Cover photography: SYSMIN Project « Caribe, Prof. Andrés Pérez Estaún in memoriam
Disen y maquetació: Masgrau-Yani, SL
The Earth Sciences offer a rich variety of research targets and opportunities. Researchers and students in this field are driven by fundamental curiosity about the past and present states of the Earth, including the origin of earthquakes, mineral resources and raw materials, volcanic activity, changes in the earth’s climate and environment, and the impacts of global changes on society.

The Institute of Earth Sciences Jaume Almera of the Spanish National Research Council (ICTJA-CSIC) in Barcelona established in the year 1965 focusing on Earth Sciences. From the Antarctica to the Caribbean, from the Mediterranean to the desert of Atacama and the Puna in the Andes, from the Pacific coast of Asia to central Asia, ICTJA-CSIC scientists work examining the Earth’s Systems through their particular specialties covering many time and space scales. Cutting across the traditional disciplinary boundaries of geology, physics, chemistry, biology and mathematics, and using advanced instruments, ICTJA-CSIC seeks to advance the understanding the geologic processes and materials to meet industrial and social needs with knowledge transfer applied to geohazards and exploration and exploitation of geological resources.

We take great pride in the integration of graduate students and technicians in our research efforts. The aim is to promote the creative thinking and the ability to develop independent and original research. Our research activities are strongly supported by the specialized technical and administrative staff available in our scientific and administrative services.

This 2014 Annual Report describes the scientific activity of the four research groups: Structure and dynamics of the Earth, Environmental changes in the geological record, Geophysical and geochemical modelling of geological hazards and resources, and Crystallography and optical properties. The Service units and laboratories section outlines the major capacities of these infrastructures. The ICTJA 10 highlighted papers section allows obtaining a fast snapshot of our research. The following sections round off this Report with a look to training, outreach activities and media presence, international collaboration, editorial activities, and finally a summary of the ICTJA big numbers for 2014.
ICTJA at a glance

Our Mission

ICTJA is an international geosciences research institute of excellence whose mission is to advance the understanding of Earth System. We will achieve this by applying advanced (forefront) experimental and analytical methodologies to well-defined, knowledge-driven research objectives. A key part of our mission is to meet industrial and societal needs through knowledge transfer applied to geohazards and exploration and exploitation of geological resources. Central to our mission is quality training of the next generation of Earth Science researchers and technicians.
Our Aims

- Identify new and emerging, high-priority research opportunities.
- Enhance our training capabilities of the next generation of Earth scientists.
- Increase our support of early career researchers.
- Raise our level of international collaboration.
- Create and translate breakthroughs in knowledge-driven research into practical applications that provide the knowledge transfer that industry and society seeks.
- Advance knowledge and understanding within and across the different fields of Earth Sciences.

Our expertise

- Geological and geophysical studies of the lithosphere and shallow subsurface.
- Characterization, quantification, monitoring, and forecasting of resources.
- Experimental and numerical modeling of geological, environmental and climate processes and hazards.
- Multidisciplinary analytical and experimental characterization of geological materials and processes.
- Technological development (instrumentation and software) applied to geophysical, geochemical and environmental monitoring, quality control, and quantitative assessment.
ICTJA Research Groups

The research groups of ICTJA are organized in two departments.

The Department of Structure and Dynamics of the Earth and Crystallography consists of two research groups:

- Earth’s structure and dynamics
- Crystallography and optical properties

Josep Gallart
Department Head

The Department of Environmental Geology and Geohazards is composed of two research groups:

- Environmental changes in the geological record
- Geophysical and geochemical modelling of geohazards processes and subsurface resourc

Santiago Giralt
Department Head
Structure and dynamics of the Earth

Group members

Ramón Carbonell, Research Professor
Manel Fernández, Research Professor
Andrés Pérez-Estaún, Research Professor
Joaquina Álvarez-Marrón, Senior Research Scientist
Dennis Brown, Senior Research Scientist
Jordi Díaz, Senior Research Scientist
Montserrat Torné, Senior Research Scientist
Jaume Vergés, Senior Research Scientist
Daniel García-Castellanos, Research Scientist
Ivonne Jiménez, Research Scientist
Martin Schimmel, Research Scientist
Antonio Villaseñor, Research Scientist
Contxi Ayala, IGME Visiting Research Scientist
Mario Ruiz, Technical staff
Stéphanie Barde-Cabusson, Contract Post-doc

Grant Buffett, Contract Post-doc
Emilio Casciello, Contract Post-doc
Charlotte Fillon, Contract Post-doc
Edouard Le Garzic, Contract Post-doc
David Martí, Contract Post-doc
Juan Diego Martín, Contract Post-doc
Ignacio Marzán, Contract Post-doc
Massimiliano Melchiorre, Contract Post-doc
Eduard Saura, CSIC-JAE Post-doc
Arantzazu Ugalde, Contract Post-doc
Siddique Akhtar, Marie Curie Pre-doc
Giovanni Cammani, CSIC-JAE Pre-doc
Alberto Carballo, JAE Pre-doc
Alba Gil, FPI Pre-doc
Jan Globig, Marie Curie Pre-doc
Lavinia Tunini, FPI Pre-doc
Vinyet Baqués, CSIC contract
Israel Cruz, CSIC contract
Beatriz Gaíte, CSIC contract
Clara Gómez, CSC contract
Mar Moragas, CSIC contract
Mireia Peral, CSIC contract
David Cruset, CSIC contract

Research outline

The multidisciplinary research of this group investigates the structure and dynamic processes of the Earth’s interior. The main objective is to understand how the Earth works at different scales through the integration of a wide range of different datasets and methodologies, including Geophysics and Geology, Numerical Modeling, Geodesy, and Geochemistry.

The acquisition of high resolution seismic, potential field data and surface geology is combined with numerical models to achieve an integrate approach to basic and applied research in Earth Sciences. Related projects to industry include applications for hydrocarbon exploration, waste disposal and geological storage of greenhouse gas emissions (CO2).
Publications 2014


National Funding Agencies

Project Title: **ALCUDIA WA – Propiedades físicas de la litosfera en la Zona Centro Ibérica (Península Ibérica)**
Financed by: PNIDI-CGL - CGL2010-17280
Years: 2011-2014
PI: R. Carbonell

Project Title: **MISTERIOS - Monitorización integrada del sistema tierra en España: red de investigación y observación sísmica.**
Financed by: PNIDI-CGL - CGL2013-48601-C2-1-R
Years: 2014-2017
PI: J. Gallart

Project Title: **PROTAI/2 - Efectos de la arquitectura heredada del margen continental sobre la deformación y cinemática de cuñas orogénicas de colisión.arcocontinente**
Financed by: PNIDI-CGL - CGL2013-43877-P
Years: 2014-2016
PI: J. Alvarez/D. Brown

Project Title: **RIFSIS – Estructura sísmica de la corteza bajo la cordillera del Rif**
Financed by: PNIDI-CGL - CGL2009-09727
Years: 2010-2014
PI: J. Gallart

Project Title: **TECLA – Interacción entre la tectónica y el clima árido de sistemas orogeno-Cuenca**
Financed by: PNIDI-CGL - CGL2011-26670
Years: 2012-2015
PI: D. García-Castellanos

Project Title: **Red TOPOIBERIA – Red TOPO IBERIA-IberArray: estudios integrados de geodinámica y estructura de la placa ibérica**
Financed by: PNIDI-CGL2014-54582-REDC
Years: 2014-2016
PI: J. Gallart
International Funding Agencies

Project Title: **EPOS – European Plate Observing System**
Financed by: **European Unión - 7PM-PP 26229**
Years: **2010-2014**
PI: **J. Gallart**

Project Title: **NERA – Network of European Research Infrastructures for Earthquake Risk Assessment and Migration**
Financed by: **European Unión - 7PM-PP 262330**
Years: **2010-2014**
PI: **J. Gallart**

Project Title: **TOPOMOD-Sculpting the Earth's topography: Insights from modelling deep-surface processes**
Financed by: **European Unión - 7PM-RTN 264157**
Years: **2011-2014**
PI: **M. Fernandez**

