New IGCP Projects accepted in 2007

Project No. 524 Arc-continent collision

Full title: Arc-continent collision: benefiting human society through an enhanced understanding of plate tectonic processes

Countries involved: Australia, Canada, China, Cuba, France, UK, USA, Russia, Spain

Proposers: Denis Brown (Spain), Chi-Yue Huang (China)

Duration: 2007–2009

Contact Address:

Denis Brown

Instituto de Ciencias de la Tierra “Juame Almera” CSIC

c/Lluís Sole i Sabari s/n

08028 Barcelona, Spain

Tel: +34 93 4095410

Fax: +34 93 4110012

E-mail: dbrown@ija.csic.es

One of the key areas of basic research among earth scientists are processes that occurred, and are occurring today, along the boundaries of the tectonic plates that make up Earth's lithosphere. Of particular importance are the processes of tectonic accretion (the addition of material) along constructive plate boundaries. These processes have occurred throughout geological time, and still occur today. One of the principal mechanisms of accretion, which leads to continental crustal growth, occurs when an intra-oceanic volcanic arc that formed above a subduction zone (where one plate slides beneath another) collides with the margin of a continent. The proposed project aims to enhance the basic understanding of this important plate tectonic process and by doing so provide an advanced model that can be used to societies benefit. Zones of arc-continent collision are producers of much of the world's primary economic wealth, especially in the form of minerals. The proposed project will provide key new data and insights that will help to advance the understanding of how, when, and where volcanic-hosted mineral deposits form and are preserved, thereby helping to develop models for mineral exploration. Zones of active arc-continent collision are among some of the most populated in the world, as well as among the most seismically active. They are, therefore, zones of high geological risk for people and infrastructure. The proposed project will provide an enhanced tectonic model for arc-continent collision zones that can be used to better understand the risks posed by seismic shaking or landslides. Understanding the geological processes that take place in the Earth's lithosphere is therefore not only of importance for our understanding of how collisional orogens evolve and how the con-

tinental crust grows, but it is also of significant importance in understanding how its mineral wealth is formed and preserved, and what the geological risks are for those who live along these active plate boundaries.

Project No. 526 Risks resources and record of the past on the continental shelf

Full title: Risks, Resources, and Record of the Past on the Continental Shelf: Mining Late Quaternary Geological Evidence

Countries involved: Argentina, Austria, Brazil, Canada, China, Italy, India, Morocco, Russia

Proposers: Francesco L. Chiocci (Italy), Lindsay Collins (Australia), Michel Michaelovitch de Mahiques (Brazil), Renée Hetherington (Canada)

Duration: 2007(–2011)

Contact Address:

Francesco L. Chiocci

Dipartimento di Scienze della Terra

Università «La Sapienza»

P.le Aldo Moro 5, 00185

Roma, Italy

Tel: +39-06-49914938

Fax: +39-06-4954729

E-mail: Francesco.chiocci@uniroma1.it

The continental shelf is a complex environment requiring multi-disciplinary research contributions and the application of various technologies. Morphology, stratigraphy, sedimentology, ecology, and human-related issues merge together in a complex environment where waves, tides, currents, input from the continent, and humans interplay through time and space. By bringing together international specialists from various disciplines, the “Risks, Resources, and Record of the Past on the Continental Shelf” (RRR) project will help better define research, management, and mitigation knowledge, criteria and strategies, thereby facilitating better global understanding of shelf processes and their influence and relevance to human society. Further, it will re-establish and expand the international collaborative research efforts developed in the predecessor IGCP projects. The RRR project will facilitate a more interdisciplinary, global, and effective approach to continental shelf studies than currently exists. It will promote the interaction of international researchers from disparate fields thereby providing input needed to resolve complex human-related problems associated with changes recorded, observed, or anticipated on the continental shelf. The RRR project will highlight continental shelf research focusing geological and human-related

research in a previously neglected research field, particularly as it relates to the carbon cycle, paleoanthropology, and other human risk- and resource-related issues. It will be left to the project's participants to emphasize or de-emphasize specific aspects, without pretending to fulfill all aspects in their entirety. A major outcome of this project will be the transfer of continental shelf research and techniques from more affluent countries to less economically developed countries for application to locally and regionally relevant human-related issues.

