

# EAGE

EUROPEAN  
ASSOCIATION OF  
GEOSCIENTISTS &  
ENGINEERS

FINAL ANNOUNCEMENT

# International Workshop on Geomechanics & Energy

The Ground as Energy Source and Storage

26-28 November 2013  
Lausanne, Switzerland

SINOPEC

[www.eage.org](http://www.eage.org)

## Committee

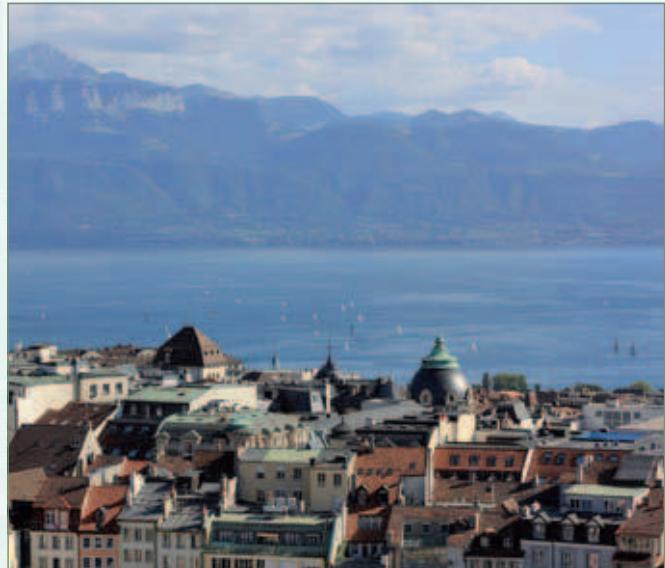
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| Lyesse Laloui<br><i>Chairman</i>     | Swiss Federal Institute of Technology        |
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| Paul Marshall                        | Nagra  |

## About the Workshop

Geomechanics plays an important role in the utilization of conventional or alternative energy sources and in the development of sustainable energy management. The understanding and the prediction of the mechanical behaviour of geomaterials involved in the exploitation or the storage of energy resources request robust sciences. This could be summarized as follows:

- Facing the limited fossil fuel resources, the way we exploit the hydrocarbon reservoir must be optimized.
- Alternative sources of energy must be promoted and developed to reduce the worldwide dependency of fossil fuel.
- Energy exploitation also means waste production. The ground offers a possible host environment as a definitive solution for the storage of those wastes, providing that the interaction between waste and earth are predictable and safe. Similar concepts could be applied to CO<sub>2</sub> sequestration.

Consequently, the development of the energy sector, sustainably and in harmony with the geological environment, requires rigorous understanding and assessment of the highly coupled geomechanical response of the geo-system.



## Short Course

### Polydôme, Swiss Federal Institute of Technology

Monday 25 November 2013

9:00 - 17:00 hrs

This course will be held prior to the start of the International Workshop on Geomechanics and Energy Workshop as an optional extra.



Course instructors: Dr. Lyesse Laloui & Dr. Alessio Ferrari

### Course description

The prediction of the behaviour of shales, soils and rocks is a fundamental requirement for the exploitation of a geosystem and the design of man-made systems.

Multiphase and non-isothermal conditions are found in numerous engineering applications, such as petroleum engineering, nuclear waste storage engineering, unconventional energy resources and CO<sub>2</sub> geological sequestration. These applications require an understanding of the behaviour of geomaterials (soils, rocks and shales) and an increased ability to predict their behaviours in variable situations.

The course gives an insight into modern trends in geomechanics for multiphase and non-isothermal geomaterials. It introduces the basic concepts for the characterisation of materials and their numerical modelling.