Project Title: **Performance of the conversion to digital form of the phase arrival times for all earthquakes included in the bulletins of the international seismological summary**
Financed by: **International Seismological Center**
Years: **2013-2014**
PI: **A. Villaseñor**
Industry

Project Title: Integrated structural and geodynamics geological research studies
Financed by: STATOIL-HYDRO PETROLEUM ASA
Years: 2008-2015
PI: J. Vergés

Project Title: Seguimiento geofísico del confinamiento geológico de CO2
Financed by: REPSOL
Years: 2010-2015
PI: A. Villaseñor

Project Title: Identificación y validación de métodos geofísicos para la detección y caracterización de discontinuidades en medios sedimentarios recientes
Financed by: ENRESA
Years: 2013-2015
PI: R. Carbonell

Project Title: Geomargen III: adquisición, análisis e interpretación de datos sismológicos de la Cuenca de Tarfaya
Financed by: REPSOL
Years: 2014-2016
PI: A. Villaseñor

Project Title: Regional structural sections across the Iraqi Kurdistan
Financed by: TOTAL
Years: 2014-2016
PI: J. Vergés
Crystallography and optical properties

Research outline

This line of research is focused on the study of the optical properties of semiconductor materials. Over the past few years we have carried out Raman scattering studies on a variety of III-V compound systems such as GaN, InN, InGaN, InAs/GaAs, InGaAs, InP, AlGaSb, InAsSb, GaSb, GaAsN, as well as on ZnO, a II-VI wide band gap material which is intensively being investigated because of its potential applications in transparent electronics and in blue and UV light emitters.

Group members

Lluis Artús
Group Leader – Senior Research Scientist

Ramón Cuscó, Research Scientist
Jordi Ibáñez, Research Scientist
Nuria Domènech, FPU Pre-doc
Robert Oliva, FPI Pre-doc
**Publications 2014**


**Research projects 2014**

### National Funding Agencies

**Project Title:** OPTOFOT Propiedades ópticas de materiales opto electrónicos y fotovoltaicos

**Financed by:** PNIDI-MAT: MT2010-16116

**Years:** 2011-2014

**PI:** Ll. Artús
Environmental changes in the geological record

Research outline

Our multidisciplinary group promotes the reconstruction of environmental and climate changes, their causes, and dynamic interactions through the multiproxy characterization of the geologic record. Throughout the history of our planet, the geological processes in general and climate change in particular have fingerprinted the sedimentary record. Furthermore, the increasing anthropogenic influence in the recent past is also readily identifiable in this geological record.

This research is carried out using a multiproxy approach and focuses on lake sedimentology and global change, impact of geological and anthropogenic processes on the natural geochemical balances, sedimentary processes and biomineralization, geochronological dating and physical and magnetic properties of the sediments as indicators of environmental and climatic processes.

The objective of the research group is the robust and accurate reconstruction of past climate oscillations and environmental fluctuations as well as identify short, medium and long term trends of these changes through the multiproxy characterization of the geological sedimentary record. These reconstructions provide valuable data to put into a broad temporal perspective the current climate and environmental trends as well as they provide useful insights about which has been the historical and current anthropogenic role in the recent evolution of the Earth. These climatic and environmental reconstructions also provide data that allows the establishment of possible future climatic and environmental scenarios.
To achieve this goal the group is developing the following research lines:

- reconstruction of climatic and environmental changes using a high temporal resolution multiproxy approach of lacustrine sedimentary records;
- determining the geochemical impact of large-scale geological processes (e.g., explosive volcanic eruptions or floods);
- evaluating the relationships between processes and sedimentary environments and biomineralization, and characterizing physical and magnetic properties of the sedimentary record as proxies of climatic and environmental events.
**Publications 2014**


ICTJA Research Groups


**Research projects 2014**

**National Funding Agencies**

**Project Title:** LACATALAS – Environmental characterization of Miocene lacustrine systems with marine-like faunas from the Duero and Ebro basins: geochemistry of biogenic carbonates and palynology

**Financed by:** PNIDI CGL - CGL2011-23438

**Years:** 2012-2014

**PI:** P. Anadón

**Project Title:** QUECA – Impactos medioambientales de erupciones cuaternarias en los Andes Centrales: Modelado para la prevención de los efectos de futuras erupciones

**Financed by:** PNIDI CGL - CGL2011-23307

**Years:** 2012-2014

**PI:** J. L. Fernandez-Turiel
Geophysical, and geochemical modelling of geohazard processes and subsurface resources

Group members

Joan Martí
Group Leader - Senior
Research Professor

Ignasi Queralt, Senior Research Scientist
Carles Soriano, Research Scientist
Maria José Jurado, Research Scientist
Adelina Geyer, JdIC /RyCajal Post-doc
F. Xavier Castelltort, CSIC contract Post-doc
Helena Gallardo, FPI Pre-doc
Raquel Noriega, FPI Pre-doc
Stefania Bartolini, JAE Pre-doc
Silvia Aragó, CSIC contract
Xavier de Bolos, CSIC contract
Laura Becerril, CSIC contract
José Crespo, CSIC contract
Carlos Viñolo, CSIC contract

Research outline

Geological, geochemical and geophysical studies are applied to model natural processes that can become geological hazards. These studies include research topics related to volcanism, seismology, landslides or geochemical transfer in subsurface and surface land. From a multidisciplinary point of view, the research is focused on the physics of hazardous geological processes, development of analytical tools for geochemistry, borehole geophysics and remote sensing.

Among the most important techniques we highlight:

- Simulation of geological processes using a combination of numerical & experimental methods
- Application of X-ray radiation for the study of materials and residual waters
- Borehole geophysics and subsurface imaging
- Development of new algorithms for remote sensing and geographic information systems.
Fig 7. Bloque diagrama. Ortofotomapa sobre DEM con la interpretación geológica a través de 2 cortes geológicos, (dirección NS y dirección SW-NE) (Modificado de Bolós et al, 2012). Se muestra la ubicación del sondeo con una columna estratigráfica simplificada.
Publications 2014


Research projects 2014

**National Funding Agencies**

**Project Title:** GEOSUB/2 - Investigación y monitorización de fallas sismogénicas en sondeos para la elaboración de una propuesta de perforación al ICDP para perforación en el SE Peninsular  
**Financed by:** PNIDI-CGL2010-21568  
**Years:** 2011-2014  
**PI:** M. J. Jurado

**Project Title:** IMPAS - Impact in Aquifer media and Soils of non-conventional water (treated-desalinated) use and sewage sludge application: laboratory and field investigations  
**Financed by:** PNIDI-CGLI - CGL22168-C03-01  
**Years:** 2011-2014  
**PI:** I. Queralt

**Project Title:** EXCAVA-Explora, caracteriza y visualiza  
**Financed by:** PNIDI-IPT - 2012-0979-380000  
**Years:** 2013-2015  
**PI:** M. J. Jurado

**Project Title:** Modelado y caracterización físico-química de los magmas en Tenerife y su aplicación en el sistema de vigilancia volcánica del Observatorio Geofísico Central  
**Financed by:** IGN  
**Years:** 2013-2014  
**PI:** J. Martí

**Project Title:** Definición de guías de exploración y explotación de recursos energéticos y minerales en calderas volcánicas de colapso (CALECOM)  
**Financed by:** Consejo Superior de Investigaciones Científicas - PROGRAMA CSIC CONEXION INTERNACIONAL  
**Years:** 2014- 2015  
**PI:** A. Geyer

**International funding agencies**

**Project Title:** VUELCO – Volcanic unrest in Europe and Latin America: Phenomenology, eruption precursors, hazard forecast, and risk mitigation  
**Financed by:** European Unión - Project # 282759  
**Years:** 2011-2015  
**PI:** J. Martí
Service units and labs

Service units

Management and General Services

The Management and General Services depend directly on the Institute’s Manager and include the administration of:

- Human resources. Management of permanent staff, contract personnel and trainees, taking up their posts, contracts, grants, end of contract, reporting joiners and leavers to the Social Security system, etc.
- Project management. This includes applying for monitoring and financial management of national and international projects (public and industrial).
- Purchasing and procurement of supplies, service and maintenance – buildings, special infrastructures, technical services, vehicles.
- Management of travel and subsistence expenses.

