DEEP CARBON OBSERVATORY

Third DCO International Science Meeting

23–25 March 2017

St Andrews, Scotland

Program

University of St Andrews | FOUNDED 1413

SCIENCE PROGRAM COMMITTEE

Chris Ballentine, *Chair*
University of Oxford

Sami Mikhail, *Local Host*
University of St Andrews

Muriel Andreani
University of Lyon

Tom Kieft
New Mexico Tech

Jie Li
University of Michigan

Craig Manning
University of California, Los Angeles

Tamsin Mather
University of Oxford

Craig Schiffries
Carnegie Institution for Science

VENUES

Conference Hotel
Fairmont St Andrews–St Andrews, Scotland, KY16 8PN

Opening Reception, Sponsored by Thermo Fisher Scientific
St Andrews Bar & Grill (Clubhouse), Fairmont St Andrews–St Andrews, Scotland, KY16 8PN

Science Meeting
Oral Sessions: Lecture Theatre, Buchanan Building, University of St Andrews
Poster Sessions: Younger Hall, University of St Andrews
Lunches and Breaks: Younger Hall, University of St Andrews

Workshops
Session I: Lecture Theatre, Buchanan Building, University of St Andrews
Session II: Schools I and V, St Salvator's Quad, University of St Andrews
Session III: Schools I and V, St Salvator's Quad, University of St Andrews

Public Lecture by DCO Executive Director Robert Hazen
Booth Lecture Theatre, School of Medicine, North Haugh

Reception
Upper College Hall, University of St Andrews

Conference Banquet
Lower College Hall, University of St Andrews

Ceilidh & Cash Bar
Upper College Hall, University of St Andrews

OVERVIEW SCHEDULE

WEDNESDAY, 22 MARCH

19:00 - 21:00	Opening Reception, Sponsored by Thermo Fisher Scientific *St Andrews Bar & Grill (Clubhouse), Fairmont St Andrews*

THURSDAY, 23 MARCH

08:00 - 09:00	Arrival, Poster Setup, and Coffee *Younger Hall*
09:00 - 09:10	Welcome *Lecture Theatre, Buchanan Building*
09:10 - 11:15	Thursday Oral Session I *Lecture Theatre, Buchanan Building*
11:15 - 12:35	Thursday Poster Session (with refreshments) *Younger Hall*
12:35 - 13:35	Lunch *Younger Hall*
13:35 - 15:40	Thursday Oral Session II *Lecture Theatre, Buchanan Building*
15:40 - 16:10	Coffee Break *Younger Hall*
16:10 - 17:30	Thursday Oral Session III *Lecture Theatre, Buchanan Building*
17:30 - 18:15	Workshop Session I *Lecture Theatre, Buchanan Building*
18:30 - 19:30	Public Lecture by DCO Executive Director Robert Hazen *Booth Lecture Theatre, School of Medicine, North Haugh*
19:30	Pub Crawl and Tours *Depart from Buchanan Building*

FRIDAY, 24 MARCH

08:00 - 09:00	Arrival, Poster Setup, and Coffee *Younger Hall*
09:00 - 11:05	Friday Oral Session I *Lecture Theatre, Buchanan Building*
11:05 - 11:15	Group Photo *Location TBA*
11:15 - 12:35	Friday Poster Session (with refreshments) *Younger Hall*
12:35 - 13:35	Lunch *Younger Hall*
13:35 - 15:20	Friday Oral Session II *Lecture Theatre, Buchanan Building*
15:20 - 15:50	Coffee Break *Younger Hall*
15:50 - 17:10	Friday Oral Session III *Lecture Theatre, Buchanan Building*
17:30 - 18:15	Workshop Session II *Schools I and V, St Salvator's Quad*
18:15 - 19:00	Workshop Session III *Schools I and V, St Salvator's Quad*
19:00 - 20:00	Reception *Upper College Hall*
20:00 - 21:30	Conference Banquet *Lower College Hall*
21:30 - 23:30	Ceilidh & Cash Bar *Upper College Hall*

SATURDAY, 25 MARCH

08:00 - 09:00	Arrival, Poster Setup, and Coffee *Younger Hall*
09:00 - 11:05	Saturday Oral Session I *Lecture Theatre, Buchanan Building*
11:05 - 12:35	Saturday Poster Session (with refreshments) *Younger Hall*
12:35 - 13:35	Lunch *Younger Hall*
13:35 - 15:40	Saturday Oral Session II *Lecture Theatre, Buchanan Building*
15:40 - 16:00	Concluding Remarks *Lecture Theatre, Buchanan Building*
16:00	Meeting Adjourns

DETAILED SCHEDULE

WEDNESDAY, 22 MARCH

19:00 - 21:00	Opening Reception, Sponsored by Thermo Fisher Scientific

THURSDAY, 23 MARCH

08:00 - 09:00	Arrival, Poster Setup, and Coffee
09:00 - 09:10	Welcome Chris Ballentine, University of Oxford, *Science Program Committee Chair* Sami Mikhail, University of St Andrews, *Local Host*
	Thursday Oral Session I (Chris Ballentine, moderator)
09:10 - 09:35 **Keynote**	*The origin of terrestrial volatiles including carbon in light of the recent results from the Rosetta mission* Bernard Marty, CRPG Université de Lorraine Altwegg K, Rubin M, and the Rosina team
09:35 - 09:55	*The use of Venusian data to constrain the origin of Earth's carbon* Sami Mikhail, University of St Andrews Heap MJ, Forgan D
09:55 - 10:15	*Role of faint luminosity of the Sun in the history of biosphere* Erik Galimov, Vernadski Institute of Geochemistry and Analytical Chemistry
10:15 - 10:35	*A reservoir model for the evolution of deep carbon through deep time* Louise Kellogg, University of California, Davis Turcotte DL
10:35 - 10:55	*Carbon, sulfur, and halogen fluxes in intraplate mantle lithosphere* Maria-Luce Frezzotti, University of Milano-Bicocca Tiraboschi C, Ferrando S, Villa IM

