THE Crafoord PRIZE

Crafoord *Days* 2014

5–7 MAY IN STOCKHOLM AND LUND, SWEDEN

The Crafoord Prize in Geoscienses 2014

Abstracts

Programmes

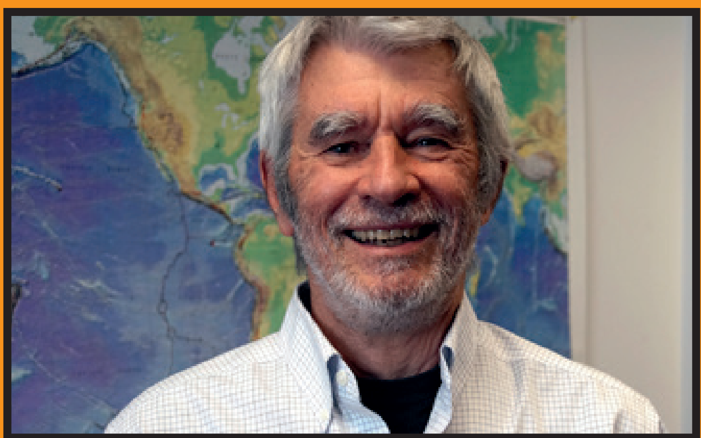


PHOTO: UNIVERSITY OF COLORADO BOULDER

PETER MOLNAR
CRAFOORD LAUREATE
IN GEOSCIENCES 2014

Anna-Greta and Holger Crafoord Fund

THE FUND WAS ESTABLISHED in 1980 by a donation to the Royal Swedish Academy of Sciences from Anna-Greta and Holger Crafoord. The Crafoord Prize was awarded for the first time in 1982. The purpose of the fund is to promote basic scientific research worldwide in the following disciplines:

- Mathematics
- Astronomy
- Geosciences
- Biosciences (with particular emphasis on Ecology)
- Polyarthritis (e.g. rheumatoid arthritis)

Support to research takes the form of an international prize awarded annually to outstanding scientists and of research grants to individuals or institutions in Sweden. Both awards and grants are made according to the following order:

year 1: Mathematics and Astronomy
year 2: Geosciences
year 3: Biosciences (with particular emphasis on Ecology)
year 4: Mathematics and Astronomy
etc.

The Prize in Polyarthritis is awarded only when the Academy's Class for medical sciences has shown that scientific progress in this field has been such that an award is justified.

Part of the fund is reserved for appropriate research projects at the Academy's institutes. The Crafoord Prize presently amounts to SEK 4 million.

The Crafoord Prize is awarded by the Royal Swedish Academy of Sciences.