The proposed project will focus on three main research topics related to the continental shelf and human society including: 1) Risks: pollutants, neotectonics, tsunamis and other high-energy events, geotechnical hazards, and emergency management; 2) Resources: mineral, aggregates, living, and environmental management; 3) Record: the carbon cycle, paleoanthropology—humans and their relationship with fauna, flora, and the changing environment of continental shelves, and climate change.

This interdisciplinary project will exploit the geological record on continental shelves to enhance our understanding of its recent evolution and the application of continental shelf studies on human activities relating to risk assessment, knowledge and exploitation of resources (both living and nonliving), and the depiction of long-term changes. Through international collaboration this project will promote the use of continental shelf geoscience research in dealing with world-scale processes (such as climate change, continental shelf geological processes, and the carbon cycle), the extraction, utilization, and preservation of continental shelf resources, whether, mineral, faunal, or floral, and with issues of relevance to human history and our future in a rapidly changing world.

Human society will particularly benefit from the resulting dissemination, comparison and interchange of methodologies and research strategies. A key outcome will be the transfer of research strategies and techniques to less affluent regions through workshops, short courses and by making available access to laboratories for scientists, students, and data from less economically developed nations. Further, through scientific collaboration, participants will be able to utilize high-cost research facilities (e.g., research vessels) that would otherwise be unavailable. As a consequence, we anticipate improved understanding of the extent of risks and resources on the continental shelf, thereby enhancing regional capabilities—particularly in developing countries, and future risk mitigation—especially those resulting from economic development and climate change. By focusing interdisciplinary research on the geological record, we anticipate greatly enhanced knowledge of changing conditions on the continental shelf both today and in the past, and improved understanding of their impact on human behaviour, migration, and habitation throughout the Quaternary interval.

Increased understanding of the interaction between the continental shelf and humans throughout history will improve our capacity to appreciate the potential impacts of environmental and climate change on this economically and environmentally critical region.

Project No. 529 Availability of groundwater resources in selected urban areas in Southern African Development Community (SADC) region

Full title: Availability of groundwater resources in selected urban areas in Southern African Development Community (SADC) region: implication on Integrated Water Resources Management
Countries involved: Botswana, Japan, Kenya, Malawi, Mozambique, Namibia, South Africa, Tanzania, Zambia, Zimbabwe

Proposers: Professor Imasiku A. Nyambe (Zambia)

Duration: 2007–2011

Contact Address:

Professor Imasiku A. Nyambe
Dept of Geology, School of Mines
University of Zambia
PO BOX 32379, Lusaka
Zambia
Tel: +260-1-294086 or 260-1-294434
E-mail: inyambe@mines.unza.zm
nyambes@zamtel.zm

Groundwater is a primary source of water supply systems in many African megacities. However, unplanned urban expansion and rapid population growth in the urban areas have put enormous pressure on this natural resource. In addition, excessive use of fertilizers, pesticides and herbicides as well as effluent from leaky sewerage systems, septic tanks, leaky fuel tanks, factories or pollutants from solid and liquid waste (garbage) dumps are major sources of groundwater pollution in these urban areas.

It is proposed that the project will be initiated in 12 cities as follows:

- Gaborone, Botswana
- Windhoek, Namibia
- Blantyre, Malawi
- Maputo, Mozambique
- Western Cape city and Pretoria, South Africa
- Dar-Es-Salaam, Tanzania
- Lusaka, Kabwe and Ndola, Zambia
- Harare and Bulawayo, Zimbabwe

The objective of this project is to contribute to:

- Groundwater management in the region, in particular community management of urban aquifers in the unplanned settlements.
- Role of groundwater in the socio-economic development in the region and how this relates to the overall Integrated Water Resource Management.
- Establishing an information network and a proposal for groundwater monitoring system on urban groundwater for the selected urban centres in Southern Africa, where planners, decision makers and interested organizations, and public can share information.

