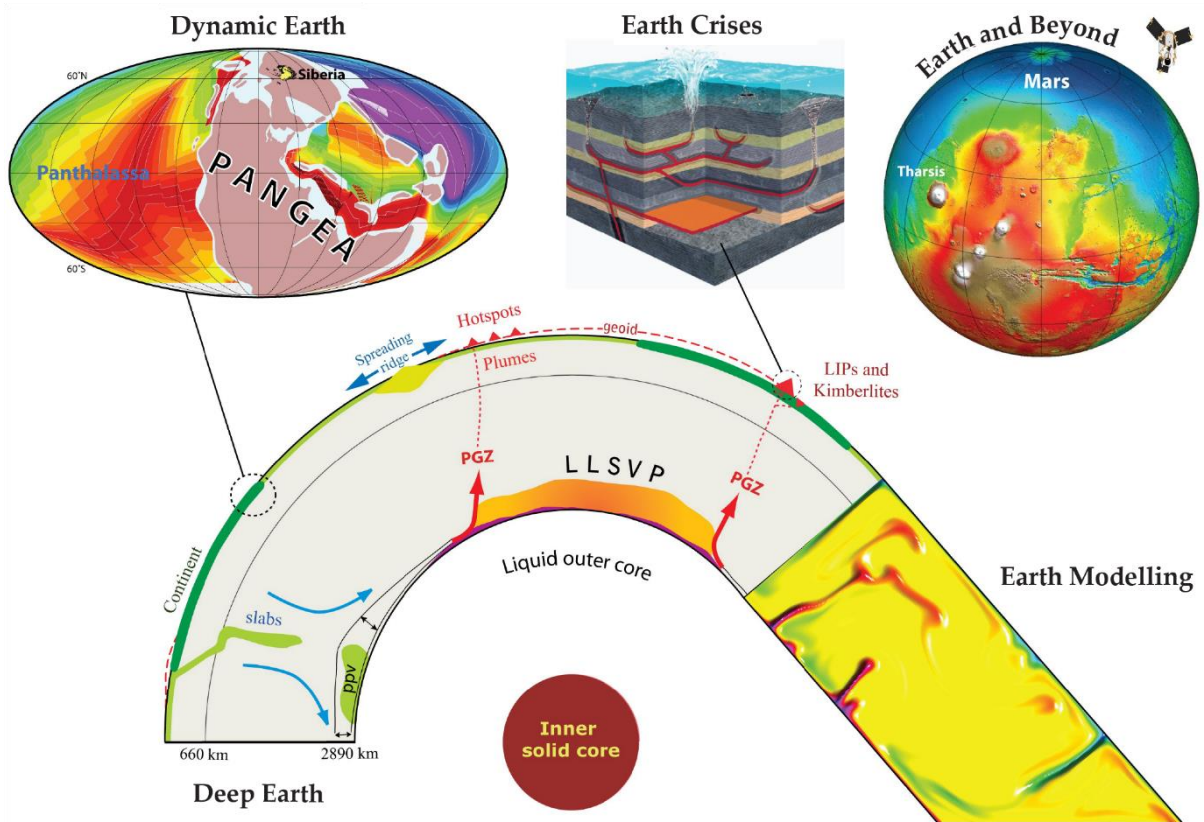


# Earth's History, Dynamics and Planetary Habitability

International conference at Sundvollen (Oslo) 13-19 November 2022

Organizing committee: Trond Torsvik, Stephanie Werner, Valentina Magni, Agnes Kiraly, Morgan Jones and Trine Sannesmoen



Lower diagram: Original cartoon used in the 2012 CEED application. *Earth Modelling* was originally named *Virtual Earth* and we added a sixth Team (*Earth Laboratory*) in 2014. LLSVP, Large Low Shear-wave Velocity Province; PGZ, Plume Generation Zone.

## Introduction

The Centre for Earth Evolution and Dynamics (CEED) is now in its final operational year as a Norwegian Centre of Excellence (2013-2023), and it is therefore timely to arrange an international meeting that summarizes our own findings but also opens up for discussions and potential future cooperation's with a large number of invited scientists.