10:55 - 11:15	*Deep Earth water maintains the long-term habitability of our planet* Dimitri A. Sverjensky, Johns Hopkins University Debret B
11:15 - 12:35	Thursday Poster Session (with refreshments)
12:35 - 13:35	Lunch
	Thursday Oral Session II (Tamsin Mather, moderator)
13:35 - 14:00 **Keynote**	*Sedimentary Carbon Input and Recycling at Subduction Zones* Terry Plank, Lamont Doherty Earth Observatory, Columbia University
14:00 - 14:20	*Coupled geodynamic models of flow and transport in subduction zones* David Rees Jones, University of Oxford Katz RF, May D, Rudge JR, Tian M
14:20 - 14:40	*An analysis of the dynamics of Mantle Melting and Outgassing related to deep volatiles* Fabrice Gaillard, University of Orleans
14:40 - 15:00	*Biology Meets Subduction: A Collaborative and Multi-disciplinary Deep Carbon Field Initiative* Peter Barry, University of Oxford Lloyd K, Pratt K, de Moor JM, Giovannelli D, Lopez T, Hummer D
15:00 - 15:20	*Submarine mud volcanoes: Microbial life and carbon flux at the interface between seafloor and subsurface* Emil Ruff, University of Calgary Felden J, Gruber-Vodicka H, Marcon Y, Knittel K, Ramette A, Boetius A
15:20 - 15:40	*The carbon puzzle is missing a piece: shallow-water hydrothermal vents* Donato Giovannelli, Earth-Life Science Institute
15:40 - 16:10	Coffee Break
	Thursday Oral Session III (Fumio Inagaki, moderator)
16:10 - 16:30	*High-pressure microbial growth in the deep biosphere* Karyn Rogers, Rensselaer Polytechnic Institute Cario A, Oliver G

16:30 - 16:50	*Persistence of microbial biosignatures with increasing metamorphic grade* Claire Cousins, University of St Andrews Mikhail S, Foucher F, Westall F, Montgomery W, Steele A, Shahar A
16:50 - 17:10	*IODP Expedition 370: Temperature Limit of the Deep Biosphere off Muroto (T-Limit)* Verena Heuer, MARUM / University of Bremen Inagaki F, Morono Y, Kubo Y, Maeda L, and the Expedition 370 Scientists
17:10 - 17:30	*Microevolutionary dynamics of subeafloor Methanothermococcus populations in high-temperature vent fluids from the Mid-Cayman Rise* Rika E. Anderson, Carleton College Huber JA
17:30 - 18:15	Workshop Session I - Earth in Five Reactions
18:30 - 19:30	Public Lecture by DCO Executive Director Robert Hazen
19:30	Pub Crawl and Tours

FRIDAY, 24 MARCH

08:00 - 09:00	Arrival, Poster Setup, and Coffee
	Friday Oral Session I (Karen Smit, moderator)
09:00 - 09:25 **Keynote**	*Constraints on mantle carbon speciation through deep time – the diamond perspective* Graham Pearson, University of Alberta Stachel T, Howell D, Nestola F, Stern RA, Harris JW, Shirey S & the DMGC consortium
09:25 - 09:45	*Searching for "deep" nitrogen through SIMS analyses of undegassed basaltic glasses* Evelyn Füri, Centre de Recherches Pétrographiques et Géochimiques (CNRS-UL) Deloule E, Dalou C
09:45 - 10:05	*Insights into the Archean deep carbon cycle revealed by >3 Ga placer diamonds* Katie Smart, University of the Witwatersrand Tappe S, Stern RA
10:05 - 10:25	*Diamond-bearing Marble in Earth's Lower Mantle Down to the Core-Mantle Boundary* Susannah Dorfman, Michigan State University Badro J, Nabiei F, Prakapenka VB, Cantoni M, Gillet P
10:25 - 10:45	*Influence of carbon on properties of solid iron under extreme conditions: Hidden carbon reservoirs in Earth's core* Bin Chen, University of Hawaii at Manoa
10:45 - 11:05	*High-pressure serpentinisation and abiotic methanogenesis* Alberto Vitale Brovarone, IMPMC - CNRS
11:05 - 11:15	Group Photo
11:15 - 12:35	Friday Poster Session (with refreshments)
12:35 - 13:35	Lunch

Friday Oral Session II (Craig Manning, moderator)

13:35 - 13:55 **Award Lecture**
A snapshot of volatile degassing at the scale of an entire subduction zone; the "Trail by Fire" expedition
Yves Moussallam, University of Cambridge
Peters N, Bani P, Schipper CI, Barnie T, Curtis A

13:55 - 14:15 **Award Lecture**
Microbial syntrophy: implications on diversity, stability, biogeography and evolution of the deep biosphere
Maggie Lau, Princeton University

14:15 - 14:40 **Keynote**
Microbial activity in the serpentinizing subsurface of Atlantis Massif: Initial Results from IODP Expedition 357
Beth N. Orcutt, Bigelow Laboratory for Ocean Sciences
D'Angelo T, Goordial J, Früh-Green GL

14:40 - 15:00
Serpentinization, carbon and life: Preliminary results of drilling the Atlantis Massif (IODP Expedition 357)
Gretchen Früh Green, ETH Zurich
Orcutt BN, Lilley MD, Green S, Cotterill C, IODP Expedition 357 Science Party

15:00 - 15:20
Carbonation & decarbonation of oceanic plates and the mantle wedge: Implications for the subduction zone carbon cycle
Peter Kelemen, Lamont Doherty Earth Observatory, Columbia University
Manning C

