



Welcome to the FIRMS Spring 2016 newsletter. Don't forget to register for the rapidly approaching 6th FIRMS Network Conference which will be held in SkyCity, Auckland (18th - 23rd Sept). It is also time once again to register for the FIRMS PT scheme ...

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Steering Group News

Since the last newsletter, having served two three year terms as Chair of the FIRMS steering group, Jim Carter (Director, Queensland Health Forensic and Scientific Services) has now stepped down in accordance with the FIRMS constitution. Phil Dunn (LGC) has now taken over the role of Chair after unanimous vote. Kylie Jones (Australian Federal Police) has agreed to take the role of Membership Secretary. Rob Posey (Food Forensics) has taken over the collating/editing of the newsletter (*ed: any suggestions for content of future editions will be gratefully received. Many thanks to Lesley Chesson, Sean Doyle and Phil Dunn for their assistance in collating this edition*).

The FIRMS Steering group currently consists of: Phil Dunn (Chair, LGC); Jim Carter (Di-

rector, Queensland Health Forensic and Scientific Services); Sean Doyle (Quality Manager, Director & Secretary, Linked Forensic Consultants Ltd); Federica Camin (IASMA); Lesley Chesson (Iso-Forensics); Max Coleman (NASA Jet Propulsion Laboratory); Russell Frew (University of Otago); Kylie Jones (Membership Secretary, Australian Federal Police); Niamh Nic Dæid (University of Strathclyde); Gerard van der Peijl (Netherlands Forensic Institute); Rob Posey (Newsletter Ed, Food Forensics); Helen Salorous (National Measurement Institute, Australia); Thomas Schaefer will replace Sabine Schneiders this year. Thank you Sabine for your efforts (Bundeskriminalamt); Libby Stern (FBI); David Widory (University of Quebec in Montreal) and Wee Chuan Yeo (Health Sciences Authority, Singapore).