**Earth History, Dynamics & Planetary Habitability**  
Sundvollen 13-19 November 2022

Arnould, Maelis	Ivanov, Boris	
Ashwal, Lewis	Jackson, Matt	
Becker, Thorsten	Jakob, Johannes	
Bercovici, Dave	Kaus, Boris	
Biggin, Andy	Lenardic, Adrian	
Billen, Magali	Lenton, Tim	
Bouvier, Audrey	Liow, Lee Hsiang	
Brasser, Ramon	Lithgow-Bertelloni, Carolina	
Buiter, Susanne	Long, Maureen	
Dannberg, Juliane	Marzoli, Andrea	
Davaille, Anne	Mather, Tamsin	
Davies, Chris	Meckler, Anna Nele	
Domeier, Mathew	Meert, Joe	
Ernst, Richard	Mojzsis, Stephen	
Faccenda, Manuele	Peron-Pinvidic, Gwenn	
Faccenna, Claudio	Reitan, Trond	
Garnero, Ed	Romanowicz, Barbara	Steinberger, Bernhard
Gerya, Taras	Royer, Dana	Stixrude, Lars
Gibson, Sally	Ruepke, Lars	Vannucchi, Paola
Giuliani, Andrea	Salminen, Johanna	Viennet, Jean-Christophe
Hannisdal, Bjarte	Schubert, Brian	Westall, Frances
Head, Jim	Searle, Mike	Wessel, Paul
Hirschmann, Mark	Spakman, Wim	Wong, Emily

**Keynote Speakers**

CEED's primary objective was to *develop an Earth model that explains how mantle processes drive plate tectonics and trigger massive volcanism and associated environmental and climate changes throughout Earth history*. CEED activities were originally divided into a thematic research framework (see front figure) aiming to develop a grand scientific synergy (from top to bottom – then until now) by combining strong numerical skills with cross-disciplinary geological and geophysical expertise.

The *Deep Earth* (headed by Reidar Trønnes) holds the key to understand mantle plumes and their surface expressions through geological time, and plumes are a prime example of a phenomenon that bridges all our research themes, from the core to the atmosphere on *Earth and Beyond* (headed by Stephanie Werner). Mantle plumes take us from the *Deep Earth* to sub-lithospheric depths where partial melting occurs and to the surface where hotspot lavas are erupting today, and where episodic large igneous province (LIP) activity through Earth history has led to *Earth Crises* (headed by Henrik Svensen). The arrival of a plume head can contribute to continental break-up and thus punctuates plate tectonics and the *Dynamic Earth* (headed by Valentina Magni) by creating and modifying plate boundaries. Conversely, plate tectonics makes an essential contribution to mantle convection through subduction. Slabs restore mass to the *Deep Earth* and could provide the triggering mechanism for plumes that rise from the margins of the large low shear-waver velocity provinces (LLSVPs). The largest volcano in our Solar System (Olympus Mons) may have been active for billions of years, and may indicate the presence of long-lived plumes on *Earth and Beyond*. Developing a robust model for plume impingement at the base of the lithosphere, the formation of LIPs as melts that make their way through the lithosphere, contributing to continental break-up, was therefore a prime numerical challenge within *Earth Modelling* (headed by Clint Conrad) as was understanding how mantle plumes generated from the edges of the LLSVPs are triggered by subducted slabs. The *Earth*

*and Beyond* theme was originally planned to be limited to our own Solar System but is now expanded to identify Earth-like planets (Exo-Earths) orbiting other stars. This is timely as we now embark on an unprecedented era of exploration of extra-solar planetary systems.

CEED activities are largely still arranged within the original thematic framework planned in 2012, although there have been some changes, including the addition of a sixth team — *Earth Laboratory* (headed by Pavel Doubrovine) — in 2014 due to the establishment of a National Research Infrastructures, the Ivar Giæver Geomagnetic Laboratory, at CEED. This laboratory provides critical observational data for the other teams, and in 2018, we also officially opened the CLIPT Stable Isotope Laboratory (headed by Anne Hope Jahren).

### **Program structure**

The program is spread over five days and on the first day (Monday) Trond Torsvik, the founding director, will outline the general motivation and history for starting CEED in 2013. This introduction is followed by invited keynote speakers that either were involved in the planning of CEED or whose scientific contributions very much stimulated us to establish CEED.

The program for the next three days is arranged according to the CEED research themes, *Deep Earth* and *Earth Modelling* (Tuesday), *Dynamic Earth* and *Earth Laboratory* (Wednesday), *Earth Crises* and *Earth and Beyond* (Thursday). The leader of each research theme will provide an overview of the main CEED results, which is then followed by 5-6 keynote lectures on related issues. There will also be two afternoons with poster-sessions (please submit a title) and on Thursday we end with a “**Debate**” on the CEED visions, achievements and disappointments.

On the final day (Friday), we will discuss future prospects beyond CEED and we have invited a number of keynote speakers that will address topics of relevance to our new Centre for Planetary Habitability (PHAB) starting in 2023. The conference ends with a “**Debate**”, on ‘*What makes a planet habitable*’ (chaired by Stephen Mojzsis). For the debates, you may prepare short presentations (2-4 minutes) to argue your view in a vigorously speedy manner.