The General Services are also responsible for maintenance of electrical and mechanical installations and devices, porter, mailing, and cleaning.

Manager
José Luis López Burguillo

Administrative support
Leonor Fernández, Purchasing and procurement
Francisco Mosquera, Payer
María Consuelo Palacio, Human Resources
Esmeralda Rodríguez, Project management
Elisa Zamorano, Travel and subsistence

Maintenance
Óscar Ávila, Technical staff
Miquel Ángel González, Technical staff
Dimas Calvo Meca, Technical contract
Jesús M. Foncubierta, Technical contract

Front desk
Xavier Pascual, Receptionist
Alejandro Tatevosian, Receptionist
Computing and Communications Service

The main objective of this service is to facilitate the communication and computing tools and basic and advanced services to allow researchers of ICTJA to achieve their scientific objectives. The unit manages a network infrastructure composed of about 150 medium size computers, a wifi spread throughout the building, some server-oriented computing, storage and connectivity with the Scientific Ring/Rediris/Geant2. ICTJA facilitates the access to 5 CSIC research institutes (CID, IBB, CEAB, IBMB and IIBB) to this Scientific Ring.

Library

The Library of Geology (UB-CSIC), housed in the Faculty of Geology, is jointly managed by the Faculty of Geology of the University of Barcelona (UB) and the Institute of Earth Sciences Jaume Almera (ICTJA-CSIC). This library is one of the most important geology libraries in Spain in terms of repository of journals and books and quality of service. In addition, major bibliographic databases are also offered (WOS, SCOPUS, GEOREF, PASCAL, CINDOC, and BIGPI). The library is currently compiling a database on Bibliography of Earth Sciences of the Iberian Peninsula (BIGPI) including more than 40,000 records of articles, lectures, books, theses, etc. on any aspect of the geology of the Iberian Peninsula.

The publication of the journal Geological Acta is also managed through this service. It is an international journal of Earth Sciences providing an innovative and high quality media of scientific dissemination. Geologica Acta aims to stimulate rapid diffusion of results and efficient exchange of ideas among the widespread communities of Earth Sciences researchers (with special emphasis on Latin-American, the Caribbean, Europe, and the Mediterranean regions). The Journal is edited in collaboration with the University of Barcelona. Since 2007, Geologica Acta is included in the Journal Citation Report of ISI Thomson with an Impact Factor (IF) of 1.483 in 2013 and a 5 year IF of 1.777.

Library

Jordi Casadellà Saladas, Chief Librarian (UB)
Dolores Fernández, Chief Librarian (CSIC)
Marta Boulosa Guerrero, Librarian (UB)
Daniel Casanueva González, Librarian (UB)
Emma Dalmau Ollé, Librarian (UB)
Maria Josefa Martínez López, Librarian (UB)
Concepción Porcar Ferrer, Librarian (UB)
Montserrat Puig, Librarian (UB)
Laura Rincón, Geologica Acta, Journal Manager (UB)
Service units and labs

The library in numbers

• 18,000 books and subscription to thousands of e-books
• 1,054 printed journals and subscription to thousands of e-journals
• 10,000 maps (geological, topographic, etc.)
• 14,000 aerial photographs
• 8,000 article reprints of the geology of the Iberian Peninsula
• 350 PhD Thesis
Scientific services and laboratories

X-Ray Diffraction Service

The X-ray Diffraction Service of ICTJA-CSIC is an analytical facility focused on the qualitative and quantitative characterization of the crystalline phases of materials. The XRD Service, with more than 30 years of experience in the field, offers support to ICTJA researchers and also to external users from public and private universities and companies.

One of the main objectives of the XRD Service at ICTJA is to support the ongoing investigations carried out by ICTJA researchers on Earth Sciences topics, including studies of volcanology, petrology and sedimentology. The XRD Service offers also support to external researchers working in geology, materials science, environment, chemistry, pharmacy, archaeology, etc. A large number of companies and organizations from the public or private sectors make use of the XRD Service at ICTJA for their industrial applications, quality control, environmental studies, forensics, etc.

Range of services offered
- Identification of crystalline phases
- Crystal-quality assessment, composition determination and microstructural analyses
- Semi-quantitative and quantitative analysis of crystalline phases and amorphous content
- Application of the Rietveld method for profile adjustment, structure refinement and quantitative phase analyses
- Investigation of small or inhomogeneous samples with micro-diffraction
- Determination of crystalline structures
- Non-destructive X-ray fluorescence analyses with a handheld spectrometer for field work and cultural heritage studies

Some examples of applications provided by the laboratory to research groups and companies
- Phase identification and quantification of geological samples. Identification and analysis of clay minerals
- Analysis of mineral phases in building materials: cement, concrete, aggregates, etc. Study of degraded calcium aluminate cements, identification of fiber cements, etc.
- Determination of the amorphous content in ashes and synthetic mixtures
- Study of corrosion products
- Determination of crystalline silica in respirable airborne dusts by direct-on-filter methods

Jordi Ibañez, Scientific Director
Josep Elvira, Technical Director
María Soledad Álvarez, Technical Staff
Service units and labs

Portable X-Ray Spectrometry of Cultural Heritage Materials
Paleomagnetism Service (CSIC-CCiTUB)

The Paleomagnetic Laboratory was founded in 1989 as a result of an agreement between the CSIC and the Catalonian Geological Service of the Generalitat de Catalunya. Since 1998, the laboratory depends on the CCiTUB and the CSIC.

The laboratory provides technical support to research groups working on several research topics within the Earth Sciences, among them:

- Magnetostratigraphic dating of sedimentary sequences and correlation with their fossil and paleoenvironmental record.
- Archaeomagnetic dating of archaeological remains.
- Paleomagnetism applied to the study of orogenic belts and plate tectonics.
- Environmental magnetic studies aimed at unravelling paleoenvironmental and climatic variations in the sedimentary record.

The laboratory facilities include superconducting and spinner magnetometers, thermal and AF demagnetizers, a susceptibility bridge and a pulse magnetizer.

Elisabet Beamud,  
Technical Director  
(CCiTUB)

Ana Gómez,  
Technical staff

Ylenia Almar,  
Technical contract
Service units and labs
labGEOTOP Service – Geochemistry Laboratory

The labGEOTOP Service, Laboratory of Elemental and Isotopic Geochemistry for Petrological Applications, carry out multi-disciplinary research in Solid Earth Sciences using an established core of world class equipment and laboratories, and expertise in the technical and applied aspects of their use. The service plays a key role in catalysing leading edge cross-disciplinary research within the CSIC and into Spain.

The labGEOTOP service provides a central mass of equipment that enables significant scientific collaboration on a regional, national and international scale. We undertake a wide variety of analytical work for scientific institutions and industry. The labGEOTOP offer elemental and isotopic analysis of solids and liquids covering the range of elements determined by high resolution-inductively coupled plasma-mass spectrometry.

The service focuses on the analytical needs of R&D projects on:

- Compositional structure and evolution of Earth’s mantle: mantle geochemistry mainly through the open window of the volcanic rocks; origin of mantle plumes.
- Compositional structure and evolution of the lithosphere: geochemical processes at the margins of tectonic plates.
- Geochemical evolution of magmatic and metamorphic processes.
- Sedimentary geology and paleoclimate reconstruction: geochronology and processes related to climate change.
- Volcanism: temporal evolution of pre- and syn-eruptive magmatic processes: geochemical flows related to volcanic activity.
- Experimental petrology and mineralogy.

The analytical services provided by the labGEOTOP go beyond ICTJA needs and represent a significant breakthrough in the analytical services required by the Spanish and international scientific community on element and isotope geochemistry for process modelling in both whole rock and high resolution single mineral analysis. The labGEOTOP is a Project co-financed by ERDF through the Scientific and Technological Infrastructure National Program in the National Plan for Scientific Research, Development and Technological Innovation (R&D) of the Ministry of Science and Innovation, Reference CSIC08-4E-001.