15:20 - 15:50 Coffee Break

Friday Oral Session III (Muriel Andreani, moderator)

15:50 - 16:10
Homogeneous reduction of CO_2 under hydrothermal conditions: effects of temperature and dissolved sulfide
Eoghan Reeves, University of Bergen
Seewald JS

16:10 - 16:30
The hydrothermal transformations of carboxylic acids in the presence of spinel-type mineral surfaces
Kristin N. Johnson, Arizona State University
Gould IR, Williams LB, Hartnett HE, Shock EL

16:30 - 16:50
The role of noble gases in interpreting deep carbon-rich systems in the crystalline basement
Oliver Warr, University of Toronto
Sherwood Lollar B, Fellowes J, Sutcliffe CN, McDermott JM, Holland G, Mabry JC, Ballentine CJ

16:50 - 17:10	*A Vision of Global Synthesis of Hydrogen, Methane and Higher Hydrocarbon production and distribution over time constrained via Noble gases* Chris Ballentine, University of Oxford Sherwood Lollar B
17:30 - 18:15	Workshop Session II - Data Science is Cool **OR** DCO's Educational Legacy
18:15 - 19:00	Workshop Session III - DCO Modeling Initiatives **OR** Making your Science Matter
19:00 - 20:00	Reception
20:00 - 21:30	Conference Banquet
21:30 - 23:30	Ceilidh & Cash Bar

SATURDAY, 25 MARCH

08:00 - 09:00	Arrival, Poster Setup, and Coffee
	Saturday Oral Session I (Jie Li, moderator)
09:00 - 09:25 **Keynote**	*Network analysis applications to carbon mineral systems* Shaunna Morrison, Carnegie Institution for Science Ahmed Eleish**,** Rensselaer Polytechnic Institute Daniel Hummer**,** Southern Illinois University Liu C, Prabhu A, Zhong H, Fox P, Ralph J, Golden JJ, Downs RT, Hystad G, Meyer M, Hazen RM
09:25 - 09:45	*Synthesizing Deep Carbon - Distillation and Dissemination in Five Reactions* Simon Redfern, University of Cambridge Li, J
09:45 - 10:05	*Spotlight on carbonates under pressure* Catherine McCammon, Bayerisches Geoinstitut, University of Bayreuth Winkler B
10:05 - 10:25	*Some Effects of Confinement on Fluid Behavior and Reactivity* Alberto Striolo, University College London Cole DE
10:25 - 10:45	*First-principles Raman spectroscopy of dissolved carbon in water under extreme conditions* Ding Pan, Hong Kong University of Science and Technology Galli G
10:45 - 11:05	*ENKI: A Jupyter notebook platform that delivers essential modeling tools to the Extreme Physics and Chemistry and the Reservoirs and Fluxes DCO communities* Mark S. Ghiorso, OFM Research Bergantz G, Fox P, Shock E, Spiegelman M, Sverjensky D
11:05 - 12:35	Saturday Poster Session (with refreshments)
12:35 - 13:35	Lunch

Saturday Oral Session II (Craig Schiffries, moderator)

13:35 - 14:00 **Keynote**
Deep methane cycles
Shuhei Ono, Massachusetts Institute of Technology
Wang DT, Danielle SG, Pape T, Bohrmann G

14:00 - 14:20
Tracing Deep Biosphere Methane Cycling with Fully Resolved $^{13}CH_3D$ and $^{12}CH_2D_2$
Jeanine Ash, University of California, Los Angeles
Egger M, Slomp CP, Kohl IE, Treude T, Rumble D, Young ED

14:20 - 14:40
Survival by any means necessary? Insights from the methanogenic archaea–associated oxidation of NH_4^+ to N_2O in three sulfide-mineral systems
Omar R. Harvey, Texas Christian University
Lazzarino P, Whitman WB, Qafoku NP

14:40 - 15:00
Low-biomass communities at the deep-biosphere extremes: Why and how do we care?
Yuki Morono, JAMSTEC
Inagaki F

15:00 - 15:20
How Thermococcus eurythermalis A501 live in deep biosphere with concise genome?
Xiang Xiao, Shanghai Jiaotong University
Zhao WS, Leng Hao, Wang H, Liu XX, Jian HH, Ma XP, Zhang Y, Li J

15:20 - 15:40
Something new from something old? Identifying factors that constrain life 2,500 meters below the surface
Kelly C. Wrighton, The Ohio State University
Daly RA, Borton MA, Hanson AJ, Welch SA, Wilson TA, Cole DR, Sharma S, Mouser PJ, Wilkins MJ

15:40 - 16:00
Concluding Remarks
Robert M. Hazen, Carnegie Institution for Science
Marie Edmonds, University of Cambridge

16:00
Meeting Adjourns

POSTER SESSIONS

THURSDAY, 23 MARCH

Origin of Materials

T-1 *Carbon and sulfur budget of the silicate Earth explained by accretion of differentiated planetary embryos*
Rajdeep Dasgupta, Rice University
Li Y, Tsuno K, Monteleone B, Shimizu N

T-2 *Self-Assembly of Prebiotic Organic Materials from Impact Events of Amino Acid Solutions*
Nir Goldman, Lawrence Livermore National Laboratory

Earth Dynamics

T-3 *The stability of carbonate in deeply subducted oceanic crust*
Michael Walter, University of Bristol
Drewitt J, Zhang H, Thomson A, McMahon S, Lord O

T-4 *Hydrous carbonatitic liquids generated by subducted pelagic carbonates*
Stefano Poli, Università degli Studi di Milano
Schettino E

T-5 *$Fe^{3+}/\sum Fe$ and fO_2 of mantle eclogites reveal highly reducing conditions during formation and recycling of Archaean oceanic crust*
Sonja Aulbach, Goethe University Frankfurt
Woodland AB, Vasilyev P, Viljoen KS

