Foto portada: Coring campaign at Maule (Chile)  
(photo by Santiago Giralt, ICTJA-CSIC)

Disseny i maquetació: Masgrau-Yani, SL
ICTJA main mission is to advance scientific understanding of Earth System Science by improving our knowledge of geological processes, mitigation of geohazards and exploration of geological resources applying advanced experimental and analytical methodologies. Central to our mission is quality training of the next generation of Earth Sciences researchers and technicians.

Following the main guidelines of ICTJA-Strategic Plan 2010-2013, during 2013 our research activities have been developed through research projects funded by public competitive sources and by industry, as well as a small percentage coming from analytical services.

Despite being still immerse in the aftershocks of the so-called “perfect storm” provoked by the financial crisis, ICTJA activities has no suffered too much (yet). Thus, income from grants in 2013 has decreased somewhat from 2012, mainly due to research budget cuts. This coupled with the fact that in 2013 there were no public calls from the 7th Framework Programme has resulted in a decrease in public funding of about 30%. Funds raised from public competitive sources both National and European accounted for 31.5% of the total (319,351.57 €), while funds coming from industry accounted for 62.6% of the total (634,590.44 €). The remaining 6.3% corresponds to funds raised from agreements with the public sector and from services. These figures are calculated as the yearly granted contribution for pluriannual projects.

Regarding the scientific activities, the number of ISI articles authored or coauthored by ICTJA staff slightly increased from 68 in 2012 to 82 in 2013, averaging 3.15 pub/res, while total publications amount to 90 (3.46 pub/res). A total of 17 PhD students were trained in 2013, which combined with the actively participation of senior researchers and postdocs (10) in doctorate and master programs, demonstrates our compromise with quality training and teaching of young researchers.

ICTJA has also been quite active in the organization of a number of specialized seminars, conferences, lectures and in disseminating our research results to the society. Among them it is worth highlighting our participation in the GEOflaix! Exhibition, an alternative look at daily objects from the perspective of Earth Sciences; Espai Ciència-Saló de l’Ensenyament, where thousands of young people and teachers got advice at the fair; and EXPOMINER, a collector’s heaven. Those events were organized jointly with the Faculty of Geology of the University of Barcelona and the former Geological Institute of Catalonia.

It is worth mentioning that 2013 has also been the year of designing ICTJA 2014-2017 strategy (available at the www.ictja.csic.es site). The imminent launch in 2014 of Horizon 2020 and the recent launch of the National Plan for Scientific and Technological Research and Innovation together with the scarcity of funding at national level requires the necessity to define a research strategy for the coming years that maintains and moves forward ICTJA’s momentum and competitiveness at both national and international levels. This exercise has also served as the basis for the development not only of ICTJA-CSIC Action Plan 2014-2017 but for our active participation in the preparation of the scientific brochures of the Natural Resources CSIC Research Area. The strategy focuses on the mission and aims of the Institute and sets out ICTJA’s flagships with the aim to achieve scientific advancement while providing strong support of industrial and societal needs. ICTJA’s flagships are:

- Knowledge-driven Research
- Applied Research
- Responding to societal needs
- Training and support of early career Researchers and Technicians

Last but not least, in the year 2013 the governing board of ICTJA approved the establishing of ICTJA-SPA Awards to the best oral and poster presentation. The aim is to help improving PhD presentations skills at EGU and AGU like conferences.

Montserrat Torne
Director
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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 Science. 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

a) Identify new and emerging, high-priority research opportunities.

b) Enhance our training capabilities of the next generation of Earth scientists.

c) Increase our support of early career researchers.

d) Raise our level of international collaboration.

e) Create and translate breakthroughs in knowledge-driven research into practical applications that provide the knowledge transfer that industry and society seeks.

f) Advance knowledge and understanding within and across the different fields of Earth Sciences.

One of our aims is to define a research strategy for the period 2014-2017. The imminent launch of Horizon 2020 (H2020) and the recent launch of the National Plan for Scientific and Technological Research and Innovation (PNIDI) include both fundamental and applied science, but their focus are squarely on: a) Societal challenges, b) Training programs, and c) Infrastructures.

Furthermore, the scarcity of funding that will be raised at a national level requires that we define research strategies for the coming years that maintains and moves forward ICTJA’s momentum and competitiveness at both the national and international level. Significantly, these aims must intersect both:

• The portfolio of ICTJA research interests and capacities.

