

# **11th Applied Isotope Geochemistry Conference (AIG 11)**

Procedia Earth and Planetary Science Volume 13

Orleans, France  
21 - 25 September 2015

**Editors:**

**Romain Millot**

**Philippe Negrel**

ISBN: 978-1-5108-1218-5

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© by Elsevier B.V.  
All rights reserved.

Printed by Curran Associates, Inc. (2015)

For permission requests, please contact Elsevier B.V.  
at the address below.

Elsevier B.V.  
Radarweg 29  
Amsterdam 1043 NX  
The Netherlands

Phone: +31 20 485 3911  
Fax: +31 20 485 2457

<http://www.elsevierpublishingsolutions.com/contact.asp>

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)



## Contents

Introduction to the Special Issue of Procedia Earth and Planetary Science: AIG-11-Applied Isotope Geochemistry Conference R. Millot, P. Négrel	1
Residence Times of Water Contributing to Headwater Streams Determined Using $^3\text{H}$ I. Cartwright, U. Morgenstern	3
Lead Isotope Systematics in Groundwater: Implications for Source Tracing in Different Aquifer Types R. Millot, P. Négrel	7
Boron Isotope Characterization to Design a Frame of Hydrogeological Functioning of a Wetland System (Massif Central, France) P. Négrel, C. Guerrot, R. Millot, E. Petelet-Giraud	11
The Contribution of Nitrate Sources in Liao Rivers, China, Based on Isotopic Fractionation and Bayesian Mixing Model F.-J. Yue, S.-L. Li, J. Hu	16
Isotope Signature of Sand Calcites in the Paris Basin: A Proxy for Permafrost/Groundwater Paleoconditions M. Thiry, C. Innocent, C. Franke	21
Geochemical Monitoring of the Thermal Manifestations Located Near the Bouillante Geothermal Power Plant, in Guadeloupe (FWI) B. Sanjuan, M. Brach	25
Tracing Sediment Sources Using Strontium Isotopes in a Pond Draining Anagricultural Catchment (Loire River Basin, France) M. Le Gall, O. Evrard, F. Thil, A. Foucher, S. Salvador-Blanes, O. Cerdan, S. Ayrault	30
Sulfur Isotope Composition in the Plesenci Native Sulfur Mineral Deposit, Republic of Macedonia T. Serafimovski, G. Tasev, L. Gjorgiev	35
Isotopic Composition of the Ogallala-High Plains Aquifer and Vadose Zone R.L. Stotler, D.O. Whitemore, J.J. Smith, B.S. Katz, A. Yoerg, J.J. Butler Jr., G.A. Ludvigson, D.R. Hirmas	39
Lead and Lithium Isotope Ratios and their Variation in Atmospheric Deposits in Fukuoka, Japan in the 1960s Y. Kikawada, N. Karasawa, Y. Matsumoto, T. Akamine, T. Oi, K. Hirose	43
Halogen Isotopes ( $^{37}\text{Cl}$ and $^{81}\text{Br}$ ) in Brines of the Siberian Platform L.P. Alexeeva, S.V. Alexeev, A.M. Kononov, M. Teng, L. Yunde	47
Nitrate Nitrogen and Oxygen Isotope Characterization of the Shiraz Aquifer (Iran) H. Amiri, M. Zare, D. Widory	52
Isotope Tracers to Investigate Reactive Zones in Stones from Built Cultural Heritage M. Saheb, Aurélie-Verney-Carron, L. Remusat, R. Duhamel, A. Gonzalez-Cano, J.-D. Mertz, C. Loisel, A. Chabas, O. Rozenbaum	56
Isotopic Insights into Biological Regulation of Zinc in Contaminated Systems R.B. Wanty, L.S. Balistrieri, J.S. Wesner, D.M. Walters, T.S. Schmidt, F. Podda, G. De Giudici, C.A. Stricker, J. Kraus, P. Lattanzi, R.E. Wolf, R. Cidu	60
Use of Hydrogen Isotopes to Understand Stained Glass Weathering Aurélie-Verney-Carron, M. Saheb, C. Loisel, R. Duhamel, L. Remusat	64
Stable Isotope Signatures within Microbial Induced Concrete Corrosion: A Field Study C. Grengg, F. Mittermayr, A. Baldermann, M.E. Böttcher, A. Leis, G. Koraimann, M. Dietzel	68
Dissolved Versus Colloidal U and Th under Acid Mine Drainage Conditions in Rio Tinto Area (Spain) M. Casas-Ruiz, L. Barbero	72
Using DGT Passive Samplers and MC-ICPMS to Determine Pb and Zn Isotopic Signature of Natural Water A.-M. Desaulty, C. Bodard, T. Laurieux, C. Guerrot, R. Millot, C. Berho	76
Stable Carbon and Oxygen Isotopes in Red Boles: A Clue to Understand their Formation Mechanism S. Sarkar, A. Sarkar	80
Insight from Surface Water-groundwater Interactions in an Alluvial Aquifer: Contributions of $\delta^2\text{H}$ and $\delta^{18}\text{O}$ of Water, $\delta^{34}\text{S}_{\text{SO}_4}$ and $\delta^{18}\text{O}_{\text{SO}_4}$ of Sulfates, $^{87}\text{Sr}/^{86}\text{Sr}$ Ratio A. Brenot, E. Petelet-Giraud, L. Gourcy	84
Dissolved $\text{CO}_2$ and Alkane Gas in Clay Formations C. Lerouge, M. Blessing, C. Flehoc, E.C. Gaucher, B. Henry, A. Lassin, N. Marty, J.M. Matray, E. Proust, D. Rufer, J. Tremosa, A. Vinsot	88
Position-Specific Isotope Analysis by Isotopic NMR Spectrometry: New Insights on Environmental Pollution Studies G.S. Remaud, M. Julien, J. Parinet, P. Nun, R.J. Robins, P. Höhener	92
Position-specific Carbon Isotope Fractionation Gives Insights into Mechanistic Models for Evaporation of Organic Liquids in the Environment P. Höhener, M. Julien, P. Nun, R.J. Robins, J. Parinet, G.S. Remaud	96