T-6 *Shear anisotropy in textured ferromagnesite in subducting slabs*
Carmen Sanchez-Valle, University of Muenster
Kupenko I, Rosa AD, Petitgirard S, Crichton W, Merkel S

T-7 *Effects of Major Element Phase Transitions on Slab Dynamics and Mass Transfer into the Lower Mantle*
Magali I. Billen, University of California, Davis
Arredondo K

T-8 *Experimental investigation of the carbonation of antigorite under the fore-arc region in subduction zones*
Greg M. Yaxley, The Australian National University
Sieber M, Hermann J

T-9 *A new estimation of volatile flux from the Southern Central American Volcanic Arc*
Maarten de Moor, National University, Costa Rica
Kern C, Aiuppa S, Fischer TP, Avard G, Muller C, Alvarez J, Ibarra M, Protti M, LaFemina P

T-10 *Earth's exhaust pipe: carbon isotope systematics in volcanic arc gases*
Marie Edmonds, University of Cambridge
Mason E, Turchyn AV

Rift/Arc Carbon

T-11 *Quantification of global volcanic CO_2 emissions from ground-based remote sensing of SO_2 and in-situ sampling of volcanic plumes*
Bo Galle, Chalmers University of Technology
Arellano S, Velasquez G, Chacon Z, Burbano V, De Moor M, Muñoz A, Mulina K, Wallius J

T-12 *Quantifying CO_2 fluxes from diffuse degassing through integration of gas dispersion models and measurements*
Antonio Costa, INGV
Chiodini G

T-13 *The influence of structure on CO_2 degassing and past volcanism in the Main Ethiopian Rift*
Tamsin Mather, University of Oxford
Hunt JA, Pyle DM, Zafu A

T-14 *New constraints on volcanic CO_2 emissions from Java, Indonesia*
Mike Burton, University of Manchester
Chiarugi A, D'Amato F, Viciani S, Queisser M, Marliyani G, Angarra F, Harijoko A

T-15 *15-years degassing activity of Miyakejima volcano, Japan*
Hiroshi Shinohara, Geological Survey of Japan, AIST
Geshi N, Matsushima N, Saito G, Kazahaya R

T-16 *Magmas near the critical degassing pressure drive volcanic unrest toward a critical state*
Giovanni Chiodini, INGV
Paonita A, Aiuppa A, Costa A, Caliro S, De Martino P, Acocella V, Vandemeulebrouck J

T-17 *Quantifying CO_2 degassing from volcanoes – Recent advancements and future challenges*
Cynthia Werner, USGS (contractor)
Chiodini G, Carn S, Aiuppa A, Burton M

T-18 *Novel laser-based instrumentation for field measurement of gaseous emissions*
Damien Weidmann, RAL Space
Mcleod N, Chu J, Kannath A, Brownsword R

T-19 *A decade of global volcanic SO_2 emissions measured from space*
Simon Carn, Michigan Technological University
Fioletov VE, McLinden CA, Li C, Krotkov NA

Life in the Seafloor

T-20 *Size, carbon content and biomolecules of microorganisms in the sub-seafloor*
Stefan Braun, Center for Geomicrobiology, Aarhus University
Morono Y, Becker KW, Hinrichs KU, Kjeldsen KU, Littmann S, Kuypers M, Aslan H, Dong M, Jørgensen BB, Lomstein BAa

T-21 *Microbial community zonation across a natural organic matter gradient spanning the Namibian shelf*
Lorenzo Lagostina, ETH Zürich
Arndt S, Lomstein B, Evans T, Pancost R, Sales De Freitas F, Lever MA

T-22 *Roles of archaea in organic matter degradation in marine sediments*
Fengping Wang, Shanghai JiaoTong University

T-23 *Microbial community composition and function in the Tonga Trench: from 400m below the sea surface to 9100m water depth and from 0 to 2 m below the seafloor*
Rosa Leon-Zayas, University of Delaware
Bartlett DH, Biddle JF

T-24 *Exploring ways to assess abundance, diversity and viability of endospores in low biomass sub-seafloor sediments of the Nankai Trough Accretionary Complex*
Bernhard Viehweger, MARUM / Universität Bremen
Wörmer L, Hinrichs KU, Lever MA, Heuer VB, Inagaki F, Morono Y, Expedition 370 Scientists

T-25 *Surficial Sediment Microbiota Present in Ultra-Deep Convergent Margins*
Doug Bartlett, Scripps Institution of Oceanography / University of California, San Diego
Peoples L, Grammatopolou E, Mayor D

DCO Cross-Cutting

T-26 *The Deep Carbon Observatory: A ten-year quest to study carbon in Earth*
Craig Schiffries, Carnegie Institution for Science
Hazen RM, Hemley R, Mangum AJ, Mays JL, Hoon-Starr M

T-27 *Carbon from Crust to Core: a history of deep carbon science*
Simon Mitton, University of Cambridge

T-28 *Resources and Partnership Opportunities in Data Science*
Kathy Fontaine, Rensselaer Polytechnic Institute
Fox P, Rogers K, Eleish A

T-29 *DCO Engagement: Telling the Deep Carbon Story*
Robert Pockalny, University of Rhode Island
Pratt C, Trew Crist D, Wood J

T-30 *Data2Paper: A stakeholder-driven solution to data publication and citation challenges*
Fiona Murphy, University of Reading
Jefferies N, Ranganathan A, Ingraham T, Murray H

FRIDAY, 24 MARCH

Diamonds are Forever

F-1 *Crystallographic orientations between diamond and its mineral inclusions: new insights into the syngenesis/protogenesis relationships*
Fabrizio Nestola, University of Padova

