



40 years with ILP
Stimulus of Lithosphere and Solid Earth Research

Hans Thybo, President

Eurasia Institute of Earth Sciences, Istanbul Technical University

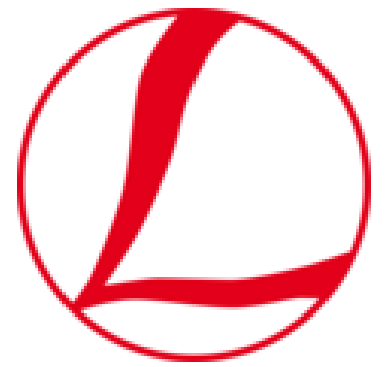
China University of Geosciences, Wuhan

Centre for Earth Evolution and Dynamics, University of Oslo



ILP - International Lithosphere Program

was initiated in 1980



**to promote interdisciplinary research
on the lithosphere**

at the interface between IUGS and IUGG

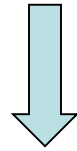
through multidisciplinary research projects

Lithosphere is the connection between deep Earth and the surface



Background projects for ILP

- International Geophysical Year (1957-1958)
 - International Upper Mantle Project (1964-1970)
 - International Geodynamics Project (1972-1979)
- (and acceptance of Plate Tectonics)

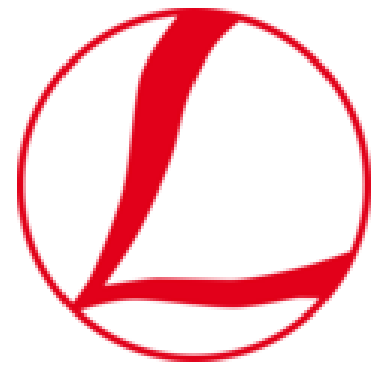


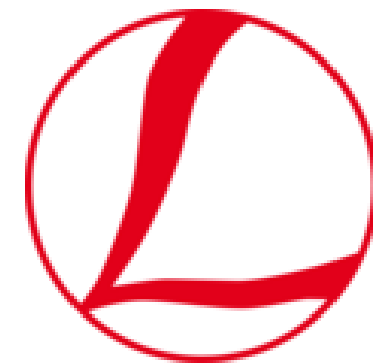
International Lithosphere Program ILP since 1980

ILP is financed through

- annual contributions from *IUGG & IUGS*,
- national contributions from member countries

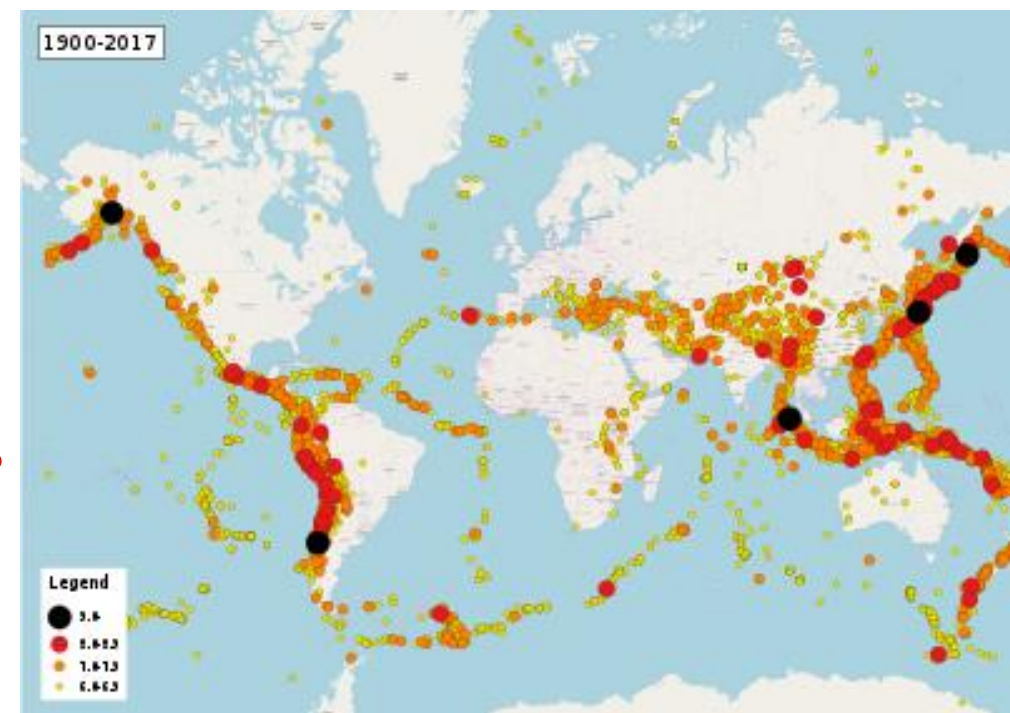
GFZ Potsdam, Germany complimentary runs the ILP Office





ILP - International Lithosphere Program

- Covers all continents
- 70 programs since 1980
- Each involving 50-1000 scientists
 - Including many
global and continent scale
interdisciplinary geoscience programmes
- ILP is a bottom-up organisation





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Mission

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Task Forces

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Since 1990, ILP projects have been operating under the umbrella of four broad research themes:

1. Geoscience of Global Change
2. Contemporary Dynamics and Deep Processes
3. Continental Lithosphere
4. Oceanic Lithosphere

ILP promotes and directs research on first-order problems in modern integrated Solid Earth Science centred on the lithosphere. Proposed subjects for new task forces should include

- Integrated mapping of the lithosphere (compilation of global, crust, lithosphere heat flow, lithosphere strength)
- Mantle dynamics (implications for lithosphere dynamics; fate of subducted lithosphere; deformation and evolution of the lithosphere)
- Response of the lithosphere to surface processes
- Paleoclimate changes (Paleoclimate record of lithosphere changes, surface temperature evolution of the atmosphere)

The science in ILP is organized in task forces and regional coordinating committees addressing a specific topic or problem in an interdisciplinary approach.

A key feature of task forces is their dynamic nature providing a challenge to bring in new talent. Task forces exist for a limited period of five years, followed by a review upon which an extension with one term can follow. A special effort will be made to catalyse on recent initiatives in Northern America on large scale data acquisition (e.g. EARTHSCOPE, TOPO EUROPE) and to seek added value between major national programmes such as vigorously pursued in e.g. China, India and South America and emerging activities elsewhere.



ILP Bureau

H. Thybo	Turkey	President
M. Scheck-Wenderoth	Germany	Secretary General
A. Rudloff	Germany	Executive Secretary (until 2020)
A. Tibaldi	Italy	Chairperson - Committee of National Representatives
K. Asch	Germany	IUGS
H. Gupta	India	IUGG
S. Cloetingh	Netherlands	Past President

ILP Advisory Board

Ö. Adiyaman Lopes	UNESCO
S. Dong	China
C. Ebinger	USA.
D. Mueller	Australia
H. Sato	Japan



Past Presidents of ILP

Sierd Cloetingh, The Netherlands	(2005 - 2017)
Asahiko Taira, Japan	(2001 - 2005)
Alan Green, Switzerland	(1996 - 2000)
Kevin Burke, U.S.A.	(1992 - 1995)
Albert Bally, U.S.A.	(1990 - 1992)
Karl Fuchs, Germany	(1985 - 1990)
Ray Price, Canada	(1980 - 1985)

Past Secretary Generals of ILP

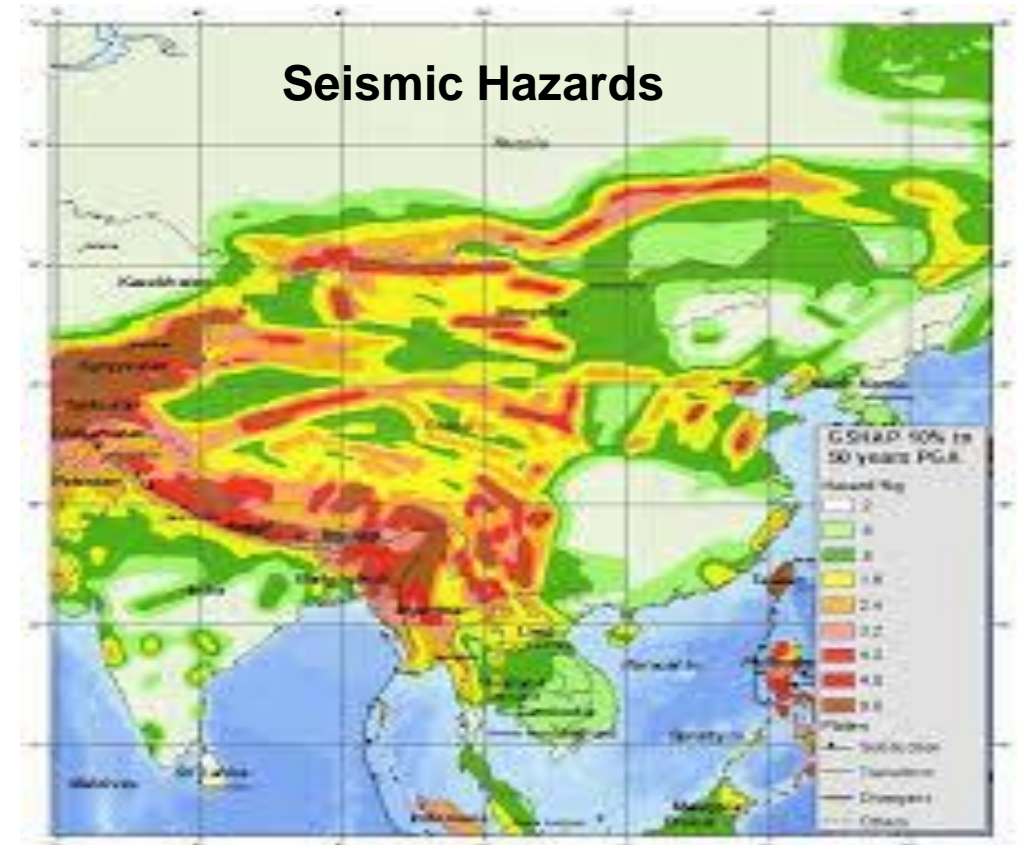
Roland Oberhänsli, Germany	(2008 - 2012)
Jörg Negendank, Germany	(2005 - 2008)
Kaye Shedlock, U.S.A.	(2000 - 2004)
Jörg Erzinger, Germany	(1996 - 2000)
Michael Berry, U.S.A.	(1990 - 1995)
Henk Zwart, The Netherlands	(1985 - 1990)
Edward Flinn, U.S.A.	(1980 - 1985)