Service units and labs

Jose-Luis Fernandez-Turiel, Scientific Director
Marta Rejas, Technical Director
Jonathan Cotano, Technical contract
Seismic Laboratory

ICTJA Seismic Laboratory is composed by two main sections, the Data Acquisition Instrumentation Pool and the Seismic Processing Center.

The Data Acquisition Instrumentation Pool includes seismic equipment intended to be used in temporary deployments. Up to 90 broadband and 36 short period seismic acquisition systems are available to allow managing both short-term controlled source seismic profiling and long-term passive seismic deployments.

The Seismic Processing Centre includes three main servers, around 100 Tbytes of disk space and Linux work stations with dedicated processing software. The Centre is now able to receive and store in near-real time seismic data from temporary seismic stations and selected permanent sites. The facility features connectivity with the Barcelona Supercomputing Centre and has research relationships with other computation, processing, interpretation and modelling facilities such as GEO-MODELS (University of Barcelona) and the Barcelona Centre for Subsurface Imaging.

Jordi Díaz Cusi, Scientific Director
Mario Ruíz, Technical Director
Raman Spectroscopy and Photoluminescence Laboratory

The Laboratory of Raman Spectroscopy and Photoluminescence is focused on the study of the optical properties of semiconductor materials. Among others, the lab carries out Raman scattering studies on a variety of III-V compound systems such as GaN, InN, InGaN, InAs/GaAs, InGaAs, InP, AlGaSb, InAsSb, GaSb, GaAsN, as well as on ZnO, a II-VI wide band gap material which is intensively being investigated because of its potential applications in transparent electronics and in blue and UV light emitters.

Lluís Artús, Scientific Director
Ramon Cuscó, Research Scientist
Jordi Ibañez, Research Scientist
LARX – Laboratory of X-ray Analytical Applications

The LARX research laboratory, created in 1994, is an excellence’s research facility of ICTJA. The activities of LARX are focused on the development of methodologies for the study of solid matter using X-ray spectroscopies such as X-ray fluorescence (WDXRF, EDXRF, TRXRF and micro-EDXRF), X-ray diffraction (XRD) and other solid-state non-invasive analytical tools. Likewise, LARX staff is leading collaborative research projects related to Environmental Geosciences and Geochemistry. Since its creation, the laboratory has also undertaken many teaching and training activities at national and international level, in collaboration with the European X-ray Spectrometry Association (EXSA), the International Atomic Energy Agency (IAEA) and X-ray instrumentation manufacturing companies. During last decade, and within this initiative have taken several doctoral and master thesis in the fields of environmental pollution and cultural heritage materials.

At now, LARX is a joint associated laboratory with the Analytical Chemistry Department of the University of Girona (Spain) and the Hydrogeochemistry Group of the Institute of Environmental Assessment and Water Research (IDAEA-CSIC). The instrumentation of this infrastructure allows the determination of major, trace and ultratrace elements in solids (minerals, rocks, particulate matter, filters, industrial wastes, etc.), including chemical mapping and microprobe analysis, layer thickness determination at nanometre scale and chemical speciation.

Through research collaborative agreements the laboratory provides technical support for research groups working on:

- Cultural Heritage materials and artworks, especially studies of paint pigments, old coinage and metallic artefacts, manuscripts and wall paint materials.
- Environmental geochemistry of soil, water and vegetation, including biogeochemical modelling.
- Forensic research related to the use of inorganic chemistry data.

Ignasi Queralt, Scientific Director
Th-230/U-234 Geochronology Laboratory

The Laboratory of Geochronology was founded in 1989 and fully updated in 2010 with the acquisition of two 8-channel ORTEC alpha spectrometers. The laboratory is specially designed for dating marine and continental carbonates such as travertines, speleothems, endogenic lacustrine carbonates, corals and marine crusts, although it is possible to date primary sulphates (gypsum) and chlorides (halite) using the uranium series desequilibrium method (230Th/234U).

The laboratory provides technical support for research groups working on:

- Absolute dating of upper Pleistocene and Holocene continental and marine carbonate samples for a large variety of purposes such as climate, anthropic, geologic and/or environmental reconstructions.
- Absolute dating of human and other archaeological carbonate prehistorical rests.

Staff

Santiago Giralt, Scientific Director
Graciela Monzon, Technical Director
The Laboratory of Geological Processes Simulation (SIMGEO) was created in 1995 as a joint venture between the Faculty of Geology of the University of Barcelona (UB) and the Institute of Earth Sciences Jaume Almera (ICTJA-CSIC) in the field of experimental and theoretical modelling of geological processes.

SIMGEO seeks to promote application of experimental and theoretical models to the study of geological processes and, in particular, processes that involve a risk to people and the environment, through funding raised by public and private research projects and contracts and agreements.

SIMGEO offers researchers a large space and equipment to design and develop experimental models. The SIMGEO has a laboratory of experimental petrology and mineral synthesis, a hydraulic channel 16 m length and a computer lab equipped with the necessary software to develop mathematical models and simulations using geographic information systems.

**Staff**

- **Joan Martí**, Scientific co-Director (CSIC)
- **Ferran Colombo**, Scientific co-Director (UB)
Scientific Boreholes Almera-1 & 2

Two scientific boreholes were drilled in 2012 in the UB campus of Barcelona as part of the subsurface research studies of the Institute of Earth Sciences Jaume Almera (ICTJA) in cooperation with the Faculty of Geology of the University of Barcelona (UB).

The Almera-1 borehole is 214.20 m deep and is used as an experimental facility for the development of geophysical data logging methods. The hole Almera-2 is 1 m away from Almera-1, reaching a depth of 46 m, and is meant to carry out routine piezometric measurements and cross hole experiments.

A subsurface connection for cables and tools with the borehole and monitoring research lab inside ICTJA building facilitate long term and continuous monitoring and control from the lab. This facility is equipped with a complete system of geophysical logging tools and borehole monitoring data loggers that are used for testing of new devices and experiments in the frame of ongoing research projects.

Staff
Maria José Jurado, Scientific Director
Jose Crespo, Technician contract
Carlos Viñolo, Technician contract
Francesc Castelltort, Technician contract
The coupling of Indian subduction and Asian continental tectonics

In order to understand the potential controls on Asian tectonics during the subduction of the Tethys and Indian lithospheres, we reconstruct the coupled subduction-continent deformation history using tomographic imaging, kinematics constraints and numerical modeling.

The global P-waves tomographic images of the mantle below the India-Asia collision zone provide constraints on the deep structure of continents and subduction history. Linking the slab positions in the mantle to the Asian tectonics reconstructions and the Indian plate kinematics, we reconstruct the timing and location of successive subduction and breakoff events, showing one major breakoff occurred between India and the Tethys Ocean ~ 45 Ma. In the western syntax, a vertical slab continuous to the continent is shown to override the deeper detached Tethys slab. In the central region similar structure is found with a detached slab, yet closer to the Tethys slab. In the eastern syntax, no slab is imaged. It is inferred that after Tethys slab had broke off, subduction only resumed in the center of the margin, while underthrusting took place at both extremities of the convergent margin. During following convergence, a second breakoff event detached the central Indian slab from the margin ~ 15 Ma ago, which renewed Indian lithosphere underthrusting below Asia. This most probably occurred when the Tibetan Plateau was already uplifted, implying that uplift is not a direct result of underthrusting.

Numerical models of breakoff during subduction illustrate the controls of slab detachment on the complexities of the Indian margin. In these models the subduction of continental lithosphere resumes after breakoff only where this is entrained by the mantle flow associated with the long lasting oceanic slab sinking, that is in the center of the margin, while converging continent edges underthrusts the upper plate. Furthermore, the breakoff during subduction has profound implications on the Asian intra-plate tectonics. In the models, the breakoff is rapidly followed by large stresses in the upper plate interiors, propagating at large distance from the margin, along a belt oriented at ~ 45° from the trench. The long-term evolution of the Asian continental tectonics shows drastic changes in the fault pattern, with successive strike-slip faulting across the Asian continent, which are in agreement with the mechanisms illustrated by the models. Transient large coupling at the trench caused by the breakoff events during India-Asia convergence offers an explanation for episodic nucleation of lithospheric faults within the Asian continent and their link to deep processes.