## Technical Programme

### Oral Presentations - Tuesday 26 November

| Polydôme   |  |
|--|--|
| <b>DEEP GEOLOGICAL DISPOSAL OF RADIOACTIVE WASTE</b> |  |
| 09:00  | <b>Word of Welcome</b> - L. Laloui* (Swiss Federal Institute of Technology) & B. François (Université Libre de Bruxelles)  |
| 09:15  | <b>Keynote Speech</b> - P. Marschall* (Nagra)  |
| 10:00  | <b>Tu 01 01 - Characterization of THM Behaviour of Compacted MX-80 Granular Bentonite Using an Advanced Double-wall Triaxial Cell</b> - A. Seiphoori* (Swiss Federal Institute of Technology), A. Ferrari (Swiss Federal Institute of Technology) & L. Laloui (Swiss Federal Institute of Technology)  |
| 10:25  | <b>Tu 01 02 - Characterization of Petrophysical Properties of Different Host-rock Formations for a Deep Geological Repository</b> - A. Papafotiou* (INTERA Inc. Swiss Branch), R. Senger (INTERA Inc. Swiss Branch), L. Keller (ZHAW, Switzerland) & P. Marschall (NAGRA)  |
| 10:50  | <b>Break</b>   |
| 11:05  | <b>Tu 01 03 - The Mont Terri HE-D Experiment as a Benchmark for the Simulation of Coupled THM Processes</b> - B.J. Graupner* (Swiss Federal Nuclear Safety Inspectorate), C. Lee (Korea Atomic Energy Research Institute), K. Maekawa (Japan Atomic Energy Agency), C. Manepally (Center for Nuclear Waste Regulatory Analyses), P. Pan (Chinese Academy of Sciences), J. Rutqvist (Lawrence Berkeley National Laboratory), W. Wang (Helmholtz Centre for Environmental Research) & B. Garitte (NAGRA) |
| 11:30  | <b>Tu 01 04 - Numerical Modelling of the Excavated Damaged Zone in Boom Clay</b> - F. Salehnia* (Université de Liège), R. Charlier (Université de Liège) & S. Levasseur (Université de Liège)  |
| 11:55  | <b>Tu 01 05 - One-year Monitoring and Digital Image Analysis of In-situ Desiccation Cracks on Tournemire Argillite Rock</b> - S. Hédan* (UMR7285 IC2MP), A.L. Fauchille (IC2MP), V. Vallé (PPRIME Institute), J. Cabrera (IRSN) & P. Cosenza (IC2MP)   |
| 12:20  | <b>Lunch Break</b>   |
| 13:20  | <b>Tu 01 06 - Coupled Geomechanical Phenomena in the Two-phase Flow Analysis of Air-injection Tests in Clay Cores</b> - R. Senger* (Intera Inc. Swiss Branch) & E. Romero (UPC)  |
| 13:45  | <b>Tu 01 07 - Modeling of Laboratory Heating Experiment on Saturated Callovo-Oxfordian</b> - X.R. Wang* (BGR), H. Shao (BGR), J. Hesser (BGR), C.L. Zhang (GRS), W.Q. Wang (UFZ) & O. Koditz (UFZ/TU Dresden)  |
| 14:10  | <b>Debate - Deep Geological Disposal of Radioactive Waste</b>  |
| <b>GEOTHERMAL ENERGY - SHALLOW</b>                   |  |
| 15:00  | <b>Break</b>   |
| 15:20  | <b>Tu 01 08 - On Using Tunnel Anchors and Bolts as Heat Exchangers with the Ground</b> - T. Mimouni* (Swiss Federal Institute of Technology Lausanne), F. Dupray (Swiss Federal Institute of Technology Lausanne) & L. Laloui (Swiss Federal Institute of Technology Lausanne)   |
| 15:45  | <b>Tu 01 09 - Advancements in the Geotechnical Design of Energy Piles</b> - A. Di Donna* (Swiss Federal Institute of Technology Lausanne) & L. Laloui (Swiss Federal Institute of Technology Lausanne)   |
| 16:10  | <b>Tu 01 10 - Impacts of Surface Fluxes on Interseasonal Heat Storage in Soils</b> - J.J.M.C. Muñoz Criollo* (Cardiff University), P.J.C. Cleall (Cardiff University) & S.W.R. Rees (Cardiff University)   |
| 16:35  | <b>Wrap up</b> - L. Laloui* (Swiss Federal Institute of Technology) & B. François (Université Libre de Bruxelles)  |