ILP Research Themes

- Geoscience of Global Change
- Contemporary Dynamics and Deep Processes
- Continental Lithosphere
- Oceanic Lithosphere



Task Forces (programs on scientific subjects) and Coordinating Committees (programs with regional focus)



- The core of ILP
- Duration: 5 years
- New programs are approved by the ILP Bureau

Task forces and coordinating committees:

- hold regular meetings and workshops open to all interested scientists (7 workshops in 2019)
- organise symposia at scientific conferences (ca. 15 in 2019)
- create international networks
- increasingly involve Young Scientists
- receive financial support from ILP to organize workshops and support young scientists
- publish special issues of scientific journals (5-10 per year)



Active Task Forces :



I. Geoscience of global change

- TF 2: Structural and rheological constraints on magma migration, accumulation and eruption through the lithosphere, A. Tibaldi (Italy), A. Gudmundsson (UK) et al.

II. Contemporary dynamics and deep processes

- TF 4: Fate of the subducted continental lithosphere: insight through analytical mineralogy and microstructures, L. Dobrzhinetskaya, U.S.A. and J. Zhang, China

- TF 8: Lithosphere dynamics: interplays between models and data. T. Gerya (Switzerland), S. Buiter (Norway), G. Houseman (Australia) et al.

- TF 9: Subduction across scales (SAS). P. Agard (France), S. Penniston-Dorland (U.S.A.), A. Cardona Molina (Colombia), J. Omrani (Iran).

III. Continental lithosphere

- TF1: Lithosphere Structure and Mineral Resources, I. Artemieva Denmark, R. Ernst, Canada, S. Dong, China

- TF 3: The seismic cycle at continental transforms from seismological observation and forward simulation, M. Bohnhoff and O. Heidbach, Germany.

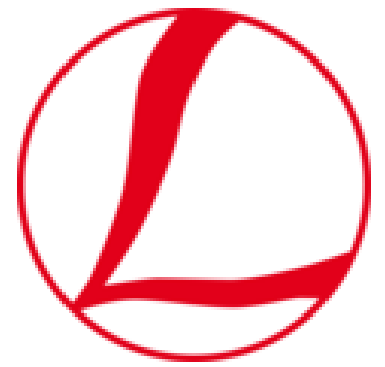
- TF 6: Sedimentary Basins, L. Matenco, Netherlands and F. H. Nader, France.

- TF 8: Lithosphere dynamics: interplays between models and data, T. Gerya, Switzerland, S. Buiter, Norway, G. Houseman, Australia/UK et al.

IV. Oceanic lithosphere

- TF 9: Subduction across scales (SAS) (Chair: P. Agard et al.)





Active Coordinating Committees :

TOPO-EUROPE: 4D Topography Evolution in Europe: Uplift, Subsidence and Sea Level Rise:

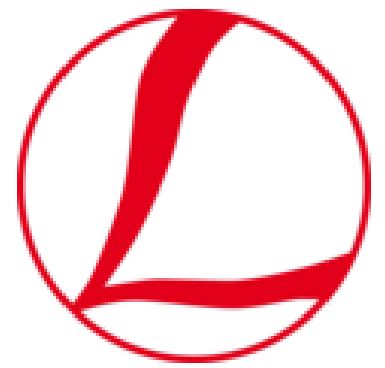
S. Cloetingh (Netherlands), S. Willet (Switzerland)

MEDYNA: Maghreb-EU integrated research on geodynamics, geo-hazards, and applied geology in

North West Africa: C. Garrido (Spain), J.-L. Bodinier (France)

Lithospheric Seismicity and Tectonics in the Himalaya, M. Karplus (USA)





New Task Forces 2021-2025:

Sedimentary Basins, L. Matenco, Netherlands and F. H. Nader, France

Global Lithospheric Stress - The World Stress Map in 3D, M. Rajabi (Australia), Sebastian von Specht (Taiwan), Oliver Heidbach (Germany)

Continental Lithosphere: a Broad-scale Investigation (CoLiBri), G. Hetenyi (Switzerland), H. Zlebcikova (Czech rep.), M. Bielik (Slovakia), J. Carlos Afonso (Australia)

LithoMar - Assessing the Relationships Between Lithospheric Processes and Seafloor Topography at Oceanic Hotspots and Divergent Margins, A. Savini (Italy), S. Krastel (Germany), A. Micallef (Malta), P. Nomikou (Greece)

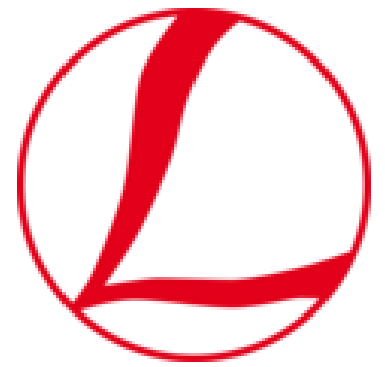
Deformation and Magmatic Processes from the Lithosphere to the Surface: Integrated Multidisciplinary Approaches, A. Tibaldi (Italy), A. Gudmundsson (UK), G. Waite (USA)

Global Geo Transects (GGT), S. Dong (China), H. Thybo (Turkey), L. Brown (USA)

Bio-Geodynamics of the Lithosphere, T. Gerya (Switzerland), R. Stern (USA)

2020-2024: TF1: Lithosphere Structure and Mineral Resources, I. Artemieva (Germany), R. Ernst (Canada), S. Dong (China)





New Coordinating Committees 2021-2025:

Lithosphere of East Antarctica, A. Reading, K. Selway, M. King (Australia)

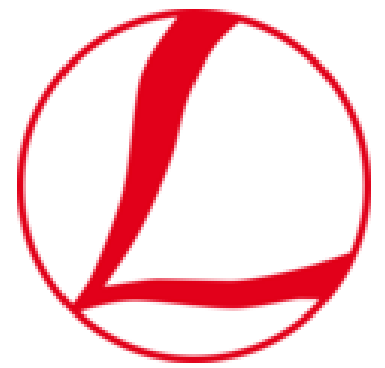
Anatolian Tectonics (ANATEC), O. Gögüs (Turkey), T. Schildgen (Germany), A. Fichtner (Switzerland), D. van Hinsbergen (Netherlands)

EUROPE: 4D Topography Evolution in Europe: Uplift, Subsidence and Sea Level Rise: T. Ehlers (Germany), I. Kovacs (Hungary), S. Cloetingh (Netherlands)

2020-2024: Lithospheric Seismicity and Tectonics in the Himalaya, M. Karplus (USA)



ILP publication examples:



TF II: Mueller et al. (2017): Stability of volcanic ash aggregates and break-up processes. **Scientific Reports-Nature.com.**

Tibaldi, A., Bonali, F.L. (2017): Intra-arc and back-arc volcano-tectonics: Magma pathways at Holocene Alaska-Aleutian volcanoes. **Earth-Science Reviews**

TF III: Li, S. et al. (2017): Postseismic uplift of the Andes following the 2010 Maule earthquake: Implications for mantle rheology. **Geophys. Res. Lett.**

