Compound Specific Stable Isotope Analysis

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Advancement and Application of Gas Chromatography Isotope Ratio Mass Spectrometry Techniques for Atmospheric Trace Gas Analysis - Brian M Giebel 2011

The use of gas chromatography isotope ratio mass spectrometry (GC-IRMS) for compound specific stable isotope analysis is an underutilized technique because of the complexity of the instrumentation and high analytical costs. However stable isotopic data, when coupled with concentration measurements, can provide additional information on a compounds production, transformation, loss, and cycling within the biosphere and atmosphere. A GC-IRMS system was developed to accurately and precisely measure [delta]13C values for numerous oxygenated volatile organic compounds (OVOCs) having natural and
Compound-specific Stable Isotope Analysis of Amino Acids from the Laboratory to the Great Lakes - Chelsey M. Blanke 2016

Method Development for Non-routine Compound Specific Stable Isotope Analysis (CSIA) of Light anthropogenic sources. The OVOCs include methanol, ethanol, acetone, methyl ethyl ketone, 2-pentanone, and 3-pentanone. Guided by the requirements for analysis of trace components in air, the GC-IRMS system was developed with the goals of increasing sensitivity, reducing dead-volume and peak band broadening, optimizing combustion and water removal, and decreasing the split ratio to the IRMS. The technique relied on a two-stage preconcentration system, a low-volume capillary reactor and water trap, and a balanced reference gas delivery system. Measurements were performed on samples collected from two distinct sources (i.e. biogenic and vehicle emissions) and ambient air collected from downtown Miami and Everglades National Park. However, the instrumentation and the method have the capability to analyze a variety of source and ambient samples. The measured isotopic signatures that were obtained from source and ambient samples provide a new isotopic constraint for atmospheric chemists and can serve as a new way to evaluate their models and budgets for many OVOCs. In almost all cases, OVOCs emitted from fuel combustion were enriched in 13C when compared to the natural emissions of plants. This was particularly true for ethanol gas emitted in vehicle exhaust, which was observed to have a uniquely enriched isotopic signature that was attributed to ethanol's corn origin and use as an alternative fuel or fuel additive. Results from this effort show that ethanol's unique isotopic signature can be incorporated into air chemistry models for fingerprinting and source apportionment purposes and can be used as a stable isotopic tracer for biofuel inputs to the atmosphere on local to regional scales.
This book highlights new and emerging uses of stable isotope analysis in a variety of ecological disciplines. While the use of natural abundance isotopes in ecological research is now relatively standard, new techniques and ways of interpreting patterns are developing rapidly. The second edition of this book provides a thorough, up-to-date examination of these methods of research. As part of the Ecological Methods and Concepts series which provides the latest information on experimental techniques in ecology, this book looks at a wide range of techniques that use natural abundance isotopes to: follow whole ecosystem element cycling understand processes of soil organic matter formation follow the movement of water in whole watersheds understand the effects of pollution in both terrestrial and aquatic environments study extreme systems such as hydrothermal vents follow migrating organisms. In each case, the book explains the background to the methodology, looks at the underlying principles and assumptions, and outlines the potential limitations and pitfalls. Stable Isotopes in Ecology and Environmental Science is an ideal resource for both ecologists who are new to isotopic analysis, and more experienced isotope ecologists interested in innovative techniques and pioneering new uses.