### Poster Presentations - Tuesday 26 November

| Polydôme                    |  |
|-----------------------------|--|
| <b>POSTER PRESENTATIONS</b> |  |
| 16:45                       | <b>Tu P01 01 - Evaluation of Relative Permeability Functions for Oil Bearing Sandstones in Electrically Enhanced Oil Recovery</b> - E. Ghazanfari* (University of Vermont) & S. Pamukcu (Lehigh University)  |
|                             | <b>Tu P01 02 - Applications of Intelligent Systems in Petroleum Geomechanics - Prediction of Geomechanical Properties in Different Types of Sedimentary Rocks</b> - M. Rajabi* (University of Adelaide) & M. Tingay (University of Adelaide)   |
|                             | <b>Tu P01 03 - Hydraulic Fracture Modeling Using Improved, Correlated Static and Dynamic Rock Mechanical Properties</b> - P. Rathj* (Pandit Deendayal Petroleum University) & S. Sharma (Pandit Deendayal Petroleum University)  |
|                             | <b>Tu P01 04 - The Effect of Confining Pressure on Dynamic to Static Young's Modulus Ratio</b> - A. R. Najibi* (Kharazmi University)   |
|                             | <b>Tu P01 05 - Impact of the Lithology and Type of Formation (Consolidated and Unconsolidated) on the LOT and XLOT Responses</b> - V. Vasquez* (PDVSA) & R. Canelon (PDVSA)  |
|                             | <b>Tu P01 06 - Interpreting Geomechanical Models</b> - M. Parotidis* (BG Group), B. Fletcher (BG Group), J. Graham (BG Group) & T. Pritchard (BG Group)  |
|                             | <b>Tu P01 07 - Modelling the In Situ Stress Distribution in a Rotliegend Gas Reservoir</b> - K. Fischer* (Technische Universität Darmstadt) & A. Henk (Technische Universität Darmstadt)   |
|                             | <b>Tu P01 08 - A Multi-disciplinary, Multi-scale Approach to Geomechanical Model Building and Geoprediction</b> - S.D. Mildren* (Ikon Science), J.J. Meyer (Ikon Science) & R.E. Swarbrick (Ikon Science)  |
|                             | <b>Tu P02 01 - Triaxial Compressive Property of Artificial CO<sub>2</sub>-hydrate-bearing Sediment Sample</b> - K. Miyazaki* (AIST), H. Haneda (AIST), K. Aoki (AIST) & T. Yamaguchi (Toho University)   |
|                             | <b>Tu P03 01 - An Innovative Technique for Water Retention Characterization of Highly Swelling Geomaterials</b> - A. Seiphoori* (Swiss Federal Institute of Technology), A. Ferrari (Swiss Federal Institute of Technology) & L. Laloui (Swiss Federal Institute of Technology)  |
|                             | <b>Tu P03 02 - Experimental Study of the Deformation Behaviour of the Callovo-Oxfordian Clay Rock</b> - Chun-Liang Zhang* (Gesellschaft für Anlagen- und Reaktorsicherheit)  |
|                             | <b>Tu P04 01 - Predicting Dynamically Evolving Permeability and Localization of Fluid Flow in Underground Waste Storage Operations</b> - S.C. Simon* (Institute for Energy Technology), L. Räss (University Lausanne), Y.Y. Podladchikov (University Lausanne), A. Souche (Institute for Energy Technology) & V. Yarushina (Institute for Energy Technology) |
|                             | <b>Tu P04 02 - Geomechanical Stability Analysis of Reservoir Rock Related to CO<sub>2</sub> Injection in Japan</b> - T. Funatsu* (AIST), Y. Kano (AIST), X. Lei (AIST) & S. Nakao (AIST)   |
|                             | <b>Tu P05 01 - Thermal Response Test in Borehole Heat Exchangers Equipped with Fiber Optics</b> - G. Radioti* (University of Liège), R. Charlier (University of Liège), F. Nguyen (University of Liège) & J.P. Radu (University of Liège)  |
|                             | <b>Tu P05 02 - Performance and Effects on the Subsoil Temperature of a Thermo-active Diaphragm Wall</b> - D. Sterpi* (Politecnico di Milano) & A. Angelotti (Politecnico di Milano)  |