Content

The Crafoord Laureate in Geosciences 2014

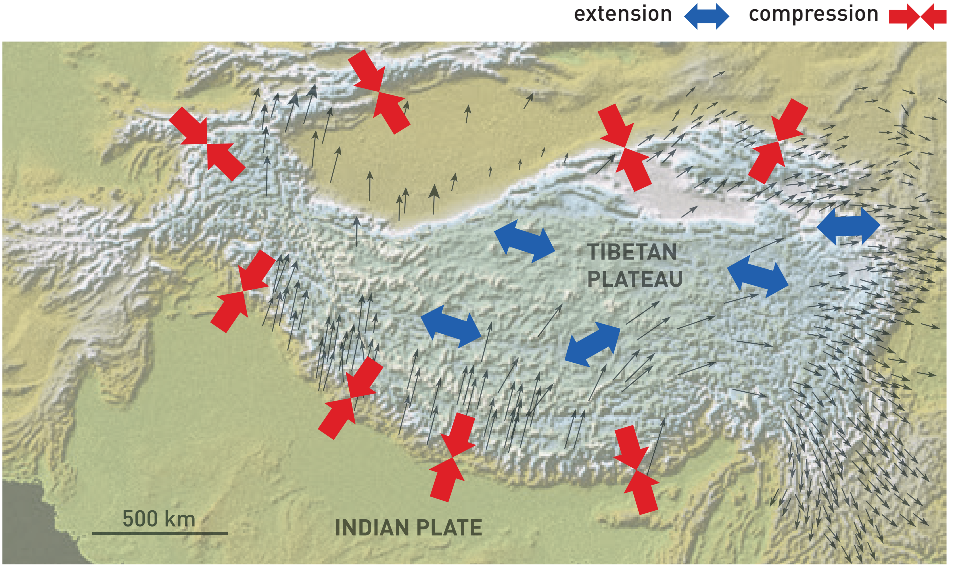
PHOTO: UNIVERSITY OF COLORADO BOULDER

PETER MOLNAR,
UNIVERSITY OF COLORADO BOULDER, CO, USA

Peter Molnar, US citizen. Ph.D. 1970 from Columbia University, NY, USA. Professor in Geological Sciences at University of Colorado Boulder, CO, USA. Prize citation: *"for his ground-breaking contribution to the understanding of global tectonics, in particular the deformation of continents and the structure and evolution of mountain ranges, as well as the impact of tectonic processes on ocean-atmosphere circulation and climate"*.

When continents collide

Why do continents move? How are mountain ranges like the Himalayas and vast elevated regions like the Tibetan Plateau formed? During the 20th century, many pieces were laid, one after the other, in the theoretical puzzle elucidating the dynamics of the Earth's crust and mantle. By observing and modelling, geoscientists were able to demonstrate not only that the compositions of oceanic and continental crust were fundamentally different, but also why these uppermost layers of the Earth, the key components of the so-called lithospheric plates, moved and were deformed.



Kinematics of the Himalaya and Tibetan plateau. Thick arrows show horizontal strain determined from investigations of earthquakes in the region; these are mainly compressional around the edges of the plateau but extensional in the middle due to recent uplift. Thin arrows show actual velocity of crustal movement based on GPS measurements (arrow length is proportional to velocity). Illustration: Johan Jarnestad/ ©The Royal Swedish Academy of Sciences

With a background in Geophysics, this year's Crafoord Laureate, **Peter Molnar**, has contributed ground-breaking knowledge about the driving forces behind plate motions and the place of continents in the plate tectonic model of Earth's evolution. Innovatively combining geological and geophysical methods of inquiry with satellite measurements and modelling, the Laureate has also paved the way to a new understanding of the formation of mountain ranges and their role in global tectonics.

Early in his career, during the latter half of the 1960s, Peter Molnar pioneered the use of seismology to investigate the relationship between deep earthquakes and plate motion, demonstrating that the sinking of oceanic crust into the mantle in subduction zones provides the main driving force (slab-pull) for moving the plates. Thereafter, Molnar focused his research on the collision of continents, where deformation is not concentrated at plate boundaries, but spread over vast areas. When Molnar and others began to analyse the crust of the Earth, recognizing its rigidity in upper parts and ductility at lower levels, and using a continuum mechanics model, crucial discoveries were made.

The Laureate focused his investigations on southern Asia and the collision between India and Eurasia, a process that began fifty million years ago and continues today, involving frequent major earthquakes in the Himalayas and Tibet. Combining interpretations of satellite images with other geological and geophysical methods of inquiry, including reconstruction of the plate convergence prior to collision, Molnar and his colleagues were better able to explain the pattern of deformation in this continent-continent collision zone.

Their work also demonstrated the fundamental differences between this and other mountain belts like the Andes, where collision occurs between oceanic and continental crust and deformation is concentrated along the plate boundary and above the subduction zone.

By contrast, when continents collide, one is usually thrust beneath the other and deformation may extend more than a thousand kilometres from the collision zone, crustal thickness more than doubles, and the ductility of the lower crust promotes mobility both across and along the mountain belt. Thus, the Laureate and his colleagues were able to offer new explanations for the formation of the Himalayas, the elevation of the Tibetan Plateau and the presence of major faults oriented approximately perpendicular to the dominant stress field, facilitating lateral escape of material from the collision zone.