F-2 *COMPOSITION OF VOLATILE COMPONENTS IN DIAMONDS AND GARNETS FROM UNIQUE DIAMONDIFEROUS PERIDOTITE OF THE UDACHNAYA PIPE, YAKUTIA, RUSSIA*
Nikolay Sobolev, Russian Academy of Sciences
Tomilenko AA, Bulbak TA, Logvinova AM

F-3 *Reduced volatiles in the deep Earth: Raman evidence from lithospheric and sub-lithospheric diamonds*
Karen Smit, Gemological Institute of America
Smith EM, Shirey SB, Steele A, Stern RA

F-4 *Insights into diamond formation from polycrystalline diamond aggregates*
Dorrit Jacob, Macquarie University
Stern RA, Piazolo S, Chapman J, Czas J

F-5 *Superdeep diamonds with metal inclusions: confirmation of an ancient, reduced, recycled C reservoir in the mantle transition zone*
Steven B. Shirey, Carnegie Institution for Science
Smith EM, Nestola F, Richardson SH, Wang W, Wang J, Bullock ES, Hauri EH, DMGC consortium

F-6 *Dating individual diamond growth zones: A new methodology for assessing potential temporal changes in the deep carbon cycle*
Gareth R. Davies, Vrije Universiteit
Gress MU, Timmerman S, Chinn IL, Koornneef JM

F-7 *Diamond oxygen geochemistry*
Pierre Cartigny, Institut de Physique du Globe de Paris

F-8 *CO_2 and H_2O under deep lower-mantle conditions and Earth's carbon–hydrogen cycles*
Eglantine Boulard, Synchrotron Soleil
Guyot F, Menguy N, Auzende A-L, Corgne A, Perrillat J-P, Fiquet G

Serpentine Loves Carbon Too

F-9 *Ubiquity of condensed carbonaceous matter in the hydrated oceanic lithosphere: implications for the deep biosphere and elemental cycles of this unaccounted fraction so far*
Bénédicte Ménez, Institut de Physique du Globe de Paris - Université Paris Diderot
Brunelli D, Richard L, Sforna MC, Pisapia C, Pasini V, Seyler M, Trias R, Gérard E

F-10 *Pathways for Abiotic Carbon Reduction During Serpentinization*
Tom McCollom, LASP, University of Colorado, Boulder

F-11 *The Shinas and Mandoos hydrothermal vent systems in the Samail Ophiolite, Oman*
Ana P.M. Jesus, German University of Technology in Oman
Cravinho A, Moreira BB, Mateus A, Pracejus B, Figueiras, Benoit M, Vermond D

F-12 *Flux & Fate of Reduced Carbon in a Carbonate-capped, Serpentinizing System: Palawan, Philippines*
Dawn Cardace, University of Rhode Island
Meyer-Dombard DR, Woycheese K, Ono S, Arcilla C

F-13 *Quantification of global serpentinisation and hydrogen production at mid-ocean spreading plate boundaries: 250 Ma to Present*
Pablo Garcia del Real, Laboratoire de Géologie de Lyon
Daniel I, Andreani M, Coltice N

F-14 *Direct access to the serpentinite subsurface: a biogeochemical investigation to characterize a unique habitat*
Susan Lang, University of South Carolina
Lilley MD, Früh-Green GL, Orcutt BN

F-15 *Metagenome-enabled explorations of ecosystems supported by serpentinization*
William Brazelton, University of Utah
Twing KI, Schrenk MO

F-16 *Microbially mediated alteration of crystalline basalts as identified from analogical reactive percolation experiments*
Rachael L. Moore, Institut de Physique du Globe de Paris
Ménez B, Stéphant S, Dupraz S, Ranchou-Peyruse M, Ranchou-Peyruse A, Gérard E

F-17 *Formation of reduced Carbon compounds using natural catalysts in hydrothermal experiments*
Isabelle Martinez, Institut de Physique du Globe de Paris
Vacquand C, Kularatne K, Sissmann O, Brunet F, Recham N

F-18 *Deep Organic Geochemistry and Metastability*
Everett Shock, Arizona State University
Robinson J, Bockisch C, Johnson K, Fecteau K, Gould I, Hartnett H, Williams L

Life and Serpentine

F-19 *The Microbiology of Serpentinizing Ultramafic Intrusions: Insights from the Kirkland Lake Kimberlites*
Matt Schrenk, Michigan State University
Hamilton S, Lacrampe-Couloume G, Sherwood Lollar B

F-20 *The uncultivated phylum TA06*
Maggie Lau, Princeton University
Becraft E, Cason E, Borgonie G, Kieft TL, Li L, van Heerdeen E, Jarett J, Woyke T, Stepanauskas R, Onstott TC

F-21 *Biogeochemistry and geomicrobiology of sediments from ferrugineous and ultraoligotrophic Lake Towuti*
Jens Kallmeyer, GFZ Potsdam
Friese A, Vuillemin A, Simister R, Bauer K, Crowe SA, Nomosatryo S, Henny C, Dianto A, the ICDP Towuti Drilling Project Science Team

F-22 *Exploring the archaebacterial communities in deep terrestrial crustal system underneath Deccan traps, India*
Pinaki Sar, Indian Institute of Technology Kharagpur
Dutta A

F-23 *Deep subsurface life in Greenland*
Malin Bomberg, VTT Technical Research Centre of Finland

F-24 *Planetary Science and Exploration in the Deep Subsurface: Boulby Mine, UK*
Charles Cockell, University of Edinburgh
Payler S et al.