• The portfolio of HORIZON 2020; PNIDI, and industry interests.
ICTJA organization chart

Scientific Board

Departments

Earth’s Structure and Dynamics and Crystallography

Research Facilities
Seismology Facility
Raman Facility

Environmental Geology and Geohazards

Research Facilities
LARX
SIMGEO
U-Th
Almera-1 & 2 Scientific Boreholes

Scientific
labGEOTOP

X-ray diff
Service units and Labs

Service Units

Management and General Services

The Management and General Services depend directly on the Institute’s Manager and provide service to all research groups; services and labs. In particular, the Management Service performs the following tasks:

- Human resources. Management of fixed personnel, contract personnel and trainees: taking up their posts, contracts, grants, end of contract, reporting joiners and leavers to the Social Security system, rounds of Social Action funding, handling the paperwork for occupational accidents, residency permits, managing and monitoring holidays, temporary incapacity, medical check-ups, insurance, etc.

- Project management. This includes applying for, monitoring and financial management of national and international projects, both public (based on a competitive basis) and private (mainly contracts and agreements with Foundations and Industry).

- Purchasing and procurement. This includes administrative procurements – purchase of supplies, technical consultancy contracts, service and works contracts, and maintenance – buildings, special infrastructures, technical services, vehicles.

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

Manager
José Luis López Burguillo

Administrative support
María Consuelo Palacio
Esmeralda Rodríguez
Francisco Mosquera
Leonor Fernández
Elisa Zamorano

Call center
Xavier Pascual
Alejandro Tatevosian

Maintenance
Oscar Ávila
Miquel Ángel González
Dimas Calvo Meca (INE contract)

Library
Dolores Fernández
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 compose 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 the Scientific Ring “Anella Científica”. The Institute also collaborates with the Barcelona Supercomputing Center through the IBM Marenostrom Supercomputer.

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). Founded in 1966, aims at the dissemination of journal articles, books, maps, etc. in the broad field of the Earth Sciences. The publication of the journal Geological Acta is also managed through this service.

Library Service

This library is one of the most important geology libraries in Spain in terms of repository of journals and books and quality of service. Books may be consulted via the computerized catalogues of the CSIC and UB, including Internet. The library has 16,500 volumes and 1054 journals (700 are received regularly), 15,000 maps and 20,000 aerial photographs in addition to the major bibliographic databases (GEOREF, PASCAL, SCI, Current Contents, CINDOC, and bibliography of the geology of Spain).

Web Biblioteca (UB): http://www.bib.ub.edu/biblioteques/geologia/

Publication of Geologica Acta

It is an international journal of Earth Science 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 Science 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 1.262 in 2012 and a 5 year IF of 1.653.
Web Geologica Acta: http://www.geologica-acta.com/

BIGPI Database

The library is currently compiling a data-base on Bibliography of Earth Sciences of the Iberian Peninsula (BIGPI): it consists of a database of articles, lectures, books, theses, etc. on any aspect of the geology of the Iberian Peninsula with references to Geology, Geochemistry, Geophysics, Mineralogy, Geomorphology, Natural Disasters, Palaeontology, Environment, Soil Science, etc.
Web BIGPI: http://www.bib.ub.edu/fileadmin/bigpi/bigpi.htm
Scientific Services

labGEOTOP Service

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 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 (CSIC08-4E-001).

Staff
José-Luis Fernandez-Turiel, Scientific Director
Marta Rejas, Technical Director
Jonathan Cotano, CSIC-contract
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

**Staff**

- Jordi Ibañez, Scientific Director
- Josep Elvira, Technical Director
- Maria Soledad Alvarez, Technical Staff
Paleomagnetism Service (CSIC-UB)

The Paleomagnetic Laboratory was founded in 1989 as a result of an agreement between the CSIC and the Catalan Geological Service of the Generalitat de Catalunya. Since 1998, the laboratory depends on the CCiT-University of Barcelona 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 to unravelling paleoenvironmental and climatic variations in the sedimentary record.

Staff

Elisabet Beamud, Technical Director (UB)
Ana Gómez, Technical Staff
Ylenia Almar, CSIC-Contract
Research Laboratories

Seismic Laboratory

ICTJA Seismic Facility 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. Broadband and short period seismic acquisition systems are available to allow managing both short-term active seismic profiling and long-term passive seismic deployments. The Seismic Processing Center includes up to 10 Linux work stations with dedicated processing software as well as computational libraries Seismic processing software as well as computational libraries is equipped with three main servers and up to 18 Tbytes of disk space. The lab also features connectivity with the Barcelona Supercomputing Center that hosts one of the largest computers in Europe the Marenosrum. Furthermore, the lab also has research relationships with other computation, processing, interpretation and modelling facilities such as GEO-MODELS (University of Barcelona) and the Barcelona Center for Subsurface Imaging.