Investigation of the delta^{13} C and delta^{15} N of individual compounds, commonly referred to as compound specific isotope analysis (CSIA), along with traditional techniques such as stomach content, dietary tracers, and bulk stable isotopic analysis (BSIA), provide a detailed description of trophic dynamics of organisms.
CSIA analysis of amino acids (CSIA-AA) in particular, has been used successfully in marine, estuarine, and more recently, terrestrial systems to estimate trophic position (TP) among organisms. Despite the analytical potential of this technique, its application in freshwater systems has remained limited. The goal of this dissertation is to bridge this knowledge gap by assessing the validity and efficacy of the CSIA-AA technique, through studies ranging from laboratory microcosm experiments, to natural freshwater ecosystems in Alabama. In Chapter 2, patterns of trophic enrichment were investigated in a freshwater phytoplankton-grazer model through a controlled feeding experiment in microcosms. Trophic fractionation among amino acids was consistent with previously published results from marine studies. TP determined by CSIA-AA provided a better estimate of trophic status than BSIA, extending the potential of this technique in freshwater systems. Chapter 3 examined the isotopic underpinnings of the phenotypic plasticity in bluegills from the Sipsey River main channel and its backwater habitats, thereby extending CSIA-AA to fluvial and lacustrine environments. BSIA of delta^{13}C indicated that the main channel bluegills were subsidized by allochthonous detrital carbon, compared to bluegills from the two floodplain lakes that relied on submerged macrophytic vegetation. Estimates of trophic length using CSIA placed bluegills from all three sites at comparable TP, between trophic levels 3 and 4, suggesting some degree of omnivory. In Chapter 4, the biotic factors affecting the significant difference in mercury concentrations between the largemouth bass from the Sipsey and Black Warrior Rivers were identified, using dual CSIA of triglyceride fatty acids (TGFA; delta^{13}C) and amino acids (delta^{15}N). Results indicate that increased presence of sulfate-reducing bacteria, coupled with detritus based food web, was the primary driver of the elevated mercury levels in the Sipsey bass. Data presented in this
dissertation clearly demonstrate the potential of CSIA-AA and CSIA-TGFA to provide high-resolution insights into complex food web interactions.

Investigation of Stable Carbon Compound Specific Isotope Analysis to Monitor and Quantify the Biodegradation of Chlorinated Ethenes in Groundwater Systems - Penny Lea Morrill 2004

Identification and quantification of chlorinated ethene biodegradation were investigated using carbon compound specific isotope analysis (CSIA). A dynamic headspace sampling technique was developed and shown to be a robust, simple and effective method for isotopic analysis of dissolved chlorinated ethenes at low concentrations (μg/L). This technique was used to monitor the biodegradation of tetrachloroethene (PCE) to ethene at a contaminated field site. At the field site, significant isotopic fractionation characteristic of biodegradation was observed in the isotope values of PCE and its degradation products trichloroethene (TCE), cis-1,2-dichloroethene (cDCE), and vinyl chloride (VC). During this study, stable carbon isotope analysis also provided one of the earliest lines of evidence for biodegradation. In laboratory and field experiments with an emplaced PCE dense nonaqueous phase liquid (DNAPL) source, isotopic fractionation was observed in the isotope values of the dechlorination intermediates produced by biodegradation, but not in the aqueous PCE near the DNAPL. These results confirm the hypothesis that isotopic fractionation due to biodegradation will not be observed in aqueous PCE close to the source zone. A model was developed to predict concentration values from isotope data for each step in the sequential reaction of PCE to non-toxic ethene. ...

Compound-specific Stable Isotope Analysis - Maik A Jochmann 2015-11-09

The use of Compound-specific Stable Isotope
Analysis (CSIA) is increasing in many areas of science and technology for source allocation, authentication, and characterization of transformation reactions. Until now, there have been no textbooks available for students with an analytical chemical background or basic introductory books emphasising the instrumentation and theory. This book is the first to focus solely on stable isotope analysis of individual compounds in sometimes complex mixtures. It acts as both a lecture companion for students and a consultant for advanced scientists in fields including forensic and environmental science. The book starts with a brief history of the field before going on to explain stable isotopes from scratch. The different ways to express isotope abundances are introduced together with isotope effects and isotopic fractionation. A detailed account of the required technical equipment and general procedures for CSIA is provided. This includes sections on derivatization and the use of microextraction techniques in GC-IRMS. The very important topic of referencing and calibration in CSIA is clearly described. This differs from approaches used in quantitative analysis and is often difficult for the newcomer to comprehend. Examples of successful applications of CSIA in food authenticity, forensics, archaeology, doping control, environmental science, and extraterrestrial materials are included. Applications in isotope data treatment and presentation are also discussed and emphasis is placed on the general conclusions that can be drawn from the uses of CSIA. Further instrumental developments in the field are highlighted and selected experiments are introduced that may act as a basis for a short practical course at graduate level.