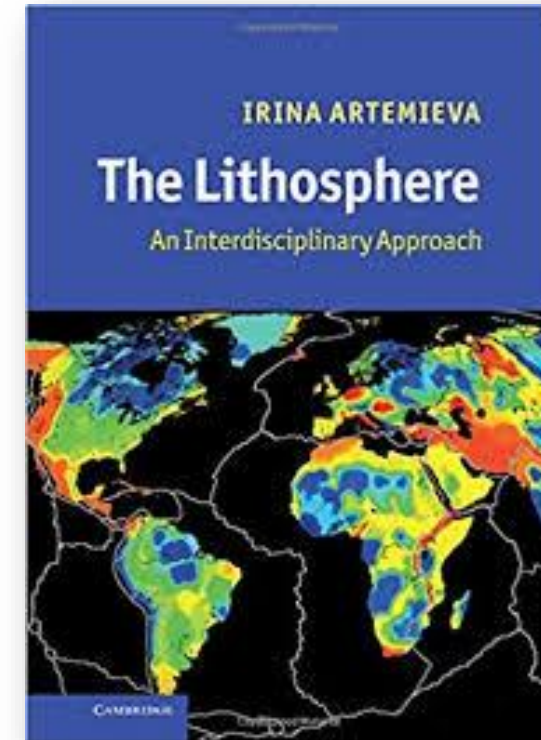
Rajabi, M., et al (2017): The present-day stress field of Australia. **Earth Science Reviews,**

TF IV: MXu, H.J., Zhang, J.F. (2017): Anatexis witnessed post-collisional evolution of the Dabie orogen, China. **Journal of Asian Earth Sciences**

Wang, L., Wang, S.J., Brown, M., Zhang, J.F., Peng, P., Jin, Z.M. (2018): On the survival of intergranular coesite in UHP eclogite. **Journal of Metamorphic Geology**

TF VI: Sato, H. et al. (2017): Evolution of fore-arc and back-arc sedimentary basins with focus on the Japan subduction system and its analogues. **Tectonophysics Special Issue**

Scheck-Wenderoth, M. et al. (2017) progress in understanding passive continental margins. **Tectonophysics Special Issue**



ILP publication examples:

TF VIII: Chowdhury, P., et al. (2017): Emergence of silicic continents as the lower crust peels off on a hot plate-tectonic Earth. **Nature Geoscience**

Le Pourhiet, L. et al (2017): A genetic link between transform and hyper-extended margins. **Earth and Planetary Science Letters**

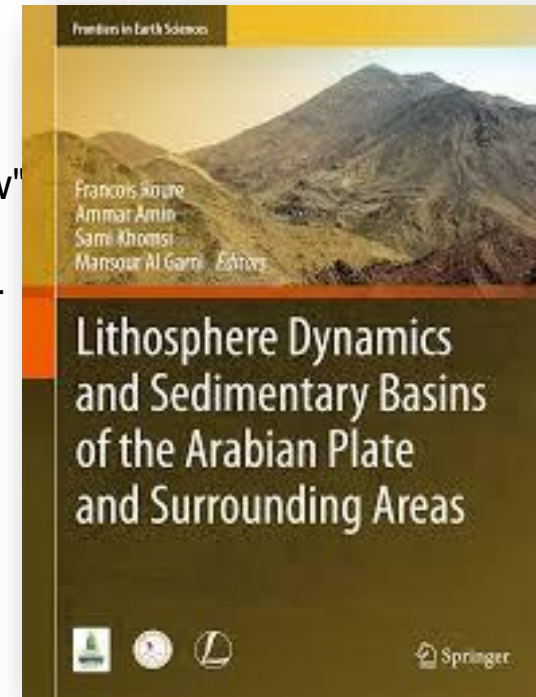
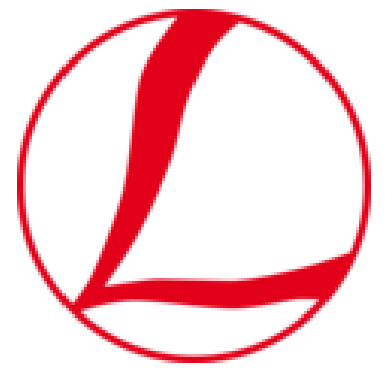
Naliboff, J.B., et al. (2017): Complex fault interaction controls continental rifting. **Nature Communications**

TF IX: Stern, R.J., Gerya, T. (2017): "Subduction initiation in nature and models: A review" **Tectonophysics, Special Issue** in Honor of E. Burov.

Incel, S., et al. (2017): Laboratory earthquakes triggered during eclogitization of lawsonite-bearing blueschist. **Earth and Planetary Science Letters**

CC MEDYNA: Ouabid, M., et al. (2017): Neoproterozoic granitoids in the basement of the Moroccan Central Meseta: Correlation with the Anti-Atlas at the NW paleo-margin of Gondwana. **Precambrian Research**

Marchesi, C et al. (2017) Multi-stage evolution of the lithospheric mantle beneath the westernmost Mediterranean: Geochemical constraints from peridotite xenoliths in the eastern Betic Cordillera (SE Spain). **Lithos**





Recent Awards

**Evgueni Burov medal for
praiseworthy mid-career achievements:**

2018: Francesca Funicello

2019: Luc Lavier

2020: Clint Conrad

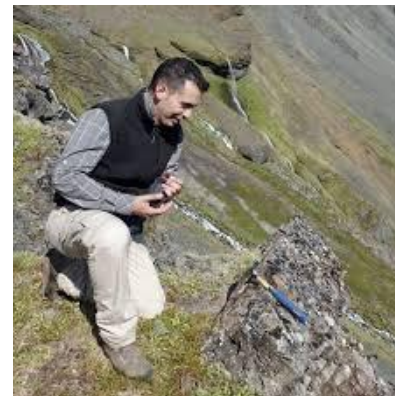


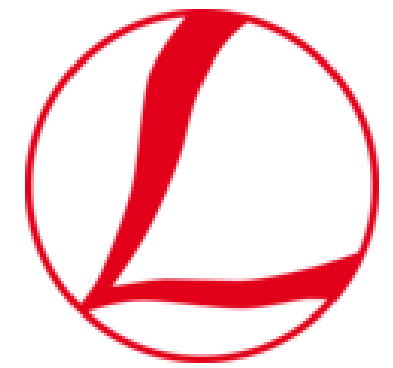
**Flinn-Hart award to an
outstanding young scientist:**

2018: Fabio Luca Bonali

2019: Alexander Koptev

2020: Attila Balazs





ILP MISSION AND PROFILE

Integrated Solid Earth research is key to the ILP mission:

Lithosphere is the connection between deep Earth and the surface

Breakthroughs in lithosphere research require:

- Cooperation between geology, geophysics, geochemistry and geotechnology
- High quality data
- Integration of imaging, monitoring, reconstruction and modelling

Earlier Task Forces and Coordinating Committees

Theme I: The Geoscience of Global Change

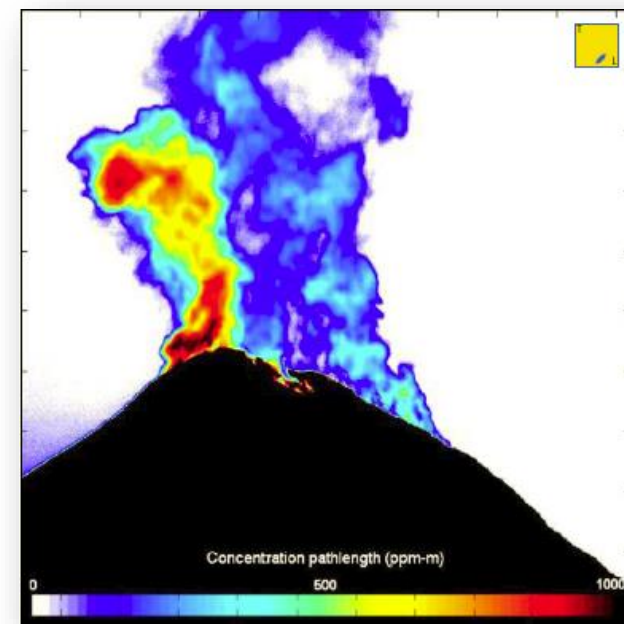
- Paleo-Map
- Space Geodesy and Global Sea Level,
- Methane Hydrate: Global Distribution and Geological Processes,
- New tectonic causes of volcano failure and possible premonitory signals,
- LE - Circum Arctic Lithosphere Evolution
- DISC - Deep Into the Subduction Channel



