



Curtin University

THE INSTITUTE FOR  
GEOSCIENCE RESEARCH (TIGeR)

# 2015 TIGeR CONFERENCE

Key issues in fluid-rock interaction:  
From the nano to the macroscale

PROGRAM

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# ORAL PRESENTATIONS

The aim of this 3-day conference is to promote progress at the leading edge of this topic through presentations and open-forum discussion.

We will focus on key aspects of:

- The mineral-fluid interface
- Mechanisms of reactive fluid flow through low permeability rocks
- Mass transfer and mineralization; timescales
- Fluids, rock strength and deformation mechanisms
- Fluids and geodynamics

The total number of participants will be limited to about 80-100, to facilitate active participation and open discussion. So register early to avoid disappointment.

## THE AGENDA

The aim is to have short presentations (20 minutes for keynote speakers, 10 minutes for other talks) focussing on specific issues for later discussion. Afternoon poster sessions will provide further discussion time. The detailed schedule will be sent out after the registration period.

## SPEAKERS INCLUDE:

Jay Ague (Yale)  
Håkon Austrheim (Oslo)  
Stephen Cox (ANU, Canberra)  
Katy Evans (Curtin University, Perth)  
Julian Gale (Nanochemistry Research Institute, Curtin University, Perth)  
Siggi Gislason (University of Iceland)  
Kliti Grice (WA Organic & Isotope Geochemistry Centre, Curtin, Perth)  
Bruce Hobbs (CSIRO, Perth)  
Rob Hough (CSIRO, Perth)  
Jon Hronsky (CET, Perth)  
Bjørn Jamtveit (University of Oslo)  
John Mavrogenes, (ANU, Canberra)  
Steven Micklethwaite (CET, Perth)  
Sandra Piazzolo (Macquarie University, Sydney)  
François Renard (Institut des Sciences de la Terre, Grenoble)  
Encarnacion Ruiz-Agudo (University of Granada)  
Rick Sibson (Otago, New Zealand)  
John Wheeler (University of Liverpool)

## WEDNESDAY 23 SEPTEMBER

### 9.00 – 10.00 WELCOME, REGISTRATION AND TEA/ COFFEE ICEBREAKER

Andrew Putnis, Director, The Institute for Geoscience Research (TIGeR)  
Andris Stelbovics, Pro-Vice Chancellor, Faculty of Science and Engineering

### 10.00 – 10.20 + 10 MINUTES DISCUSSION

**Julian Gale**  
Exploring the Aqueous Interface with Carbonate Minerals using Computer Simulation.

### 10.30 – 10.40 + 5 MINUTES DISCUSSION

**Christine V. Putnis**  
Coupled dissolution and precipitation at mineral-fluid interfaces.

### 10.45 – 11.05 + 10 MINUTES DISCUSSION

**Encarnación Ruiz-Agudo**  
The control of mineral weathering by dissolution-precipitation processes at the mineral interface.

### 11.15 – 11.25 + 5 MINUTES DISCUSSION

**Lijun Wang**  
Monomeric Amelogenin's C-Terminus modulates mineralization dynamics of calcium phosphate.

### 11.30 – 11.40 + 5 MINUTES DISCUSSION

**Weihua Liu**  
Can we track ore fluid chemistry from the chemical zonation of minerals? An experimental study of arsenic-bearing apatite.

### 11.45 – 11.55 + 5 MINUTES DISCUSSION

**Joel Brugger**  
Textural and compositional complexities resulting from coupled dissolution-reprecipitation reactions in ore systems.