The project's specific tasks will include:

- Assessment of groundwater availability, quality and vulnerability so as to raise public awareness.
- Identification of hot spots and major threats of groundwater aquifers in SADC urban areas.
- Evaluating legal and institutional framework options for better safeguarding groundwater aquifers in SADC urban areas, including pollution and health problems mitigation.
- Hydrogeological modelling of groundwater vulnerability in SADC urban areas; and
- Establishment of a network for sharing information and a proposal for a groundwater monitoring network, e.g. on possible groundwater contamination in a particular urban area.

These specific tasks have been translated into specific elements to be executed in the proposed work programme. A narrative summary of the Work Plan is indicated and outlined, starting with the Goal, Purpose, Main Output that has been sub-divided into six sub-outputs. Under each sub-output, a number of activities have been developed. A summary of these milestones are as follows:

- **Goal:** To strengthen water resource management in the SADC region and contribute to economic development and reduce poverty.
- **Purpose:** To develop and strengthen capacity of Ministries of Water in the management of groundwater in selected Urban Centres.
- **Main Output:** Proper Groundwater Management in selected Urban Centres that takes into account IWRM frameworks developed in the SADC member states.

The sub-outputs with their aims are as follows:

- **Sub-Output 1:** Production of Hydrogeological Maps and Models of the Urban Centres, aimed at "*Developing procedures and mechanisms for the production of maps and models that provide an opportunity for stakeholders to participate in and provide input to the final product*".
- **Sub-Output 2:** Data base on water usage including assessment of boreholes, aquifers and their hydrogeological parameters in place, aimed at "*Assisting Urban Centres to have information on Groundwater usage*".
- **Sub-Output 3:** Regional Urban Centre Groundwater Information Network systems in place, aimed at "*Assisting Urban Centres in setting a monitoring network and, setting-up and managing an information system on urban groundwater*".
- **Sub-Output 4:** Role of Groundwater in Integrated Water Resource Management (IWRM) elaborated, aimed at "*Bringing to authorities and public that groundwater is a finite resource that needs proper policy options for better safeguard of groundwater aquifers in SADC urban areas,*

including pollution and health problems mitigation".

- **Sub-Output 5:** Sharing of information at conferences, workshops at regional and international level, aimed at "*Sharing ideas on best practices in groundwater mapping, exploration, exploitation and management*".
- **Sub-Output 6:** A final report document on the overall groundwater resources, usage, pollution, protection and role in IWRM including maps and publication of results, aimed at "*Providing best practices in groundwater mapping, exploration, exploitation and management to stakeholder institutions and public*".

In carrying out this IGCP project, African scientists will learn a lot from the interaction with other researchers from non-African countries. These researches will provide capacity building and share their own experiences in this area from their own countries. It is in this framework that Dr Qingcheng He from China and Professor Igor Zektser from Russia will act as advisors to the Project.

Project No. 534 Reconstruction of the past coastal environments and its management

Full title: Reconstruction of the past coastal environments by means of geomorphology and geoarchaeology: management through geosites and virtual itineraries

Countries involved: Bulgaria, Georgia, Germany, Greece, Italy, Morocco, Romania, Russia, Spain, Tunisia, Turkey

Proposers: Marta Pappalardo (Italy), Florina Grecu (Romania)

Duration: 2007 (–2011)

Contact Address:

Prof. Marta Pappalardo,
Dipartimento di Scienze della Terra,
Università di Pisa (Italy),
Via S. Maria,
53, 56126 - Pisa, Italy
Phone: 0039(0)50/2215748,
E-mail: pappalardo@dst.unipi.it

This project is aimed at studying the effects of climatic change on the coastal environment through palaeogeographic and palaeoecologic evolution reconstructions in specific study sites. Coastline changes during the last 125,000 years will be studied and their effects on the coastal landscape will be reconstructed. The methods employed will be geomorphological mapping, remote sensing, sediment analysis and dating (OSL, 14C, dendrocronology). Within the research high resolution proxies will be used for the last 2500 years, in which, in the study sites, the evolution of the coastal settlement was influenced by the changes of the littoral environment under the control of climatic factors and relative sea level changes. For this study period methods of geoarchaeological analysis in addition to the others will be employed.