Reference

On 27 March 2013, a 6.2 ML earthquake occurred at 19 km depth in eastern Nantou, central Taiwan. Over a 2 week period it was followed by more than 680 aftershocks that ranged to 5 ML. Most events occurred below the -10-km-deep detachment fault predicted for this part of the mountain belt, coinciding with other precisely located hypocenters that indicate that much of the crust in this area is seismically active. We combine geological data with a three-dimensional (3-D) P-wave velocity model derived from local tomography and earthquake hypocenters to determine a model for the structure of central Taiwan. Much of the surface geology of the area comprises the uplifted Eocene rocks of the Hsuehshan Basin. The 3-D P-wave velocity model shows a shallowing of higher velocities across the Hsuehshan Basin and hypocenter data indicate that its western bounding fault is clearly defined by an eastward-dipping band of events that extends to >20 km depth. The eastern bounding fault is interpreted to coincide at depth with a cluster of events between 20 and 30 km depth. These data suggest that the preexisting, rift-related extensional faults of the Hsuehshan Basin are currently being reactivated and the basin is being inverted. We present hypocenter data from the Nantou sequence that corroborate this interpretation and show the importance of choosing the correct structural model when assessing seismic risk.

Reference

Subduction-driven recycling of continental margin lithosphere

Whereas subduction recycling of oceanic lithosphere is one of the central themes of plate tectonics, the recycling of continental lithosphere appears to be far more complicated and less well understood. Delamination and convective downwelling are two widely recognized processes invoked to explain the removal of lithospheric mantle under or adjacent to orogenic belts. Here we relate oceanic plate subduction to removal of adjacent continental lithosphere in certain plate tectonic settings. We have developed teleseismic body wave images from dense broadband seismic experiments that show higher than expected volumes of anomalously fast mantle associated with the subducted Atlantic slab under northeastern South America and the Alboran slab beneath the Gibraltar arc region; the anomalies are under, and are aligned with, the continental margins at depths greater than 200 kilometres. Rayleigh wave analysis finds that the lithospheric mantle under the continental margins is significantly thinner than expected, and that thin lithosphere extends from the orogens adjacent to the subduction zones inland to the edges of nearby cratonic cores. Taking these data together, here we describe a process that can lead to the loss of continental lithosphere adjacent to a subduction zone. Subducting oceanic plates can viscously entrain and remove the bottom of the continental thermal boundary layer lithosphere from adjacent continental margins. This drives surface tectonics and preconditions the margins for further deformation by creating topography along the lithosphere–asthenosphere boundary. This can lead to development of secondary downwelling under the continental interior, probably under both South America and the Gibraltar arc, and to delamination of the entire lithospheric mantle, as around the Gibraltar arc. This process reconciles numerous, sometimes mutually exclusive, geodynamic models proposed to explain the complex oceanic-continental tectonics of these subduction zones.

Reference

Seismic anisotropy from the Variscan core of Iberia to the Western African Craton: New constrains on upper mantle flow at regional scales

The regional mantle flow beneath the westernmost Mediterranean basin and its transition to the Atlantic domain is addressed by inspecting the anisotropic properties of the mantle. More than 100 new sites, from the Variscan core of Iberia to the northern rim of the Western African Craton, are now investigated using the data provided by different temporary and permanent broad-band seismic arrays. Our main objective is to provide a larger regional framework to the results recently presented along the Gibraltar Arc in order to check the validity of the different geodynamic interpretations proposed so far.

The significant variations in the retrieved anisotropic parameters suggest that different processes must be invoked to explain the origin of the observed anisotropy. Beneath the Variscan units of the Central Iberian Massif the new results show a moderate amount of anisotropy with fast polarization directions (FPD) oriented close to E–W. Those results can only be explained in terms of global mantle flow if models accounting for contributions from surface plate motion, net lithosphere rotation and density variations are taken into consideration. One of the major results presented is the significant number of good quality data without evidence of anisotropy (“nulls”) observed beneath permanent stations in southern Portugal. Those “nulls” can be explained by the presence of a predominantly vertical mantle flow associated to large
variations in the lithospheric thickness. Beneath the Gibraltar Arc the FPD show a spectacular rotation, evidenced by the results presented by Díaz et al. (2010) and Miller et al. (2013). Those results are reviewed here taking also into consideration the geodynamic modeling presented recently by Alpert et al. (2013) and other geophysical and geodetic results. Further South, the analysis of new broad-band stations installed in the Moroccan Meseta and the High Atlas show a small degree on anisotropy and a large number of “null” events, pointing again to the presence of vertical flow in the mantle.

The results favor an asthenospheric origin related to present-day mantle flow for the anisotropy observed from the Variscan core of Iberia to the northern rim of the West African Craton. This flow is deflected around the high velocity slab beneath the Gibraltar Arc and seems affected locally by vertical flow associated to edge-driven convective cells. The presence of significant backazimuthal variations in the anisotropic parameters retrieved from single events suggests that a second order contribution from an anisotropic layer within the lithosphere may also exist.

Reference

Coupled mantle dripping and lateral dragging controlling the lithosphere structure of the NW-Moroccan margin and the Atlas Mountains: A numerical experiment

Recent studies integrating gravity, geoid, surface heat flow, elevation and seismic data indicate a prominent lithospheric mantle thickening beneath the NW-Moroccan margin (LAB > 200 km-depth) followed by thinning beneath the Atlas Domain (LAB about 80 km-depth). Such unusual configuration has been explained by the combination of mantle underthrusting due to oblique Africa–Eurasia convergence together with viscous dripping fed by asymmetric lateral mantle dragging, requiring a strong crust–mantle decoupling. In the present work we examine the physical conditions under which the proposed asymmetric mantle drip and drag mechanism can reproduce this lithospheric configuration. We also analyse the influence of varying the kinematic boundary conditions as well as the mantle viscosity and the initial lithosphere geometry. Results indicate that the proposed drip–drag mechanism is dynamically feasible and only requires a lateral variation of the lithospheric strength. The further evolution of the gravitational instability can become either in convective removal of the lithospheric mantle, mantle delamination, or subduction initiation. The model reproduces the main trends of the present-day lithospheric geometry across the NW-Moroccan margin and the Atlas Mountains, the characteristic time of the observed vertical movements, the amplitude and rates of uplift in the Atlas Mountains and offers an explanation to the Miocene to Pliocene volcanism. An abnormal constant tectonic subsidence rate in the margin is predicted.

Reference

Structural complexities in a foreland thrust belt inherited from the shelf-slope transition: Insights from the Alishan area of Taiwan

The Alishan area of Taiwan spans the transition from the platform with full thickness of the Eurasian continental margin in the north to the thinning crust of its slope in the south. This part of the foreland thrust and fold belt includes important along-strike changes in structure, stratigraphy, and seismic velocities. In this paper we present the results of new geological mapping from which we build geological cross sections both across and along the regional structural trend. Fault contour, stratigraphic cutoff, and branch line maps provide 3-D consistency between the cross sections. Minimum shortening is estimated to be ~15 km with displacement overall to the northwest. A P wave velocity model helps constrain the structure at depth by providing insight into the possible rock units that are
present there. P wave velocities of U5.2 km/s point toward the presence of basement rocks in the shallow subsurface throughout much of the southeastern part of the area, forming a basement culmination. The changes in strike of thrusts and fold axial traces, the changing elevation of thrusts and stratigraphic contacts, and the growing importance of Middle Miocene sediments that take place from north to south are interpreted to be associated with a roughly northeast striking lateral structure coincident with the northern flank of this basement culmination. These transverse structures appear to be associated with the inversion of Eocene- and Miocene-age extensional faults along what was the shelf-slope transition in the Early Oligocene, uplifting the margin sediments and their higher P wave velocity basement during Pliocene-Pleistocene thrusting.