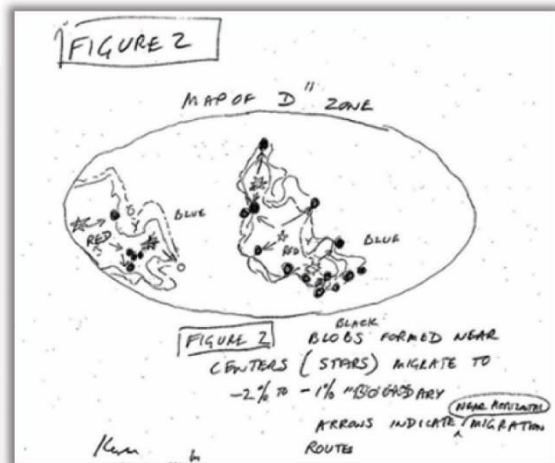


## Daily Program

Time	Monday (14.11)	Title
09:45-10:00	Coffee	
<i>Chair: CARMEN GAINA</i>		
10:00-11:00	Bjørn Jamtveit	Welcome by the Science Dean, Faculty of Mathematics and Natural Sciences (University of Oslo)
	Trond Torsvik	<b>WHY CEED</b>
11:00-11:30	Bernhard Steinberger	Mantle Dynamics and the birth of CEED
11:30-12:00	Ed Garnero	History and status of LLSVP research
12:00-13:00	Lunch	
13:00-13:30	Wim Spakman	Linking the mantle record of subduction to plate tectonic evolution and mantle flow
13:30-14:00	Barbara Romanowicz	Seismic tomography and imaging of plumes in the mantle
<i>Chair: TROND TORSVIK</i>		
14:00-14:30	Richard Ernst	Large Igneous Provinces
14:30-15:00	Lew Ashwal	Possible and impossible mantle sources for LIPs
15:00-15:30	Coffee Break	
15:30-16:00	Susanne Buitert	A role of mantle plumes in continental break-up?
16:00-16:30	Anne Davaille	Planetary interior dynamics and their surface expressions (Venus and Earth)
16:30-17:00	Jim Head III	Planetary exploration – Past Presence and Future ( <i>Zoom</i> )
17:15-19:30	Ice breaker	
19:30	Dinner	

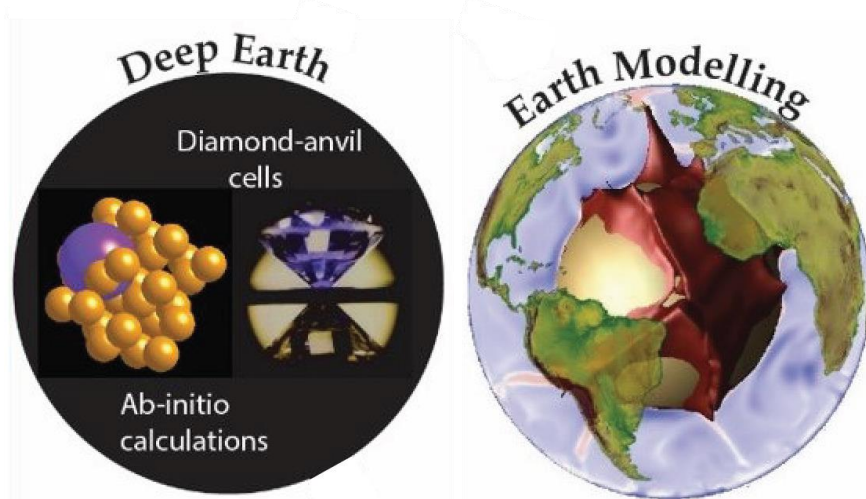
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NATURE  
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Large Igneous Provinces  
formed by plumes from  
the base of the Mantle