The Crafoord Laureate, still an active researcher, has taken an interdisciplinary approach not only to the study of processes in the Earth's crust and mantle, but also to their influence on climate. His contributions to our knowledge of the formation of mountain ranges and high plateaux, taken together with evidence for the opening and closing of seaways between continents has added to our understanding of ocean current circulation and its influence on regional and global climate. Peter Molnar's research has also yielded additional knowledge about earthquake risks, a subject that is highly relevant in the densely populated areas of the southern Himalayas and also in eastern Tibet.

ABSTRACTS

Crafoord *Days* 2014

Mantle dynamics and the rise and fall of mountain belts

PETER MOLNAR, DEPARTMENT OF GEOLOGICAL SCIENCES AND COOPERATIVE INSTITUTE FOR RESEARCH IN ENVIRONMENTAL SCIENCES, UNIVERSITY OF COLORADO BOULDER, CO, USA

Most agree that the engine that builds mountain ranges and high plateaus lies in the mantle, but we disagree about how mantle dynamics creates high terrain. Two basic processes, operating in a state of isostatic balance, create most high terrain: crustal thickening resulting from convergence between two expanses of crust, or lithospheric plates, and the replacement of cold mantle lithosphere by hotter, less dense asthenosphere. Most high ranges and plateaus result from the isostatic compensation of horizontally shortened and thickened crust, whose details offer targets worthy of study (but not discussed here). More controversial and less understood is removal of mantle lithosphere.

Convection moves mass anomalies and applies tractions to boundaries. Simple numerical experiments suggest that for surface topography, the movement of mass anomalies is crucial, but flow-induced normal tractions applied to the base of the crust support negligible high topography. Abundant evidence shows that the Tibetan Plateau grew by crustal shortening and thickening; at 15-10 Ma, however, normal faulting and crustal thinning began, and loci of active thickening grew outward. Both are predictable consequences of removal of mantle lithosphere. Not clear is how such removal occurs (if it does): Do, for example, small blobs drip from the base of Tibet's mantle lithosphere, or could a sheet of mantle lithosphere sink beneath southern Tibet?

The Tien Shan may illustrate ongoing removal of mantle lithosphere. Zones of high P-wave speeds beneath its flanks suggest that sheets of cold, dense mantle lithosphere descend there, while mantle lithosphere beneath high terrain thins.

Seismic tomography and paleo-altimetry seem to offer the best constraints on the underlying processes, but the best test of how mantle dynamics builds high terrain may come from quantities (geochemical, petrological, or even paleontological) not yet made, or imagined to be relevant.

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Plate tectonic constraints on mountain belt formation

JOANN M. STOCK, SEISMOLOGICAL LABORATORY, CALIFORNIA INSTITUTE OF TECHNOLOGY, CA, USA

The link between mountain belts and plate convergence (Dewey and Bird, 1970) indicates that plate tectonic history is a key constraint on orogenic deformation. Because continental geological deformation leaves a complex geological record over a wide area, the convergence history of two plates can be better determined using marine data (magnetic anomaly and fracture zone picks) whose best-fit rotations describe past relative plate positions. Combined into "plate circuits", these give rates and directions of motion including differences along strike in mountain belts, and can reveal sudden speedup or slowdown events whose dynamic cause may then be sought in changes in buoyancy or rheology of the material involved in the collisions.

Peter Molnar's early work included determining plate motion histories, and linking them to important events and structures in mountain belts. He improved the methods of determining best-fit rotations with uncertainties, and combined rotations to constrain plate boundaries that lacked tight kinematic constraints. Along boundaries of all types – extensional, strike-slip, compressional (e.g., East African Rift, Western North America, New Zealand, Andes, Alpine-Himalayan orogen) – he sought dynamic explanations consistent with the kinematic evolution of mountain belts and high topography.

Technological advances continually improve the dataset used for plate motions (e.g., Seton et al., 2014) and reduce the uncertainties, yielding better information on kinematic variations within orogens. During the closure of the Tethys Ocean, convergence of India with Eurasia since 70 Ma decreased westward, with Arabia-Eurasia convergence even slower, leading to differences in geological development along strike of the orogen (Hatzfeld and Molnar, 2010). A drop in convergence rate, attributed to the onset of continental collision, is older for the India sector and younger for the Arabia sector. Increasingly fine details of the plate circuits should be resolved as the problematic areas of the seafloor receive more marine geophysical study.