### 12.00 – 12.10 + 5 MINUTES DISCUSSION

**Cristiana Ciobanu**  
Why bridge micron- to nanoscale observations in ore minerals?

### 12.15 – 13.15 LUNCH

### 13.15 – 14.15 POSTERS

### 14.15 – 14.35 + 10 MINUTES DISCUSSION

**Katy Evans**  
Eccentric zoning in pyrite: what does it record?

### 14.45 – 15.05 + 10 MINUTES DISCUSSION

**Jon Hronsky**  
Ore Formation – the product of anomalous fluid flux organization

### 15.15 – 15.25 + 5 MINUTES DISCUSSION

**Alison Ord**  
Coupled fluid flow, mineral reactions and deformation in hydrothermal mineralising systems.

### 15.30 – 16.00 COFFEE/TEA BREAK

### 16.00 – 16.20 + 10 MINUTES DISCUSSION

**Holly Stein**  
From Fluids – Realizing, Refurbishing, and Refining Resources.

### 16.30 – 16.40 + 5 MINUTES DISCUSSION

**Fang Xia**  
The Origin of varied length scale of shape preservation in mineral replacement reactions – Insights from the replacement of pentlandite by violarite.

### 16.45 – 16.55 + 5 MINUTES DISCUSSION

**Mark Pearce**  
Carbonate replacement reactions in hydrothermal systems.

### 17.00 – 18.00 POSTERS

### 18.00 BARBEQUE : GEOLOGY BUILDING 312

## SPONSORS

Major



Supporting



## THURSDAY 24 SEPTEMBER

### 9.00 – 9.10 + 5 MINUTES DISCUSSION

Jing Zhao

The “exsolution” or fluid catalysed unmixing behaviour under hydrothermal conditions.

### 9.15 – 9.25 + 5 MINUTES DISCUSSION

Joseph White

Nano-particulates, Silicification and Fluid Pressure Transitions - Fluid Flow versus Mineralization, Kiggavik Region, Nunavut, Canada.

### 9.30 – 9.50 + 10 MINUTES DISCUSSION

John Mavrogenes

Experimental simulation of porphyry copper deposit formation via SO<sub>2</sub>-triggered sulfide precipitation from metalliferous brine.

### 10.00 – 10.20 + 10 MINUTES DISCUSSION

Steven Micklethwaite

Fluid mass transfer and rapid rates of deposit formation contrasted against gold remobilisation and high grade ore shoot formation.

### 10.30 – 11.00 COFFEE/TEA BREAK

### 11.00 – 11.20 + 10 MINUTES DISCUSSION

Kliti Grice

Role of organic geochemistry in mineral deposits.

### 11.30 – 11.40 + 5 MINUTES DISCUSSION

Andrew Putnis

Coupled mass transfer through a fluid phase and volume preservation during the hydration of granulite: An example from the Bergen Arcs, Norway.

### 11.45 – 11.55 + 5 MINUTES DISCUSSION (BUT THIS IS A 10 MINUTE TALK)

Ian Fitzsimons

Charnockites, chickens and eggs.

### 12.00 – 13.00 LUNCH

### 13.00 – 14.00 POSTERS

### 14.00 – 14.20 + 10 MINUTES DISCUSSION

Jay Ague

Rare Earth Element mobility in the middle to lower crust and subduction zones.

### 14.30 – 14.40 + 5 MINUTES DISCUSSION

Oliver Plümper

Channelized fluid escape from subduction zones.

### 14.45 – 15.05 + 10 MINUTES DISCUSSION

Stephen Cox

The dynamics of fluid flow in high fluid flux fault regimes: implications for fluid - rock reaction.

### 15.15 – 15.25 + 5 MINUTES DISCUSSION

Tom Raimondo

Fluid-controlled rheological responses during intraplate orogeny.

### 15.30 – 16.00 COFFEE/TEA BREAK

### 16.00 – 16.20 + 10 MINUTES DISCUSSION

Rick Sibson

Critical stress-overpressure states in seismically active fault zones and their significance for mineralization

### 16.30 – 16.50 + 10 MINUTES DISCUSSION

Håkon Austrheim

Scapolite, sulfides, seismicity and fluid induced eclogite- and amphibolite facies metamorphism of thickened continental crust.

### 17.00 – 17.20 + 10 MINUTES DISCUSSION

François Renard

Rock transformations controls shallow creep in active faults.