**Stable Carbon Isotope Ratios and Biodegradation Rates of BTEX Compounds at the Tranguch Gasoline Site, Hazelton, Pennsylvania - 2005**

In April 2002, NRL sampled groundwater at the
Tranguch Gasoline Site (TGS), located in Hazelton, Pennsylvania. The goal of this study was to determine the rates and efficacy of on-site bacterial fuel hydrocarbon biodegradation; measure the overall metabolic activity and state of the on-site bacterial consortia; and determine fuel hydrocarbon stable isotope ratios. Mineralization rates were relatively high, and calculated turnover (removal of ambient pool) times for benzene and toluene were on the order of days. The exception was OSMW-02, which had a benzene turnover time of about 5 months. In wells with appreciable BTEX, mineralization of benzene and toluene accounted for \(^{100}\%\) of the calculated production. From compound-specific stable carbon isotope analysis, it was determined that the BTEX in each well was significantly different from the BTEX of every other well.

**Application of Compound Specific Stable Isotope Analysis to Spatial and Temporal Tracing of Organic Molecular Biomarkers**

**Through the Environment** - Abigail M Oakes 2017

One of the critical challenges facing modern environmental chemistry is how to identify sources, process of formation, and transport of organic compounds and pollutants in the environment. In recent decades, molecular and stable isotopic analysis of individual organic biomarkers, produced by living organisms, has emerged as a novel tool for identifying sources and processes associated with the synthesis of biological compounds. Specifically, this thesis focused on the questions related to processes controlling the production and movement of n-alkanes produced in plant leaf waxes and PAHs produced through the partial combustion of organic material. The aims of this thesis were to use compound-specific isotope analysis of these organic molecular biomarkers to understand how environmental changes are recorded, determine source materials, and evaluate potential methods of transport through the
environment. Chapters 3 and 4 used stable hydrogen (\( { }^{1}D \)) and carbon (\( { }^{13}C \)) isotopes of n-alkanes produced by leaf waxes to determine how differences in taxonomic class are recorded and how these biomarkers are preserved in fluvial sediments. This study found that n-alkanes from individual plants record plant specific differences in photosynthetic processes and physiology whereas n-alkanes preserved in fluvial sediments can identify large scale ecosystem changes. In Chapter 5, the concentrations, \( { }^{1}D \) and \( { }^{13}C \) of 16 EPA priority PAHs were measured from samples collected from around the states of Connecticut and Rhode Island. Using a multivariate approach to source identification, this study found that PAHs extracted from sediments and soils in Connecticut were sourced from a complex mixture of vehicular exhaust, coal burning exhaust, and industrial emissions. These projects represent a significant contribution to the understanding of carbon mobility over the earth surface with broad applications to environmental pollution tracing and paleoenvironmental reconstructions.

**Stable Carbon Isotope Ratio of Polycyclic Aromatic Hydrocarbons (PAHs) in the Environment** - Moon Koo Kim 2004

Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous, toxic contaminants that are released to the environment from various petrogenic and pyrogenic sources. In an effort to more clearly identify and trace sources of PAHs in the environment, purification and compound specific isotope analysis methods were developed to accurately measure the stable carbon isotope ratio of individual PAHs. Development of the method included improving accuracy and precision of the isotopic measurement by producing highly pure extracts using various chromatographic techniques. The method was refined by improving compound separations using purification techniques and high resolution chromatographic columns. The purification
method consists of alumina/silica gel column chromatography, gel permeation chromatography and thin layer chromatography. The mean recovery of PAHs after the purification procedure was approximately 80%. Sample purities after purification were verified by GC/FID and full scan mass spectrometry. To better resolve peaks and provide more accurate stable carbon isotope measurements, various gas chromatographic conditions were evaluated. The precision of the method ranged between 0.08 and 0.43. The analytical protocols were evaluated to confirm compositional and stable isotopic integrity during purification and stable isotopic analysis. To confirm the utility of the purification and isotope analysis methods, various environmental samples from marine, land and lacustrine environments were analyzed. The isolates were analyzed for the composition and the stable carbon isotope ratios of PAHs. The stable carbon isotope ratio was measured by GC/IRMS and the results, along with quantitative compound compositions, were used to characterize and identify the contaminant sources. The sources of the PAHs in the study areas were differentiated by PAH molecular ratios and confirmed by stable carbon isotope ratios. This study confirms that compound specific isotope analysis of pollutants by GC/IRMS can be used to identify PAH sources in environmental samples. The study also confirms that the purification and stable carbon isotope analysis methods that were developed can be used to accurately measure the stable carbon isotope ratios of PAHs in environmental samples for the purpose of source identification. GC/IRMS measurement of stable isotopic compositions can be an effective fingerprinting method when used in conjunction with traditional molecular composition methods.