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| Tu P05 03 - Numerical Modeling of Ground Source Bridge Deck Deicing - C.G. Olgun* (Virginia Tech) & G.A. Bowers (Virginia Tech)  | <b>GEOTHERMAL ENERGY - DEEP</b>  |
| Tu P05 04 - Seasonal Heat Storage in Unsaturated Soils with Variable Thermal Properties - S. Nikoosokhan* (INSA de Strasbourg), D.R. Hossein Nowamooz (INSA de Strasbourg) & D.R. Cyrille Chazallon (INSA de Strasbourg) | 15:35 We 01 09 - Crack Features Derived from Effective Medium Modeling During Hydraulic Stimulation of the Geothermal Reservoir in Soultz - M. Adelinet* (IFP Energies Nouvelles), C. Dorbath (EOST Strasbourg), M. Calo (EOST Strasbourg), L. Dorbath (EOST Strasbourg) & M. Le Ravalec (IFP Energies Nouvelles)  |
| Tu P06 01 - Transport Up-scaling in Highly Heterogeneous Media - A.R. Tyukhova (ETH Zürich), M. Willmann (ETH Zürich) & W. Kinzelbach (ETH Zürich)   | 16:00 We 01 10 - Coupled Hydro-mechanical Modelling of Reservoir Stimulation in Case of Two Horizontal Boreholes - V. Badoux* (Geowatt AG), D. Ollinger (Geowatt AG) & T. Mégel (Geowatt AG)   |
| Tu P06 02 - Thermal Properties of Rocks after Cyclic Heating - Radim Hladký* (ARCADIS Geotechnika a.s.), Z. Metelkova (ARCADIS Geotechnika a.s.) & K. Sosna (ARCADIS Geotechnika a.s.)                                   | 16:25 We 01 11 - Effect of Cyclic Heating on Mechanical Properties of Different Types of Rock - Zdenka Metelková* (Arcadis Geotechnika), R. Hladký (Arcadis Geotechnika) & K. Sosna (Arcadis Geotechnika)  |
| Tu P06 03 - Geothermal Reservoir Simulation - F J Guerrero* (University of Glasgow)  | 16:50 We 01 12 - In Situ Stress in Switzerland - from Pointwise Field Data to a 3D Continuous Quantification - O. Heidbach* (GFZ German Research Centre for Geosciences), T. Hergert (Karlsruhe Institute of Technology), J. Reinecker (GeoThermal Engineering GmbH), K. Reiter (GFZ German Research Centre for Geosciences), S.B. Giger (NAGRA), T. Vietor (NAGRA) & P. Marschall (NAGRA) |
| Tu P06 04 - Stress Field Modelling in the Alberta Basin, Canada - K. Reiter* (GFZ German Research Centre for Geosciences), O. Heidbach (GFZ German Research Centre for Geosciences) & I. Moeck (University of Alberta)   | 17:15 Wrap up - L. Laloui* (Swiss Federal Institute of Technology) & B. François (Université Libre de Bruxelles)   |

## Oral Presentations - Wednesday 27 November

### Polydôme

#### CONVENTIONAL HYDROCARBON EXPLORATION

|       |   |
|-------|---|
| 09:00 | Keynote Speech - P. Connolly (Chevron Energy Technology Co)   |
| 09:45 | We 01 01 - Micro-hydromechanical Analysis of Sand Production Problem in Small Oil Perforations - D. Garolera* (Universitat Politècnica de Catalunya), I. Carol (Universitat Politècnica de Catalunya) & C.M. López (Universitat Politècnica de Catalunya)   |
| 10:10 | We 01 02 - Geomechanical Reservoir Simulations – a Workflow for Model Building and Validation - A. Henk* (Technical University Darmstadt) & K. Fischer (Technical University Darmstadt)   |
| 10:35 | We 01 03 - Inclusion of Geomechanics in Streamline Simulation for Full-Field Hydrogeomechanical Modelling - Different Coupling Strategies - B. Koohmarae Hosseini* (University of Alberta)  |
| 11:00 | Break   |
| 11:15 | We 01 04 - Integrated Hydro-mechanical and Seismic Modelling of the Valhall Reservoir - Predicting Subsidence, AVOA and Microseismic - D.A. Angus* (University of Leeds), M. Dutko (Rockfield Software Ltd), Q.J. Fisher (University of Leeds), J.M. Kendall (University of Bristol), A.F. Baird (University of Bristol), T.G. Kristiansen (BP Norway), O.I. Barkved (BP Norway), J. Yu (Rockfield Software Ltd) & S. Zhao (Rockfield Software Ltd) |
| 11:40 | We 01 05 - Depletion-induced Reservoir Compaction in Shallow Overconsolidated Reservoir - S. Narongsirikul* (University of Oslo), N.H. Mondol (University of Oslo and Norwegian Geotechnical Inst) & J. Jahren (University of Oslo)   |
| 12:05 | We 01 06 - Data Assimilation of PS-InSAR Movement Measurements Applied to the Bergermeer Gas Field - P.A. Fokker* (TNO), B.B.T. Wassing (TNO), F.J. van Leijen (TU Delft), R.F. Hanssen (TU Delft) & D.A. Nieuwland (TAQA Energy BV)  |
| 12:30 | Lunch Break   |
| 13:30 | We 01 07 - Application of Partial Hydromechanical Coupling Methodology in a Fault Reactivation Analysis - S.A.B. Fontoura* (PUC-Rio / GTEP), G.L. Righetto (PUC-Rio / GTEP), C.E.R. Lautenschläger (PUC-Rio / GTEP), N. Inoue (PUC-Rio / GTEP), A.L. Serra (Petrobras / CENPES) & G.M. Bechara (Petrobras / CENPES)   |
| 13:55 | We 01 08 - Geomechanical Forward Modelling of the Genesis of Polygonal Fault Systems - D.T. Roberts* (Cardiff University), A.J.L. Crook (University of Leeds), J.A. Cartwright (University of Oxford), M.L. Profit (Rockfield Software Ltd.) & J.M. Rance (Rockfield Software Ltd.)   |
| 14:20 | Debate - Conventional Hydrocarbon Exploration   |
| 15:10 | Break   |