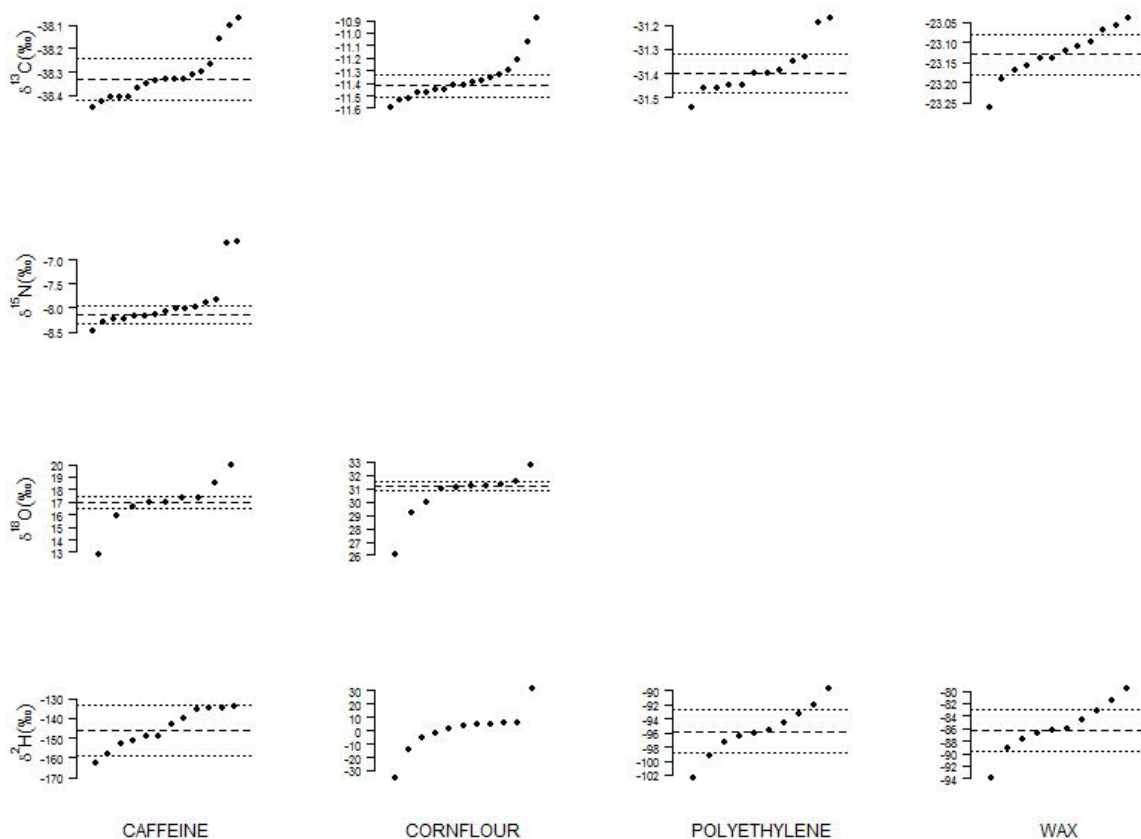
Proficiency Testing Scheme

We are pleased to inform you that the FIRMS proficiency testing scheme has now been added to LGC's scope of accreditation to ISO 17043:2010.

There have been two further rounds (228 and 233) of the FIRMS PT scheme during 2015 - a summary of the results can be found below while a copy of the main report can be downloaded from [the FIRMS website](#). Compared with 2014 there was a small increase in the number of participants with a maximum of 17 reporting results for a given analyte. Due to a LGC mix up, polyethylene was provided in place of PET for round 233. Generally the data reported was good for most analytes with the exception of delta 2H in corn-

flour for which there was a wide range of values reported and therefore performance scores were not calculated for this analyte in this round. Given that round 233 only looked at C and H isotope ratios, in future rounds, materials will be chosen such that each round of testing will include at least one analysis for each of the 4 isotope ratios.

Registration for participation in the FIRMS PTS for 2016 is now open with samples for the first round due for dispatch in April. The test materials scheduled for 2016 are cellulose, saccharin, caffeine and propylene glycol. To register for the scheme or for more information contact ptcustomerservices@lgcgroup.com.



Results from FIRMS PT scheme in 2015. The lines represent the median of the results (dashed) plus or minus the robust standard deviation (dotted) following the exclusion of outliers.



Approved Practitioners Scheme



FIRMS is the only forensic science body that offers practitioner certification compliant with an international standard; ISO9001:2008 (soon to be ISO9001:2015).

The principal aim of the scheme is to assure customers of the competence of the practitioner for a given analyte in a given matrix and the reliability of forensic outputs. Certified practitioners are listed on the FIRMS website which is accessible to the customer community and other stakeholders.

Candidates are assessed against a number of criteria and, if successful, are certified for a period of four years. During that period certified practitioners must submit an annual return

to demonstrate continuing compliance with the FIRMS Regulatory Framework.

The requirement in many jurisdictions is for providers of forensic laboratory services to be accredited to ISO17025:2005. However, a business case for gaining and maintaining accreditation by providers of isotopic analysis is often difficult to make. The FIRMS AP scheme offers a cost effective quality standard where ISO17025 accreditation is not an option.

FIRMS requires all members that provide forensic services to be either ISO17025:2005 accredited or FIRMS certified.

There are currently three Approved Practitioners covering most of the analytes and matrices of forensic interest. Anyone interested in the AP scheme can find out more and apply via the [FIRMS website](#).

News in Brief For or From the FIRMS Community

At AGU 2015 Thermo Scientific showcased their new Thermo Scientific 253 Ultra High Resolution Isotope Ratio Mass Spectrometer (HR-IRMS) which is designed to optimise the measurement of site-specific and clumped-isotope-ratio analysis. Also at AGU were Isoprime showcasing two new products; The precisION IRMS offers Iso-primers most compact footprint to date and the flexibility to meet a wide range of research requirements. The isoFLOW stable isotope sample handling platform enables concentration and separation of a variety of gas samples.

Picarro has released the G5131-i Analyzer which uses Cavity Ring-Down Spectroscopy (CRDS) technology to provide continuous, precise and stable measurements of nitrous oxide (N₂O) concentrations and isotopes.