**Anaerobic Utilization of Hydrocarbons, Oils, and Lipids - 19??**

**Strategies for High-precision Nitrogen and**

*compound-specific-stable-isotope-analysis*
Carbon Position-specific Isotope Analysis - Nabil Mohamed Reda Saad 2003
An alternative enzymatic strategy for N-PSIA is also described and is implemented on commercially available compound-specific isotope analysis systems. This strategy necessitates chemical derivatization for some of the deaminated compounds to enhance volatility for GC analysis. High-precision measurements were achieved for the two non-equivalent N positions of lysine (SD(delta 15N))

Sorption and Degradation Studies of Environmental Organic Contaminants by Compound-specific Stable Isotope Analysis - Heide Schürner 2015

The Palaeodietary Implications of Amino Acid Stable Isotope Analysis - Noah Vangelis Honch 2009

Characterization of Anaerobic Microbial Dehalogenation in Thauera Chlorobenzoica and Dehalococcoides Mccartyi Using Multi-element Compound-specific Stable Isotope Analysis - Steffi Franke 2018

Stable Isotopes as Indicators of Ecological Change - 2011-09-21
The 20th century has experienced environmental changes that appear to be unprecedented in their rate and magnitude during the Earth’s history. For the first time, Stable Isotopes as Indicators of Ecological Change brings together a wide range of perspectives and data that speak directly to the issues of ecological change using stable isotope tracers. The information presented originates from a range of biological and geochemical sources and from research fields within biological, climatological and physical disciplines covering time-scales from days to centuries. Unlike any other reference, editors discuss where isotope data can detect, record, trace and help to interpret environmental change. Provides researchers
with groundbreaking data on how to predict the terrestrial ecosystems response to the ongoing rapid alterations Reveals how ecosystems have responded to environmental and biotic fluctuations in the past Includes examples from research by a wide range of biological and physical scientists who are using isotopic records to both detect and interpret environmental change Encyclopedia of Paleoclimatology and Ancient Environments - Vivien Gornitz 2008-10-31 One of Springer’s Major Reference Works, this book gives the reader a truly global perspective. It is the first major reference work in its field. Paleoclimate topics covered in the encyclopedia give the reader the capability to place the observations of recent global warming in the context of longer-term natural climate fluctuations. Significant elements of the encyclopedia include recent developments in paleoclimate modeling, paleo-ocean circulation, as well as the influence of geological processes and biological feedbacks on global climate change. The encyclopedia gives the reader an entry point into the literature on these and many other groundbreaking topics.

Compound Specific Stable Isotope Analysis - Safdar Bashir 2014-08-12 One of the most promising tools for both characterizing contaminant sources and monitoring in situ degradation of organic contaminants in aquifers is compound-specific stable isotope analysis, in which the stable isotope ratios of one or more elements in a given compound are measured in order to investigate the transformation processes at work. The objective of this book was to validate the application of carbon-compound specific stable isotope analysis (CSIA) and enantiomer specific stable isotope analysis (ESIA) to characterize biotic and abiotic transformation of Hexachlorocyclohexane (HCH) in situ. Additionally, to prove that CSIA in combination with enantiomer-selective degradation of -HCH
can be applied as an effective and reliable tool for monitoring natural attenuation of HCH. The variability in enrichment factors observed for enantiomers during biotic investigation showed the preferential reactivity of enzymes for one enantiomer over the other which is not observed in abiotic studies. Thus CSIA combined with ESIA and enantiomer fractions (EF) can help to distinguish biotic and abiotic reactions taking place in situ."