Earlier Task Forces and Coordinating Committees

Theme II: Contemporary Dynamics and Deep Processes

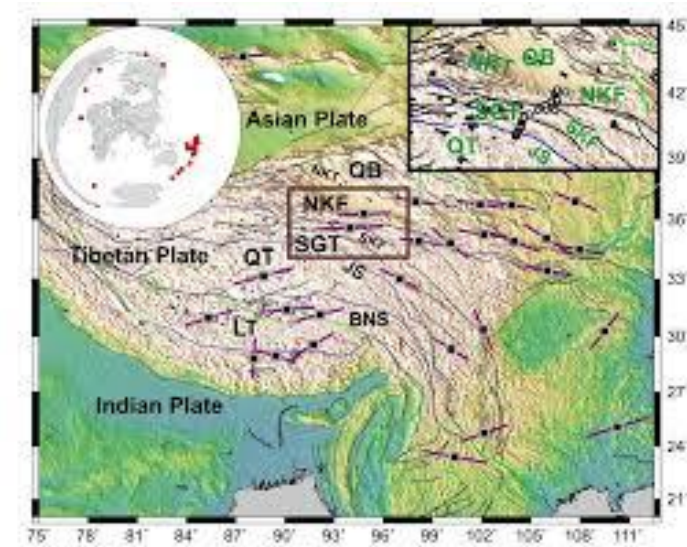
- Global Seismic Hazard Assessment Program (GSHAP)
- World Stress Map
- Temporal and Spatial Change of Stress and Strain
- World Map of Major Active Faults Eastern Hemisphere,
- Paleoseismicity of the Late Holocene,
- Three-Dimensional Modelling of the Earth's Tectosphere,
- Earthquake Recurrence Through Time
- Global and regional parameters of paleoseismology; implications for fault scaling and future earthquake hazard
- Mantle Plumes, Hot Spots and Geodynamics of Continental Rifting and Break-Up
Baby plumes in Central Europe
- Earthquakes and Megacities Initiative (EMI)
- Global Strain Rate Map
- Global Earthquake Potential
- Ultra-Deep Continental Crust Subduction (UDCCS)
- Volcanoes and society: environment, health and public outreach
- Bridging the gap from microseismicity to large earthquakes
- 3D Geomechanical modelling of geodynamic processes in the lithosphere
- Lithosphere dynamics: interplays between models and data



Earlier Task Forces and Coordinating Committees

Theme III: Continental Lithosphere

- Global Geoscience Transects (GGT)
- Origin of Sedimentary Basins
- Sedimentary Basins
- Processes in the Lithosphere as Reflected in Integrated Petrological and Geophysical Studies
- Dynamics of the Subcontinental Mantle: From Seismic Anisotropy to Mountain Building,
- Ultrahigh-Pressure Metamorphism and Geodynamics in Collision-Type Orogenic Belts,
- Global Impact Studies Project,
- Processes and Geodynamics in the Formation and Exhumation of Ultrahigh-Pressure Metamorphic Terrain,
- Earth Accretionary Systems (in space and time) (ERAS),
- Lithosphere-Asthenosphere Interactions,
- Continental Collisional Orogens: from Atomic Scales to Mountain Buildings
- LAPBOX - The lithosphere-asthenosphere boundary depth paradox
- The Unconventionals



Earlier Task Forces and Coordinating Committees

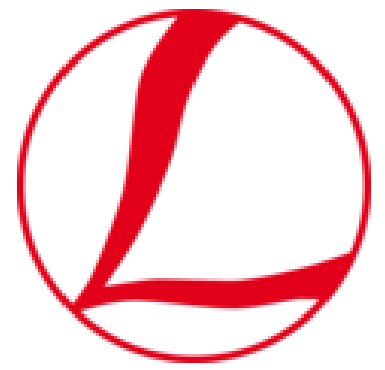
Theme IV: Oceanic Lithosphere

- The Ocean-Continent Lithosphere Boundary
- Hydrogeology of the Oceanic Lithosphere,

Coordinating Committees

- Global integrated geoscience transects
- European GeoTraverse
- EUROPROBE
- DynaQlim
- TOPO-CENTRAL-ASIA: "4D Topographic Evolution in Central Asia: Lithosphere Dynamics and Environmental Changes since Mesozoic Upper Mantle Dynamics and Quaternary Climate in Cratonic Areas
- TOPO-EUROPE



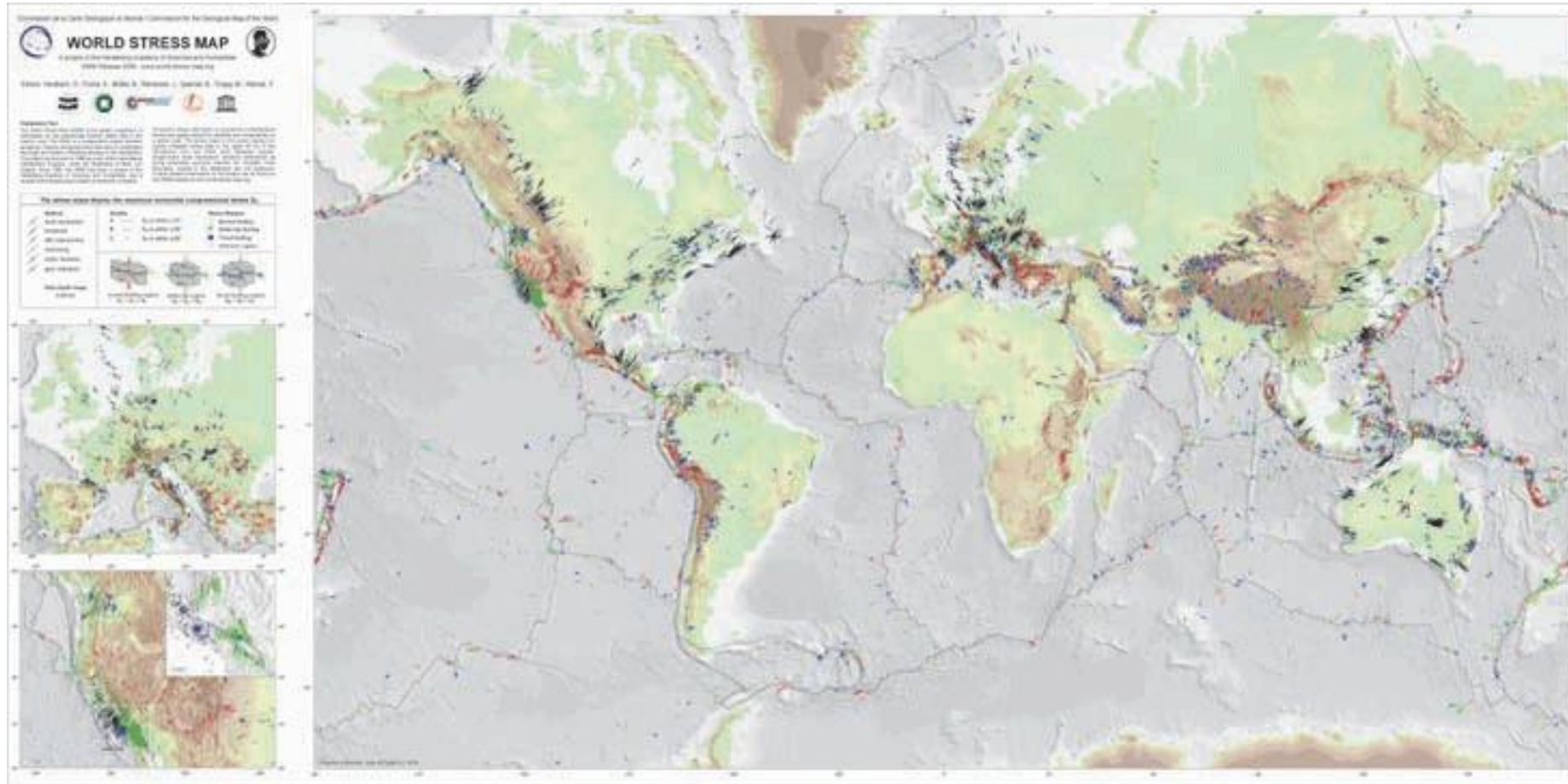


Some major ILP achievements :

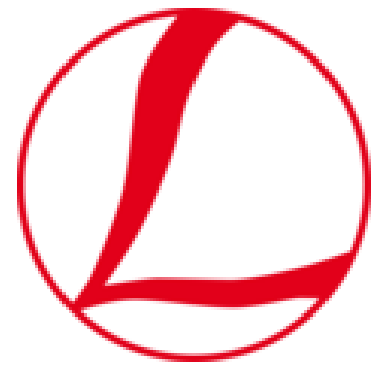
- **Global Seismic Hazard Assessment Map**
- **World Stress Map**
- **Global Strain Rate Map**
- **Global Impact Studies**
- **International Continental Drilling Program (ICDP)**
- **Global Geoscience Transects and programmes:**
 - **EGT, EUROPROBE, TOPOEUROPE, TOPOASIA**
 - **Regional geoscience transects**