Novel Tool for Simultaneous Carbon and Nitrogen Stable Isotope Analyses in Aqueous Samples E. Federherr, R.J. Panetta, L. Lange, H.J. Kupka .....	100
Using Natural Radon as a Tracer of Gasoline Contamination G. De Simone, G. Galli, C. Lucchetti, P. Tuccimei .....	104
Isotopic Geochemistry of Panama Rivers R.S. Harmon, G. Wörner, M.J. Pribil, Z. Kern, I. Fórizs, W.B. Lyons, C.B. Gardner, S.T. Goldsmith .....	108
U Isotope Systematics of Groundwaters from the Triassic Aquifer of the Northeastern Paris Basin and of the Rhine Graben, France C. Innocent, W. Kloppmann, R. Millot, L. Vaute .....	112
Measurement of <i>in situ</i> Sulfur Isotopes by Laser Ablation Multi-collector ICPMS: Opening Pandora's Box W.I. Ridley, M.J. Pribil, A.E. Koenig, J.F. Slack .....	116
C and Cl-CSIA for Elucidating Chlorinated Methanes Biotic and Abiotic Degradation at a Polluted Bedrock Aquifer D. Rodríguez-Fernández, M. Rosell, C. Domènech, C. Torrentó, J. Palau, A. Soler .....	120
Evaluation of Two Carbon Sources for Inducing Denitrification: Batch and Column Experiments A. Grau-Martínez, R. Carrey, C. Torrentó, A. Folch, A. Soler, N. Otero .....	124
$\delta^{44}\text{Ca}$ of Stratabound Fluorite Deposits in Burgundy (France): Tracing Fluid Origin and/or Fractionation Processes M. Gigoux, P. Négrel, C. Guerrot, B. Brigaud, G. Delpech, M. Pagel, T. Augé .....	129
Lithium Isotope Fingerprints in Coal and Coal Combustion Residuals from the United States J.S. Harkness, L.S. Ruhl, R. Millot, W. Kloppman, J.C. Hower, H. Hsu-Kim, A. Vengosh .....	134
Late Quaternary Climatic Record from ODP Site 705 in the Northern Indian Ocean A. Sarkar, N. Ogle .....	138
Treatment Protocol for Using Tree-ring Zn Isotopes for Environmental Studies L. Dinis, P. Gammon, M.M. Savard, C. Bégin, I. Girard, J. Vaive .....	142
Investigation of $^{36}\text{Cl}$ Distribution: Towards a New Estimation of Groundwater Residence Times in the Confined Aquifer of the LCB? C. Bouchez, P. Deschamps, J. Goncalves, B. Hamelin, F. Sylvestre, J.C. Doumnang, A.M. Nour, I.B. Goni, G. Favreau, P. Genthon, J.L. Seidel .....	147
Mass Independent Fractionation of Mercury Isotopes as Source Tracers in Sediments R. Das, W. Landing, M. Bizimis, L. Odom, J. Caffrey .....	151
Fate of Four Herbicides in an Irrigated Field Cropped with Corn: Lysimeter Experiments C. Torrentó, R. Bakkour, E. Ryabenko, V. Ponsin, V. Prasuhn, T.B. Hofstetter, M. Elsner, D. Hunkeler .....	158
Testing the Steady State Assumption for the Earth's Surface Denudation Using Li Isotopes in the Amazon Basin M. Dellinger, J. Bouchez, J. Gaillardet, L. Faure .....	162