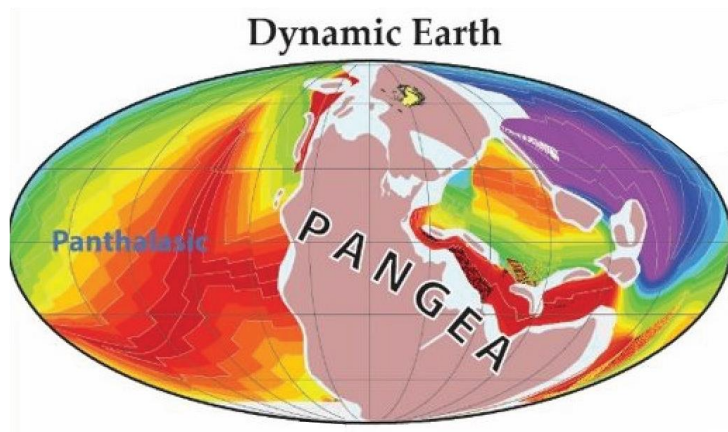
## Daily Program

Time	Tuesday (15.11)	Title
06:30-08:15	Breakfast	
<i>Chair: CHRIS MOHN</i>		
08:15-08:45	Reidar Trønnes	<b>DEEP EARTH</b>
08:45-09:15	Thorsten Becker	On convective memory
09:15-09:45	Maureen Long	Seismic anisotropy in the deep mantle and LLSVPs
09:45-10:00	Coffee Break	
10:00-10:30	Matthew Jackson	Mantle geochemistry through time: the influence of delayed onset of continental subduction
10:30-11:00	Andrea Giuliani	Remnants of early Earth differentiation in the sources of kimberlites and other mantle-derived magmas
11:00-11:30	Marc Hirschmann	Processing of volatiles during accretion and differentiation of Earth and its precursors
11:30-12:00	Carolina Lithgow-Bertelloni	Combining petrology and mantle convection
12:00-13:00	Lunch	
<i>Chair: AGNES KIRALY</i>		
13:00-13:30	Clint Conrad	<b>EARTH MODELLING</b>
13:30-14:00	Boris Kaus	Implementing new methods for geodynamic modelling
14:00-14:30	Manuele Faccenda	Modeling techniques to address the role of anisotropic fabric in mantle dynamics
14:30-15:00	Magali Billen	Deformation of the subducting lithosphere on its journey to the deep mantle
15:00-15:30	Coffee Break	
15:30-16:00	Maëlis Arnould	Mantle geodynamics behind plate tectonics: a focus on plume-induced processes
16:00-16:30	Adrian Lenardic	The Whole Earth Effects of Pangea Assembly and Dispersal
16:30-17:00	Juliane Dannberg	How subduction history and lowermost mantle viscosity control the evolution of thermochemical structures at the core-mantle boundary
17:15-19:30	Poster Session 1	
19:30	Dinner	