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Geological constraints on the tectonic evolution of the Himalaya, Karakoram and Tibet

MIKE SEARLE, DEPARTMENT OF EARTH SCIENCES, UNIVERSITY OF OXFORD, UK

The closing of NeoTethys as recorded by the youngest marine sediments in the Indus suture zone along the Himalaya occurred at 50.5 Ma. Several hundred kilometres of shortening in the Indian plate upper crust is recorded by folds/thrusts in the north Himalayan Tethyan zone. The Greater Himalaya Sequence (GHS) records (1) deep subduction of the leading edge of India to Ultrahigh Pressure eclogite facies (750°C; ~28kbar; >100 km depth; 51-47 Ma), (2) regional Barrovian kyanite grade metamorphism (700°C; 10-12 kbar; 39-30 Ma), and (3) regional sillimanite ± cordierite grade metamorphism (650-750°C; ~5-6 kbar; 28-13 Ma). Crustal melting resulted in garnet two-mica tourmaline leucogranites emplaced in mid-crustal levels. The entire 20 km thick mid-crustal GHS was extruded to the south between the ductile shear zones of the Main Central Thrust below and the low-angle normal fault the South Tibetan Detachment above (Channel Flow) by a combination of pure shear and simple shear during the Early and Middle Miocene.

Along the Asian margin in South Tibet uncommon outcrops of mid-lower crust rocks suggest that most metamorphism and deformation was Triassic-Jurassic in age. Mantle-derived shoshonitic volcanics and lower crust derived adakites contain xenoliths that sample the lower crust. These Miocene xenoliths comprise felsic and mafic granulites (900-1300°C; 14-17 kbar; 15-17 Ma) that suggest that the crust of Tibet was thick and hot during that time. The Karakoram (=Qiangtang) terrane shows long-lived periods of high-grade metamorphism, and crustal melting throughout the last 65 my, culminating with intrusion of the Baltoro batholith at 26-13 Ma. The crust of Tibet has been thick and high throughout the Cenozoic. Strike-slip faults show limited geological offsets and continental extrusion is limited to <~100 km.

Creating high mountains of the Longmen Shan through partitioned pure shear thickening: the 2008 Wenchuan earthquake

PEIZHEN ZHANG, INSTITUTE OF GEOLOGY, CHINA EARTHQUAKE ADMINISTRATION, BEIJING, CHINA

Most major mountain ranges result from horizontal contraction due to rapid convergence of the continental crust. The Longmen Shan (the Dragon's Gate Mountains in Chinese) along eastern margin of the Tibetan Plateau stands out as unusual with a very steep mountain front that undergoes insignificant horizontal shortening and hence without adjacent flexure subsidence. Interseismic and coseismic deformations associated with the 2008 Wenchuan earthquake provide a rare opportunity to probe geological processes of this enigmatic mountain building. The primary features associated with the 2008 Wenchuan earthquake rupture have been narrowly distributed coseismic deformation and predominantly vertical displacements, that could be interpreted as the result of slips on the high-angle listric reverse faults. Deep seismic reflection profiling across the seismogenic faults indeed reveals high-angle listric geometry in the brittle upper crust and downward ductile shearing in the viscous lower crust. Visco-elastic finite element modeling of coseismic strain and slip distributions shows that calculated dip angles of coseismic slip vectors increase from less than 20° to more than 80° near the fault, suggesting a significant upward rotation from prominent horizontal slip to dominantly vertical displacements near the fault. Similarly, the orientations of maximum extensional strain axes change from nearly horizontal near western edge of the model to almost perpendicular to the high-angle listric seismogenic fault, while the maximum contractive strain axes rotate from sub-vertical to sub-parallel to the fault. The magnitudes of both extensional and contractive strains reach maxima near the steep segment of the listric reverse fault with the former larger than the later, indicating that the coseismic deformation does not apply significant loading to flex the Sichuan basin. We suggest that the combination of decoupled listric reverse faulting in the brittle upper crust and ductile shearing in the ductile lower crust, in a fashion of pure shear, internally accommodates eastward growth of the eastern Tibet to thicken the lithosphere of the Longmen Shan without exerting horizontal loading to deform the adjacent Sichuan basin. The results provide better understanding of more diverse processes in creating mountain belts worldwide.

