



# Geochimica et Cosmochimica Acta

JOURNAL OF THE GEOCHEMICAL SOCIETY  
AND THE METEORITICAL SOCIETY

EXECUTIVE EDITOR: MARC NORMAN

ASSOCIATE  
EDITORS:

JEFFREY C. ALT  
YURI AMELIN  
LAWRENCE M. ANOVITZ  
WOLFGANG BACH  
MIRYAM BAR-MATTHEWS  
THOMAS S. BIANCHI  
RUTH BLAKE  
JANNE BLICHERT-TOFT  
JEAN-FRANÇOIS BOILY  
ANDREW R. BOWIE  
MAUD BOYET  
JOCHEN J. BROCKS  
PETE BURNARD  
ROBERT H. BYRNE  
ELIZABETH A. CANUEL  
JEFFREY G. CATALANO  
THURE CERLING  
JON CHOROVER

GEORGE COOPER  
NICOLAS DAUPHAS  
ANTHONY DOSSETO  
JAMES FARQUHAR  
JÉRÔME GAILLARDET  
JIWCHAR GANOR  
JITENDRA N. GOSWAMI  
CHRIS M. HALL  
CHRIS HERD  
PETER HERNES  
GREGORY F. HERZOG  
EDWARD HORNIBROOK  
SHICHUN HUANG  
TREVOR IRELAND  
JUN-ICHIRO ISHIBASHI  
ANDREW D. JACOBSON  
BJØRN JAMTVEIT  
KAREN JOHANNESSEN

CLARK JOHNSON  
DAVID T. JOHNSTON  
CHRISTOPHER S. KIM  
PENELOPE L. KING  
CHRISTIAN KOEBERL  
ALEXANDER N. KROT  
TIMOTHY J. LYONS  
TOM MCCOLLOM  
FRANK McDERMOTT  
ANDERS MEIBOM  
JACK J. MIDDELBURG  
JOHN W. MOREAU  
FREDERIC MOYNIER  
ALFONSO MUCCI  
ALEXANDER NEMCHIN  
MARTIN NOVAK  
RICHARD PANCOST  
DIMITRI PAPANASTASSIOU

CAROLINE L. PEACOCK  
ANN PEARSON  
GLEB S. POKROVSKI  
MARK REHKAMPER  
W. UWE REIMOLD  
PETER W. REINERS  
EDWARD M. RIPLEY  
CLAIRE ROLLION-BARD  
YAIR ROSENTHAL  
SARA S. RUSSELL  
NITA SAHAI  
EDWIN A. SCHAUBLE  
ALEX SESSIONS  
SILKE SEVERMANN  
TIMOTHY J. SHAW  
STEVEN B. SHIREY  
DAVID L. SHUSTER  
JAAP S. SINNINGHE DAMSTÉ

CARL STEEFEL  
BRIAN W. STEWART  
CLAUDINE STIRLING  
WEIDONG SUN  
MICHAEL J. TOPLIS  
BENJAMIN A.S. VAN MOOY  
WIM VAN WESTRENE  
RICHARD J. WALKER  
JOSEF WERNE  
STEFAN WEYER  
JAN G. WIEDERHOLD  
ROY A. WOGELIUS  
QING-ZHU YIN  
CHEN ZHU

Volume 126

February 1, 2014

## Articles

- B. D. WALKER, T. P. GUILDERTSON, K. M. OKIMURA, M. B. PEACOCK, M. D. MCCARTHY: Radiocarbon signatures and size-age-composition relationships of major organic matter pools within a unique California upwelling system . . . . . 1
- D. HOULE, C. MARTY, L. DUCHESNE, C. GAGNON: Humus layer is the main locus of secondary SO<sub>4</sub> production in boreal forests . . . . . 18
- J. HARVEY, I. P. SAVOV, S. AGOSTINI, R. A. CLIFF, R. WALSHAW: Si-metasomatism in serpentinized peridotite: The effects of talc-alteration on strontium and boron isotopes in abyssal serpentinites from Hole 1268a, ODP Leg 209 . . . . . 30
- H. YANG, R. D. PANCOST, X. DANG, X. ZHOU, R. P. EVERSHERD, G. XIAO, C. TANG, L. GAO, Z. GUO, S. XIE: Correlations between microbial tetraether lipids and environmental variables in Chinese soils: Optimizing the paleo-reconstructions in semi-arid and arid regions . . . . . 49
- P. HÖHENER, O. ATTEIA: Rayleigh equation for evolution of stable isotope ratios in contaminant decay chains . . . . . 70
- J. COSMIDIS, K. BENZERARA, G. MORIN, V. BUSIGNY, O. LEBEAU, D. JÉZÉQUEL, V. NOËL, G. DUBLET, G. OTHMANE: Biomineralization of iron-phosphates in the water column of Lake Pavin (Massif Central, France) . . . . . 78
- Y. GOLDSMITH, M. STEIN, Y. ENZEL: From dust to varnish: Geochemical constraints on rock varnish formation in the Negev Desert, Israel . . . . . 97
- A. CHAPPAZ, T. W. LYONS, D. D. GREGORY, C. T. REINHARD, B. C. GILL, C. LI, R. R. LARGE: Does pyrite act as an important host for molybdenum in modern and ancient euxinic sediments? . . . . . 112
- I. GALECZKA, D. WOLFF-BOENISCH, E. H. OELKERS, S. R. GISLASON: An experimental study of basaltic glass-H<sub>2</sub>O-CO<sub>2</sub> interaction at 22 and 50 °C: Implications for subsurface storage of CO<sub>2</sub> . . . . . 123
- T. E. LAURILA, M. D. HANNINGTON, S. PETERSEN, D. GARBE-SCHÖNBERG: Early depositional history of metalliferous sediments in the Atlantis II Deep of the Red Sea: Evidence from rare earth element geochemistry . . . . . 146