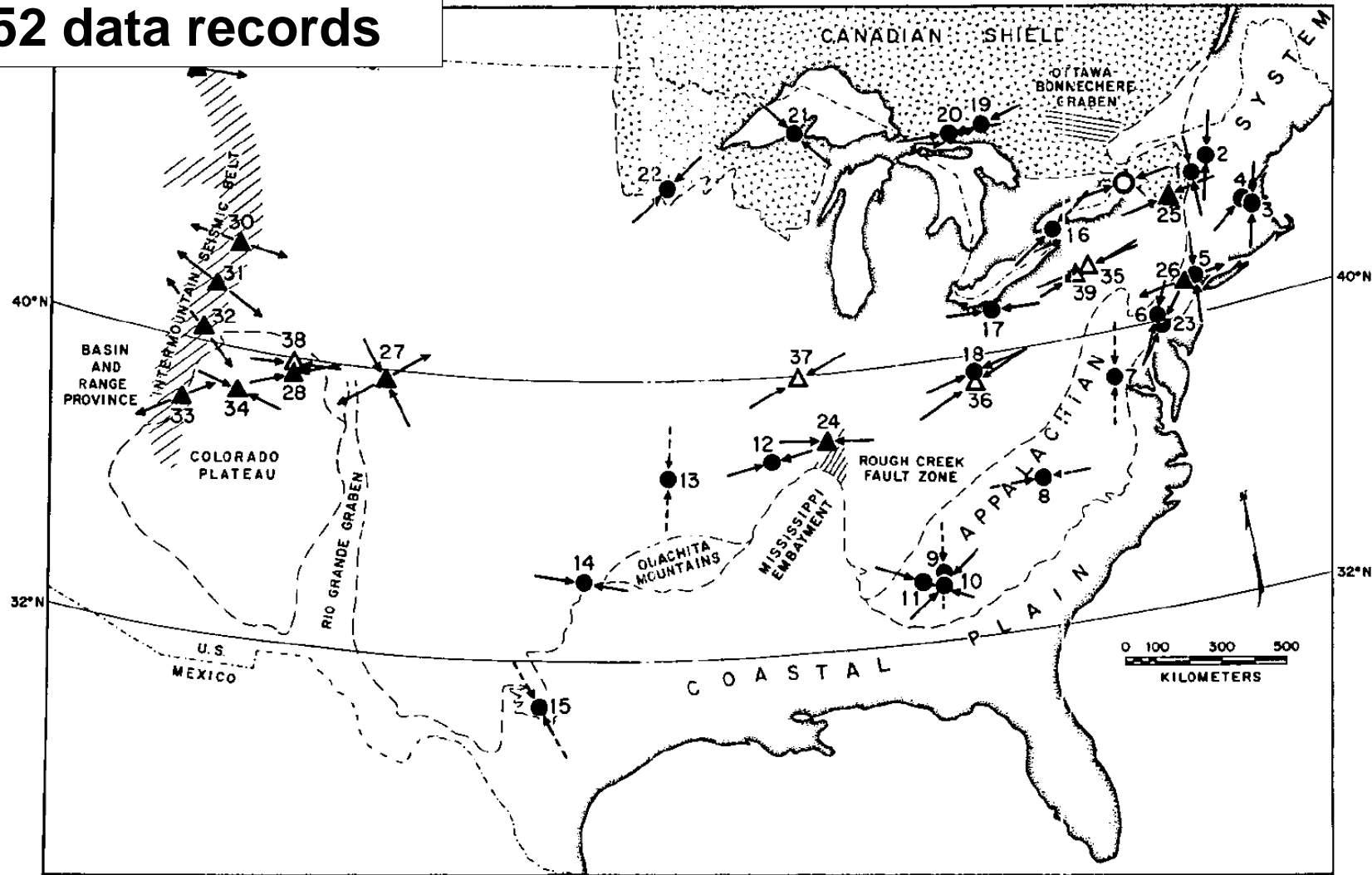
ILP World Stress Map, now back in new form



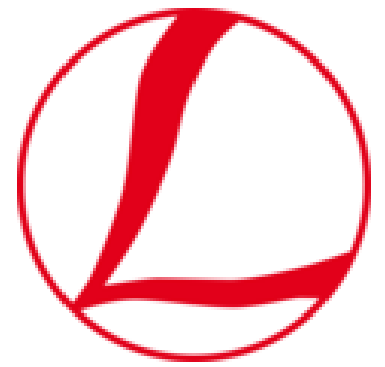
First Regional Compilation – Sbar & Sykes (1973)



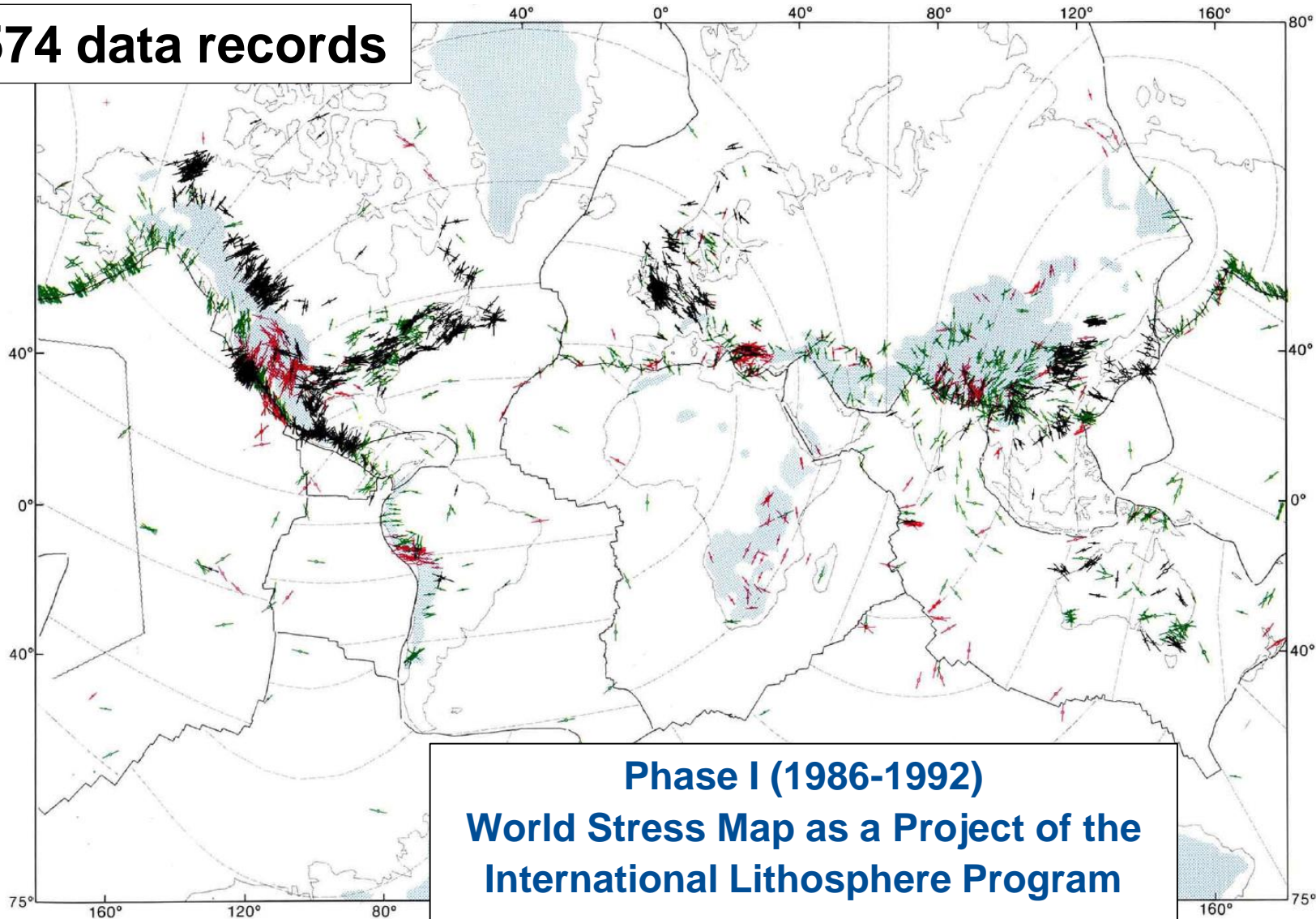
52 data records



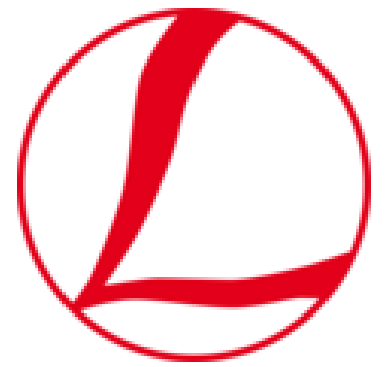
First World Stress Map – Zoback et al. (1989)