Arc-continent collision, continent-continent collision, and continental subduction in the Himalaya (or what, where, when, and maybe why)

LEIGH ROYDEN AND **OLIVER JAGOUTZ**, DEPARTMENT OF EARTH, ATMOSPHERIC AND PLANETARY SCIENCES, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, MA, USA

In addition to the north-dipping Andean subduction boundary along the southern margin of Eurasia, a north-dipping intra-oceanic subduction boundary was present between India and Eurasia during Cretaceous and Early Cenozoic time. This was a remnant of an intra-oceanic subduction boundary that once extended from the eastern Mediterranean to Indonesia. In Oman and to the west, this intra-oceanic subduction boundary collided southward with Africa-Arabia at ~80-95 Ma. East of the Himalaya, it collided northward with continental blocks of Burma and Indonesia at ~80 Ma. Thus, after ~80 Ma, the domain between India and Eurasia was occupied by a small oceanic plate, the Kshiroda plate, bounded to the east and west by transform boundaries approximately coincident with the Himalayan syntaxes. Paleomagnetic data from the magmatic arcs north and south of the Kshroda plate indicate that it was ~1500-3000 km wide in Cretaceous time. Recent isotopic and geochronological data show that the oceanic Kshroda plate existed until ~40 Ma and, equating the convergence rate from 50-40 Ma with the subduction rate of the Kshiroda plate, suggest that the Kshiroda plate was still ~800 km wide at 50 Ma.

The anomalously rapid convergence of India and Eurasia, which reached rates of 130-180 mm/a at 70-50 Ma, can be explained by slab pull along two coupled subduction zones. Results from a quantitative model of double subduction yield rates of convergence up to ~140 mm/a that begin when the Kshiroda plate is isolated from regions to the east and west by transform faults and ends when Indian continental lithosphere enters the intra-oceanic subduction zone at 50 Ma – not when India collides with Eurasia at 40 Ma.

Post-collisional convergence of India and Eurasia is marked by atypical subduction as indicated by a "cloud" of fast P-wavespeeds that extends north-south for ~800-1000 km beneath the western and central Himalaya, but much less beneath the eastern Himalaya. Fast P-wavespeeds do not descend below ~400 km depth, suggesting that the subducted material has neutral density and requiring that ~20 km of crust be stripped from the Indian continent during subduction. The apparent volume of subducted lithosphere is consistent with the volume of Indian continental lithosphere computed to have "disappeared" during post-collisional convergence except beneath the eastern Himalaya, where it is much less. We suggest that post-collisional convergence was largely accommodated by different mechanisms along the Himalayan-Tibetan zone, with subduction of greater India beneath the central and western Himalaya and eastward extrusion Tibetan lithosphere occurring behind the eastern Himalaya. The latter was accommodated along shear zones that exhibit high-grade metamorphism beginning at ~30-35 Ma, consistent with a collisional age of ~40 Ma in the eastern Himalaya.

Survival of an island arc in continental collision: Kohistan

JEAN-PIERRE BURG, DEPARTMENT OF EARTH SCIENCES, EIDGENÖSSISCHE TECHNISCHE HOCHSCHULE ZÜRICH, SWITZERLAND

Magmatic arcs are intrinsic elements of convergence systems that ultimately lead to continental collision. However, there is only few known complete island arc sections; Kohistan (Pakistan, western Himalayas) is reportedly the best exposed. Systematic investigation using thermo-mechanical laboratory experiments allowed exploration of the behaviour of the volcanic arc during intra-oceanic arc-continent collision following oceanic subduction (Boutelier et al., 2003). The crustal thickness of the arc controls whether complete arc subduction, complete arc accretion or partial arc subduction/accretion dominate the gross tectonic evolution.