Continued from front cover

D. A. STOLPER, A. L. SESSIONS, A. A. FERREIRA, E. V. SANTOS NETO, A. SCHIMMELMANN, S. S. SHUSTA, D. L. VALENTINE, J. M. EILER: Combined $^{13}\text{C}$ -D and D-D clumping in methane: Methods and preliminary results . . . . .	169
S. R. GAINEY, E. M. HAUSRATH, J. A. HUROWITZ, R. E. MILLIKEN: Nontronite dissolution rates and implications for Mars . . . . .	192
A. WATENPHUL, C. SCHMIDT, S. JAHN: Cr(III) solubility in aqueous fluids at high pressures and temperatures . . . . .	212
J.-M. ZHU, T. M. JOHNSON, S. K. CLARK, X.-K. ZHU, X.-L. WANG: Selenium redox cycling during weathering of Se-rich shales: A selenium isotope study . . . . .	228
G. HARTMAN, M. RICHARDS: Mapping and defining sources of variability in bioavailable strontium isotope ratios in the Eastern Mediterranean . . . . .	250
N. F. BERNAL, S. A. GLEESON, A. S. DEAN, X.-M. LIU, P. HOSKIN: The source of halogens in geothermal fluids from the Taupo Volcanic Zone, North Island, New Zealand . . . . .	265
E. TONUI, M. ZOLENSKY, T. HIROI, T. NAKAMURA, M. E. LIPSCHUTZ, M.-S. WANG, K. OKUDAIRA: Petrographic, chemical and spectroscopic evidence for thermal metamorphism in carbonaceous chondrites I: CI and CM chondrites . . . . .	284
K. SHIRAI, B. R. SCHÖNE, T. MIYAJI, P. RADARMACHER, R. A. KRAUSE Jr., K. TANABE: Assessment of the mechanism of elemental incorporation into bivalve shells ( <i>Arctica islandica</i> ) based on elemental distribution at the microstructural scale . . . . .	307
O. J. LECHTENFELD, G. KATTNER, R. FLERUS, S. L. MCCALLISTER, P. SCHMITT-KOPPLIN, B. P. KOCH: Molecular transformation and degradation of refractory dissolved organic matter in the Atlantic and Southern Ocean . . . . .	321
N. N. AKINFIEV, A. V. PLYASUNOV: Application of the Akinfiev–Diamond equation of state to neutral hydroxides of metalloids ( $\text{B}(\text{OH})_3$ , $\text{Si}(\text{OH})_4$ , $\text{As}(\text{OH})_3$ ) at infinite dilution in water over a wide range of the state parameters, including steam conditions . . . . .	338
F. RICHTER, B. WATSON, M. CHAUSSIDON, R. MENDYBAEV, D. RUSCITTO: Lithium isotope fractionation by diffusion in minerals. Part 1: Pyroxenes . . . . .	352
E. M. MERVINE, S. E. HUMPHRIS, K. W. W. SIMS, P. B. KELEMEN, W. J. JENKINS: Carbonation rates of peridotite in the Samail Ophiolite, Sultanate of Oman, constrained through $^{14}\text{C}$ dating and stable isotopes . . . . .	371
J. R. A. GODINHO, S. PIAZOLO, T. BALIC-ZUNIC: Importance of surface structure on dissolution of fluorite: Implications for surface dynamics and dissolution rates . . . . .	398
A. FERNANDEZ, J. TANG, B. E. ROSENHEIM: Siderite ‘clumped’ isotope thermometry: A new paleoclimate proxy for humid continental environments . . . . .	411

Continued on last page of this issue

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

**ScienceDirect**

*Geochimica et Cosmochimica Acta* is abstracted/listed in *Mineral. Abstr.*, *Biol. Abstr.*, *Chem. Abstr.*, *Curr. Cont.*, *Excerpt. Med.*, *Ocean. Abstr.*, *Pollut. Abstr.*, *Sci. Abstr.*, *Sci. Cit Ind.*, *AESIS*, *Br. Geol. Lit.*, *Deep-Sea Res. & Oceanogr. Abstr.*, *Fuel & Energy Abstr.*, *Geo. Abstr.*, *GoeRef.*, *INIS Atomind.*, *Ind. Sci. Rev.*, *Int. Aerosp. Abstr.*, *E&P Hlth.*, *Mass Spectr. Bull.*, *Org. Geochem.*, *Petrol. Abstr.*, *Sel. Water Res. Abstr.*, *So. Pac. Per. Ind.*, *Soils & Fert.*, *Gas Process. & Ppl.*, *W.R.C. Inf.*, *Meteor. & Geostrophys. Abstr.*, *Off. Tech.* Also covered in the abstract and citation database Scopus®. Full text available on ScienceDirect®