### 17.30 – 18.30 POSTERS

### 18.30 – BUS TO CONFERENCE DINNER

Boatshed Restaurant

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## FRIDAY 25 SEPTEMBER

### 9.00 – 9.20 + 10 MINUTES DISCUSSION

Bjørn Jamtveit

Disequilibrium metamorphism.

### 9.30 – 9.50 + 10 MINUTES DISCUSSION

John Wheeler

Dramatic effects of stress on metamorphic reactions.

### 10.00 – 10.20 + 10 MINUTES DISCUSSION

Bruce Hobbs

Equilibrium in stressed solid/liquid and solid/solid systems.

### 10.30 – 11.00 COFFEE/TEA BREAK

### 11.00 – 11.20 + 10 MINUTES DISCUSSION

Sandra Piazzolo

The chemical signature of syn-deformational fluid-rock interaction: Nano - to microscale

### 11.30 – 11.40 + 5 MINUTES DISCUSSION

Piotr Szymczak

On the formation, growth, and shapes of solution pipes

### 11.45 – 11.55 + 5 MINUTES DISCUSSION

Brent McInnes

Application of automated mineralogy techniques to understanding fluid-rock interactions in peridotite xenoliths from subduction zones.

### 12.00 – 12.10 + 5 MINUTES DISCUSSION

Steven Reddy

A shocking transformation: probing Precambrian reidite using state of-the-art micro- to sub-nanometer 3D imaging.

### 12.15 – 13.15 LUNCH

### 13.15 – 15.15 POSTERS AND COFFEE BREAK

### 15.15 – 15.25 + 5 MINUTES DISCUSSION

Xuan-Ce Wang

First direct evidence for hydrous mantle transition originated continental flood basalts.

### 15.30 – 15.40 + 5 MINUTES DISCUSSION

Weronika Gorczyk

Magma emplacement in 3D.

### 15.45 – 15.55 + 5 MINUTES DISCUSSION

Aaron Cavosie

Boiled zircons? Vesicular texture in detrital zircons from the Chelmsford Formation, Sudbury impact structure, Canada.

### 16.00 – 16.20 + 10 MINUTES DISCUSSION

Sigurdur Gislason

The CarbFix project: solubility and mineral storage of gas mixtures in basalt.

### 16.30 – 16.40 + 5 MINUTES DISCUSSION

David McNamara

Fracture Sealing in Geothermal Reservoirs: Insights from combined EBSD and chemical mapping.

### 16.45 – 16.55 + 5 MINUTES DISCUSSION

Stéphanie Vialle

Geophysical signature of fluid-rock interactions: Core-flooding experiments of CO<sub>2</sub>-rich fluids in carbonate rocks.

### 17.00 – CLOSE

## POSTERS

### TIME-SCALES AND PHYSICO-CHEMICAL CONSEQUENCES OF ULTRAMAFIC ROCK CARBONATION

Andreas Beinlich<sup>1,2,6</sup>, Timm John<sup>3</sup>, Masako Tominaga<sup>4</sup>, Tomas Magna<sup>5</sup> & Bjørn Jamtveit<sup>6</sup>

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2 EOAS, The University of British Columbia, Canada;

3 Dept of Earth Sciences, Freie Universität Berlin, Germany;

4 Dept of Geology and Geophysics, Texas A&M, USA ;

5 Czech Geological Survey, Czech Republic;

6 PGP, University of Oslo, Norway

### METAMORPHIC CONSTRAINTS ON THE FLUID ASSISTED TRANSITION OF GRANULITE TO ECLOGITE ON HOLSNOY IN THE BERGAN ARCS, NORWAY.