## Oral Presentations - Thursday 28 November

### Polydôme

#### CO<sub>2</sub> STORAGE

|       |  |
|-------|--|
| 09:00 | Keynote Speech   |
| 09:45 | Th 01 01 - Geological Storage of CO <sub>2</sub> in Coal Beds - From Material to Reservoir - S. Nikoosokhan* (INSA de Strasbourg), D.R. Matthieu Vandamme (Ecole des Ponts ParisTech) & D.R. Patrick Dangla (IFSTTAR/Ecole des Ponts Paristech)                              |
| 10:05 | Th 01 02 - Permeability and Seismic Velocities in CO <sub>2</sub> Carbonates Reservoir - The Laboratory Insight - S. Fabbri (ETH Zurich), C. Madonna* (ETH Zurich) & A. Zappone (ETH Zurich)   |
| 10:25 | Th 01 03 - Stress Induced by Precipitation of Salts under CO <sub>2</sub> Injection in Deep Saline Aquifers - F. Osselin* (Laboratoire Navier), T. Fen-Chong (Laboratoire Navier), A. Fabbri (ENTPE), P. Dangla (Laboratoire Navier), A. Lassin (BRGM) & J.M. Pereira (ENPC) |
| 10:45 | Break  |
| 11:00 | Th 01 04 - Earthquakes Induced by Fluid Injection - Implications for Secure CO <sub>2</sub> Storage - J.P. Verdon* (University of Bristol) & J.M. Kendall (University of Bristol)  |
| 11:20 | Th 01 05 - Influence of Complex Internal Structures of Reservoir-scale Fault Zones on Shear Reactivation Induced by CO <sub>2</sub> Injection - J. Rohmer* (BRGM) & C. Allanic (BRGM)  |
| 11:40 | Th 01 06 - Surface Heave due to CO <sub>2</sub> Injection Induced Overpressure with Application to In Salah Project - C. Li* (Swiss Federal Institute of Technology), P. Barès (Swiss Federal Institute of Technology) & L. Laloui (Swiss Federal Institute of Technology)   |
| 12:00 | Th 01 07 - Geomechanical Assessment of Ground Surface Uplift due to CO <sub>2</sub> Storage at In Salah, Algeria - B. Bohlooli* (Norwegian Geotechnical Institute), T.I. Bjørnarå (NGI), L. Grande (NGI), J. Park (NGI), V. Oye (NORSAR), D. Kühn (NORSAR) & A. Rucci (TRE)  |
| 12:20 | Debate CO <sub>2</sub> Storage - P. Dangla* (Laboratoire Navier) & F.J. Ulm (Massachusetts Institute of Technology)  |
| 12:45 | Break  |
|       | <b>NON-CONVENTIONAL ENERGY</b>   |
| 13:45 | Th 01 08 - An Insight into the Fluid Retention Capabilities of Shales - V. Favero* (Swiss Federal Institute of Technology), A. Ferrari (Swiss Federal Institute of Technology) & L. Laloui (Swiss Federal Institute of Technology)   |