Singly (IAEA 604-606) and doubly (IAEA 607-609) labeled enriched reference waters are available from IAEA as of November 2015. They cover δ^2H and $\delta^{18}O$ values in the range of 800-

16000 ‰ and 100-2000 ‰ respectively.

The highly regarded "Good Practice Guide for isotope ratio mass spectrometry" (FIRMS 2011) will be updated this year to provide further invaluable guidance for the IRMS community. If you would like to contribute to the latest version or if you have any recommendations for improvement please [contact us](#).

Don't forget to visit the [FIRMS members forum](#) for the latest news from the FIRMS network. The forum is a great resource for sparking debate over the latest articles, networking and sourcing help and knowledge from the FIRMS community. We will also endeavor to keep the forum updated with upcoming conferences of interest.

Forthcoming conferences of interest to the FIRMS community include the [American Academy of Forensic Sciences \(AAFS\) 68th Annual Scientific Meeting \(22th-27th February 2016 in Las Vegas, USA\)](#), [Pittcon \(6th-10th March 2016](#)



in Atlanta, USA), IsoEcol (3rd-8th April 2016 in Tokyo, Japan), EGU General Assemble (17th-22nd April 2016 in Vienna, Austria), Forensics Europe Expo (19th-20th April 2016 in London, UK), Food Integrity 2016 Conference (6th-7th April 2016 in Prague, Czech Republic), Gold-

6th FIRMS Network Conference

We extend a warm welcome to you all to Auckland, New Zealand, for the 6th FIRMS Network Conference to be held in conjunction with the 23rd Australian and New Zealand Forensic Science Society (ANZFSS) International Symposium on the Forensic Sciences. The Symposium is to be held from Sunday 18th to Friday 23rd September 2016 at the SkyCity Convention Centre in the heart of downtown Auckland.

Professor Gabe Bowen of the University of Utah will be the FIRMS plenary speaker.

In addition to the Conference, FIRMS will be

schmidt 2016 (26th June - 1st July 2016 in Yokohama, Japan), Joint European Stable Isotope User Group Meeting (4th-9th September 2016 in Ghent, Belgium), AGU Fall Meeting (12th-16th December 2016 in San Fransisco, USA).

offering a workshop on the forensic application of isotopic analysis.

The call for abstract submission process is now closed but there is still time to [register your interest for attendance!](#) FIRMS members are entitled to the ANZFSS discount.

In addition to the 6th FIRMS Conference, FIRMS members will be able to participate in one of the highest quality forensic science symposia with an excellent social program.

For information about travel to the conference, accommodation and the venue visit www.conference.co.nz/anzfss16. We look forward to seeing you there.





Recent Publications

Books & Book Chapters

A book chapter that may be of interest to the FIRMS community that has been published since the release of the last newsletter is "Application of stable isotopes and radioisotopes in environmental forensics" by R. Paul Philip which appears in "Introduction to environmental forensics" (Third Edition, 2015) and provides a review as well as recent examples of how stable isotope information is obtained and interpreted in environmental forensic investigations.

Journal Special Editions

With the 6th FIRMS network conference fast approaching, it is worth noting that Science and Justice will once again be hosting a special edition for conference submissions.

Papers

Disclaimer: This section contains a non-comprehensive list of recent publications that may be of interest to the FIRMS community. Inclusion of an article in this list does not mean that FIRMS approves the content. You are encouraged to consider critically whether (i) the experimental work complies with SI guidelines and the FIRMS Good Practice Guide; and (ii) whether the conclusions drawn are based on sound scientific background information.