The expected results are the individuation of geomorphological and geoarchaeological markers that can supply new data

about the position of ancient shorelines. The research will focus on those landforms that can be considered geomorphosites for their geomorphological or geoarchaeological relevance of comparable scientific value and great educational and drawing power. These geomorphosites will therefore be used to divulge information relative to the evolution of past coastal environments and within each study area they will be connected together in a followed itinerary with the aim to tell the story of the site. For this purpose, methods for spreading high-level scientific knowledge to a vast public of visitors of coastal area will be employed. The project will profit from the collaboration with a technological centre specialized in virtual reality and engineering. The long-term results of basic research activities will be promoting a sustainable tourism and a new environmental recognition which, in turn, could generate new forms of protection and respect and consequently long-term conservation of environmental and cultural resources.

Project No. 540 Gold-bearing hydrothermal fluids of orogenic deposits

Full title: Composition of hydrothermal fluids of orogenic gold deposits from state-of-the-art fluid inclusion microanalysis, and applications to mineral exploration

Countries involved: Canada, Australia, Morocco, China, Hungary, Germany, USA, India, Brazil, Italy, Chile, Czech Republic

Proposers: P. S. Garofalo (Italy), J. R. Ridley (USA), Vsevolod Prokofiev (Russia)

Duration: 2007–2011

Contact Address:

Dr. P. S. Garofalo
Università di Bologna
Dipartimento di Scienze della Terra e Geologico-Ambientali
Piazza di Porta S. Donato
1-40127 Bologna, Italy
E-mail: garofalo@geomin.unibo.it,
Tel: +39-051-2094917

This project considers orogenic gold deposits, one of the most relevant mineral resources of the world market. Orogenic deposits are vein networks generated by syn-tectonic flow of hydrothermal fluids through large sections of active continental margins of late Archean to Tertiary age. Veins are made of quartz-carbonate-sulfide assemblages, and are located within high-dilatancy areas of narrow, steeply dipping shear zones. Because hydrothermal fluid flow controls how Au is transported and deposited within the vein networks, knowledge of the physical and chemical properties of the ore fluid at the time of vein formation is one of the strategic components of a genetic model. Such properties have been constrained after decades of academic and industrial research, but work is still in progress considering that the actual genetic models do not allow for effective exploration strategies.

This project proposes a multi-technique study of fluid inclusions to implement the fundamental knowledge on the composition of Au-transporting hydrothermal fluids by considering the following analytical strategy: (1) petrographic identification of co-genetic inclusions related to Au deposition; (2) spindle-stage measurements of the liquid/vapor ratio in the fluid inclusions; (3) microthermometric determination of phase transitions; (4) Laser Ablation-ICP-Mass Spectrometry of single representative fluid inclusions to determine the concentration of Au and other major and trace chemical components in the ore fluid; (5) Raman spectroscopy to determine nature and composition of the vapor phase; (6) SEM and X-ray diffraction analysis of all the minerals that make the assemblages of the Au-bearing veins.

This data set has never been compiled systematically at a global scale, and data from LA-ICP-MS are scarce. Therefore, this study defines a comprehensive and quantitative approach to the study of fluid inclusions in orogenic gold deposits, hopefully providing answers to fundamental questions like the effects of post-entrapment re-equilibration of fluid inclusions in the determination of the ore fluid properties, and the significance of microchemical analyses of fluid inclusions from this tectonically-active environment. These data represent fundamental ingredients of working genetic models.

The participants to this project carry out leading research in the field of orogenic gold deposits. Following a spirit of trans-national cooperative research, this project would involve ore deposit geologists from 12 countries, making available the new techniques of fluid inclusion analysis. In the first year of the project, we will focus on the set up of a template data set from a small number of well-studied deposits from the Superior Province of Canada and from the Yilgarn Block of W Australia, in order to test the feasibility of this strategy. The results of this part of the project will be presented in international meetings and published in international journals. After this feasibility test, work will concentrate on fluid inclusions from deposits located worldwide, e. g. in Morocco (Central Anti Atlas), Bohemian Massif (Krasna Hora), Chile (North Coastal Range), India (South Indian Shield), China (Jiaodong Peninsula), Russia (Eastern Transbaikalia, Siberia; Ural region), and Australia.