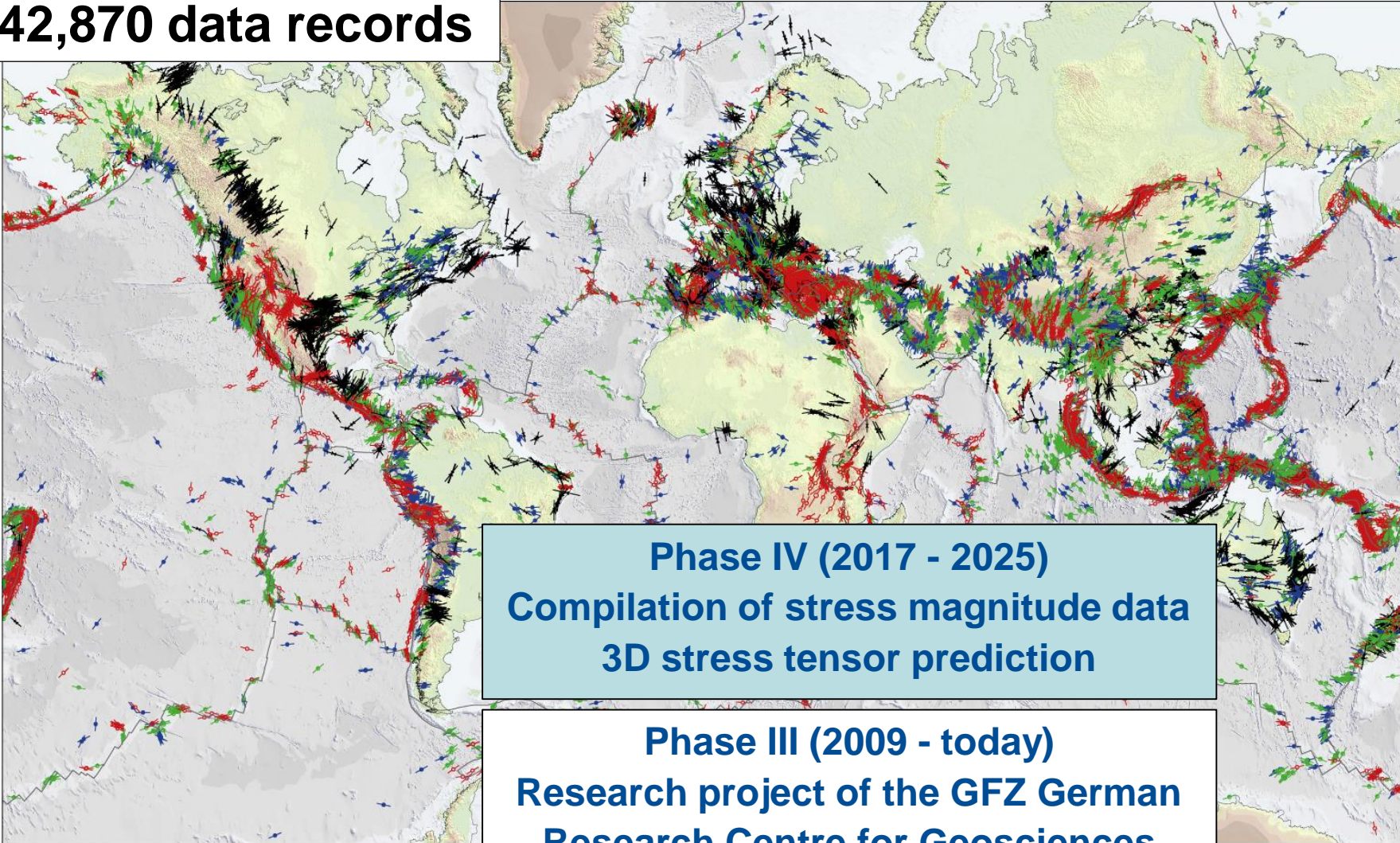
3,574 data records



World Stress Map – 2016 Database Release



42,870 data records



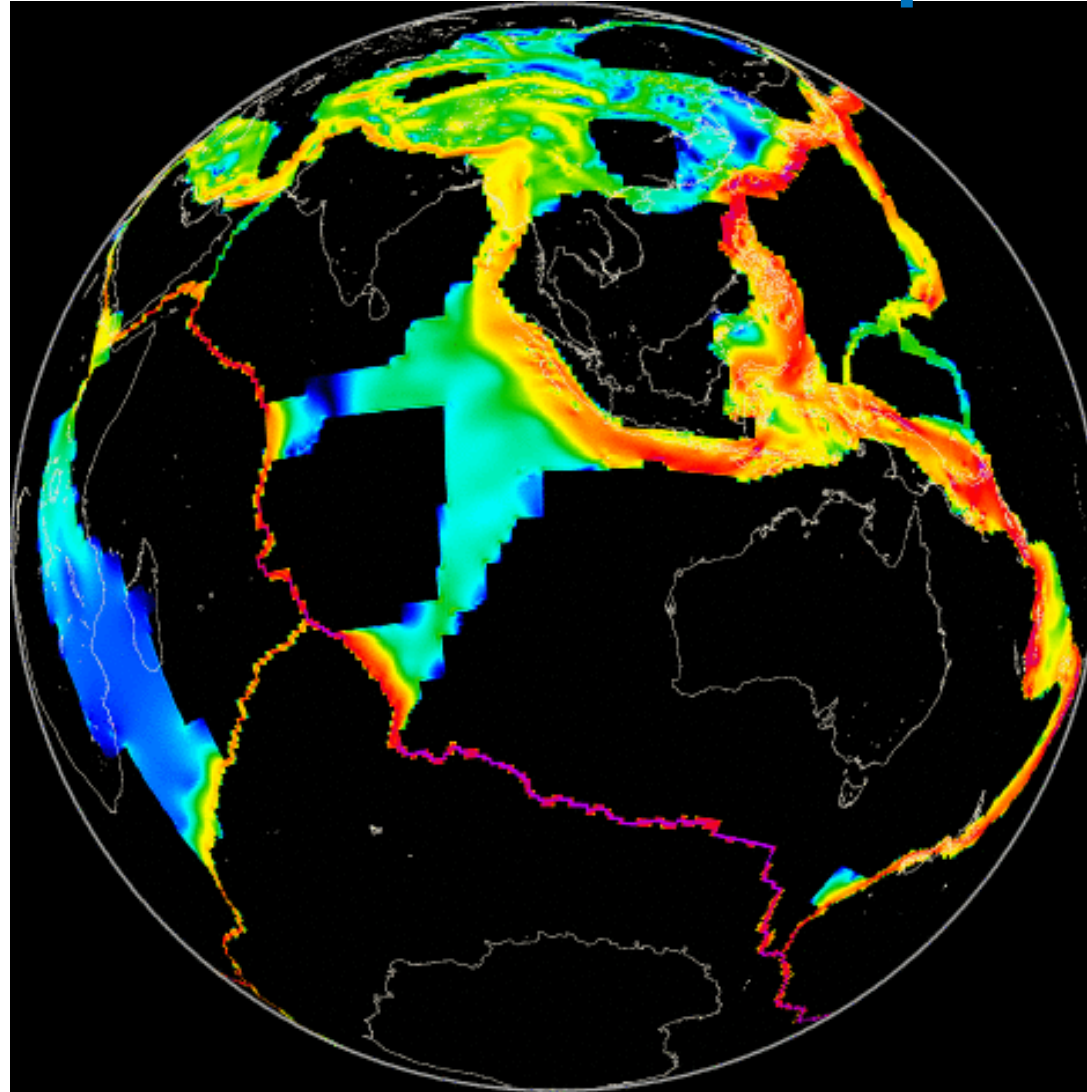
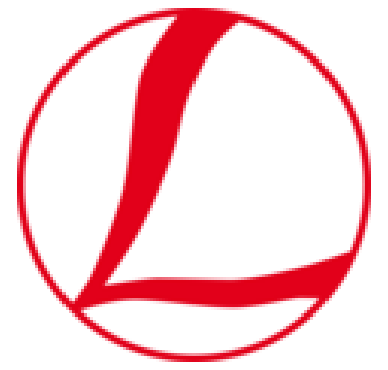
Phase IV (2017 - 2025)
Compilation of stress magnitude data
3D stress tensor prediction

Phase III (2009 - today)
Research project of the GFZ German
Research Centre for Geosciences

