I$ ratios

J. L. RIDGLEY[1] AND G.T. SNYDER[2]

[1]U.S. Geological Survey, MS 939, Bx 25046 DFC, Denver, CO 80225, USA (ridgley@usgs.gov)
[2]Rice University, Earth Science Department, MS 126, Houston, TX 77251, USA (gsnyder@rice.edu)

More than nine trillion cubic feet of microbially generated methane has been produced from the Upper Cretaceous Belle Fourche Formation, Medicine Hat Sandstone and its lateral equivalents, Milk River Formation, and Eagle Sandstone in Alberta and Saskatchewan, Canada, and eastern Montana. The microbial methane was produced in an aqueous setting via CO_2 reduction. Twenty-five wells were sampled for gas and co-produced water in the producing formations. Chemical and stable isotopic compositions were determined for both gas and water fractions. Of the sampled wells, 14 samples showed equilibrium between the methane and water. $^{129}I/I$ ratios of the waters were also obtained.

Stable isotopes of water, patterns of methane-water equilibria, or regional trends in gas and water composition do not provide information on the time and duration of gas generation. However, they might be useful in indicating local and regional flow paths. $^{129}I/I$ of the produced water helps place constraints on the time and duration of gas generation by determining the residence time of the water in the reservoirs and the probable source of the iodine. For samples where the methane and water are in equilibrium, this also provides some time constraints on gas generation. Minimum $^{129I}/I$ ages for all samples range from 23.5 to 101.4 Ma. Preliminary corrected (for fissiogenic production) $^{129}I/I$ ages for all samples from range 24.4 to to 101.4 Ma, whereas samples in which the methane and water are in equilibrium have corrected $^{129}I/I$ ages ranging from 31.6 to 92.6 Ma. Ages are generally younger than any of the reservoir rocks and indicate some past mixing of connate and meteroic water. There is no regional pattern or depth relation to age distribution within the formations that would indicate the presence of a large continuous regional flow system. Rather, $^{129}I/I$ data when used in conjunction with other gas and water geochemical parameters indicate multiple flow paths affected by depositional patterns of local reservoirs and exsolution of free gas. Based on $^{129}I/I$ ages, methane was generated from the Middle Cretaceous through the Oligocene.