Reference

High-resolution imaging of the Pyrenees and Massif Central from the data of the PYROPE and IBERARRAY portable array deployments

The lithospheric structures beneath the Pyrenees, which holds the key to settle long-standing controversies regarding the opening of the Bay of Biscay and the formation of the Pyrenees, are still poorly known. The temporary PYROPE and IBERARRAY experiments have recently filled a strong deficit of seismological stations in this part of western Europe, offering a new and unique opportunity to image crustal and mantle structures with unprecedented resolution. Here we report the results of the first tomographic study of the Pyrenees relying on this rich data set. The important aspects of our tomographic study are the precision of both absolute and relative traveltime measurements obtained by a nonlinear simulated annealing waveform fit and the detailed crustal model that has been constructed to compute accurate crustal corrections. Beneath the Massif Central, the most prominent feature is a widespread slow anomaly that reflects a strong thermal anomaly resulting from the thinning of the lithosphere and upwelling of the asthenosphere. Our tomographic images clearly exclude scenarios involving subduction of oceanic lithosphere beneath the Pyrenees.

In contrast, they reveal the segmentation of lithospheric structures, mainly by two major lithospheric faults, the Toulouse fault in the central Pyrenees and the Pamplona fault in the western Pyrenees. These inherited Hercynian faults were reactivated during the Cretaceous rifting of the Aquitaine and Iberian margins and during the Cenozoic Alpine convergence. Therefore, the Pyrenees can be seen as resulting from the tectonic inversion of a segmented continental rift that was buried by subduction beneath the European plate.

Reference
An 8700-year record of the interplay of environmental and human drivers in the development of the southern Gran Sabana landscape, SE Venezuela

The vegetation of the southern Gran Sabana (SE Venezuela) consists primarily of a treeless savanna with morichales (Mauritia flexuosa palm stands), despite the prevailing climate being more favorable for the development of extensive rainforests. Here, we discuss the results of our 8700-year paleoecological reconstruction from Lake Encantada based on the analysis of pollen, algal remains, charcoal, and geochemical proxies. We use the findings to assess a number of hypotheses that seek to explain the dominance of savanna vegetation and consider the relative importance of factors such as climate, fire, and erosion on the landscape. The reconstruction of vegetation changes suggests the following trends: open savanna with scattered forest patches (8700–6700 yr BP), forest-savanna mosaic (6700–5400 yr BP), open savanna with forest patches (5400–1700 yr BP), and treeless savanna with morichales (1700 yr BP–the present). We conclude that the interplay between climate and fire and the positive feedback between the presence of grasses and increased fire frequency played a major role in the vegetation dynamics from the early to middle Holocene (8700–6700 yr BP). The synergistic action between reduced fires and wetter conditions appears to be a determinant in the development of rainforest around 6700 yr BP. Despite higher
available moisture at ~5400 yr BP, the savanna expanded with the increased frequency of fire, potentially driven by human land-use practices. We also propose that the interplay between fire and erosion created forest instability during the middle and late Holocene. The current southern Gran Sabana landscape is the result of the complex interplay between climate, fire, erosion, and vegetation.

**Reference**

Environmental processes in Rano Aroi (Easter Island) peat geochemistry forced by climate variability during the last 70 kyr

We analyze the geochemistry of Rano Aroi mire record (Easter Island) using bulk peat composition (C, N, S) and stable isotopes (δ13C, δ15N, δ34S) and major, minor and trace elemental compositions obtained by ICP-AES (Al, Ti, Zr, Sc, V, Y, Fe, Mn, Th, Ba, Ca, Mg and Sr). Peat geochemistry and the pollen record are used to reconstruct the environmental changes during the last 70 kyr BP. Principal component analysis on ICP-AES data revealed that three main components account for the chemical signatures of the peat. The first component, characterized by lithogenic elements (combined signal of V, Al, Sc, Y, Cr, Cd, Ti, Zr and Cu), evidences long-term changes in the basal fluxes of mineral material into the mire. This component, in combination with stable isotopes and pollen data suggests a link between soil erosion and vegetation cover changes in the Rano Aroi watershed. The second component is identified by the signal of Fe, Mn, Th, Ba, Zr and Ti, and is indicative of strong runoff events during enhanced precipitation periods. The third component (tied mainly to Ca, Sr and Mg) reflects a strong peat oxidation event that occurred during an arid period with more frequent droughts, sometime between 39 and 31 kyr BP. Correlation coefficients and a multiple regression model (PCR analysis) between peat organic chemistry and the principal components of ICP-AES analysis were calculated. Isotope chemistry of the peat organic matter further contributes to define Rano Aroi environmental history: δ13C data corroborates a vegetation shift documented by the palynological record from C4 to C3 between 55 and 45 cal kyr BP; the δ15N record identifies periods of changes in mire productivity and denitrification processes, while the δ34S peat signature indicates a marine origin of S and significant diagenetic cycling. The geochemical and environmental evolution of Rano Aroi mire is coherent with the regional climatic variability and suggests that climate was the main forcing in mire evolution during the last 70 kyr BP. The coupling of geochemical and biological proxies improves our ability to decipher depositional processes in tropical and subtropical peatlands and to use these sequences for paleoenvironmental and paleoclimate reconstructions.

Reference
Pressure dependence of the refractive index in wurtzite and rocksalt indium nitride

We have performed high-pressure Fourier transform infrared reflectance measurements on a freestanding InN thin film to determine the refractive index of wurtzite InN and its high-pressure rocksalt phase as a function of hydrostatic pressure. From a fit to the experimental refractive-index curves including the effect of the high-energy optical gaps, phonons, free carriers, and the direct (fundamental) band-gap in the case of wurtzite InN, we obtain pressure coefficients for the low-frequency (electronic) dielectric constant $\varepsilon_\infty$. Negative pressure coefficients of $-8.8 \times 10^{-2}$ GPa$^{-1}$ and $-14.8 \times 10^{-2}$ GPa$^{-1}$ are obtained for the wurtzite and rocksalt phases, respectively. The results are discussed in terms of the electronic band structure and the compressibility of both phases.

Reference
The 1970 eruption on Deception Island (Antarctica): Eruptive dynamics and implications for volcanic hazards

In the southern winter of 1970, a phreatomagmatic eruption occurred in the northern part of Deception Island (South Shetland Archipelago, Antarctic Peninsula). The eruption, with no eyewitnesses to the event, occurred in the same general area as the 1967 eruption, but with new, more widely distributed vents. Two contrasting groups of craters were formed in the 1970 eruption, showing that different active fissures and eruptive dynamics were operating. One group consists of ‘maar-like’ craters, whereas the other comprises conical edifices. The 1970 eruption can be classified as volcanic explosivity index (VEI) 3, with mainly phreatomagmatic phases that generated a bulk volume of about 0.1 km³ of pyroclastic material and an eruptive column at least 10 km high, from which fallout deposits are recognized more than 100 km to the NE. The 1970 eruption was similar to that of 1967 and together these two eruptive events show how eruption dynamics can be controlled by the uppermost part of the volcano substrate and the width and orientation of the eruptive fissure. These influence magma–water interaction and hence may imply different eruptive phases and associated volcanic hazards.

Reference
Volcanic stratigraphy of the Quaternary La Garrotxa Volcanic Field (north-east Iberian Peninsula)

The monogenetic Quaternary La Garrotxa Volcanic Field forms part of the Catalan Volcanic Zone (north-east Iberian Peninsula), one of the alkaline volcanic provinces of the European rift system. It harbours more than 50 basaltic monogenetic cones that range in age from the Middle Pleistocene to the Early Holocene and include cinder and scoria cones, lava flows, tuff rings and maars. This study is the result of extensive fieldwork, including the study of ephemeral outcrops and the stratigraphic logging of new water wells and geotechnical drill holes, also taking into account existing information gathered by recent geophysical studies that have applied shallow geophysical methods to establish the substrate geology of this volcanic field. We have obtained a comprehensive volcanic stratigraphy of the area that identifies the products of each single eruption, their relative stratigraphy and their surface area. This volcanic stratigraphy constitutes an essential tool for understanding the evolution of this volcanic field and for establishing a correct volcanic hazard assessment for the area, but it also provides a precise reference for the Quaternary tephrochronology of the lake sediments in neighbouring areas.