A Comparative $^{87}\text{Sr}/^{86}\text{Sr}$ Study in Red and White Wines to Validate its Use as Geochemical Tracer for the Geographical Origin of Wine I. Tescione, S. Marchionni, M. Mattei, F. Tassi, C. Romano, S. Conticelli .....	169
Pb Isotopic Compositions of Fin Whale Baleen Plates – A Clue to Unravel Individual Migrations between the Atlantic Ocean and the Mediterranean Sea? P. Roubira, D. Bosch, I. Bentaleb .....	173
Integrating Hydrogeochemical and Isotope Data in Studying Regional Groundwater Flow Systems in the Great Hungarian Plain T. Szocs, S. Frapé, R. Gwynne .....	177
Stable Carbon Isotope Ratio for Sugar, Amino Acid, and Caffeine by Liquid Chromatography/Isotope Ratio Mass Spectrometry N. Suto, H. Kawashim .....	181
The Fractionation Factors of Hydrogen Stable Isotopes for VOCs H. Kawashima .....	185
Geochemical Study of a Crater Lake: Lake Pavin, France: A view through Li-O-H Isotopes F. Gal, A. Gadalia, R. Millot .....	189
Assessment of Groundwater Salinity Mechanisms in the Coastal Aquifer of El Haouaria, Northern Tunisia M.F. Ben Hamouda, A.J. Kondash, N. Lauer, L. Mejri, J. Tarhouni, A. Vengosh .....	194
Modeling the Recharge and the Renewal Rate Based on $^3\text{H}$ and $^{14}\text{C}$ Isotopes in the Coastal Aquifer of El Haouaria, Northern Tunisia J. Tarhouni, M.F. Ben Hamouda, A.J. Kondash, L. Mejri, A. Vengosh .....	199
Boron Isotope Variation during Flood Events in a Mediterranean Basin: Tracer of the Water Compartments (Hérault, S. France) E. Petelet-Giraud, P. Négrel, C. Guerrot .....	203
In-situ Isotopic and Chemical Study of Pyrite from Chu-Sarysu (Kazakhstan) Roll-front Uranium Deposit P. Lach, M. Cathelineau, M. Brouand, N. Fiet .....	207
O, H, $\text{C}_{\text{DIC}}$ , Sr, B and $^{14}\text{C}$ Isotope Fingerprinting of Deep Groundwaters in the Karoo Basin, South Africa as a Precursor to Shale Gas Exploration J. Miller, K. Swana, S. Talma, A. Vengosh, G. Tredoux, R. Murray, M. Butler .....	211
Comparing the Residence Time of Deep vs Shallow Groundwater in the Karoo Basin, South Africa Using $^3\text{H}$ , $^{14}\text{C}$ , $^{36}\text{Cl}$ and $^4\text{He}$ Isotopes K.A. Swana, J.A. Miller, A.S. Talma, T.H. Darrah, M. Butler, K. Fifield .....	215
Identifying the Source of Methane in Groundwater in a 'virgin' Area with Regards to Shale Gas Exploitation: A Multi-isotope Approach G. Bordeleau, C. Rivard, D. Lavoie, A. Mort, J. Ahad, X. Malet, X. Xu .....	219
O, H and Sr Isotopes Tracing the Migration Distance of Mining, ore Processing and Metallurgical Activities End-products in a River Basin (Subarnarekha River, India) B. Lemièrre, P. Négrel .....	223