F-25 *Expression of metabolic pathways in microbial communities from a tropical serpentinizing environment*
Katrina Twing, University of Utah
Crespo-Medina M, Brazelton WJ, Sanchez-Murillo R, Schrenk MO

Life Techniques

F-26 *Current status and future of extreme biophysics*
Catherine A. Royer, Rensselaer Polytechnic Institute

F-27 *Recent developments in the use of perfluorocarbon tracers for contamination monitoring in ocean drilling*
Mark A. Lever, ETH Zürich
Eickenbusch P, Torti A, Hoshino T, Inagaki F, Jørgensen BB, Kevorkian RT, Liu C, Marshall IPG & IODP Expeditions 337, 347, and 366 Scientists

F-28 *Sampling Microbes in the Subsurface: A cautionary tale*
Brandi K. Reese, Texas A&M University
Sheik CS, Colwell FS, Sylvan JB, Grim S, Lau M, D'Hondt S, Morono Y, Inagaki F, Briggs BR, Schrenk MO, Lever MA, Onstott TC, Sogin M

F-29 *MetaSeek: A Sequencing Data Discovery Platform*
Adrienne Hoarfrost, University of North Carolina at Chapel Hill
Brown N

DCO Cross-Cutting

F-30 *Synthesis of Deep Carbon Observatory Science*
Marie Edmonds, University of Cambridge
Trew Crist, D

F-31 *Earth in Five Reactions: A Deep Carbon Perspective*
Jie Li, University of Michigan
Redfern S

SATURDAY, 25 MARCH

Mantle Carbon

S-1 *Reconstructing the variability in mantle carbon contents underneath mid-ocean ridges*
Sujoy Mukhopadhyay, University of California, Davis
Tucker JM, Gonnermann H

S-2 *Volatiles beneath mid-ocean ridges: deep melting, channelised transport, focusing, and metasomatism*
Tobias Keller, Stanford University
Katz RF, Hirschmann MM

S-3 *Solid Earth--climate coupling at inter/glacial timescales?*
Richard F. Katz, University of Oxford
Burley J, Huybers P

S-4 *Modeling CO_2 degassing rates across the ocean basins: A comparison of on-axis vs. off-axis fluxes*
Mark D. Behn, Woods Hole Oceanographic Institution
Clerc F, Parmentier EM

S-5 *The solid Earth's involvement in oxygen cycling: Observations and theory*
Oliver Shorttle, University of Cambridge
Stolper E, Antoshechkina P, Asimow P, Jennings E, Gaetani G, Graham D, Hartley M, Williams H, Brounce M, Halldorsson S

S-6 *DEEP HYDROCARBON CYCLE*
Vladimir Kutcherov, KTH Royal Institute of Technology
Kolesnikov A, Kudryavtsev D, Mukhina E, Serovaisky A

Extreme Carbon

S-7 *Chemistry of carbon in carbonates at extreme pressure-temperature conditions*
Alexander Goncharov, Carnegie Institution for Science
Lobanov SS, Dong X, Martirosyan NS, Oganov AR, Gavryshkin PN, Litasov KD, Greenberg E, Prakapenka VB

S-8 *Fate of $MgCO_3$ in subducting slabs and formation of superdeep diamonds and oxidizing zone in the deep lower mantle*
Eiji Ohtani, Tohoku University
Madeda F, Kamada S, Sakamaki T, Hirao N, Ohishi Y

S-9 *Candidate carbonate phases in the Earth: experimental X-ray diffraction studies*
Marco Merlini, Università degli Studi di Milano

S-10 *Crystallization of water mediated by carbon*
Tianshu Li, George Washington University
Bi Y, Cao B, Cabriolu R, Porras A

S-11 *Ultrafast dynamical processes of pure water and solutions under pressure*
Roberto Bini, LENS - Università di Firenze
Citroni M, Fanetti S, Falsini N, Calvagna C, Lapini A, Bartolini P, Taschin A, Torre R, Foggi P, Righini R

S-12 *Carbon speciation in pyrolite melts*
Razvan Caracas, CNRS, Ecole Normale Superieure de Lyon

S-13 *An experimental study on the origin and emplacement of carbonate-rich melts through time*
Vincenzo Stagno, Sapienza University of Rome
Kono Y, Stopponi V, Scarlato P, Lustrino M, Irifune T

S-14 *Structure and Dynamics of Carbon-bearing Fluids in Nanopores*
David R. Cole, The Ohio State University
Striolo A, Gautam S

Sediment Life

S-15 *Viral dynamics and global estimates for the biomass and biodiversity of the subsurface*
Cara Magnabosco, Simons Foundation
Bradley J, Onstott TC

S-16 *Exploring Ecological Patterns of Earth's Subsurface Life*
Joshua Ladau, Gladstone Institutes
Magnabosco C, Ruff SE, Colwell F, D'Hondt S, Gaidos E, Grim S, Kieft T, Leon-Zayas R, Lloyd K, Onstott TC, Reese BK, Rogers K, Schrenk M, Sherwood Lollar B, Soares A, Sogin M

S-17 *The global biogeography of subseafloor sedimentary microbiomes*
Fumio Inagaki, JAMSTEC
Hoshino T, Wömer L, Morono Y, D'Hondt S, Hinrichs K-U

S-18 *Characterization of methane hydrate reservoirs in the Gulf of Mexico*
Afu Lin, University of Texas at Austin
Dong T, Flemings PB, Polito PJ

S-19 *Modeling anaerobic oxidation of methane in dynamic methane hydrate-bearing sediments*
Michael Graw, Oregon State University
Colwell FS

S-20 *Understanding the depositional conditions of the Union Springs and Oatka Creek members of the Marcellus Formation: Are they different?*
Jeremy C. Williams, Kent State University
Darrah TD, Koons RC, Stebbins AG, Hannigan R