Reference
The present contribution presents a preliminary investigation of the chemical composition with respect to major, minor, trace, and ultratrace elements in several clam species that are frequently used for human consumption in Portuguese markets and worldwide. In order to use a simple and rapid analytical methodology for clam analysis, energy dispersive X-ray fluorescence (EDXRF) spectrometry and total reflection X-ray fluorescence (TXRF) spectrometry were selected as analytical techniques. The analytical capabilities of TXRF spectrometry were evaluated for the determination of minor and trace elements in commercial edible clams. We compared the direct analysis of powdered suspensions (using different sample amounts and dispersant agents) with the analysis of the digested samples for trace element determination. Inductively coupled plasma mass spectrometry analysis of clam digests was also performed to evaluate the analytical possibilities of TXRF spectrometry for trace and ultratrace analysis.

Reference
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<td>The last 70 kyr of Rano Aroi (Easter Island, 27oS) peatrecord: new insights for the Central Pacific paleoclimatology</td>
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## Courses and Seminars

### Courses

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</table>
Glycerol Dialkyl Glycerol Tetraethers (GDGTs) have been studied in sediments of several ecosystems (ocean, peats, and rivers) and only recently have been determined in lakes. Here we have used them to reconstruct past temperature changes for the 700 years recorded in Lake Azul (Sao Miguel Island, Azores archipelago, Portugal) sediments at multiannual time resolution. This unique continental record in the southern pole of the North Atlantic Oscillation has allowed us to unravel the evolution of the atmospheric circulation patterns in the North Atlantic during episodes of rapid climate change for the last 700 years. Thus, the Little Ice Age (from 1400 to 1750 yrs AD in this record) has been characterized by lower than usual temperatures that imply a positive predominance of the NAO, whereas the recorded recent warming (since 1930 yr AD) is marked by the negative NAO control.

The African continent shows striking topographic features and has recently been target of numerous geophysical and seismic studies to determine its crustal structure, locally and regionally. Observation of surface tectonics coupled with knowledge of variations in crustal thickness provide a top to bottom frame to investigate sub-crustal processes, which affect the uppermost lithosphere and control today’s African topography. As the significance of previous models of crustal thickness in Africa is debatable and favors premature conclusions here our motivation is to address the detailed structure of the African lithosphere revealing Moho and LAB geometry using 1D modeling of elevation, geoid and thermal data including the thermotectonic age of the crust as well as age and thickness of sediments to better account for lateral variations in crustal density. The four-layered model is composed of crust and lithospheric mantle plus sea water and asthenosphere, assuming Airy isostasy and is benchmarked against a detailed compilation of seismic Moho data from active and passive seismic experiments across the continent and its margins. Relating better surface topography with the depth of the Moho and the LAB contributes to improve knowledge on the lithospheric structure in Africa that mainly comes from global models, such as CRUST1.0, regional tomography models and gravity modeling, which unfortunately miss a proper relation between elevation, mean crustal density and crustal thickness. Our approach therefore is seen to support the discussion around the strongly debated processes responsible for the anomalous high elevation especially in the south eastern part of Africa and the observed undulations in Moho depth from about 20 km below the extended regions of the East African Rift System to 50 kilometers underneath the thickest Proterozoic belts. By linking differences in age, density and thermal state of the lithosphere with topography and geoid we want to provide new information especially for the data remote areas in Northern and Central Africa.
Outreach Activities

The scientific and technical staff of the institute continued in 2014 with the task of bringing science to society through a series of activities to disseminate the scientific knowledge on Earth Sciences, mainly resulting from the research projects carried out at ICTJA. One of the main objectives is to bring science to young people to promote scientific vocations. In this sense, trying to reach the public as possible, outreach activities focused on showing the relevant role that Earth sciences in society, from the aspects related to geological hazards to the importance of raw materials in the technological development. As example, Geoflaix! is a look at our lives from the perspective of minerals and rocks that are part of our environment. From minerals we obtain materials that are the key to a more comfortable life. The exhibition aims to show visitors how the majority of objects that surround us have a geological basis. It is also a taste for exploring the rocks ... what we obtain and what they tell us! These activities are usually co-organized with the Facultat de Geologia of the Universitat de Barcelona, and the Institut Cartogràfic i Geològic de Catalunya.

**Recerca a Ciències de la Terra**, EspaiCiència, Saló de l’Ensenyament, Fira de Barcelona
Co-organized by ICTJA-CSIC and Facultat de Geologia-UB (12-16 Març 2014)

**GEOflaix**
Travelling Exhibition co-organized by ICTJA-CSIC, Facultat de Geologia-UB, Institut Geològic de Catalunya
Institut Mercè Rodoreda, Hospitalet de Llobregat. 14 January - 5 February 2014
I.E.S. Domenech i Montaner, Barcelona (14 February - 5 March 2014)
I.N.S. Castellar, Castellar del Vallès (14 March - 11 April 2014)
Institut Cartogràfic i Geològic de Catalunya, Tremp (15 May - 15 Juny 2014)

**Espai Viu la Geologia**, EXPOMINER exhibition, Fira de Barcelona
Co-organized by ICTJA-CSIC, Facultat de Geologia-UB, Institut Cartogràfic i Geològic de Catalunya (14-16 November 2014)

**Què investiguem a les ciències de la terra?, Setmana de la Ciència**
Organized by ICTJA-CSIC (17-21 November 2014)

**El CSIC en el Aula**, Formació del professorat en Ciències, Tecnologia i Matemàtiques (CTM), Departament d’Ensenyament, Generalitat de Catalunya
Qué podemos aprender d’un sismograma? by Jordi Díaz Cusí (3 December 2014)
ICTJA-CSIC scientists contributed in the media to disseminate issues with ongoing research projects and to assist in the explanation news events related to the Earth Sciences. TV, radio and newspapers publish these interviews. Topics discussed ranged from Bárðarbunga volcano eruption in Iceland, the structure of the crust in the Strait of Gibraltar and the genesis of earthquakes in the Nankai Trough in Japan.
Other activities

Organization of congresses

1st International Workshop on Volcano Geology, IAVCEI, Madeira, Portugal, July 7-11

Editorial activities

<table>
<thead>
<tr>
<th>Journal</th>
<th>Editor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontiers in Earth Science</td>
<td>J.C. Larrasoaña, Associate Editor</td>
</tr>
<tr>
<td>Frontiers in Volcanology</td>
<td>A. Geyer, Associate Editor</td>
</tr>
<tr>
<td>Geologica Acta</td>
<td>J. Alvarez-Marrón, Associate Editor</td>
</tr>
<tr>
<td>Geological Society of America Bulletin</td>
<td>D. Brown, Editorial Board</td>
</tr>
<tr>
<td>Geology</td>
<td>D. Brown, Editorial Board</td>
</tr>
<tr>
<td>Journal of Asian Earth Sciences</td>
<td>D. Brown, Editorial Board</td>
</tr>
<tr>
<td>Journal of Volcanology and Geothermal Research, Elsevier</td>
<td>J. Martí, Co-editor-in-Chief</td>
</tr>
<tr>
<td>Solid Earth</td>
<td>R. Carbonell, Editorial Board</td>
</tr>
<tr>
<td>Tectonophysics</td>
<td>R. Carbonell, Editor-in-Chief</td>
</tr>
<tr>
<td>X-ray Spectrometry</td>
<td>I. Queralt, Editorial Board</td>
</tr>
</tbody>
</table>