Geological Kohistan is an obducted island arc developed during the Mesozoic above a north-dipping subduction zone in the Tethys Ocean. Intrusion ages span a long growth history from ca 150 Ma to ca 30 Ma, with little evidence for magmatic lulls between pulsed events. Cretaceous convergence was absorbed in two parallel and simultaneous subduction zones, on both sides of Kohistan. Arc rifting at ~85 Ma marked a change in convergence processes, likely due to slab rollback on the southern side of Kohistan (Burg, 2011). Geological information points to closure of forearc, intra-arc and back-arc basins during Eocene–Oligocene times as part of the collisional locking of both sutures and full collision between India and Asia. Analogue and numerical modelling explores the roles of island arcs and interplay of suture zones in the dynamics of collision systems. Results are tentatively applied to mountain belts with nearly no trace of arc activity (Oman, Alps), with accreted arc (Kohistan, Zagros) and with small remnants of subducted arc (southern Tibet).

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The deep structure of continents

DAN MCKENZIE, DEPARTMENT OF EARTH SCIENCES, UNIVERSITY OF CAMBRIDGE, UK

Almost 30 years ago I was a co-author of a paper with Peter Molnar (Houseman, McKenzie, and Molnar 1981) that suggested the mantle lithosphere beneath Tibet had been removed by a convective instability caused by shortening. Surface wave tomography carried out by a number of groups has now clearly shown that material with high S wave velocity is still present everywhere beneath the plateau (see Priestley and McKenzie 2013). I believe that this material is cold, and therefore that the original proposal does not apply to Tibet. Cold lithosphere has not been removed by delamination, and, at least in the northern part, the mantle beneath the Moho is hotter than that at greater depths. Furthermore the thickness of the lithosphere, of ~ 250 km, is greater than that beneath any other continental region. This unexpected behaviour can be understood if the density of the lithosphere is a function of both its temperature and its composition. Mantle nodules brought up by melts and the composition of the melts themselves show that much of the continental lithosphere has been depleted by melt removal, leaving a harzburgite whose density is substantially less than that of the fertile mantle. The application of surface wave tomography to the Himalaya-Tibet Orogen thus provides a good example of how interpretations change, as our technologies improve.

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Geochronology and the pace of Himalayan tectonics

RANDALL R. PARRISH, NERC ISOTOPE GEOSCIENCES LABORATORY, KINGSLEY DUNHAM CENTRE, KEYWORTH, UK

Geochronology is about the measurement of time in Earth Science; without it, little would be understood about Earth's geological processes or their rates; we wouldn't know the age of the Solar System, recognise where the oldest rocks on Earth are, or have any ability to establish rates of environmental change using past sediment records in oceans, lakes, or rocks. Following some key scientific breakthroughs ~ 100 years ago, scientists have developed many clever ways of measuring geological time using radioactive decay of isotopes, and applied these to a diverse range of problems and materials, in order to reconstruct the Earth's evolution, its thermal state, the pace that rocks heat up and cool down, how quickly mountains rise and to quantify the rate of oceanic crust formation.

The Himalaya is one of the most spectacular mountain ranges, being high and young and a consequence of continental collision of India and Asia, something we can all appreciate. It is a place where many methods of geochronology have been applied to address many fascinating problems. The Crafoord Laureate Peter Molnar appreciated the value of time from his earliest work and worked with many colleagues throughout his career to obtain temporal information relevant to continental tectonics.

This talk will look at some of the most fascinating discoveries to do with geochronology and its methods and applications to geology, and will then summarise some applications of these methods to the Himalayan orogen to illustrate the pace of its development and then reconstruct some of the events that are so fascinating. For example – the synchroneity of thrust and normal faulting and testing ideas like crustal and channel flow; dating the rate of transport and erosion/exhumation of the crystalline core of the Himalaya; identifying whether the Tsangpo River was captured by the Brahmaputra; dating when super-fast exhumation from great depth took place in coesite-bearing high pressure rocks soon after collision of India and Asia; determining the rate of erosion and uplift in Himalayan syntaxes where uplift rates are amongst the highest on Earth – these are some of the questions that can be answered with geochronology and which often capture our geological imagination.

Overview programme Crafoord *Days* 2014

Monday 5 May

PRIZE SYMPOSIUM IN GEOSCIENCES 08.45–18.00

Mountain belt dynamics

Lectures by the Crafoord Laureate **PETER MOLNAR** and invited speakers.