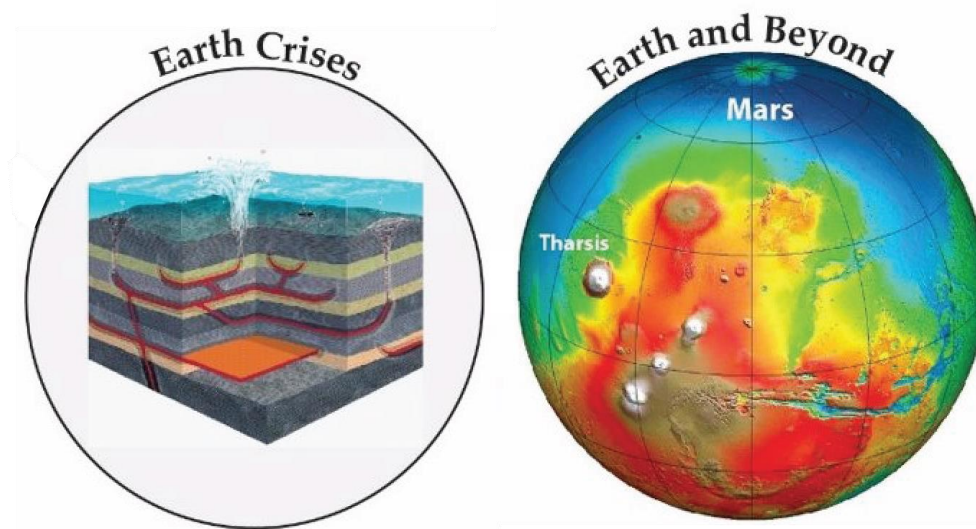
## Daily Program

Time	Wednesday (16.11)	Title
06:30-08:15	Breakfast	
<i>Chair: GRACE SHEPHARD</i>		
08:15-08:45	Valentina Magni	<b>DYNAMIC EARTH</b>
08:45-09:15	Claudio Faccenna	Plumes, continental break-up, rivers, and mammal dispersion: A tale from the Middle East
09:15-09:45	Lars Ruepke	Structure of ocean basins, transform faults revisited
09:45-10:00	Coffee Break	
10:00-10:30	Johannes Jakob	Tectonostratigraphy of the Scandinavian Caledonides and its role in understanding the Scandian Orogeny
10:30-11:00	Paola Vannucchi	Wilson cycle: From rifted margins to continental collision
11:00-11:30	Gwen Peron-Pinvidic	Rifted margins and continental break-up ( <i>Zoom</i> )
11:30-12:00	Mike Searle	Continental collision and the structural and metamorphic geology of the Himalaya-Karakoram-Tibet ( <i>Zoom</i> )
12:15-13:15	Lunch	
<i>Chair: ANNIQUE VAN DER BOON</i>		
13:15-13:45	Pavel Doubrovine	<b>EARTH LABORATORY</b>
13:45-14:15	Johanna Salminen	Plate Reconstructions of Early Earth
14:15-14:45	Joe Meert	Supercontinents
14:45-15:15	Andy Biggin	Geodynamo: paleointensity, reversal rates and inner core nucleation
15:15-15:45	Coffee Break	
15:45-16:15	Paul Wessel	Musings on the Absolute Motions of the Pacific Plate and its Hotspots
16:15-16:45	Mathew Domeier	The enduring Ediacaran paleomagnetic enigma
17:00-19:30	Poster Session 2	
19:30-	Dinner	



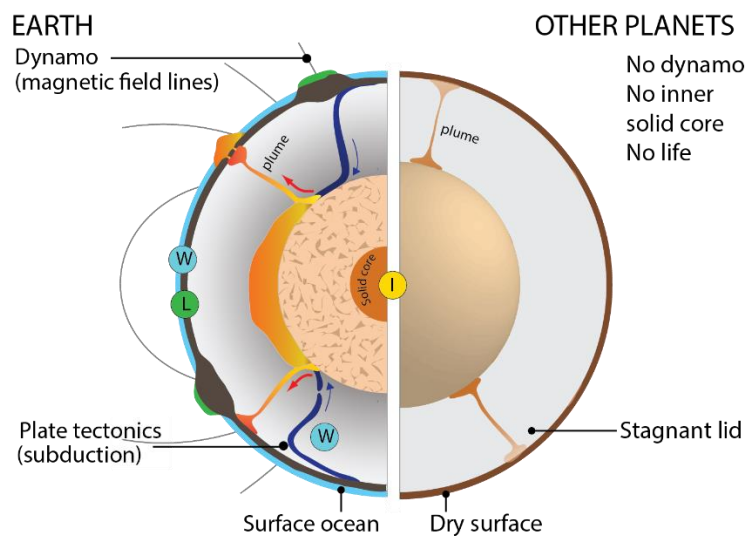
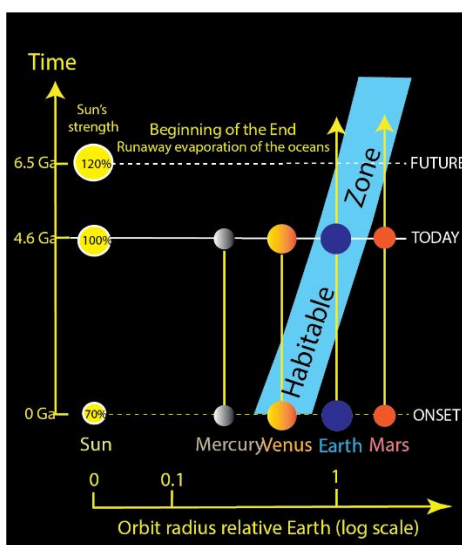
## Daily Program

Time	Thursday (17.11)	Title
06:30-08:15	Breakfast	
<i>Chair: MORGAN JONES</i>		
08:15-08:45	Henrik Svensen	<b>EARTH CRISES</b>
08:45-09:15	Brian Schubert	Paleoclimate change using fossil plants
09:15-09:45	Anna Nele Meckler	Cenozoic evolution of deep ocean temperatures
09:45-10:00	Coffee Break	
10:00-10:30	Tamsin Mather	Insights into the magmatic processes, volatiles and environmental impacts through the life cycle of large igneous province volcanism
10:30-11:00	Sally Gibson	Spatial and temporal variability in mantle volatile fluxes during the formation of Large Igneous Provinces
11:00-11:30	Andrea Marzoli	The crustal magmatic plumbing system of LIP basalts and its impact on Earth crises. Examples from the CAMP and Deccan
11:30-12:00	Bjarte Hannisdal	Earth science, "systems", and the problem of disciplinarity
12:00-13:00	Lunch	
<i>Chair: AGATA KRZESINSKA</i>		
13:00-13:30	Stephanie Werner	<b>BEYOND EARTH</b>
13:30-14:00	Ramon Brassler	Solar System Formation and Evolution
14:00-14:30	Emily Wai Wong	From modelled crater chronology of the outer solar system to the absolute ages of Enceladus' terrain
14:30-15:00	Boris Ivanov	Impact Cratering and Cratering Chronology ( <i>Zoom</i> )
15:00-15:30	Coffee Break	
15:30-16:00	Frances Westall	Early Earth and Mars - Conditions for life ( <i>Zoom</i> )
16:00-16:30	Jean-Christophe Viennet	Organic-rich clays in asteroid Ryugu and other C-types asteroids
17:00-18:30	John Brodholt	<i>Debate:</i> CEED visions, achievements & disappointments
19:30	Dinner	