International and National Committees

<table>
<thead>
<tr>
<th>Committee</th>
<th>Members/security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academia Europaea, section Earth &amp; Cosmic Sciences</td>
<td>M. Fernandez and J. Martí, Members</td>
</tr>
<tr>
<td>ANECA</td>
<td>J. Gallart, panel de expertos ACADEMIA</td>
</tr>
<tr>
<td>Comisión Asesora a la Presidencia del CSIC, Mujer y Ciencia</td>
<td>J. Alvarez-Marrón, representante del personal científico permanente por el Área de Recursos Naturales</td>
</tr>
<tr>
<td>Comisión de Evaluación del programa de Formación Postdoctoral 2014 (contratos Juan de la Cierva, área de Ciencias de la Tierra)</td>
<td>A. Villaseñor, Miembro</td>
</tr>
<tr>
<td>Comisión Permanente de Normas Sismoresistentes (desde el 28/02/2014 hasta la fecha)</td>
<td>A. Villaseñor, Miembro</td>
</tr>
</tbody>
</table>
## Other activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comissió Dona i Ciència del Consell Interuniversitari de Catalunya</td>
<td>J. Alvarez-Marrón, Membre</td>
</tr>
<tr>
<td>COST Action no. ES1401</td>
<td>Martin Schimmel, Spanish representant</td>
</tr>
<tr>
<td>EGU, Program Committee for the Tectonics and Structural Geology Division</td>
<td>Daniel García-Castellanos, Member</td>
</tr>
<tr>
<td>ESFRI-EPOS</td>
<td>J. Gallart, Spanish Scientific Representant</td>
</tr>
<tr>
<td>GMES Initial Operations</td>
<td>A. Lobo Aleu</td>
</tr>
<tr>
<td>Integrated Ocean Drilling Program, IODP</td>
<td>M. J. Jurado, NantroSeize Project scientist</td>
</tr>
<tr>
<td>Integrated Ocean Drilling Program, IODP</td>
<td>M. J. Jurado, IODP Expedition 348, scientific group leader</td>
</tr>
<tr>
<td>International Union of Geodesy and Geophysics (IUGG)</td>
<td>J. Martí, Executive Committee Member</td>
</tr>
<tr>
<td>International Association of Volcanology and Chemistry of the Earth Interior (IAVCEI)</td>
<td>Secretary General</td>
</tr>
<tr>
<td>International Continental Drilling Program, ICDP</td>
<td>M. J. Jurado, Science Advisory Group (SAG)</td>
</tr>
<tr>
<td>International Continental Drilling Program, ICDP</td>
<td>M. J. Jurado, Operational Support Group</td>
</tr>
<tr>
<td>of Copernicus Global Land Products</td>
<td>A. Lobo, Member of the Review Panel</td>
</tr>
<tr>
<td>ORFEUS</td>
<td>J. Gallart, Direction Board member</td>
</tr>
<tr>
<td>RES (Red Esp. de Supercomputación)</td>
<td>R. Carbonell, Coordinador del panel de Ciencias de la Tierra</td>
</tr>
<tr>
<td>Secretary General of the Union Commission for Data and Information (UCDI)</td>
<td>A. Geyer</td>
</tr>
<tr>
<td>Service National d’Observation en Volcanologie, CNRS-INSU, France</td>
<td>J. Martí, President of International Scientific Committee</td>
</tr>
<tr>
<td>Sociedad Geológica de España</td>
<td>J. Alvarez-Marrón, Vocal</td>
</tr>
<tr>
<td>Union Commission for Data and Information (UCDI-IUGG)</td>
<td>A. Geyer, Secretary General</td>
</tr>
</tbody>
</table>
## Invited scientists

<table>
<thead>
<tr>
<th>Institution</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Taiwan University, Department of Geosciences, Taiwan Visiting Research Scientist, November 2014 - April 2015.</td>
<td>Dennis Brown</td>
</tr>
<tr>
<td>Universidad Nacional de San Luis, Facultad de Química, Bioquímica y Farmacia, San Luis, Argentina</td>
<td>J.L. Fernandez-Turiel</td>
</tr>
<tr>
<td>Universidad Nacional de San Luis, Facultad de Química, Bioquímica y Farmacia, San Luis, Argentina</td>
<td>Visitant Professor, June 2014</td>
</tr>
</tbody>
</table>

## Invited talks

<table>
<thead>
<tr>
<th>Title</th>
<th>Speaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Un repte per al segle XXI: millorar el coneixement del planeta on vivim VIII Cicle Desafiaments del S. XXI Residència d’Estudiants Barcelona, February, 3</td>
<td>Montserrat Torné</td>
</tr>
<tr>
<td>X-ray Fluorescence spectrometry: Application to materials characterization Workshop on Materials Characterization techniques by XRD and XRF, EU RADDEL Intersectorial European network ICMAB-CSIC, May 2014</td>
<td>I. Queralt</td>
</tr>
<tr>
<td>Cerro Blanco originó la mayor erupción de los últimos 5000 años en el noroeste de Argentina Sociedad Argentina de Antropología Museo Etnográfico Juan B. Ambrosetti, Buenos Aires, Argentina, June, 10</td>
<td>F.J. Perez-Torrado y J.L. Fernandez-Turiel</td>
</tr>
<tr>
<td>Fukushima: un paisaje, la tierra viva Residència d’Estudiants Barcelona, June, 16</td>
<td>M. J. Jurado</td>
</tr>
<tr>
<td>Event</td>
<td>Location</td>
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<td>----------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Evaluación del impacto ambiental geoquímico asociado a ceniza volcánica; aplicación a erupciones recientes y antiguas</td>
<td>INQUISAL-CONICET y Universidad Nacional de San Luis Facultad de Química, Bioquímica y Farmacia de la Universidad de San Luis, San Luis, Argentina</td>
</tr>
<tr>
<td>Cerro Blanco originó la mayor erupción de los últimos 5000 años en el noroeste de Argentina</td>
<td>Facultad de Ciencias Naturales e Instituto Miguel Lillo de la Universidad Nacional de Tucumán San Miguel de Tucumán, Argentina</td>
</tr>
<tr>
<td>The use of XRF instrumentation in Environmental Impact Assessment Studies</td>
<td>63rd Denver X-ray Conference, ICDD</td>
</tr>
<tr>
<td>Designing probabilistic tools for multihazard assessment and risk management</td>
<td>Session Risk Assessment Methodologies, 5th International Disaster and Risk Conference IDRC 2014 'Integrative Risk Management - The role of science, technology &amp; practice'</td>
</tr>
<tr>
<td>Downhole logging in active fault scientific drilling</td>
<td>ICDP Training Course on Active Fault Zone Drilling</td>
</tr>
<tr>
<td>La colonització de l’Illa de Pascua o la importancia de ser geòleg</td>
<td>Opening of the Scholar Year of the Faculty of Geology, Universitat de Barcelona Barcelona, October, 22</td>
</tr>
<tr>
<td>Uso de técnicas de microfluorescencia de rayos X para la determinación rápida de capas y multicapas a escala nanométrica</td>
<td>Actos del Año Internacional de la Cristalografía en el CSIC Centro Nacional de Investigaciones Metalúrgicas, CENIM, October</td>
</tr>
<tr>
<td>La Investigación del subsuelo desde una perspectiva científica: preguntas y respuestas</td>
<td>Centro Tecnológico del Mármol, CTM, Cehegín, Murcia, December, 5</td>
</tr>
</tbody>
</table>
ICTJA in numbers

Personnel

- Researchers 72%
- Technicians-Others 28%
- General Services 7
- Administration 6
- Technician external 2
- Technician staff 5
- PhD Students 6
- Researcher Contract 17
- Researcher Staff 25
- Researcher External 3

Personnel total = 71

Data at 31/12/2014

Funding

- Total Funding: €2,310,000
- Services-Others: €50
- Industry Collaboration: €640
- Public Funding: €1,611

Publications

ICTJA-SCI Publications

- Number of publications from 2000 to 2014
How to reach us

The Institute of Earth Sciences Jaume Almera, ICTJA, is located at the Pedralbes Campus of the University of Barcelona.

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Annual Report
ICTJA-2014
Institute of Earth Sciences Jaume Almera