Aceto, M., "Chapter 9 - Food Forensics," in Y. Pic (ed.), "Advanced Mass Spectrometry for Food Safety and Quality," (Elsevier, 2015), vol. 68 of *Comprehensive Analytical Chemistry*, 441 – 514

Badia-Melis, R., Mishra, P. and Ruiz-Garca, L., "Food traceability: New trends and recent advances. a review," *Food Control* (2015), **57**:393 – 401, ISSN 0956-7135

Banerjee, S., Kyser, T.K., Vuletich, A. and Leduc, E., "Elemental and stable isotopic study of sweeteners and edible oils: Constraints on food authentication," *Journal of Food Composition and Analysis* (2015), **42**:98 – 116, ISSN 0889-1575

Barkan, E., Musan, I. and Luz, B., "High-precision measurements of $\delta^{17}O$ and ^{17}O excess of NBS19 and NBS18," *Rapid Communications in Mass Spectrometry* (2015), **29**(23):2219–2224, ISSN 1097-0231, rCM-15-0285.R1

Beckett, N.M., Cresswell, S.L., Grice, D.I. and Carter, J.F., "Isotopic profiling of seized benzylpiperazine and trifluoromethylphenylpiperazine tablets using $\delta^{13}C$ and $\delta^{15}N$ stable isotopes," *Science & Justice* (2015a), **55**(1):51 – 56, ISSN 1355-0306, {FIRMS} Conference 2013

Feature Article

The FIRMS Steering Group feel that the recent ENFSI "Guideline for Evaluative Reporting in Forensic Science" is worthy of mention. This document provides guidance for standardising and improving evaluative reporting across ENFSI laboratories.

Also of interest for this edition of the newsletter is the article "Isotopic tracing of perchlorate sources in groundwater from Pomona California" by N.C. Sturchio *et al* (*Applied Geochemistry*, vol 44, 2014) and the subsequent discussion that it raised in the literature during 2015. In the original paper, stable isotope analysis was used to determine the source of perchlorate pollution identified in the groundwater of Pomona, California. This article and the related court case (*City of Pomono vs. SQM North America Corporation*) is very relevant to the issues faced by forensic scientists working with stable isotopes and highlights the difficulties that can be faced when presenting stable isotope data in court.



- Beckett, N.M., Grice, D.I., Carter, J.F. and Cresswell, S.L., “Precursor discrimination of designer drug benzylpiperazine using $\delta^{13}C$ and $\delta^{15}N$ stable isotopes,” *Science & Justice* (2015b), **55**(1):57 – 62, ISSN 1355-0306, {FIRMS} Conference 2013
- Bennett, P., “Comments on isotopic tracing of perchlorate sources in groundwater from Pomona, California by Neil C. Sturchio, Abelardo Beloso Jr., Linnea J. Heraty, Stephen Wheatcraft, Rina Schumer,” *Applied Geochemistry* (2015), **52**:191 – 194, ISSN 0883-2927
- Bononi, M., Quaglia, G. and Tateo, F., “Easy extraction method to evaluate $\delta^{13}C$ vanillin by Liquid Chromatography Isotopic Ratio Mass Spectrometry in chocolate bars and chocolate snack foods,” *Journal of Agricultural and Food Chemistry* (2015), **63**(19):4777–4781, PMID: 25965784
- Bontempo, L., Camin, F., Ziller, L., Biondi, L., D’Urso, M.G., Vasta, V. and Luciano, G., “Variations in stable isotope ratios in lamb blood fractions following dietary changes: a preliminary study,” *Rapid Communications in Mass Spectrometry* (2016), **30**(1):170–174, ISSN 1097-0231, rCM-15-0311.R1
- Bontempo, L., Camin, F., Ziller, L., Perini, M., Nicolini, G. and Larcher, R., “Isotopic and elemental composition of selected types of Italian honey,” *Measurement* (2015):–, ISSN 0263-2241
- Brust, H., Koeberg, M., van der Heijden, A., Wiarda, W., Mglar, I., Schrader, M., Vivo-Truyols, G., Schoenmakers, P. and van Asten, A., “Isotopic and elemental profiling of ammonium nitrate in forensic explosives investigations,” *Forensic Science International* (2015), **248**:101 – 112, ISSN 0379-0738
- Camin, F., Bertoldi, D., Santato, A., Bontempo, L., Perini, M., Ziller, L., Stroppa, A. and Larcher, R., “Validation of methods for H, C, N and S stable isotopes and elemental analysis of cheese: results of an international collaborative study,” *Rapid Communications in Mass Spectrometry* (2015), **29**(5):415–423, ISSN 1097-0231, rCM-14-0329.R2
- Camin, F., Pavone, A., Bontempo, L., Wehrens, R., Paolini, M., Faberi, A., Marianella, R.M., Capitani, D., Vista, S. and Mannina, L., “The use of IRMS, 1H NMR and chemical analysis to characterise Italian and imported Tunisian olive oils,” *Food Chemistry* (2016), **196**:98 – 105, ISSN 0308-8146
- Carter, J., Tinggi, U., Yang, X. and Fry, B., “Stable isotope and trace metal compositions of Australian prawns as a guide to authenticity and wholesomeness,” *Food Chemistry* (2015a), **170**:241 – 248, ISSN 0308-8146
- Carter, J., Yates, H. and Tinggi, U., “A global survey of the stable isotope and chemical compositions of bottled and canned beers as a guide to authenticity,” *Science & Justice* (2015b), **55**(1):18 – 26, ISSN 1355-0306, {FIRMS} Conference 2013
- Carter, J.F., Yates, H.S.A. and Tinggi, U., “Isotopic and elemental composition of roasted coffee as a guide to authenticity and origin,” *Journal of Agricultural and Food Chemistry* (2015c), **63**(24):5771–5779, PMID: 26001050
- Carter, J.F., Yates, H.S.A. and Tinggi, U., “Stable isotope and chemical compositions of European and Australasian ciders as a guide to authenticity,” *Journal of Agricultural and Food Chemistry* (2015d), **63**(3):975–982, PMID: 25536876
- Chesson, L.A., Tipple, B.J., Barnette, J.E., Cerling, T.E. and Ehleringer, J.R., “The potential for application of ink stable isotope analysis in questioned document examination,” *Science & Justice* (2015), **55**(1):27 – 33, ISSN 1355-0306, {FIRMS} Conference 2013