This project will establish a benchmark approach to the study of fluid inclusions applicable in metamorphic rocks, as all deposits reflect regional fluid flow in tectonically unroofed orogenic belts. Therefore, support to this study of the chemistry of hydrothermal fluids would not be just be applicable to the evaluation of global gold resources, but also would provide a potential step towards a rationale use of fluid inclusion data for effective and sustainable Earth resource valuation.

Project No. 543 Low-temperature thermochronology: applications and inter-laboratory calibration

Full title: Low-temperature thermochronology and its applications: worldwide transfer of knowledge and inter-laboratory calibration

Countries involved: Australia, Canada, Chile, Egypt, France, Germany, India, Italy, Japan, Norway, UK, Ukraine, USA, Spain

Proposers: Massimiliano Zattin (Italy), J. I. Garver (USA), Vitaliy A. Privalov (Ukraine), Alexei V. Soloviev (Russia), Cornelia Spiegel (Germany), Maarten de Wit (South Africa), Dewen Zheng (China)

Duration: 2007–2010

Contact Address:

Prof. Massimiliano Zattin
Dipartimento di Scienze della Terra e Geologico-Ambientali
Università di Bologna, Via Zamboni 67
40127 Bologna, Italy
Phone: +39 051 2094579
Fax: +39 051 2094522
E-mail: zattin@geomin.unibo.it

Quantification of geological processes is a demanding task of primary importance for different Earth science topics. A valuable tool is given by low-temperature thermochronology (mainly fission-track and U-Th/He analyses) which finds many applications in oil industry, in the exploration and sustainable management of water and mineral resources and in the analyses of the relationships between tectonics and climate change. In fact, because these methodologies are sensitive to the thermal regime in the shallow crust, they allow to give some constraints to the analysis of magmatic, sedimentary, tectonic and geomorphic processes. Main applications of thermochronology are:

- quantification of exhumation processes and relationships between tectonics, uplift, erosion and climate;
- thermal history of sedimentary basins;
- provenance of sediments.

This project has two primary aims:

1. The transfer of knowledge to developing countries. Low-temperature methodologies are relatively low-cost techniques (this is especially true for fission-track analysis) which can find many applications in different fields. For this reason, many developing and emerging countries were trying to set up new laboratories in the last years but a considerable gap of knowledge is still existing.
2. The testing of the methodologies for applications. Although fission-track analysis is used since some years in hydrocarbon and mining industry as well as in tectonic studies, the potentialities of integration of different methodologies are partially unexplored. Moreover, the development of modelling techniques can improve the significance to the obtained results.

Although thermochronology is extensively applied since the '80, many uncertainties on basic theory (e.g. kinetics of fission and diffusion processes) and analytical procedures (e.g. etching conditions) are still existing. Moreover, the thermal regime in uplifting chains is a transient process which is depending on different factors (e.g. variations in erosion rates and topography) and different approaches to model the isotherms behaviour are existing. Given that many people from different laboratories have shown an interest in the proposal, we have the chance to work on some basic aspects of the methodologies. Therefore, as by-product of the project, we will discuss and hopefully run an inter-laboratories calibration.

The project plans to organize annual workshops which will cover the main topics relevant for thermochronology. Participants will be invited to present their main results on basic research but, above all, to propose and discuss protocols for inter-laboratory calibrations. The workshops will be preceded by a short course on the discussed methodology which could be particularly helpful for people who are setting up new laboratories or for students.

Project No. 545 Clays and clay minerals in Africa

Full title: Clays and clay minerals in Africa: their geneses and paleoenvironmental considerations, mineralogy, geochemistry and applications

Countries involved: Botswana, UK, Cameroon, China, Hungary, Kenya, Mauritius, Mozambique, Nigeria, Uganda, Senegal, South Africa, Swaziland, Tanzania
Proposers: Georges-Ivo E. Ekosse (South Africa)

Duration: 2007–2011

Contact Address:

Dr Georges-Ivo E. Ekosse
 Coordinator of Geology, Mining and Minerals Programs
 School of Physical and Mineral Sciences,
 University of Limpopo
 Private Bag X1106
 SOVENGA 0727 South Africa
 Tel: +27 15 268 2451
 Fax: +27 15 268 2362/2893
 E-mail: ekosse@ul.ac.za
 Gekosse@excite.com

Clays and clay minerals are very important in several geochemical and mineralogical processes, and have very wide and varied industrial applications. Whereas clays and clay minerals occurrences and deposits in other parts of the world are comprehensively represented and well documented, this does not seem to be the case with those in the African continent. It is therefore compulsively imperative to elucidate on the geology, mineralogy, chemistry, technological properties and applications of these very important industrial minerals in Africa, thereby contributing to the Clays and Clay Minerals Body of Knowledge (CCMBK) globally, and advancing opportunities for sustainable developmental projects that local communities could possibly embark on.

This study, which brings together scientists and researchers interested in understanding clays and clay minerals in Africa, also advances opportunities in the role of these minerals as indicators for the reconstruction of ancient environments. The study aims to identify and characterize selected suite of clays and clay minerals in the African continent that can bring more understanding of palaeo-environments, and also advise on their exploitation potentials. Researchers and other relevant stakeholders will work with research collaborators in areas in which clays and clay mineral occurrences are found in the continent for applied research geared towards the understanding of these minerals. Opportunities for the transfer of acquired knowledge and expertise to communities will enhance the sustainability of livelihoods in some of the communities where these minerals occur and residents live in abject poverty.

In a broad context, the following aims of the project should be achieved:

1. Show where possible, relationships between various mineral occurrences and geological, structural, geographical and other controls that might have influenced the formation of the clays and clay minerals deposits and occurrences.
2. Summarise basic geology, geochemistry and mineralogy, thereby reducing the risks associated with green fields investigations.
3. Contribute to the application of clays and clay minerals in the understanding of paleo-environments.
4. Assist in optimal utilisation of clays and clay mineral resources.
5. Contribute to the development of services to a growing African clays for industrial product manufacturing industry.
6. Contribute to knowledge transfers.

More specifically, the following key aims and objectives of the project will be addressed:

7. Basic clays and clay minerals products identification and characterization exercises will be carried out, from which further beneficiation studies will be performed for tailor-made applications of the resources.
8. Identification of the most appropriate technologies for the utilization of the clays and clay minerals resources that will be most economically beneficial to communities.
9. Advancement of the most suitable rehabilitation techniques of mining sites prior to their decommissioning. This aspect will also emphasise the application of environmental rehabilitation techniques that seek to encourage the use of rehabilitated sites for other more sustainable post-mining activities, such as agriculture, recreational facilities etc.
10. Running of short courses, workshops and seminars aimed at promoting knowledge in clays and clay minerals.
11. Relating clays and clay minerals occurrences in Africa to others globally in an effort of globally contextualising their occurrences and roles as indicators for the interpretation of palaeoenvironments.

Project No. 546 Subduction zones of the Caribbean

Full title: Age and thermobaric structure of subduction zones and sutures of the Caribbean

Countries involved: Austria, Colombia, Costa Rica, Cuba, Germany, Guatemala, Japan, Mexico, Nicaragua, Panama, Puerto Rico, Spain, Switzerland, USA

Proposers: Antonio Garcia-Casco (Spain), Uwe Martens (USA)

Duration: 2007–2011

Contact Address:

Antonio Garcia-Casco
 Departamento de Mineralogía y Petrología
 Facultad de Ciencias
 Universidad de Granada
 Fuentenueva s/n 18002 Granada, Spain
 Tel: +34 958 246613
 Fax: +34 958 243368
 E-mail: agcasco@ugr.es

Oceanic trenches constitute the largest physiographical construction in the surface of Planet Earth, with more than 55,000 km of aggregated length. They form as lithosphere is consumed, a process called subduction, and the resulting plate-scale structure is a convergent margin where intense seismic activity and volcanism take place. Subducted material recrystallizes in response to increased pressure and temperature into dense rocks such as blueschist and eclogite, which sink down into the Earth's mantle responding to negative buoyancy forces. Rarely do tectonic conditions allow the return and exhumation of previously subducted materials. Collision of buoyant lithospheric blocks terminates subduction leaving its relics as a suture in orogenic belts. Analysis of high-pressure (HP) rocks from sutures around the world has demonstrated the non-steady thermal state of subduction zones, both in time and space, which ultimately controls the distribution of earthquakes and volcanoes.