## Daily Program

Time	Friday (18.11)	Title
06:30-09:30	Breakfast	
<i>Chair: TROND TORSVIK</i>		
09:30-10:00	Coffee	
10:00-10:30	Bernd Etzelmüller Stephanie Werner	Introduction by the Chair of Geosciences (UiO) <b>PHAB</b> in brief (New Center of Excellence)
10:30-11:00	Dana Royer	Phanerozoic atmospheric CO <sub>2</sub> and climate sensitivity
11:00-11:30	Lee Hsiang Liow and Trond Reitan	Drivers of large-scale biodiversification
11:30-12:00	Taras Gerya	Bio-geo-dynamics
12:00-12:30	Chris Davies	Constraining deep Earth evolution using the geomagnetic field
12:30-13:30	Lunch	
<i>Chair: STEPHANIE WERNER</i>		
13:30-14:00	Tim Lenton	Planetary Tipping Points ( <i>Zoom</i> )
14:00-14:30	Stephen Mojzsis	Sources and fates of water oceans on primordial Earth, Mars and maybe Venus
14:30-15:00	Lars Stixrude	Magma ocean, early Earth, volatiles and silicate dynamo
15:00-15:30	Coffee Break	
15:30-16:00	Audrey Bouvier	Making Earth, ingredients and processes
16:00-16:30	Dave Bercovici	Plate Tectonics: When, how and implications for planetary habitability
16:30-17:30	Stephen Mojzsis (Chair)	<b>Debate:</b> What makes a planet habitable
17:30-19:00	Farewell drinks	
19:30-	Dinner	





## Posters

Lead Speaker	Poster Title
<b>Poster Session 1(15.11)</b>	
Bultel, Benjamin	The martian crust is volatile-rich
Brodholt, John	Is CaSiO <sub>3</sub> perovskite in the lower mantle weak or strong?
Bögels, Tim	Studying vaporization processes with atomistic simulations based on machine learning potentials
Callegaro, Sara	New insights on the early phase of the Oslo Rift
Capriolo, Manfredo	Melt and fluid inclusions to constrain LIPs emplacement
Caracas, Razvan	Giant impacts between rocky planets form supercritical protolunar disks
Córdoba, Antonio M-C	Grain-Size Evolution and the tectonic divergence of Venus and Earth
Crameri, Fabio	Independent CEED initiatives and how they have contributed to pave the way for another decade of successful geosciences
Davis, Anne	Vaporization of He and C from a pyrolite melt
Dowding, Elizabeth	LIPSynch prerelease
El Bilali, Hafida	Atla Regio, Venus: plume centre, LIP, and dyke swarm history
Faleide, Jan Inge	Quantification and restoration of pre-drift extension across NE Atlantic conjugate margins
Figowy, Sarah	First-principle modelling of the diffusion of noble gases (He, Ne, Ar, Kr, Xe) in SiO <sub>2</sub> polymorphs
Gallo, Leandro	On the feasibility of Paleomagnetic Euler Pole Analysis
Gassmoeller, Rene	Computational Infrastructure for Geodynamics – the next 5 years
Guerer, Derya	Plate tectonic chain reaction constrained from noise in the Cretaceous Quiet Zone
Hagopian, William	Research Highlights from the CLIPT Lab
Heilman, Erin	Modeling Evolution of Oceanic Plate Boundaries with Damage Rheology
Jerram, Dougal	Science Outreach from Volcanoes to the Centre of the Earth
Jones, Morgan	Tracking North Atlantic volcanism and North Sea - Ocean connectivity across the Paleocene-Eocene Thermal Maximum
Király, Ágnes	Anisotropic viscosity in mantle dynamics
Krzesinska, Agata	Aqueous alteration in Martian meteorites
Kusiak/Dunkley	Generations of Eoarchean crust: early results from the Poles Together project
<b>Poster Session 2 (16.11)</b>	
Augland, Lars Eivind	Plume dynamics in the upper mantle inferred from mantle zircon geochronology
Bajard, Manon	A tipping point in the erosion of southeast Norway: the development of human activities enhanced vulnerability to climate changes in the Little Ice Age
Marcilly, Chloe	Understanding the early Paleozoic carbon cycle balance and climate change from modeling
Maupin, Valerie	New seismic models of the Fennoscandian lithosphere