- Chiocchini, F., Portarena, S., Ciolfi, M., Brugnoli, E. and Lauteri, M., "Isoscapes of carbon and oxygen stable isotope compositions in tracing authenticity and geographical origin of Italian extra-virgin olive oils," *Food Chemistry* (2016):-, ISSN 0308-8146
- Collins, M. and Salouros, H., "A review of some recent studies on the stable isotope profiling of methylamphetamine: Is it a useful adjunct to conventional chemical profiling?" *Science & Justice* (2015), **55**(1):2 – 9, ISSN 1355-0306, {FIRMS} Conference 2013
- Degnan, J.R., Bhlke, J.K., Pelham, K., Langlais, D.M. and Walsh, G.J., "Identification of groundwater nitrate contamination from explosives used in road construction: Isotopic, chemical, and hydrologic evidence," *Environmental Science & Technology* (2016), **50**(2):593–603, PMID: 26709616
- Dunn, P.J.H., Hai, L., Malinovsky, D. and Goenaga-Infante, H., "Simple spreadsheet templates for the determination of the measurement uncertainty of stable isotope ratio delta values," *Rapid Communications in Mass Spectrometry* (2015), **29**(22):2184–2186, ISSN 1097-0231, rCM-15-0313.R1
- Ehtesham, E., Hayman, A., Hale, R.V. and Frew, R., "Influence of feed and water on the stable isotopic composition of dairy milk," *International Dairy Journal* (2015), **47**:37 – 45, ISSN 0958-6946
- Faghihi, V., Meijer, H.A.J. and Grning, M., "A thoroughly validated spreadsheet for calculating isotopic abundances (2H , ^{17}O , ^{18}O) for mixtures of waters with different isotopic compositions," *Rapid Communications in Mass Spectrometry* (2015), **29**(15):1351–1356, ISSN 1097-0231, rCM-15-0058.R1
- Font, L., Jonker, G., van Aalderen, P.A., Schiltmans, E.F. and Davies, G.R., "Provenancing of unidentified World War II casualties: Application of strontium and oxygen isotope analysis in tooth enamel," *Science & Justice* (2015a), **55**(1):10 – 17, ISSN 1355-0306, {FIRMS} Conference 2013
- Font, L., van der Peijl, G., van Leuwen, C., van Wetten, I. and Davies, G.R., "Identification of the geographical place of origin of an unidentified individual by multi-isotope analysis," *Science & Justice* (2015b), **55**(1):34 – 42, ISSN 1355-0306, {FIRMS} Conference 2013
- Gentile, N., Siegwolf, R.T., Esseiva, P., Doyle, S., Zollinger, K. and Delmont, O., "Isotope ratio mass spectrometry as a tool for source inference in forensic science: A critical review," *Forensic Science International* (2015), **251**:139 – 158, ISSN 0379-0738
- Gilevska, T., Gehre, M. and Richnow, H.H., "Multidimensional isotope analysis of carbon, hydrogen and oxygen as tool for identification of the origin of ibuprofen," *Journal of Pharmaceutical and Biomedical Analysis* (2015), **115**:410 – 417, ISSN 0731-7085
- Hlsemann, F., Lehn, C., Schneiders, S., Jackson, G., Hill, S., Rossmann, A., Scheid, N., Dunn, P.J.H., Flenker, U. and Schnzer, W., "Global spatial distributions of nitrogen and carbon stable isotope ratios of modern human hair," *Rapid Communications in Mass Spectrometry* (2015), **29**(22):2111–2121, ISSN 1097-0231, rCM-15-0200.R1
- Hoffmann, W.D. and Jackson, G.P., "Forensic Mass Spectrometry," *Annual Review of Analytical Chemistry* (2015), **8**(1):419–440, PMID: 26070716
- Holder, P.W., Frew, R. and Van Hale, R., "The geographic origin of an intercepted biosecurity pest beetle assigned using hydrogen stable isotopes," *Journal of Economic Entomology* (2015), **108**(2):834–837, ISSN 0022-0493
- Jackson, G.P. and Barkett, M.A., "A history of the forensic applications of mass spectrometry," in M.L. Gross and R.M. Caprioli (eds.), "The Encyclopedia of Mass Spectrometry," (Elsevier, Boston, 2016), ISBN 978-0-08-043848-1, 271 – 284