K. MOELLER, R. SCHOENBERG, T. GRENNE, I. H. THORSETH, K. DROST, R. B. PEDERSEN: Comparison of iron isotope variations in modern and Ordovician siliceous Fe oxyhydroxide deposits . . . . .	422
M. MATSUMOTO, K. TOMEOKA, Y. SETO, A. MIYAKE, M. SUGITA: Nepheline and sodalite in the matrix of the Ningqiang carbonaceous chondrite: Implications for formation through parent-body processes . . . . .	441
B. A. HALEY, M. FRANK, E. HATHORNE, N. PISIAS: Biogeochemical implications from dissolved rare earth element and Nd isotope distributions in the Gulf of Alaska . . . . .	455
R. HALAMA, M. KONRAD-SCHMOLKE, M. SUDO, H. R. MARSCHALL, M. WIEDENBECK: Effects of fluid–rock interaction on <sup>40</sup> Ar/ <sup>39</sup> Ar geochronology in high-pressure rocks (Sesia-Lanzo Zone, Western Alps) . . . . .	475
C. LE LOSQ, D. R. NEUVILLE, P. FLORIAN, G. S. HENDERSON, D. MASSIOT: The role of Al <sup>3+</sup> on rheology and structural changes in sodium silicate and aluminosilicate glasses and melts . . . . .	495
R. BELISSONT, M.-C. BOIRON, B. LUIS, M. CATHELINEAU: LA-ICP-MS analyses of minor and trace elements and bulk Ge isotopes in zoned Ge-rich sphalerites from the Noailhac – Saint-Salvy deposit (France): Insights into incorporation mechanisms and ore deposition processes . . . . .	518
T. KLUGE, H. P. AFFEK, Y. G. ZHANG, Y. DUBLYANSKY, C. SPÖTL, A. IMMENHAUSER, D. K. RICHTER: Clumped isotope thermometry of cryogenic cave carbonates . . . . .	541
L. LI, F. SALEHIKHO, S. L. BRANTLEY, P. HEIDARI: Spatial zonation limits magnesite dissolution in porous media . . . . .	555
Y. YANG, Y. MIN, J. LOCOCO, Y.-S. JUN: Effects of Al/Si ordering on feldspar dissolution: Part I. Crystallographic control on the stoichiometry of dissolution reaction . . . . .	574
Y. YANG, Y. MIN, Y.-S. JUN: Effects of Al/Si ordering on feldspar dissolution: Part II. The pH dependence of plagioclases' dissolution rates . . . . .	595
M. ZECH, C. MAYR, M. TUTHORN, K. LEIBER-SAUHEITL, B. GLASER: Oxygen isotope ratios ( <sup>18</sup> O/ <sup>16</sup> O) of hemicellulose-derived sugar biomarkers in plants, soils and sediments as paleoclimate proxy I: Insight from a climate chamber experiment . . . . .	614
M. TUTHORN, M. ZECH, M. RUPPENTHAL, Y. OELMANN, A. KAHMEN, H. F. del VALLE, W. WILCKE, B. GLASER: Oxygen isotope ratios ( <sup>18</sup> O/ <sup>16</sup> O) of hemicellulose-derived sugar biomarkers in plants, soils and sediments as paleoclimate proxy II: Insight from a climate transect study . . . . .	624

**Comments and Responses**

G. S. POKROVSKI: Use and misuse of chemical reactions and aqueous species distribution diagrams for interpreting metal transport and deposition in porphyry copper systems: Comment on Sun et al. (2013) “The link between reduced porphyry copper deposits and oxidized magmas”, <i>Geochim. Cosmochim. Acta</i> 103, 263–275 . . . . .	635
W.-D. SUN, C.-C. ZHANG, H.-Y. LIANG, M.-X. LING, C.-Y. LI, X. DING, H. ZHANG, X.-Y. YANG, T. IRELAND, W.-M. FAN: The genetic association between magnetite–hematite and porphyry copper deposits: Reply to Pokrovski . . . . .	639
J. P. RICHARDS: Discussion of Sun et al. (2013): The link between reduced porphyry copper deposits and oxidized magmas . . . . .	643
W.-D. SUN, R.-F. HUANG, H.-Y. LIANG, M.-X. LING, C.-Y. LI, X. DING, H. ZHANG, X.-Y. YANG, T. IRELAND, W.-M. FAN: Magnetite–hematite, oxygen fugacity, adakite and porphyry copper deposits: Reply to Richards . . . . .	646