**Developing Compound-specific Stable Isotope Tools for Monitoring Landfill Leachate** - Timothy James Benbow 2007

**Stable Isotope Forensics** - Wolfram Meier-Augenstein 2017-10-06

The number-one guide, internationally, to all aspects of forensic isotope analysis, thoroughly updated and revised and featuring many new case studies. This edition of the internationally acclaimed guide to forensic stable isotope analysis uses real-world examples to bridge discussions of the basic science, instrumentation and analytical techniques underlying forensic isotope profiling and its various technical applications. Case studies describe an array of applications, many of which were developed by the author himself. They include cases in which isotope profiling was used in murder, and drug-related crime investigations, as well as for pharmaceutical and food authenticity control studies. Updated with coverage of exciting advances occurring in the field since the publication of the 1st edition, this 2nd edition explores innovative new techniques and applications in forensic isotope profiling, as well as key findings from original research. More than a simple update, though, this edition has been significantly revised in order to address serious problems that can arise from non-comparable and unfit-for-purpose stable isotope data. To that end, Part II has been virtually rewritten with greater emphasis now being placed on important quality control issues in
stable isotope analysis in general and forensic stable isotope analysis in particular. Written in a highly accessible style that will appeal to practitioners, researchers and students alike. Illustrates the many strengths and potential pitfalls of forensic stable isotope analysis. Uses recent case examples to bridge underlying principles with technical applications. Presents hands-on applications that let experienced researchers and forensic practitioners match problems with success stories. Includes new chapters devoted to aspects of quality control and quality assurance, including scale normalisation, the identical treatment principle, hydrogen exchange and accreditation. Stable Isotope Forensics, 2nd Edition is an important professional resource for forensic scientists, law enforcement officials, public prosecutors, defence attorneys, forensic anthropologists and others for whom isotope profiling has become an indispensable tool of the trade. It is also an excellent introduction to the field for senior undergraduate and graduate forensic science students. "All students of forensic criminology, and all law enforcement officers responsible for the investigation of serious crime, will want to study this book. Wolfram highlights the value, and future potential, of Stable Isotope Forensics as an emerging powerful tool in the investigation of crime." — Roy McComb, Deputy Director, Specialist Investigations, National Crime Agency (NCA), UK “A single author text in these days is rare and the value of this book lies in the dedication and experience of the author which is evident in the clarity of prose, the honest illustration of evidence and the realistic practical application of the subject - it makes this a text of genuine scientific value.” — Prof Dame Sue Black, PhD, DBE, OBE, FRSE, Leverhulme Research Centre for Forensic Science, University of Dundee, UK The book provides an excellent, vivid and comprehensible introduction into the world of stable isotope science and analytics. Compared to the first edition, the
aspects of quality control and assurance in the analysis of stable isotopes in general, and forensic application in particular, are now taking much more room. This allows the book to serve the target groups: students, academic professionals and practitioners, and serves as a solid resource of basic and applicable information about the strengths and potential pitfalls of the application of stable isotope signatures. The present high-quality book shows the great potential of stable isotopes and is a must for everyone interested in isotope forensics. M.E. Böttcher & U. Flenker, Isotopes in Environmental and Health Studies, January 2018.

**Earth, Life, and Isotopes** - Ohkouchi/Naohiko 2010-08


**Handbook of Stable Isotope Analytical Techniques** - Pier A. de Groot 2004-10-27

(Parent with price) Volume I contains subjective reviews, specialized and novel technique descriptions by guest authors. Part 1 includes contributions on purely analytical techniques and Part 2 includes matters such as development of mass spectrometers, stability of ion sources, standards and calibration, correction procedures and experimental methods to obtain isotopic
fractionation factors. Volume II will be available in 2005.