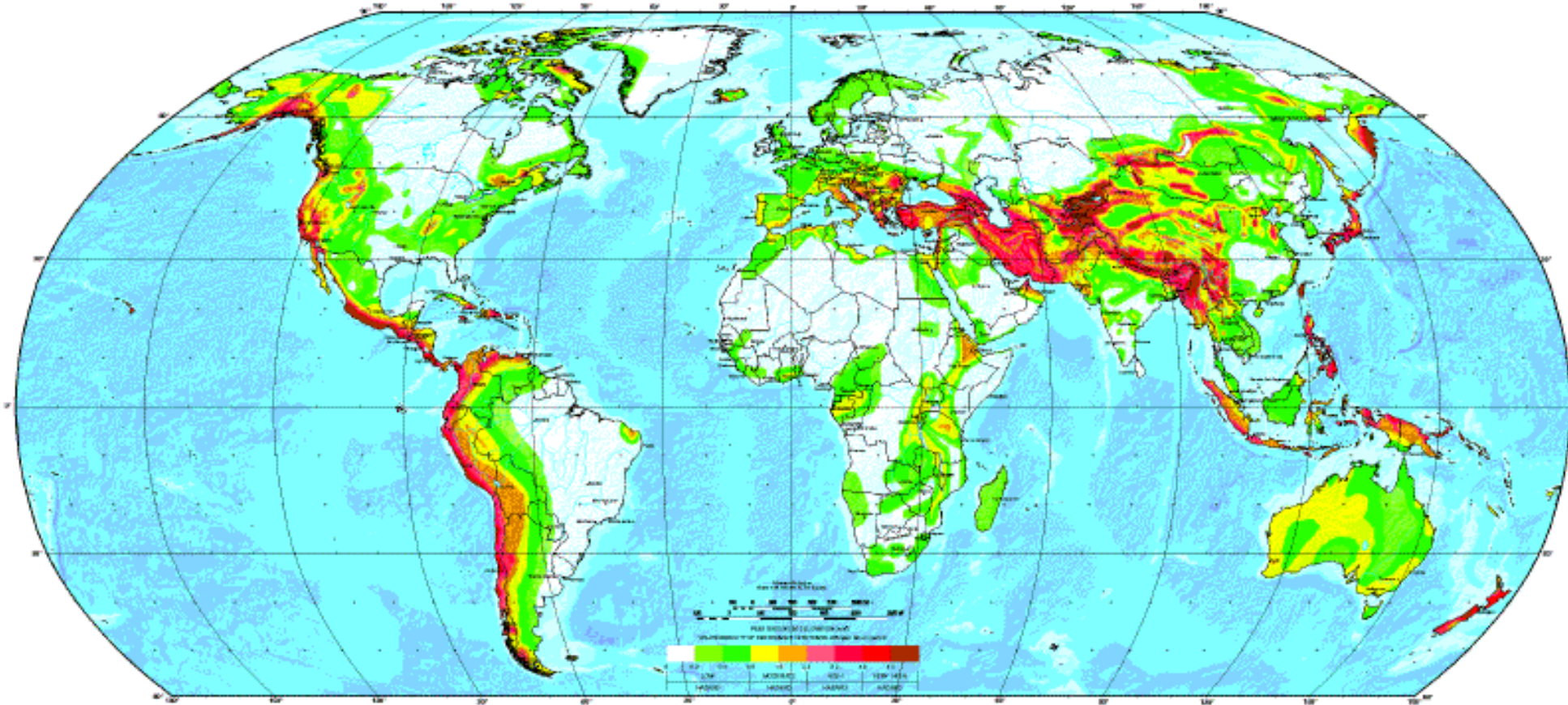
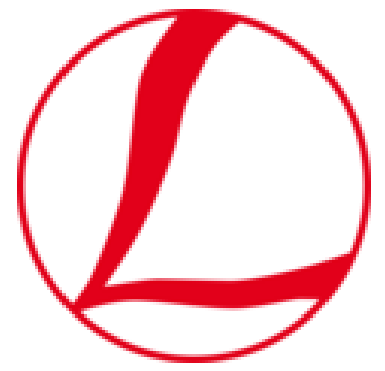
Heidbach et al. (2018)



ILP World Strain Map



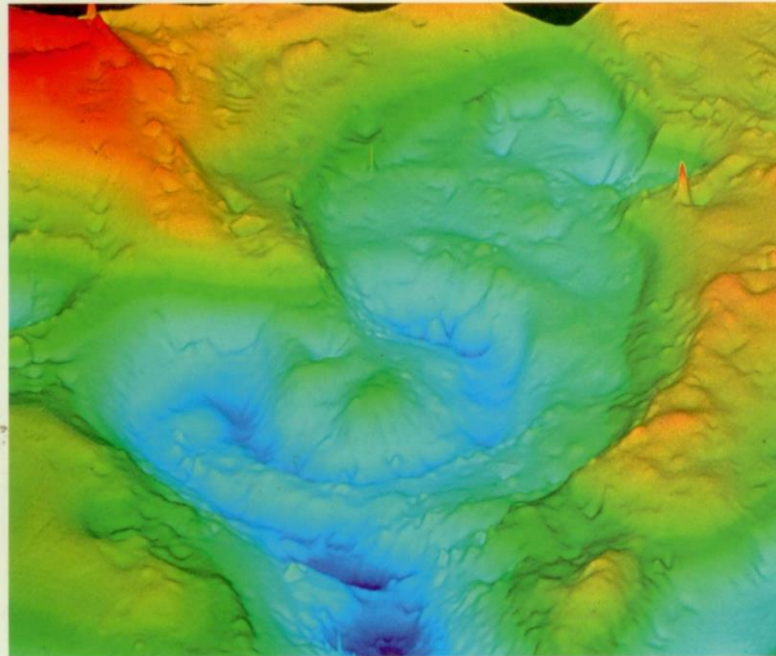
GLOBAL SEISMIC HAZARD MAP



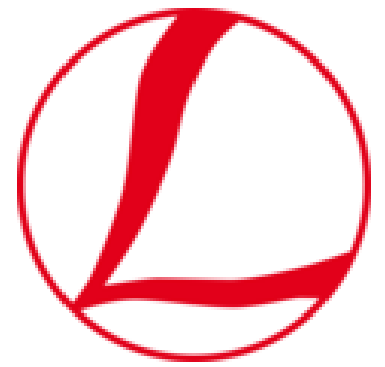
ICDP International Continental Drilling Programme

- Initiated
by ILP

Scientific Rationale for Establishment of an
International Program of Continental Scientific Drilling



International Lithosphere Program
Coordinating Committee Continental Drilling (CC4)
Mark D. Zoback & Rolf Emmermann

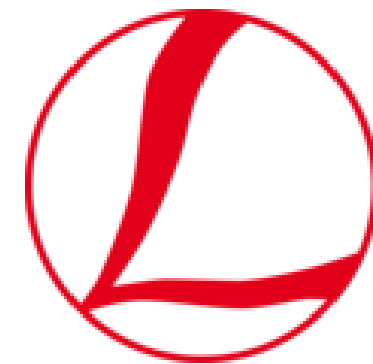


International Lithosphere Program

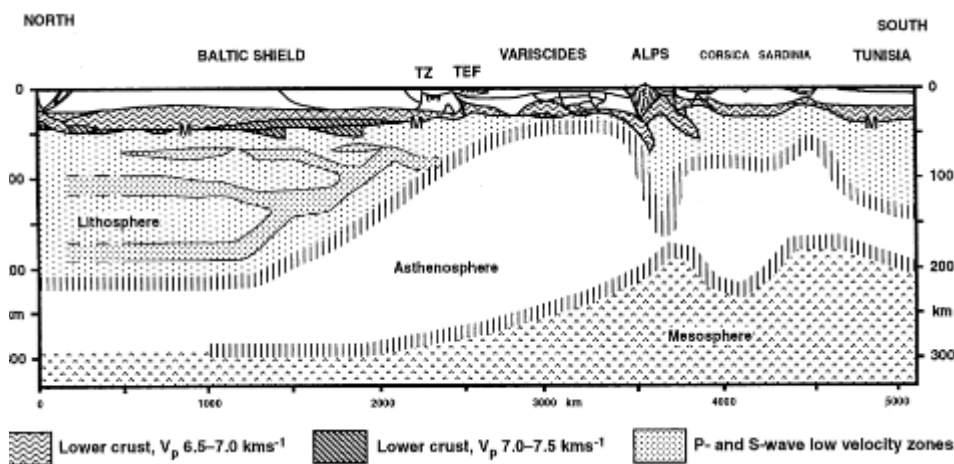
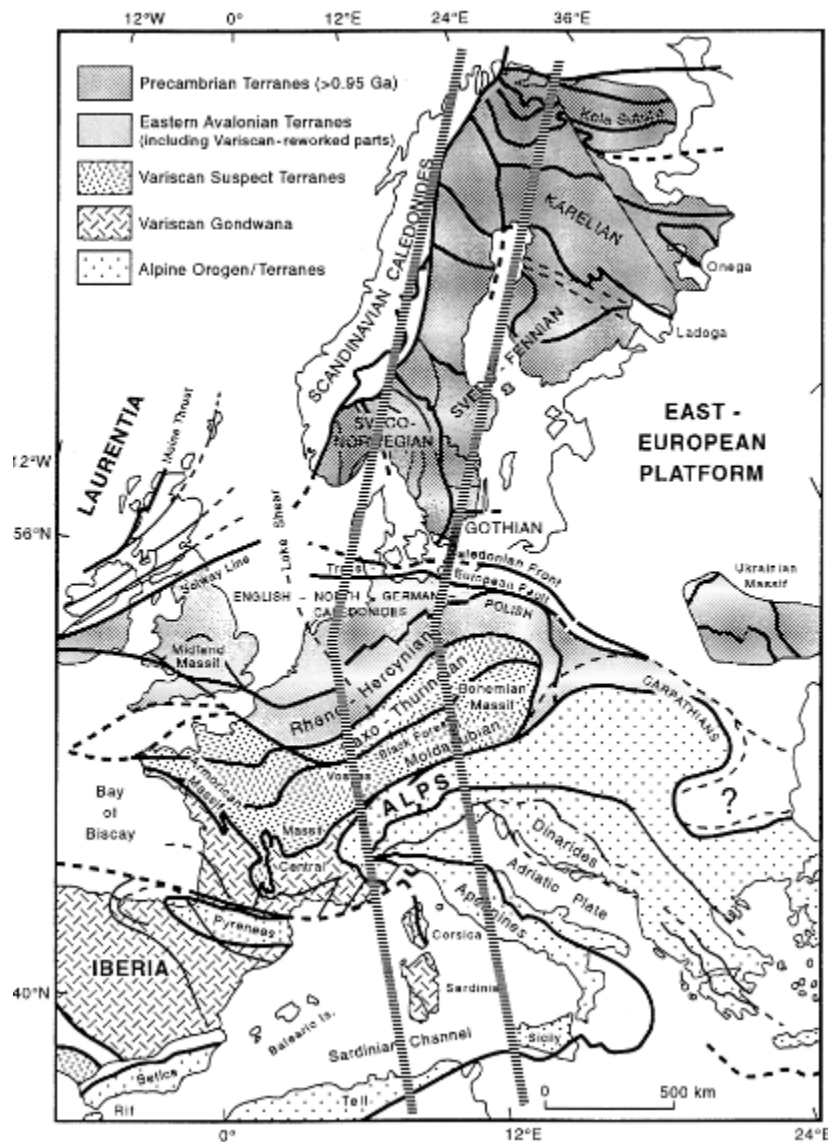