S-21 *IDENTIFICATION OF INFLOW OF FRESH LIGHT HYDROCARBONS IN THE OIL RESERVOIR THROUGH THE STUDY OF THE COMPOSITION OF OIL*
Irina N. Plotnikova, The Academy of Sciences of the Republic of Tatarstan
Ostroukhov SB, Pronin NV, Nosova FF

S-22 *Guar gum stimulates biogenic sulfide production at elevated pressures: Implications for shale gas extraction*
Sophie Nixon, University of Manchester
Walker L, Streets M, Boothman C, Eden B, Taylor K, Lloyd J

S-23 *A visual guide to the interpretation of methane stable isotopologue data - application to deep carbon cycles*
David T. Wang, MIT
Ono S

S-24 *The relative abundances of resolved $^{12}CH_2D_2$ and $^{13}CH_3D$ and mechanisms controlling isotopic bond ordering in abiotic and biotic methane gases*
Issaku E. Kohl, University of California, Los Angeles
Ash JL, Etiope G, Blank JG, Young ED

Carbon Minerals

S-25 *The Carbon Mineral Challenge: A worldwide search for undiscovered minerals*

Daniel Hummer, Southern Illinois University

Hazen RM, Downs RT, Hystad G, Golden JJ

S-26 *Redox equilibria involving chromium minerals in aqueous fluids under subduction zone conditions*

Jingyi Huang, Johns Hopkins University

Sverjensky DA

S-27 *Intercalation of Solid Hydrogen in Graphite*

Choong-Shik Yoo, Washington State University

Lim J, Kim M

S-28 *Copper mineral ecology and network analysis through deep time*

Shaunna Morrison, Carnegie Institution for Science

Eleish A, Liu C, Prabhu A, Zhong H, Fox P, Golden JJ, Ralph J, Downs RT, Hystad G, Meyer M, Hummer DR, Hazen RM

WORKSHOPS

SCHEDULE

Workshop Session I Thursday, 23 March, 17:30 - 18:15	Earth in Five Reactions
Workshop Session II Friday, 24 March, 17:30 - 18:15	Data Science is Cool **OR** DCO's Educational Legacy
Workshop Session III Friday, 24 March, 18:15 - 19:00	DCO Modeling Initiatives **OR** Making your Science Matter

DESCRIPTIONS

Earth in Five Reactions: Which are the most important?

Lecture Theatre, Buchanan Building

This is your chance to participate in the first dedicated discussion to define the key reactions that govern the transformation and movement of carbon in Earth. In what promises to be a lively and spirited event, workshop leaders Jie Li (University of Michigan, USA) and Simon Redfern (University of Cambridge, UK) will introduce a number of carbon-related reactions as initial candidates, to stimulate discussion of their merits and provoke consideration of additional possibilities. Participants will debate and vote on their favored five, as a starting point, which will inform a broader discussion of these reactions by the full DCO Science network. The five most important carbon reactions selected will serve as themes in the synthesis and dissemination of recent advances in deep carbon science.

Data Science is Cool

School I, St Salvator's Quad

Data Science has created a buzz in many traditional research communities, and DCO is a leading example. Find out more about what the DCO Data Science initiative can do for you! We will demonstrate some of the cool tools available to the DCO science network through deepcarbon.net. We'll show you how to use Jupyter notebooks and set them up on your laptop. They are a powerful way to store, manipulate, share data and code and do science. We'll also present the Data2Paper initiative, which provides a very fast way to publish your data sets.

DCO's Educational Legacy

School V, St Salvator's Quad

DCO has produced fundamental new understanding of the quantities, movements, forms and origins of carbon in Earth. Successfully integrating this new knowledge into the upper undergraduate and graduate-level curriculum would be an important contribution to training our next generation of scientists and a valued legacy of DCO. Please join Dave Cole (The Ohio State University, USA) and Claire Cousins (University of St Andrews, UK) to explore opportunities to integrate DCO discoveries into educational curricula. This is a chance to contribute your thinking and to get involved in this exciting initiative. The meeting will involve a presentation to demonstrate potential outputs and how they may be implemented; and discussion of community ideas for engagement.

DCO Modeling Initiatives: Tools for understanding and sharing deep carbon science

School I, St Salvator's Quad

This workshop features demonstrations of interactive visualizations, dynamic models, and others tools for researchers to explore carbon-bearing minerals and fluids in Earth. Shaunna Morrison (Carnegie Institution for Science, USA), Ahmed Eleish (Rensselaer Polytechnic Institute), and Robert Hazen (Carnegie Institution for Science, USA) will present their new work on carbon mineral distribution and diversity using data analysis and network visualization tools. Mark Ghiorso (OFM Research, USA) and Dimitri Sverjensky (Johns Hopkins University, USA) will demonstrate how the thermodynamic model MELTS may be combined with the Deep Earth Water (DEW) model to create an overarching understanding of carbon-bearing fluids in the mantle and crust.

Making your Science Matter: How to tell your science story

School V, St Salvator's Quad

Have you ever struggled to explain your science to your barista, barber, or best friend? This workshop will give you the tools you need to craft an explanation that is easy-to-understand by all. Using a time-tested "and, but, therefore" approach, DCO's Engagement Team will help you develop your own science story -- one that will also intrigue your colleagues, interest potential funders, and engage members of the media. All you need to do is to come to the workshop armed with curiosity, creativity, and a sense of humor.