**A New Method for Compound-specific Stable Chlorine Isotope Analysis** - Kaori Sakaguchi-Söder 2010

**Stable Isotope Ecology** - Brian Fry 2007-01-15
A solid introduction to stable isotopes that can also be used as an instructive review for more experienced researchers and professionals. The book approaches the use of isotopes from the perspective of ecological and biological research, but its concepts can be applied within other disciplines. A novel, step-by-step spreadsheet modeling approach is also presented for circulating tracers in any ecological system, including any favorite system an ecologist might dream up while sitting at a computer. The author’s humorous and lighthearted style painlessly imparts the principles of isotope ecology. The online material contains color illustrations, spreadsheet models, technical appendices, and problems and answers.

**Organic Mass Spectrometry in Art and Archaeology** - Prof Maria Perla Colombini 2009-07-28
Offers an overview of the analysis of art and archaeological materials using techniques based on mass spectrometry. Illustrates basic principles, procedures and applications of mass spectrometric techniques. Fills a gap in the field of application on destructive methods in the analysis of museum objects. Edited by a worldwide respected specialists with extensive experience of the GC/MS analysis of art objects. Such a handbook has been long-awaited by scientists, restorers and other experts in the analysis of art objects.

**The Biological Fractionation of Isotopes** - Eric Galimov 2012-12-02
The Biological Fractionation of Isotopes focuses on the biological fractionation of isotopes and presents calculations of the thermodynamic
isotopic beta factor for polyatomic carbon compounds. This book provides experimental and theoretical evidence of the phenomenon of thermodynamically ordered distribution of isotopes in biological systems. This book consists of 12 chapters and opens with an overview of the causes of fractionation of isotopes, along with concepts such as isotopic composition and isotopic effects. The discussion then turns to the isotopic composition of the carbon of organisms; a method of calculating the thermodynamic isotopic factors of polyatomic compounds; and results of experimental investigations of intermolecular and intramolecular isotopic effects. A theoretical model of biological fractionation of isotopes is also described. The following chapters explore the regularities of the biological distribution of isotopes and present the results of some biochemical experiments, including the enzymatic decarboxylation of pyruvate and microbiological oxidation of ethanol to acetic acid. In addition, the geologic aspects of thermodynamically ordered isotopic distributions in biological products are analyzed. This monograph will be of interest to biologists, geochemists, analytical chemists, and geologists. *Tracing Organic Matter Pathways in Marine Food Webs Using Fatty Acids and Compound Specific Stable Isotope Analysis* - Stephanie Denise Smith 2015

Organic matter inputs to the marine environment vary over seasonal and spatial scales, altering the type and availability of food sources for marine consumers. It is important to identify diet in order to understand basic ecology, characterize trophic interactions, and predict consequences of biotic and abiotic change within a community. Methods of direct observation of diet and feeding can be difficult, so indirect methods have been developed such as analysis of gut contents and fecal pellets. However, these methods only represent a snapshot of the last meal, and provide information about what was ingested, but not
what was actually incorporated into consumer tissues. Therefore, biogeochemical approaches such as fatty acid (FA) and stable isotope analyses have been developed, which provide a time-integrated measure of diet. Further, stable isotope measurements of specific FA markers can be used to identify carbon sources, and can be applied to a variety of food web studies (Iverson et al., 2004). The purpose of this research is to examine the linkages between organic carbon sources and trophic transfer by consumers. To achieve this, we use FA biomarkers and compound specific stable isotope analysis (CSIA) to trace carbon cycling. This study has two main components: environmental sampling and experimental research. Chapter 1 demonstrates the use of these tools for elucidating seasonal trophic linkages in invertebrates collected from the Alaskan Arctic coast. Overall, invertebrate diets were characterized by terrestrial, detrital, and carnivorous sources in winter and spring, with a shift toward autochthonous diatom-based diets in summer. Our results demonstrate the importance of terrestrial organic carbon as a subsistence food source in winter, whereas in situ production in summer was critical for accumulating FA stores rich in essential FAs.