Mazzini, Adriano	The Lusi mud eruption: results from the LUSI LAB ERC project
Minakov, Alexander	4-D integrated geophysical modeling of lithosphere
Mojzsis, Stephen	Thermal consequences of impact bombardments to silicate crusts of terrestrial-type planets
Mulykova, Elvira	How Microscopic Crystalline Defects Control the Motion of Tectonic Plates
Ozgurel, Ozge	Helium partitioning between the mantle and the core at the early Earth
Planke, Sverre	IODP Expedition 396: NE Atlantic Magmatism and Paleoclimate
Polteau, Stéphane	Isotope Systems for Understanding the Precambrian Earth Evolution
Robert, Boris	Modelling of True Polar Wander of the last 200 Myrs
Rolf, Tobias	From the Earth to Europa - my solar system exploration at CEED
Saurety, Adrien	Noble gases behaviour in Magma Ocean
Shephard, Grace	Polar tectonics and mantle dynamics
Stokke, Ella W.	Explosive volcanism during emplacement of the North Atlantic Igneous Province
Straume, Eivind	Implications of Plate Motions and Mantle Convection on Ocean Circulation and Climate
Trønnes, Reidar	The role of davemaoite in the lowermost mantle: implications for the ULVZs and LLSVPs
Vaes, Bram	Calculating apparent polar wander and tectonic displacements using site-level paleomagnetic data
Vickers, Madeleine	Cooling and ash in the Paleogene Greenhouse
Wang, Yijun	Olivine texture evolution under simple deformation: Comparing different numerical methods for calculating LPO and anisotropic viscosity
Webb, Sue	Deep drilling in the Bushveld Complex, the world's largest layered intrusion: the BVDP Project of the ICDP
Xue, Yi	Reconnaissance on inclination shallowing effect of Lower Triassic red beds from North China Block by the anisotropy of remanence

## Participant list

Andersen, Torgeir B.  
Anzulovic, Ana  
Arnould, Maelis  
Ashwal, Lewis  
Augland, Lars Eivind  
Bajard, Manon  
Becker, Thorsten  
Benjamin Bultel  
Bercovici, David  
Biggin, Andy  
Billen, Magali  
Bjørlykke, Arne  
Bouvier, Audrey  
Brasser, Ramon  
Brodholt, John  
Buiten, Susanne  
Bögels, Tim  
Cala, Juan Camilo Meza  
Callegaro, Sara  
Capriolo, Manfredo  
Caracas, Razvan  
Cloetingh, Sierd  
Conrad, Clint  
Córdoba, Antonio M-C  
Cramer, Fabio  
Dannberg, Juliane  
Davaille, Anne  
Davies, Chris  
Davis, Anne  
Domeier, Mathew  
Doubrovine, Pavel  
Dowding, Elizabeth  
Dunkley, Daniel  
El Bilali, Hafida  
Ernst, Richard  
Etzelmüller, Bernd  
Faccenda, Manuele  
Faccenna, Claudio  
Faleide, Jan Inge  
Figowy, Sarah  
Gabrielsen, Roy Helge  
Gaina, Carmen  
Gallo, Leandro  
Garnero, Ed  
Gassmoeller, Rene  
Geng, Ming  
Gerya, Taras  
Gibson, Sally  
Giuliani, Andrea  
Guerer, Derya  
Gørbitz, Trine-Lise K.  
Hagopian, William  
Hannisdal, Bjarte  
Hatalova, Petra  
Head, Jim  
Heilman, Erin  
Heyn, Björn  
Hirschmann, Mark  
Ivanov, Boris  
Jackson, Matt  
Jacobsen, Stein B  
Jahren, Anne Hope  
Jakob, Johannes  
Jamtveit, Bjørn  
Jerram, Dougal  
Jones, Morgan  
Kaus, Boris  
Király, Ágnes  
Krzyszowska, Agata  
Kusiak, Monika A.  
Larsen, Bjørn Tore  
Lenardic, Adrian  
Lenton, Tim  
Liow, Lee Hsiang  
Lithgow-Bertelloni, Carolina  
Long, Maureen  
Lukens, Bill  
MacNioCail, Conall  
Magni, Valentina  
Mamonova, Elena  
Mandea, Mioara  
Marcilly, Chloe  
Marzoli, Andrea  
Mather, Tamsin  
Maupin, Valerie  
Mazzini, Adriano  
Meckler, Anna Nele  
Medvedev, Sergei  
Meert, Joe  
Minakov, Alexander  
Mohn, Chris  
Mojzsis, Stephen  
Mulykova, Elvira  
Neumann, Else Ragnhild  
Ozgurel, Ozge  
Peron-Pinvidic, Gwenn  
Planke, Sverre  
Ramirez, Florence  
Reitan, Trond  
Robert, Boris  
Rolf, Tobias  
Romanowicz, Barbara  
Royer, Dana  
Ruepke, Lars  
Ryen, Sofie H  
Salminen, Johanna  
Sannesmoen, Trine  
Saurety, Adrien  
Schubert, Brian  
Schweitzer, Johannes  
Searle, Mike  
Shephard, Grace  
Sigloch, Karin  
Skjelkvåle, Brit-Lisa