International Union of Geodesy and Geophysics
Union Géodésique et Géophysique Internationale

 IUGS
International Union of Geodesy and Geophysics

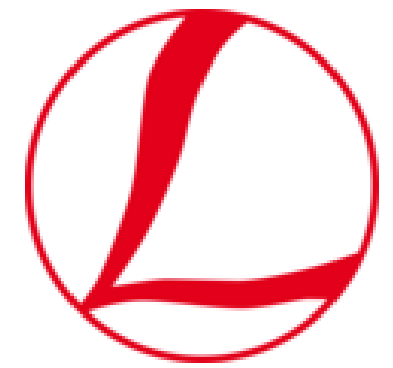


ILP Regional interdisciplinary transects: European GeoTraverse 1982-1992

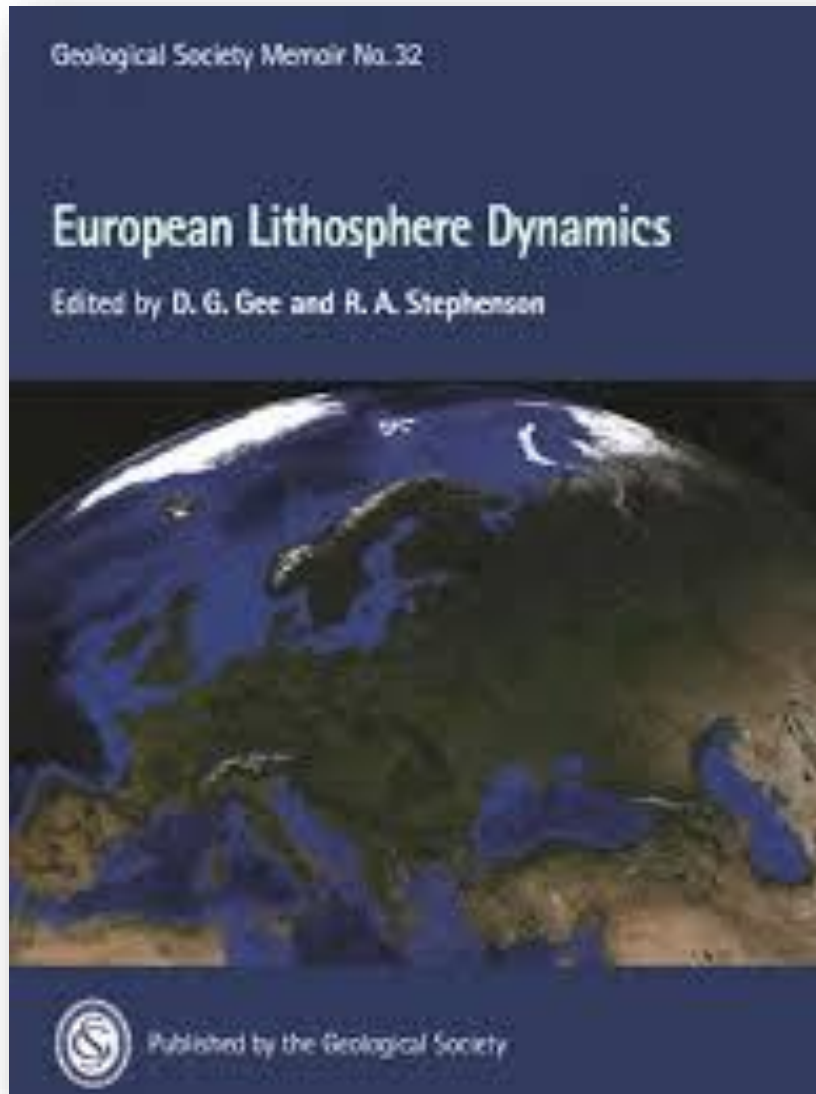


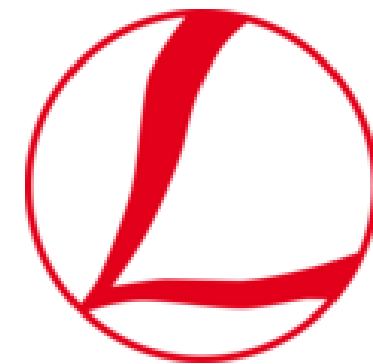
Blundell et al. (eds), 1992





ILP Regional interdisciplinary programme: **EUROPROBE** **1992-2002**

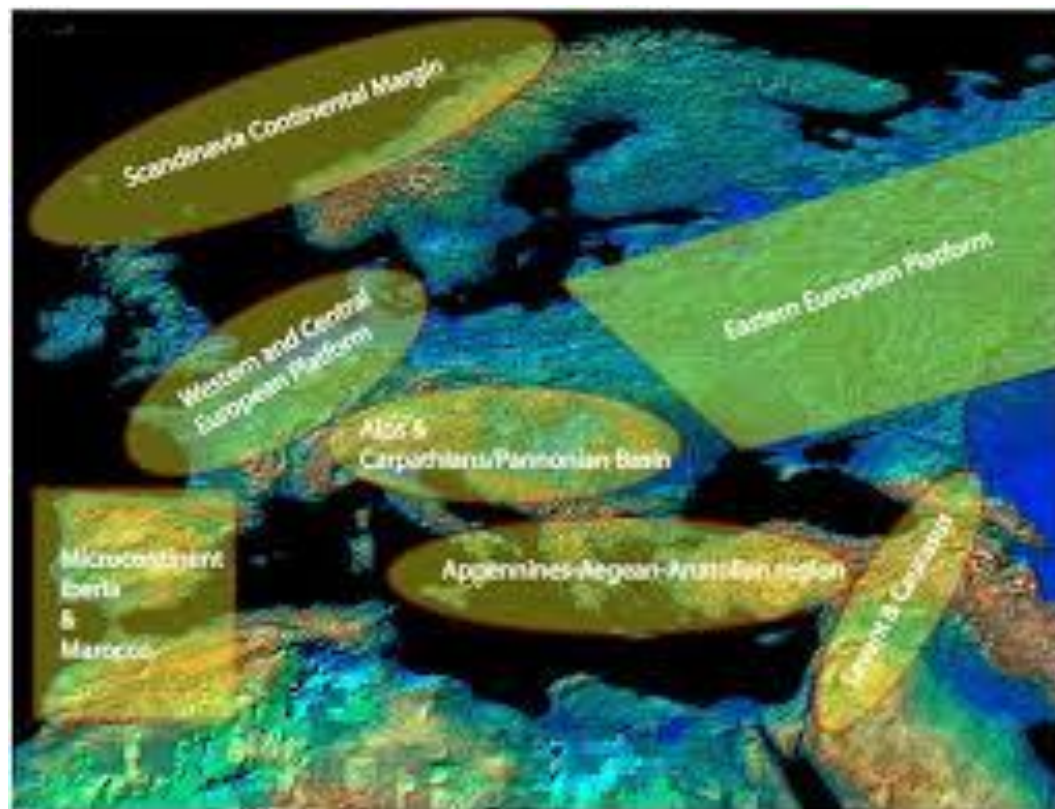




TOPO-EUROPE:

The geoscience of coupled deep Earth-surface processes

2006-2014



CHALLENGES TO ILP

Advancing fundamental lithosphere research will lead to the formulation of novel concepts concerning a process-oriented understanding of the Earth.

Challenges are:

- Strengthen the connection between solid-earth and non-solid-earth aspects
- Strengthen societal relevance, i.e. energy, resources and environment;
- Be attractive to young researchers
- Promote training of young researchers on lithosphere studies;
- Initiate dedicated programs on world-class problems





ILP is a bottom-up organisation!

40 years old, but as active as ever!

- Provides support to research initiatives
 - from organisations and
 - groups of scientists
- Priorities are based on
 - scientific quality and
 - societal needs
- 70 programs since 1980
- Each involving 50 to >1000 scientists

Join ILP!



International Lithosphere Program



International Union of Geodesy and Geophysics
Union Géodésique et Géophysique Internationale

 **IUGS**
International Union of Geodesy and Geophysics