XXXVIII IAH Congress

Groundwater Quality Sustainability
Krakow, 12–17 September 2010

Extended Abstracts

Editors:
Andrzej Zuber
Jarosław Kania
Ewa Kmiecik

University of Silesia Press 2010

abstract id: **218**

topic: **3**
Aquifer management

3.4
Environmental and artificial tracers in hydrogeology

title: **Long-term migration of solutes in thick, surfical, clay-rich aquitards using multiple environmental tracers**

author(s): **M. James Hendry**
University of Saskatchewan, Canada, jim.hendry@usask.ca

Leonard I. Wassenaar
Envirionment Canada, Canada, len.wassenaar@ec.gc.ca

keywords: iostopes, tracers, aquitards

Over the past decade, high resolution 1-D depth profiles of multiple tracers (^{3}H, δD and $\delta^{18}O$, ^{14}C-DOC and -DOC, ^{36}Cl, ^{4}He, and major ions) and hydraulic data were applied to study residence times, transport mechanisms, and source areas of pore water and solutes in a thick aquitard system in Southern Saskatchewan, Canada. The dual aquitard system consisted of 80 m of plastic clay-rich Battleford till discomformably overlying 77 m of late Cretaceous plastic marine claystone (Cretaceous Snakebite Member of the Bearpaw Formation; 72 Ma to 71 Ma BP). The surficial 3 to 4 m of till is oxidized (brown color) and visibly fractured, whereas the underlying till and claystone aquitards are massive, unoxidized (dark gray color) and nonfractured. We found that individual and independent tracers yield consistent findings. They showed that late Pleistocene age pore water is present in the till aquitard between 35 and 55 m below ground. Transport modeling revealed that this water was emplaced between 15 ka–20 ka BP during ice retreat and till deposition and that the late Holocene glacial-interglacial climatic transition occurred between 7 ka–10 ka BP. The multiple tracer profiles further confirmed that transport of solutes in the aquitard system is by molecular diffusion. This detailed compilation and comparison of environmental tracers showed that solute transport in clay-rich aquitards can be predicted for time scales well in excess of 20 ka, providing clear evidence that aquitards may be suitable for the long-term isolation of hazardous and nuclear wastes.

International Association of Hydrogeologists

AGH University of Science and Technology

2-vol. set + CD
ISSN 0208-6336
ISBN 978-83-226-1979-0