- Kamal, M. and Karoui, R., “Analytical methods coupled with chemometric tools for determining the authenticity and detecting the adulteration of dairy products: A review,” *Trends in Food Science & Technology* (2015), **46**(1):27 – 48, ISSN 0924-2244
- Kim, H., Kumar, K.S. and Shin, K.H., “Applicability of stable C and N isotope analysis in inferring the geographical origin and authentication of commercial fish (Mackerel, Yellow Croaker and Pollock),” *Food Chemistry* (2015a), **172**:523 – 527, ISSN 0308-8146
- Kim, K., Song, J.H., Heo, S.C., Lee, J.H., Jung, I.W. and Min, J.S., “Discrimination of ginseng cultivation regions using light stable isotope analysis,” *Forensic Science International* (2015b), **255**:43 – 49, ISSN 0379-0738, international Association of Forensic Sciences (IAFS) 20th Meeting
- Kim, S.T., Coplen, T.B. and Horita, J., “Normalization of stable isotope data for carbonate minerals: Implementation of IUPAC guidelines,” *Geochimica et Cosmochimica Acta* (2015c), **158**:276 – 289, ISSN 0016-7037
- Lehn, C., Rossmann, A. and Graw, M., “Provenancing of unidentified corpses by stable isotope techniques : A presentation of case studies,” *Science & Justice* (2015), **55**(1):72 – 88, ISSN 1355-0306, {FIRMS} Conference 2013
- Li, S., Levin, N.E. and Chesson, L.A., “Continental scale variation in ^{17}O -excess of meteoric waters in the United States,” *Geochimica et Cosmochimica Acta* (2015), **164**:110 – 126, ISSN 0016-7037
- Longobardi, F., Casiello, G., Cortese, M., Perini, M., Camin, F., Catucci, L. and Agostiano, A., “Discrimination of geographical origin of lentils (*Lens culinaris* Medik.) using isotope ratio mass spectrometry combined with chemometrics,” *Food Chemistry* (2015), **188**:343 – 349, ISSN 0308-8146
- Lott, M.J., Howa, J.D., Chesson, L.A. and Ehleringer, J.R., “Improved accuracy and precision in $\delta^{15}\text{N}_{AIR}$ measurements of explosives, urea, and inorganic nitrates by elemental analyzer/isotope ratio mass spectrometry using thermal decomposition,” *Rapid Communications in Mass Spectrometry* (2015), **29**(15):1381–1388, ISSN 1097-0231, rCM-15-0052.R2
- Mihailova, A., Abbado, D., Kelly, S.D. and Pedentchouk, N., “The impact of environmental factors on molecular and stable isotope compositions of n-alkanes in mediterranean extra virgin olive oils,” *Food Chemistry* (2015), **173**:114 – 121, ISSN 0308-8146
- Mimmo, T., Camin, F., Bontempo, L., Capici, C., Tagliavini, M., Cesco, S. and Scampicchio, M., “Traceability of different apple varieties by multivariate analysis of isotope ratio mass spectrometry data,” *Rapid Communications in Mass Spectrometry* (2015), **29**(21):1984–1990, ISSN 1097-0231, rCM-15-0268.R1
- Nielsen, J.A., Frew, R.D., Whigham, P.A., Callaway, R.M. and Dickinson, K.J.M., “Thyme travels: ^{15}N isoscapes of *Thymus vulgaris* L. invasion in lightly grazed pastoral communities,” *Austral Ecology* (2016), **41**(1):28–39, ISSN 1442-9993
- Philp, R.P., “Chapter 11 - application of stable isotopes and radioisotopes in environmental forensics,” in B.L. Murphy and R.D. Morrison (eds.), “Introduction to Environmental Forensics (Third Edition),” (Academic Press, San Diego, 2015), third edition edn., ISBN 978-0-12-404696-2, 395 – 455
- de Rijke, E., Schoorl, J., Cerli, C., Vonhof, H., Verdegaal, S., Viv-Truyols, G., Lopatka, M., Dekter, R., Bakker, D., Sjerps, M., Ebskamp, M. and de Koster, C., “The use of $\delta^2\text{H}$ and $\delta^{18}\text{O}$ isotopic analyses combined with chemometrics as a traceability tool for the geographical origin of bell peppers,” *Food Chemistry* (2016):–, ISSN 0308-8146