|              |  |
|--------------|--|
| <b>14:05</b> | <b>Th 01 09 - Nano-Chemomechanical Characterization of Gas Shales</b> - S. Abedi* (Massachusetts Institute of Technology), N. Ferralis (Massachusetts Institute of Technology) & F.J. Ulm (Massachusetts Institute of Technology)  |
| <b>14:25</b> | <b>Th 01 10 - 3D Numerical Modeling of Shale Gas Stimulation and Seismicity</b> - A.S. Shahid* (Politecnico di Torino), B.B.T. Wassing (TNO), F. Verga (Politecnico di Torino) & P.A. Fokker (TNO / Politecnico di Torino)   |
| <b>14:45</b> | <b>Th 01 11 - Geomechanics and Physics Related to Shale Strength, Stiffness and Anisotropy</b> - D. Dewhurst* (CSIRO), J. Sarout (CSIRO), C. Delle Piane (CSIRO), M. Josh (CSIRO), A.F. Siggins (CSIRO) & M.D. Raven (CSIRO)   |
| <b>15:05</b> | <b>Break</b>   |
| <b>15:30</b> | <b>Th 01 12 - Thermo-hydro-mechanical Sand Production Model in Hydrate-bearing Sediments</b> - S. Uchida (Technion - Israel Institute of Technology), A. Klar* (Technion - Israel Institute of Technology), Z. Charas (Technion - Israel Institute of Technology) & K. Yamamoto (Japan Oil, Gas and Metals National Corpora) |
| <b>15:50</b> | <b>Th 01 13 - Instability Analysis of Methane Hydrate Bearing Soil Considering Dissociation</b> - F. Oka* (Kyoto University), S. Kimoto (Kyoto University) & H. Iwai (Kyoto University)  |
| <b>16:10</b> | <b>Th 01 13 - Coupled Thermo-hydro-mechano-chemical Model for Gas Hydrate Disassociation</b> - X. Yu* (Case Western Reserve University) & Z. Liu (Case Western Reserve University)   |
| <b>16:30</b> | <b>Debate Non-Conventional Energy</b> - F. Oka (Kyoto University) & A. Ferrari (Swiss Federal Institute of Technology)   |
| <b>17:00</b> | <b>Wrap up</b> - L. Laloui* (Swiss Federal Institute of Technology) & B. François (Université Libre de Bruxelles)  |

## Social Programme

### Icebreaker reception

Tuesday 26 November 2013

17:00 - 19:00 hrs

Please join us for an informal gathering in the workshop venue on the first evening of the workshop. The reception is a perfect occasion for catching up with colleagues and speaking with poster presenters and company display representatives. Fingerfood and drinks will be provided.

### Workshop dinner

Wednesday 27 November 2013

Lausanne Palace Hotel, Rue du Grand Chene 7-9

19:00 - 23:00 hrs

Since its opening in 1915, the Lausanne Palace & Spa has been one of the city's social hubs, providing a meeting place for locals and an escape for visitors. The hotel overlooks Lake Geneva and the Alps. It is located at walking distance from Lausanne-CFF Station.

The Workshop Dinner offers a great networking opportunity in a relaxed setting!

*The workshop dinner is sponsored by*



## Registration Fees

### Workshop

|                                  | Until<br>31/08/2013 | 1/9/2013 -<br>28/11/2013 |
|----------------------------------|---------------------|--------------------------|
| EAGE member                      | € 595               | € 695                    |
| EAGE student member <sup>1</sup> | € 295               | € 345                    |
| Non-member                       | € 695               | € 795                    |
| Full-time student non-member     | € 345               | € 395                    |
| Family member                    | € 130               | € 150                    |

### Short Course

|                              | Until<br>31/08/2013 | 1/9/2013 -<br>28/11/2013 |
|------------------------------|---------------------|--------------------------|
| EAGE member                  | € 455               | € 495                    |
| EAGE student member          | € 455               | € 495                    |
| Non-member                   | € 555               | € 595                    |
| Full-time student non-member | € 555               | € 595                    |

<sup>1</sup> To qualify for the reduced registration fee, a copy of your student identification card for a geoscience institute must be submitted together with your registration.

<sup>2</sup> The non-member fee includes EAGE membership for the remainder of 2014.

<sup>3</sup> Please note that the EAGE reserves the right to cancel the workshop due to low participation. In this case, payment will be refunded in full.

## Venue

The workshop will take place at the Swiss Federal Institute of Technology (EPFL) in Lausanne, Switzerland.

## Sponsors

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## Contact

For more information or enquiries about this workshop please visit the event's website ([www.eage.org](http://www.eage.org)) or contact the EAGE Europe Office via [eage@eage.org](mailto:eage@eage.org).

We hope to see you in Lausanne!

# EAGE

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