Staff

Josep Gallart,
Scientific Director

Mario Ruiz,
Technical Staff
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.

Staff

Lluis 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.

Staff
Ignasi Queralt,
Scientific Director
U-Th 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
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

M. José Jurado, Scientific Director
José Crespo, CSIC-JAE Technician
Carlos Viñolo, CSIC-contract
Francesc Castelltort, CSIC-contract
**SIMGEO (UB-CSIC)**

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) 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.
Service units and Labs

![Image of service units and labs](image-url)
Personnel

- INEM Contract: 1
- Researchers Permanent Staff: 27
- Administration Permanent Staff: 6
- Services Permanent Staff: 5
- Technicians Permanent Staff: 6
- Post-doc Researchers: 13
- PhD Researchers: 16
- IGME Visiting Scientists: 2
- Contracted Technicians: 17

Total: 93
How to reach us

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

Lluís Solé i Sabaris s/n
08028 Barcelona (Spain)
Phone: +34 934095410
Fax: +34 934110012
ICTJA Research Groups

- Earth’s structure and dynamics
- Crystallography and Optical properties
- Environmental Changes in the Geological Record
- Geophysical and Geochemical Modelling of Geohazards
  Processes and Subsurface Resources
Earth’s structure and dynamics

Group members

Josep Gallart, Group Leader - Research Professor

Andrés Perez-Estaún, Research Professor
Manel Fernández, Research Professor
Ramón Carbonell, Research Professor
Dennis Brown, Senior Research Scientist
Jaume Vergés, Senior Research Scientist
Joaquina Alvarez-Marrón, Senior Research Scientist
Jordi Díaz, Senior Research Scientist
Montserrat T orné, Senior Research Scientist
Antonio Villaseñor, Research Scientist
Daniel García-Castellanos, Research Scientist
Ivonne Jiménez, Research Scientist
Martin Schimmel, Research Scientist
Contxi Ayala, IGME Visiting Research Scientist
Eduard Saura, CSIC-JAE post-doc
Alexandra Robert, CSIC contract post-doc
Arantzazu Ugalde, CSIC contract post-doc
Charlotte Fillon, CSIC contract post-doc

David Martí, CSIC contract post-doc
Emilio Casciello, CSIC contract post-doc
Ignacio Marzan, CSIC contract post-doc
Juan Diego Martín, CSIC contract post-doc
Jan Globig, Marie Curie pre-doc
Siddique Akhtar, Marie Curie pre-doc
Alba Gil, FPI pre-doc
Lavinia Tunini, FPI pre-doc
Alberto Carballo, JAE pre-doc
Giovanni Cammani, JAE pre-doc
Beatriz Gaite, CSIC contract
Daniel Vázquez, CSIC contract
Israel Cruz, CSIC contract
Mar Moragas, CSIC contract
Marcel Cembrowski, CSIC contract
Sofía Casquero, CSIC contract
Vinyet Baqués, CSIC contract
Research outline

The multidisciplinary research 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 integrative 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 2013


Escuder-Viruete, J., P. Valverde-Vaquero, Y. Rojas-Agramonte, J. Jabites, and A. Pérez-Estaún (2013), From intra-oceanic subduction to arc accretion and arc-continent collision:


Research projects 2013

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:* 2011-2013
*PI:* R. Carbonell

Project Title: ATIZA – Caracterización del manto litosferico debajo de la cadena orogénica alpina a partir de métodos numéricos
*Financed by:* PNIDI-CGL - CGL2009-09662
*Years:* 2010-2013
*PI:* I. Jimenez Munt

Project Title: PROTAI – Procesos de colisión Arco-Continente en Taiwan
*Financed by:* PNIDI-CGL - CGL2009-11843
*Years:* 2010-2013
*PI:* D. Brown

Project Title: RIFISIS – Estructura sísmica de la corteza bajo la cordillera del Rif
*Financed by:* PNIDI-CGL - CGL2009-09727
*Years:* 2010-2013
*PI:* J. Gallart

Project Title: TECLA – Interacción entre la tectónica y el clima árido de sistemas orogénicos-Cuenca
*Financed by:* PNIDI-CGL - CGL2011-26670
*Years:* 2012-2014
*PI:* D. García-Castellanos