- Stevenson, R., Desrochers, S. and Hlie, J.F., "Stable and radiogenic isotopes as indicators of agri-food provenance: Insights from artisanal cheeses from Quebec, Canada," *International Dairy Journal* (2015), **49**:37 – 45, ISSN 0958-6946
- Sturchio, N., "Reply to the comments by P. Bennett on isotopic tracing of perchlorate sources in groundwater of Pomona, California by N.C. Sturchio, A. Beloso Jr., L.J. Heraty, S. Wheatcraft, and R. Schumer," *Applied Geochemistry* (2015), **52**:195 – 196, ISSN 0883-2927
- Sturchio, N.C., Jr., A.B., Heraty, L.J., Wheatcraft, S. and Schumer, R., "Isotopic tracing of perchlorate sources in groundwater from Pomona, California," *Applied Geochemistry* (2014), **43**:80 – 87, ISSN 0883-2927
- Wang, M., Wang, C. and He, S., "Source identification of oil spills using compound-specific carbon isotope analysis based on ⁷⁻¹⁶ oil spill in Dalian, China," *Aquatic Procedia* (2015), **3**:197 – 202, ISSN 2214-241X, maritime Oil Spill Response
- Wassenaar, L.I., Hobson, K.A. and Sisti, L., "An online temperature-controlled vacuum-equilibration preparation system for the measurement of δ^2H values of non-exchangeable-H and of $\delta^{18}O$ values in organic materials by isotope-ratio mass spectrometry," *Rapid Communications in Mass Spectrometry* (2015), **29**(5):397–407, ISSN 1097-0231, rCM-14-0325.R2