THE BEIJER HALL
THE ROYAL SWEDISH ACADEMY OF SCIENCES
LILLA FRESCATIVÄGEN 4A, STOCKHOLM

Registration at www.crafoordprize.se or http://kva.se

Tuesday 6 May

PRIZE AWARD CEREMONY 16.20–17.15

In the presence of H.M. King Carl XVI Gustaf and H.M. Queen Silvia of Sweden.

THE BEIJER HALL
THE ROYAL SWEDISH ACADEMY OF SCIENCES
LILLA FRESCATIVÄGEN 4A, STOCKHOLM

Registration at www.crafoordprize.se or http://kva.se

Wednesday 7 May

THE CRAFOORD PRIZE LECTURE 15.30–17.15

Held by the Crafoord Laureate **PETER MOLNAR**.

PANGEA, GEOCENTRUM II
THE GEOBIOSPHERE SCIENCE CENTRE
LUND UNIVERSITY, SÖLVEGATAN 12, LUND

No registration.

Detailed programme

THE CRAFOORD PRIZE IN GEOSCIENCES 2014

PRIZE SYMPOSIUM IN GEOSCIENCES

Mountain belt dynamics

08.45–18.00

THE BEIJER HALL,
THE ROYAL SWEDISH ACADEMY OF SCIENCES,
LILLA FRESCATIVÄGEN 4A, STOCKHOLM

Open to the public and free of charge. Seating is limited. Registration is required and must be made before 1 May 2014 at http://kva.se/CrafoordSymposium2014

Monday 5 May

08.45	Registration & coffee	
09.15	Opening address	*Staffan Normark*, Permanent Secretary of the Royal Swedish Academy of Sciences
09.30	*Mantle dynamics and the rise and fall of mountain belts*	**CRAFOORD LAUREATE 2014** **PETER MOLNAR**, Department of Geological Sciences and Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, CO, USA
10.20	*Plate tectonic constraints on mountain belt formation*	*Joann M. Stock*, Seismological Laboratory, California Institute of Technology, CA, USA
11.10	*Geological constraints on the tectonic evolution of the Himalaya, Karakoram and Tibet*	*Mike Searle*, Department of Earth Sciences, University of Oxford, UK
12.00	Lunch	(Included for registered participants)
13.20	*Creating high mountains of the Longmen Shan through partitioned pure shear thickening: the 2008 Wenchuan earthquake*	*Peizhen Zhang*, Institute of Geology, China Earthquake Administration, Beijing, China
14.10	*Arc-continent collision, continent-continent collision and continental subduction in the Himalaya (or what, where, when and maybe why)*	*Leigh Royden* and *Oliver Jagoutz*, Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology, MA, USA
15.00	*Survival of an island arc in continental collision: Kohistan*	*Jean-Pierre Burg*, Department of Earth Sciences, Eidgenössische Technische Hochschule Zürich, Switzerland
15.50	Break with refreshments	
16.20	*The deep structure of continents*	*Dan McKenzie*, Department of Earth Sciences, University of Cambridge, UK
17.10	*Geochronology and the pace of Himalayan tectonics*	*Randall R. Parrish*, NERC Isotope Geosciences Laboratory, Kingsley Dunham Centre, Keyworth, UK
18.00	End of the symposium	

Detailed programme

THE CRAFOORD PRIZE IN GEOSCIENCES 2014

PRIZE LECTURE IN GEOSCIENCES

From the building of high mountains and plateaus to the initiation of ice ages, via tropical islands

15.30–17.15

PANGEA, GEOCENTRUM II
THE GEOBIOSPHERE SCIENCE CENTRE
LUND UNIVERSITY, SÖLVEGATAN 12, LUND

Open to the public and free of charge. No registration. Seating is limited. For more information please visit http://kva.se/CrafoordLecture2014