Chapter 2 is an experimental feeding study designed to quantify the incorporation rates of 18:2n-6 from diet to tissue in Atlantic croaker. Liver tissues accumulated FAs more quickly than muscle tissues, but both tissues reached equilibrium at 5 to 7 weeks. From these experiments, quantitative assessments of diet sources can be made with confidence when using FAs to understand trophic interactions of Atlantic croaker and other similar species. 

Investigation of Stable Carbon Compound Specific Isotope Analysis to Monitor and Quantify the Biodegradation of Chlorinated Ethenes in Groundwater Systems - Penny Lea Morrill 2005
The use of Compound-specific Stable Isotope Analysis (CSIA) is increasing in many areas of science and technology for source allocation, authentication, and characterization of transformation reactions. Until now, there have been no textbooks available for students with an analytical chemical background or basic introductory books emphasising the instrumentation and theory. This book is the first to focus solely on stable isotope analysis of individual compounds in sometimes complex mixtures. It acts as both a lecture companion for students and a consultant for advanced scientists in fields including forensic and environmental science. The book starts with a brief history of the field before going on to explain stable isotopes from scratch. The different ways to express isotope abundances are introduced together with isotope effects and isotopic fractionation. A detailed account of the required technical equipment and general procedures for CSIA is provided. This includes sections on derivatization and the use of microextraction techniques in GC-IRMS. The very important topic of referencing and calibration in CSIA is clearly described. This differs from approaches used in quantitative analysis and is often difficult for the newcomer to comprehend. Examples of successful applications of CSIA in food authenticity, forensics, archaeology, doping control, environmental science, and extraterrestrial materials are included. Applications in isotope data treatment and presentation are also discussed and emphasis is placed on the general conclusions that can be drawn from the uses of CSIA. Further instrumental developments in the field are highlighted and selected experiments are introduced that may act as a basis for a short
practical course at graduate level. Carbon Compound Specific Stable Isotope Analysis (CSIA) of Polycyclic Aromatic Hydrocarbons (PAH) in Air Particulate Matter (PM) for Source Apportionment - 2006

**Stable Isotopes** - H. Griffiths 2020-08-18
In this authoritative review, leading international researchers explore the growing range of applications of stable isotope techniques for probing and integrating biological processes and palaeoclimatic cycles. The interdisciplinary approach covers a wide range of issues, opportunities and developments, setting interactions with plants in the context of water and nutrient cycles, exchanges with the atmosphere and modelling past and present climate change. This important book will appeal to those requiring an overview of the use of stable isotopes in aquatic, terrestrial and climatic processes and is in tune with current global concerns. In addition postgraduates and research scientists will find an extensive guide to more specialist disciplines, including developing mass spectrometer technologies, compound-specific and cellular-discrimination processes or whole organism and ecosystem responses.

Assessing Trophic Ecology and Nutritional Status of Marine Mammals with Bulk and Compound-specific Amino Acid Isotope Analysis - Leslie Roland 2011

Characterisation of Microbial Transformation of Halogenated Organic Contaminants Using Compound-specific Stable Isotope Analysis - 2016
Dehalococcoides; chlorinated ethenes; monochlorobenzene; stable isotope fractionation; compound-specific stable isotope analysis; biodegradation; organohalide respiration; anaerobic microbiology; reductive dehalogenation

Tracking Animal Migration with Stable
**Isotopes** - Keith A. Hobson 2018-09-13

Tracking Animal Migration with Stable Isotopes, Second Edition, provides a complete introduction to new and powerful isotopic tools and applications that track animal migration, reviewing where isotope tracers fit in the modern toolbox of tracking methods. The book provides background information on a broad range of migration scenarios in terrestrial and aquatic systems and summarizes the most cutting-edge developments in the field that are revolutionizing the way migrant individuals and populations are assigned to their true origins. It allows undergraduates, graduate students and non-specialist scientists to adopt and apply isotopes to migration research, and also serves as a useful reference for scientists. The new edition thoroughly updates the information available to the reader on current applications of this technique and provides new tools for the isotopic assignment of individuals to origins, including geostatistical multi-isotope approaches and the ways in which researchers can combine isotopes with routine data in a Bayesian framework to provide best estimates of animal origins. Four new chapters include contributions on applications to the movements of terrestrial mammals, with particular emphasis on how aspects of animal physiology can influence stable isotope values. Includes an animal physiology component that is an in-depth overview of the cautions and caveats related to this technique Covers marine and aquatic isoscapes and methods to track marine organisms for researchers trying to apply isotopic tracking to animals in these environments Features state-of-the-art statistical treatments for assignment and combining diverse datasets