The Caribbean plate is bounded by the active Central American and the Antillean subduction zones, which cause intense seismic activity and volcanism in the region. This region also contains a number of Mesozoic-Tertiary sutures documenting former subduction. Establishing the link between ancient and current subduction is critical for a well founded understanding of the tectonic evolution of the associated convergent plate-margins, shedding light on the geodynamics of such a populated and geologically hazardous region. Current studies on HP rocks found within these sutures have identified an unusual thermal and compositional range since ~120 Ma: (a) Very cold subduction of oceanic lithosphere recorded in lawsonite-bearing eclogites south of the Motagua suture (Guatemala) and the Samaná peninsula (Dominican Republic); (b) Cold- to hot-subduction of oceanic lithosphere (including volcanic arc material) recorded in blueschists, eclogites and garnet amphibolites in the Villa del Cura-Cordillera de la Costa-Margarita Island (Venezuela), Puerto Rico forearc, Samaná Peninsula, Blue Mountains (Jamaica), Purial complex (eastern Cuba), northern serpentinite belt (west-cen-

tral Cuba), the northern Motagua suture (Guatemala), and the Río San Juan complex (Dominican Republic); (c) Very hot subduction of oceanic lithosphere recorded in partially melted garnet-amphibolites in eastern Cuba; (d) subduction of continental material of the Chuacús (Guatemala), Guaniguanico, Isle of Pines, and Escambray massifs (Cuba); (e) Garnet-bearing mantle peridotites that record extraordinary depth of formation at Río San Juan (Dominican Republic).

Although many local studies have been carried out in the past few years, the precise timing of subduction-related metamorphism and thermobaric structure of subduction zones have not been established in many of the sutures. In addition the relations between oceanic and continental HP belts are poorly understood, and few studies have integrated information from this wide range of HP occurrences for a systematic comparison. As a consequence, it is unknown whether the aforementioned HP occurrences correspond to one or several subduction zones that evolved in time and space, leading to considerable speculation in plate-tectonic reconstructions for the region. The project plans to organize a series of workshops and field trips throughout the Caribbean that will enable a systematic comparison of high-pressure belts and help unravel the tectonic history of the region.

Project No. 555 Rapid environmental/climate change in the Cretaceous greenhouse world

Full title: Rapid Environmental/Climate Change in the Cretaceous Greenhouse World: Ocean-Land Interactions

Countries involved: Austria, Canada, China, Czech Republic, Bulgaria, Germany, India, Iran, Japan, New Zealand, Poland, Romania, Russia, Slovakia, Spain, Switzerland, Turkey, Tunisia, UK, USA

Proposers: Chengshan Wang (China), Robert Scott (USA), Hugh Jenkyns (UK), Michael Wagreich (Austria), William Hay (USA); Zakharov Y.D. (Russia)

Duration: 2007–2010

Contact Address:

Prof. Chengshan Wang
China University of Geosciences, Beijing
Xueyuan Lu 29, Haidian District
100083, Beijing, P. R. China
Tel: +86-10-8232 1612
Fax: +86-10-8232 2171
E-mail: chshwang@cugb.edu.cn

Until recently it was thought that rapid climate change was restricted to the unstable climates of the past few million years. We now know that rapid climate change can occur during times of relatively stable climate, such as the warm equable greenhouse climate of the Cretaceous. Our goal is to understand causes of rapid environmental change during times of otherwise stable climate. Over the past few million years the Earth's climate has oscillated between "glacial episodes" with development of large ice sheets on the northern hemisphere continents, and geologically short "interglacial episodes" when the ice sheets were restricted