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### STRESS, FLUID AND METAMORPHISM

Stephen Centrella<sup>1</sup>, Håkon Austrheim<sup>2</sup>, Andrew Putnis<sup>1,3</sup>

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3 The Institute for Geoscience Research (TIGeR), Curtin University, Perth, 6102, Australia

### TRACE ELEMENT ZONATION OF ULTRAMAFIC SULPHIDES AND SPINELS FROM ALPINE CORSICA

Rosalind Crossley<sup>1</sup>, Katy Evans<sup>1</sup>, Noreen Evans<sup>1,2</sup> & Brad McDonald<sup>1,2</sup>

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### MICROPOROUS GOLD: COMPARISON OF TEXTURES FROM NATURE AND EXPERIMENTS

Barbara Etschmann<sup>1,2,3</sup>, Victor M. Okrugin<sup>4,5</sup>,

Elena Andreeva<sup>4,5</sup>, Kan Li<sup>2,3</sup>, Allan Pring<sup>2</sup>, Grant Griffiths<sup>8</sup>,

Gregory R. Lumpkin<sup>8</sup>, and Joël Brugger<sup>1,2</sup>

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3 School of Chemical Engineering, The University of Adelaide, 5005, South Australia

4 Institute of Volcanology and Seismology, Russian Academy of Science, Petropavlovsk-Kamchatsky, 683 006, Russia

5 Vitus Bering Kamchatka State University Petropavlovsk-Kamchatsky, 683 006, Russia

6 Institute of Materials Engineering, Australian Nuclear Science & Technology Organisation, Kirrawee DC, New South Wales 2232, Australia

### GOLD REMOBILISATION FROM ARSENOPYRITE THROUGH HIGH STRAIN AND METAMORPHISM: CRYSTAL-PLASTICITY VS FLUID-MINERAL REACTIONS

Denis Fougereuse<sup>1</sup>, Steven Micklethwaite<sup>2</sup>, Andrew G. Tomkins<sup>3</sup>, Yuan Mei<sup>4</sup>, Matt Kilburn<sup>5</sup>, Paul Guagliardo<sup>6</sup>, Louise A. Fisher<sup>7</sup>, Angela Halfpenny<sup>8</sup>

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4 CSIRO Mineral Resources Flagship, Clayton, Victoria

5 Centre for Microscopy, Characterisation and Analysis, The University of Western Australia:

6 Centre for Microscopy, Characterisation and Analysis, The University of Western Australia:

7 CSIRO Mineral Resources Flagship, Bentley, Western Australia

8 Microscopy & Microanalysis Facility, John de Laeter Centre, Curtin University:

### DECARBONATION OF SUBDUCTING SLABS: INSIGHT FROM PETROLOGICAL-THERMOMECHANICAL MODELING

C.M. Gonzalez<sup>1</sup>, W. Gorczyk<sup>1</sup>, T.V. Gerya<sup>2</sup>

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2 Swiss Federal Institute of Technology (ETH), Zurich, Switzerland

### THE PRESERVATION OF FRAMBOIDAL PYRITE IN BLUESCHIST

S. Hayes, K. Evans, S. Reddy, S. Hu

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### 120 MYR OF EPISODIC MID-CRUSTAL METAMORPHISM AND FLUID-ROCK INTERACTION DURING THE ALICE SPRINGS OROGENY: THE STRANGWAYS RANGE, CENTRAL AUSTRALIA

Daniel Howlett<sup>1</sup>, Martin Hand<sup>1</sup>, Tom Raimondo<sup>2</sup>.

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### GEOLOGIC APPLICATIONS FOR HIGH-RESOLUTION SECONDARY ION MASS SPECTROMETRY (SIMS) TO STUDY FLUID-ROCK INTERACTION

Heejin Jeon<sup>1</sup>, Crystal LaFlamme<sup>2</sup>, Laure Martin<sup>1</sup>, John Cliff<sup>1</sup>, Marco Fiorentini<sup>2</sup>, Matt Kilburn<sup>1</sup>

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### THE LONG-TERM STRENGTH OF THE LITHOSPHERE AS DETERMINED BY GRAVITY AND TOPOGRAPHY

Jon Kirby & Chris Swain

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### FELDSPAR REPLACEMENT REACTIONS IN IOCG SYSTEMS: THE OLYMPIC CU-AU PROVINCE