MEETING PARTICIPANTS

Rika E. Anderson, Carleton College
Muriel Andreani, Université de Lyon
Jeanine Ash, University of California, Los Angeles
Sonja Aulbach, Goethe University Frankfurt
Jesse Ausubel, Rockefeller University / Alfred P. Sloan Foundation
Chris Ballentine, University of Oxford
John Baross, University of Washington
Peter Barry, University of Oxford
Doug Bartlett, Scripps Institution of Oceanography / University of California, San Diego
Mark D. Behn, Woods Hole Oceanographic Institution
Magali I. Billen, University of California, Davis
Roberto Bini, LENS - Università di Firenze
Malin Bomberg, VTT Technical Research Centre of Finland
Eglantine Boulard, Synchrotron Soleil
Stefan Braun, Center for Geomicrobiology, Aarhus University
William Brazelton, University of Utah
L. Taras Bryndzia, Shell International Exploration & Production, Inc.
Mike Burton, University of Manchester
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Dawn Cardace, University of Rhode Island
Simon Carn, Michigan Technological University
Pierre Cartigny, Institut de Physique du Globe de Paris
Bin Chen, University of Hawaii at Manoa
Giovanni Chiodini, INGV
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David R. Cole, The Ohio State University
Rick Colwell, Oregon State University
Antonio Costa, INGV
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Isabelle Daniel, Université de Lyon
Rajdeep Dasgupta, Rice University
Gareth R. Davies, Vrije Universiteit
Maarten de Moor, National University, Costa Rica
Donald Dingwell, Ludwig Maximilian University
Susannah Dorfman, Michigan State University
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Tucker Ely, Arizona State University
Kathleen Fontaine, Rensselaer Polytechnic Institute
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Pablo Garcia del Real, Laboratoire de Géologie de Lyon

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Donato Giovannelli, Earth-Life Science Institute
Nir Goldman, Lawrence Livermore National Laboratory
Alexander Goncharov, Carnegie Institution for Science
Michael Graw, Oregon State University
Doug Hamilton, Thermo Fisher
Omar R. Harvey, Texas Christian University
Robert M. Hazen, Carnegie Institution for Science
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Kai-Uwe Hinrichs, University of Bremen
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Michelle Hoon-Starr, Carnegie Institution for Science
Jingyi Huang, Johns Hopkins University
Daniel Hummer, Southern Illinois University
Fumio Inagaki, JAMSTEC
Dorrit Jacob, Macquarie University
Claude Jaupart, Institut de Physique du Globe de Paris
Ana P.M. Jesus, German University of Technology in Oman
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Adrian P. Jones, University College London
Jens Kallmeyer, GFZ Potsdam
Richard F. Katz, University of Oxford
Peter Kelemen, Lamont Doherty Earth Observatory, Columbia University
Tobias Keller, Stanford University
Louise Kellogg, University of California, Davis
Thomas L. Kieft, New Mexico Tech
Issaku E. Kohl, University of California, Los Angeles
Vladimir Kutcherov, KTH Royal Institute of Technology
Joshua Ladau, Gladstone Institutes
Lorenzo Lagostina, ETH Zürich
Susan Lang, University of South Carolina
Maggie Lau, Princeton University
Rosa Leon-Zayas, University of Delaware
Mark A. Lever, ETH Zürich
Tianshu Li, George Washington University
Jie Li, University of Michigan
Afu Lin, University of Texas at Austin
Karen Lloyd, University of Tennessee
Cara Magnabosco, Simons Foundation
Magda Mandic, Thermo Fisher
Andrea J. Mangum, Carnegie Institution for Science
Craig Manning, University of California, Los Angeles
Sally Mapstone, University of St Andrews
Isabelle Martinez, Institut de Physique du Globe de Paris
Bernard Marty, CRPG Université de Lorraine
Tamsin Mather, University of Oxford
Jennifer L. Mays, Carnegie Institution for Science
Catherine McCammon, Bayerisches Geoinstitut, University of Bayreuth
Tom McCollom, LASP, University of Colorado, Boulder

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Marco Merlini, Università degli Studi di Milano
Sami Mikhail, University of St Andrews
Simon Mitton, University of Cambridge
Rachael L. Moore, Institut de Physique du Globe de Paris
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Fabrizio Nestola, University of Padova
Sophie Nixon, University of Manchester
Eiji Ohtani, Tohoku University
Paula J. Olsiewski, Alfred P. Sloan Foundation
Shuhei Ono, MIT
Beth N Orcutt, Bigelow Laboratory for Ocean Sciences
Ding Pan, Hong Kong University of Science and Technology
Graham Pearson, University of Alberta
Melissa Plail, Nature Communications
Terry Plank, Lamont Doherty Earth Observatory, Columbia University
Irina N. Plotnikova, The Academy of Sciences of the Republic of Tatarstan
Robert Pockalny, University of Rhode Island
Stefano Poli, Università degli Studi di Milano
Katie Pratt, University of Rhode Island
Simon Redfern, University of Cambridge
David Rees Jones, University of Oxford
Brandi K. Reese, Texas A&M University
Eoghan Reeves, University of Bergen
Karyn Rogers,Rensselaer Polytechnic Institute
Catherine A. Royer, Rensselaer Polytechnic Institute
Emil Ruff, University of Calgary
Carmen Sanchez-Valle, University of Muenster
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Craig M. Schiffries, Carnegie Institution for Science
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Everett Shock, Arizona State University
Oliver Shorttle, University of Cambridge
Katie Smart, University of the Witwatersrand
Karen Smit, Gemological Institute of America
Nikolay Sobolev, Russian Academy of Sciences
Mitchell Sogin, Marine Biological Laboratory
Vincenzo Stagno, Sapienza University of Rome
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Michael Walter, University of Bristol
Fengping Wang, Shanghai JiaoTong University
David T. Wang, MIT
Oliver Warr, University of Toronto
Damien Weidmann, RAL Space
Cynthia Werner, USGS (contractor)
Amy Whitchurch, Nature Geoscience
Jeremy C. Williams, Kent State University
Josh Wood, University of Rhode Island
Kelly C. Wrighton, The Ohio State University
Xiang Xiao, Shanghai Jiaotong University
Greg M. Yaxley, The Australian National University
Choong-Shik Yoo, Washington State University

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