to Antarctica and Greenland. Over the past 800,000 years there have been 8 glacial-interglacial cycles. The buildup to full glacial conditions has typically lasted 60,000 years, the glacial maximum 20,000 years, the deglaciation 10,000 years, and the interglacial interval 10,000. However, during most of the past 500 million years, the Earth's equator-to-pole temperature gradient in surface seawater was ~15°C, less than half that of today, and there were no ice sheets on the continents. The terms "icehouse" and "greenhouse" have been used to describe these alternate states of the Earth's climate. These climate oscillations correspond to changes in the Earth's orbital parameters, affecting the amount of radiation received from the sun at different latitudes and amplified by Earth's varying albedo, as ice accumulated or melted, sea level fell and rose, the planet's plant cover changed and the mass of plankton in the oceans varied: effects augmented by small changes in nutrient availability and atmospheric greenhouse gas content. Large, rapid climate perturbations also occurred during the "greenhouse world" of the Cretaceous. These events were not the direct result of orbital variations, but most likely reflect changes in atmospheric greenhouse gas content forced by tectonics. It is suspected that these episodes of climate change were a result of the sudden injection into the atmosphere of methane trapped on the continental margins and in the deep sea. The release of the methane is thought to be in response to gradual warming of the ocean as a result of widespread undersea volcanic activity and tectonic disturbance of the sediments containing the gas.

Building on previous work, the project aims to investigate the causes, processes, and consequences of rapid environmental changes in the Cretaceous greenhouse world. In contrast to the oscillating glacial-interglacial climates of the past few million years, the Cretaceous was a time of long-term climate stability with warm equable climates resulting from a higher content of atmospheric greenhouse gases. However, this stable climate was periodically disturbed by short-term episodes of warming and cooling, apparently related to rapidly changing greenhouse gas concentrations. We want to understand, in detail, the causes and effects of these perturbations of the otherwise stable system. The results of this investigation will be relevant to understanding potential variations in the Earth's near-term future climate.

Project No. 557 Diamonds, xenoliths and kimberlites

Full title: Diamonds, xenoliths and kimberlites: A window into the Earth's Interior

Countries involved: Australia, Austria, Canada, France, Germany, Italy, USA

Proposers: Holger Sommer (Botswana), Klaus Regenauer-Lieb (Australia), Christoph Hauzenberger (Austria), Jonathan Kashabano (Tanzania), Gétan Moloto-A-Kenguemba (Université de Bangui)

Duration: 2007–2011

Contact Address:

Dr. Holger Sommer
Department of Geology
University of Botswana—Private Bag 0022
Gaborone, Botswana
Phone: +0267 355 5123
Fax: +0267 355 5123
E-mail: sommerh@mopipi.ub.bw

The principal aim of this study is to develop a model describing for the formation of e- and p-types of diamonds. Hence, this project incorporates the study of the Earth's Interior. The main topics of the project include:

- a) to predict the p- and e-type diamond distribution through space and time;
- b) to study the petrology of the diamond bearing rocks (kimberlites and xenoliths);
- c) to test optimal plate tectonic scenarios for the p- and e-types of diamonds;
- d) to study the cogenetic inclusions in diamonds;
- e) to analyze the stability fields of diamondiferous layers in the lithosphere;
- f) to characterize and date the lower crustal fragments (metasediments and metamafic xenoliths) in kimberlites;
- g) to compare the mineral chemistries obtained from both the experimental and field data;
- h) to establish a novel thermodynamics simulation tool for 3-D geodynamics modeling of a subduction zone;
- i) capacity building programmes for scientists from developing countries.

Societal benefits

- a) The results from this project will bring a better understanding of the formation of diamonds in the Deep Earth. This knowledge is necessary for future discoveries of diamond bearing kimberlites, and subsequent global exploration for diamonds in different terrains and at different scales.
- b) The results from this project will make a significant contribution to the general scientific knowledge of the Earth's Interior. This knowledge is relevant to schools, universities and the general public. Capacity building programs for scientists from the developing countries is an important component of the project.
- c) The results from this project will promote the collaboration between research/training institutions and the private sector (e.g. companies dealing with diamond exploration and mining).

IGCP Secretariat

UNESCO, Division of Ecological and Earth Sciences

1, Rue Miollis

75732 Paris Cedex 15

FRANCE

Tel: +33 1 45 68 41 18

Fax: +33 1 45 68 58 22

E-mail: igcp@unesco.org