Customized Injection Techniques for Compound-specific Isotope Analysis of Natural Gas Samples M. Blessing, E. Proust, C. Fléhoc .....	227
New Frontiers for Sulfur Isotopic Analyses F. Fourel, C. Lécuyer, V. Balter .....	232
Improving Precision and Signal/Noise Ratios for MC-ICP-MS T. Breton, N.S. Lloyd, A. Trinquier, C. Bouman, J.B. Schwieters .....	240
Isotopic Fingerprints for Delineating the Environmental Effects of Hydraulic Fracturing Fluids A. Vengosh, N.R. Warner, A. Kondash, J.S. Harkness, N. Lauer, R. Millot, W. Kloppman, T.H. Darrah .....	244
Concrete Corrosion in Tunnels: A Stable O and H Isotope Study of TSA Mechanism F. Mittermayr, A. Demény, D. Thaller, A. Leis, G. Czuppon, M. Dietzel .....	248
Strontium Isotope Characterization of Wines from the Quebec (Canada) <i>Terroir</i> V. Victor, S. Ross, P. Karine, P. André, H. Jean-François, W. David .....	252
Investigating the Origin and Interaction between Karstic and Alluvial Aquifers in NW of Zagros Mountain Range, Iran, Using Isotopic and Geochemical Tools H. Mohammadzadeh, R. Aravena .....	256
Investigating Li Isotope Composition of Nile Deltaic Sediments as Paleotracer of Continental Alteration L. Bastian, M. Revel, N. Vigier .....	261
Dolomitization Processes in Hydrocarbon Reservoirs: Insight from Geothermometry Using Clumped Isotopes J. MacDonald, C. John, J.-P. Girard .....	265
Characterisation of Radon Concentrations in Karoo Groundwater, South Africa, as a Prelude to Potential Shale-gas Development A. Eilers, J. Miller, K. Swana, R. Botha, S. Talma, R. Newman, R. Murray, A. Vengosh .....	269
Lead Isotopes Tracing the Origin of Lead in an Irrigated Agricultural Soil in Crete C. Lise, K. Wolfram, P. Georgios .....	273
Stable Isotopes of Lithium as Indicators of Coal Seam Gas-bearing Aquifers D.D.R. Owen, R. Millot, P. Négrel, K. Meredith, M.E. Cox .....	278
Large Variation of Mercury Isotope Composition during a Single Precipitation Event at Lhasa City, Tibetan Plateau, China S. Yuan, Y. Zhang, J. Chen, S. Kang, J. Zhang, X. Feng, H. Cai, Z. Wang, Z. Wang, Q. Huang .....	282
Sr Isotopic Ratios of Two Magmatic Series Unraveling the Role of Crustal Contamination in NW Firoozeh, NE Iran M.R. Ghorbani, P. Ahmadi, E. Braschi, S. Conticelli, M. Ghaderi .....	287
Isotope Studies and Chemical Investigations of Tattapani Hot Springs in Kotli (Kashmir, NE Pakistan): Implications on Reservoir Origin and Temperature M. Anees, M.M. Shah, A.A. Qureshi .....	291
Extreme Boron Isotope Ratios in Groundwater W. Kloppmann, E. Petelet-Giraud, C. Guerrot, L. Cary, H. Pauwels .....	296
How to Estimate Mean Residence Times of Groundwater M. Kralik .....	301
Stable Isotopes (Li, O, H) Combined with Brine Chemistry: Powerful Tracers for Li Origins in Salar Deposits from the Puna Region, Argentina B. Orberger, W. Rojas, R. Millot, C. Flehoc .....	307
Evidence for Nutrient Biolifting in Hawaiian Climosequence Soils as Revealed by Alkaline Earth Metal Stable Isotope Systematics T. Bullen, O. Chadwick .....	312
Triple Isotopic Ratios to Characterize Atmospheric N Compounds in Alberta—Work in Progress M.M. Savard, R. Vet, A. Smirnoff, A. Cole .....	316
Prospects and Limitations of Chemical and Isotopic Groundwater Monitoring to Assess the Potential Environmental Impacts of Unconventional Oil and Gas Development B. Mayer, P. Humez, V. Becker, M. Nightingale, J. Ing, A. Kingston, C. Clarkson, A. Cahill, E. Parker, J. Cherry, R. Millot, W. Kloppmann, K. Osadetz, D. Lawton .....	320