Sleveland, Marie  
Spakman, Wim  
Steinberger, Bernhard  
Stixrude, Lars  
Stokke, Ella W.  
Straume, Eivind  
Svensen, Henrik  
ten kate, Inge  
Torsvik, Trond  
Trønnes, Reidar

Uppalapati, Sruthi  
Vaes, Bram  
van der Boon, Annique  
van Hinsbergen, Douwe  
VanDecar, John  
Vannucchi, Paola  
Vickers, Madeleine  
Viennet, Jean-Christophe  
Walderhaug, Harald  
Wang, Yijun

Webb, Sue  
Weerdesteijn, Maaïke  
Werner, Stephanie  
Werts, Scott  
Wessel, Paul  
Westall, Frances  
Wong, Emily Wai  
Xue, Yi

## Practical Information

### Directions to Sundvollen Hotel from Oslo airport

(Address: Dronningveien 2, 3531 Krokkleiva).

#### 1. Bus:

It is possible to take the airport bus "Askeladden flybuss" from the airport to the hotel. The bus is at platform 36. The bus ride takes about 1 hour and 30 minutes. For more information about the airport shuttle, see here: <https://askeladden.net/en/airportshuttle/>  
Tickets are purchased on the bus. The bus stop is called "Sundvolden".

The timetable will be the same for November as it is now. Please notice that on Sundays, the bus only goes in the afternoon.

D = Daily, X = Except, 6 = Saturday, 7 = Sunday

#### 2. Train:

It is also possible to take the airport express train from Oslo airport Gardermoen to Sandvika stasjon and then take bus number 200 to get to the hotel. The trip takes about 1 hour and 25 minutes.

You can search for the most convenient schedule here: <https://ruter.no/en/journey-planner/?from=%7B%22id%22%3A%22NSR%3AStopPlace%3A58211%22%2C%22name%22%3A%22Oslo+lufthavn%22%2C%22county%22%3A%22Viken%22%2C%22locality%22%3A%22Ullensaker%22%2C%22coordinates%22%3A%7B%22x%22%3A11.097887%2C%22y%22%3A60.193361%7D%2C%22category%22%3A%5B%22airport%22%2C%22busStation%22%2C%22onstreetBus%22%2C%22railStation%22%5D%7D&customTime=true&travelTime=2022-11-13T11%3A30%3A00.292Z&to=%7B%22id%22%3A%22OSM%3ATopographicPlace%3A1060355024%22%2C%22name%22%3A%22Sundvolden+hotel%22%2C%22county%22%3A%22Viken%22%2C%22locality%22%3A%22Hole%22%2C%22coordinates%22%3A%7B%22x%22%3A10.310471600000001%2C%22y%22%3A60.0623117%7D%2C%22category%22%3A%5B%22hotel%22%2C%22poi%22%5D%7D>

From: Oslo Lufthavn, to: Sundvolden Hotel. The bus stop is "Sundvollen E16".

You can buy tickets for the train at the airport or in the Ruter app. For bus nr. 200 (towards Hønefoss), tickets are purchased in the Brakar Billett-app or directly on the bus (cash/card). The price for a single adult ticket on the bus is 123 NOK + 20 NOK fee if the ticket is purchased on the bus.

This bus also goes from Oslo bus terminal in the center of Oslo.

#### 3. Taxi:

The hotel cooperates with "Ring Taxi" and they get a special price estimate for guests of the hotel.

If you are unable to find a suitable travel arrangement with option 1 or 2 above, please contact Trine that can contact the hotel to book a taxi.

## **Food and alcohol**

All meals and hotel accommodations are covered by CEED and during our dinners at the hotel you will all have three 3 units (mineral water, beer or wine) included with each meal (maximum state rules). On Monday and Friday, one of these free units will be used during the "Ice breaker" and "Farewell Drinks" before dinner. You will receive one drinking ticket for each of these occasions. If you wish to drink more than this, feel free to pay for that personally. If you charge drinks to your hotel room please pay for that before you leave the hotel.