Alkis Kontonikas-Charos<sup>1</sup>, Cristiana L. Ciobanu<sup>2</sup>, Nigel J. Cook<sup>2</sup>, Kathy Ehrig<sup>3</sup> and Vadim S. Kamenetsky<sup>4</sup>

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3 BHP Billiton, Olympic Dam, Adelaide, SA, 5000, Australia

4 School of Physical Sciences, University of Tasmania, Hobart, TAS, 7001, Australia

### CONTRASTING RECORD OF FLUID HISTORY IN GARNET: EXAMPLES FROM ALPINE CORSICA AND THE BERGEN ARCS

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2 ISTerre, Grenoble, France

### EXPERIMENTAL STUDY OF CO<sub>2</sub> SEQUESTRATION VIA GOETHITE CARBONATION

Teresita Moraila-Martinez<sup>1</sup>, Christine V. Putnis<sup>1,2</sup>, Andrew Putnis<sup>1,3</sup>

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### BASE AND PRECIOUS METAL MINERAL INTERACTIONS WITH AQUEOUS AMINO ACIDS UNDER OXIDISING ALKALINE CONDITIONS.

Elsayed Oraby and Jacques Eksteen

Western Australian School of Mines, Curtin University

### EXPERIMENTAL STUDY OF THE REPLACEMENT OF CALCIUM CARBONATES BY APATITE AND FLUORITE: RATES AND TEXTURES

Elisabete Trindade Pedrosa<sup>1</sup>, Christine V. Putnis<sup>1,2</sup>, Andrew Putnis<sup>1,3</sup>

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### THE LOST SAMPLES OF THE GOLDEN MILE: NEW DATA SHEDS LIGHT ON THE DEPTH AND TEMPERATURE OF EMPLACEMENT OF THIS GIANT GOLD DEPOSIT

Kirsten U. Rempel<sup>1</sup> and Phillip M. Stothard<sup>2</sup>

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### BASO<sub>4</sub> CRYSTALLIZATION IN THE PRESENCE OF POLYMERS: EVIDENCE OF BARITE CRYSTALLIZATION VIA NON-CLASSICAL PATHWAYS

Cristina Ruiz Agudo<sup>1</sup>, Encarnación Ruiz-Agudo<sup>2</sup>, Alejandro Burgos-Cara<sup>2</sup>, Christine Putnis<sup>1,3</sup>, Aurelia Ibáñez Velasco<sup>2</sup> Carlos Rodríguez-Navarro<sup>2</sup> and Andrew Putnis<sup>1,4</sup>

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### THE CHEMICAL OSCILLATOR: A NEW PERSPECTIVE ON FLUID FLOW AND PERMEABILITY IN THE DUCTILE CRUST

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### THE PRESENCE OF SPHALERITE IN PYRITE FRAMBOIDS

Siyu Hu<sup>1,2</sup>, Katy Evans<sup>1</sup>, Kirsten Rempel<sup>1</sup>, Kliti Grice<sup>2</sup>,

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### HYDRATION THROUGH MELT-ROCK INTERACTION TRIGGERS LOCAL PARTIAL MELTING IN THE LOWER CRUST: EXAMPLE FROM FIORDLAND, NEW ZEALAND

Catherine Stuart, Sandra Piazzolo and Nathan Daczko

ARC Centre of Excellence for Core to Crust Fluid Systems (CCFS) and GEMOC, Department of Earth and Planetary Sciences, Macquarie University

### STRIATION DEVELOPMENT DURING FAULT SLIP DEPENDS ON TEMPERATURE UNDER HYDROTHERMAL CONDITIONS

Virginia G. Toy<sup>1</sup>, Andre Niemeijer<sup>2</sup>, Luiz Morales<sup>3</sup>, Richard Wirth<sup>3</sup>, Francois Renard<sup>4</sup>

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### REGIONAL-SCALE METASOMATISM IN THE HAMERSLEY BASIN: THE SOURCE OF AUSTRALIA'S IRON ORE?

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