Wednesday 7 May

Moderator: *Daniel Conley*, Lund University, Sweden

15.30	Welcome and practical information	*Daniel Conley*, Lund University, Sweden
15.35	Introduction of the Crafoord Laureate in Geosciences 2014	*Georgia Destouni*, Chair of the Crafoord Prize Committee in Geosciences
15.50	**CRAFOORD PRIZE LECTURE** *From the building of high mountains and plateaus to the initiation of ice ages, via tropical islands*	**CRAFOORD LAUREATE 2014** **PETER MOLNAR**, Department of Geological Sciences and Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, CO, USA
16.20	Break with refreshments	
16.30	Panel discussion and questions	*Peter Molnar*, University of Colorado Boulder, CO, USA *Georgia Destouni*, Stockholm University, Sweden *David Gee*, Uppsala University, Sweden *Anders Schersten*, Lund University, Sweden *Hans Thybo*, University of Copenhagen, Denmark
17.15	End of day	

Anna-Greta and Holger Crafoord

Holger Crafoord (1908–1982) was prominent in Swedish industry and commerce. He began his career with AB Åkerlund & Rausing and devoted a larger part of his working life to this company. In 1964, Holger Crafoord founded Gambro AB in Lund, Sweden, where the technique of manufacturing the artificial kidney was developed. This remarkable dialyser soon became world famous. Since then, a series of medical instruments has been introduced on the world market by Gambro.

HOLGER AND ANNA-GRETA CRAFOORD

In 1980, Holger Crafoord founded the Crafoord Foundation, which annually contributes greatly to the Anna-Greta and Holger Crafoord Fund.

Holger Crafoord became an honorary doctor of economics in 1972 and in 1976 an honorary doctor of medicine at the University of Lund.

Anna-Greta Crafoord (1914–1994) took, as Holger Crafoord's wife, part in the development of Gambro AB. Through generous donations and a strong commitment in the society around her, she contributed to the scientific and cultural life. In 1986 she founded the Anna-Greta Crafoord foundation for rheumatological research and in 1987 Anna-Greta Crafoord became an honorary doctor of medicine at the University of Lund.

Over the years, the Crafoords have furthered both science and culture in many ways and it is noteworthy that research in the natural sciences has received an important measure of support from the Anna-Greta and Holger Crafoord Fund.

THE ROYAL SWEDISH ACADEMY OF SCIENCES is an independent, nongovernmental organization whose aim is to promote the sciences and strengthen their influence in society. Traditionally, the Academy takes a special responsibility for the natural sciences and mathematics, and strives to increase exchanges between various disciplines.

The activities of the Academy are aimed mainly at

- spreading knowledge of discoveries and problems in current research
- providing support for young researchers
- rewarding outstanding contributions in research
- stimulating interest in mathematics and the natural sciences in schools
- spreading scientific and popular-scientific information in various forms
- offering unique research environments
- maintaining contact with foreign academies, learned societies and other international scientific organisations
- representing the sciences in society
- carrying out independent analyses and evaluations based on scientific grounds on issues of importance for society

THE ACADEMY HAS has about 450 Swedish members and 175 foreign members. The Swedish members are active within Classes and committees. They initiate investigations, responses to government proposals, conferences and seminars. Once a month, the Academy holds a General Meeting, with a connected public lecture.

THE ACADEMY´S OWN INSTITUTES offer unique research environments for botany, ecological economics, the history of science and mathematics.

IN ADDITION TO THE CRAFOORD PRIZE, the Academy annually awards a number of prizes, the best known of which are the Nobel Prizes in Physics and Chemistry and the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel. Others are the Söderberg Prize and the Göran Gustafsson Prize. The latter are awarded to outstanding young researchers and are a combination of a personal prize and a research grant. The Academy also supports researchers through scholarships and mentoring programmes, and is engaged in appointing many promising young researchers to long-term positions that are financed by foundations.

THROUGH ITS VARIOUS COMMITTEES, the Academy also works for the development of a society based on scientific grounds. Great interest in environmental and educational issues has resulted in a wide variety of Academy activities in these areas.

THE CRAFOORD PRIZE IS AWARDED BY
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BOX 50005, SE-104 05 STOCKHOLM, SWEDEN
TEL: +46 8 673 95 00 | INFO@KVA.SE | HTTP://KVA.SE