Compound specific isotope analysis of individual amino acids (CSI-AA) is a powerful tool for
tracing nitrogen (N) source and transformation in biogeochemical cycles. Specifically, the delta15N value of phenylalanine (delta15N Phe) represents an increasingly used proxy for baseline delta15N values, with particular promise for paleoceanographic applications. Further, multiple studies have shown that delta15N values of Phe and glutamic acid (Glu) can be coupled to provide precise estimates of trophic position (TP), while simultaneously decoupling baseline delta15N values from the effects of trophic transfer. However, current derivatization/gas chromatography (GC) methods require expensive and relatively uncommon instrumentation, and have relatively low precision, posing significant issues for many potential applications. Here we present a new approach to CSI-AA based on a high-pressure liquid chromatography (HPLC) purification of underivatized amino acids, followed by offline elemental analysis-isotope ratio mass spectrometry (EA-IRMS). The utility of this approach is demonstrated in two different applications using natural materials: 1) the construction of a high precision paleoceanographic record from the delta15NPhe in proteinaceous coral tissue and 2) the TP estimation of five marine organisms using the coupled delta15N values of Glu and Phe. Both demonstrations were compared to values measured by an established GC based method. In all cases both methods produced equivalent values, however, values generated by the new HPLC/EA-IRMS approach had higher average precision in all cases. These results demonstrate that this approach represents a viable alternative to traditional GC based methods for delta15NAA measurement and may therefore allow significant expansion of CSI-AA applications, requiring only commonly available instrumentation to produce high precision delta15N AA values.

The Encyclopedia is a complete and authoritative reference work for this rapidly evolving field. Over 200 international scientists, each experts in their specialties, have written over 330 separate topics on different aspects of geochemistry including geochemical thermodynamics and kinetics, isotope and organic geochemistry, meteorites and cosmochemistry, the carbon cycle and climate, trace elements, geochemistry of high and low temperature processes, and ore deposition, to name just a few. The geochemical behavior of the elements is described as is the state of the art in analytical geochemistry. Each topic incorporates cross-referencing to related articles, and also has its own reference list to lead the reader to the essential articles within the published literature. The entries are arranged alphabetically, for easy access, and the subject and citation indices are comprehensive and extensive. Geochemistry applies chemical techniques and approaches to understanding the Earth and how it works. It touches upon almost every aspect of earth science, ranging from applied topics such as the search for energy and mineral resources, environmental pollution, and climate change to more basic questions such as the Earth’s origin and composition, the origin and evolution of life, rock weathering and metamorphism, and the pattern of ocean and mantle circulation. Geochemistry allows us to assign absolute ages to events in Earth’s history, to trace the flow of ocean water both now and in the past, trace sediments into subduction zones and arc volcanoes, and trace petroleum to its source rock and ultimately the environment in which it formed. The earliest of evidence of life is chemical and isotopic traces, not fossils, preserved in rocks. Geochemistry has allowed us to unravel the history of the ice ages and thereby deduce their cause. Geochemistry allows us to determine the swings in Earth’s surface temperatures during the ice ages, determine the temperatures and pressures at which rocks have
been metamorphosed, and the rates at which ancient magma chambers cooled and crystallized. The field has grown rapidly more sophisticated, in both analytical techniques that can determine elemental concentrations or isotope ratios with exquisite precision and in computational modeling on scales ranging from atomic to planetary.

**Diet at Herculaneum in AD 79** - Silvia Soncin 2021

**Guidelines for Sediment Tracing Using the Compound Specific Carbon Stable Isotope Technique** - International Atomic Energy Agency 2019

**Authenticity of Aroma Components** - Anne-Mette Sølvbjerg Hansen