Project Title: TOPOIBERIA – Geociencias en Iberia: estudios integrados de topografía y evolución 4D
*Financed by:* PNIDI-CONSOLIDER - CSD2006-00041
*Years:* 2006-2013
*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 includes 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:* 2008-2013  
*PI:* J. Vergés

**Project Title:**
**Seguimiento geofísico del confinamiento geológico de CO₂**  
*Financed by:* REPSOL YPF, S.A.  
*Years:* 2010-2013  
*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:* A. Pérez-Estaún
Crystallography and Optical properties

Group members

- **Lluis Artús**, Group Leader – Senior Research Scientist
- **Ramon Cuscó**, Research Scientist
- **Jordi Ibañez**, Research Scientist
- **Nuria Domènech**, FPU pre-doc
- **Robert Oliva**, FPI pre-doc

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.
Publications 2013


Research projects 2013

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

Group members

José Luis Fernandez-Turiel, 
Group Leader - Senior Research Scientist
Ramón Julià, Research Professor (Ad-honorem)
Pere Anadón, Senior Research Scientist
Antonio Vazquez, Research Scientist
Rosa Utrilla, Research Scientist
Santiago Giralt, Research Scientist
Agustín Lobo, CSIC contract researcher
Juan Cruz Larrasoña, IGME 
Visiting Research Scientist
Miriam Gómez-Paccard, CSIC JAE-doc and Visiting Marie-Curie post-doc
Maria Jesús Rubio, FPI pre-doc
Guiomar Sánchez, JAE pre-doc
Alejandro Rodriguez, CSIC-contract
Maria Dolores Jimenez, CSIC-JAE Technician

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 re-cords;
- 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 2013


Research projects 2013

**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*

**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*

**PALEONAO - Evolución de la NAO durante los últimos 15000 años en la Península Ibérica y en Azores, a partir del estudio de registros lacustres y datos climáticos instrumentales**

*Financed by: PNIDI CGL - CGL2010-15767*
*Years: 2011-2013*
*PI: S. Giralt*
Geophysical and Geochemical Modelling of Geohazard Processes and Subsurface Resources

Group members

Joan Martí, Group Leader - Research Professor
Ignasi Queralt, Senior Research Scientist
Carles Soriano, Research Scientist
Maria José Jurado, Research Scientist
Adelina Geyer, JdIC post-doc
Marta Tarraga, JAE post-doc
Rosa María Sobradelo, CSIC contract post-doc
Stéphanie Barde-Cabusson, JAE post-doc
Helena Gallardo, FPI pre-doc
Raquel Noriega, FPI pre-doc
Dario Pedrazzi, JAE pre-doc
Stefania Bartolini, JAE pre-doc
Silvia Aragó, CSIC contract pre-doc
Xavier de Bolós, CSIC contract pre-doc
Sara Quesada, CSIC contract
Laura Becerril, 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.
ICTJA Research Groups

Geophysical and Geochemical Modelling of Geohazard Processes and Subsurface Resources

ANNUAL REPORT ICTJA 2013
Publications 2013


**Research projects 2013**

**National Funding Agencies**

**Project Title:** GEOSUB/2 - Investigación en proyectos de perforación del ICDP: Preparación de un nuevo proyecto  
*Financed by:* PNIDI-ACI - ACI2008-0773  
*Years:* 2009-2013  
*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 - CGLI22168-C03-01  
*Years:* 2011-2013  
*PI:* I. Queralt

**Project Title:** HIERRO-DOS - Interpretación de la fase de inestabilidad precursora de la erupción del Hierro 2011  
*Financed by:* PNIDI-CGL - CGL2011-16144-E  
*Years:* 2012-2013  
*PI:* M. Martí

**Project Title:** PEVOLDEC - Análisis de la peligrosidad volcánica de la isla de Decepción  
*Financed by:* PNIDI-CTM - CTM2011-13578-E  
*Years:* 2012-2013  
*PI:* A. Geyer
**Project Title:** PLUVOL - Understanding the plutonic-volcanic connection in supervolcanoes  
*Financed by:* PNIDI-CGL-CGL2010-22022-C02-02  
*Years:* 2011-2013  
*PI:* J. Martí

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

**Project Title:** Desarrollo de actividades de investigación del subsuelo mediante testificación geofísica  
*Financed by:* IGME  
*Years:* 2010-2013  
*PI:* M. J. Jurado

**Project Title:** Investigación del subsuelo mediante sondas geofísicas. Estudios entre sondeos y monitorización  
*Financed by:* CIUDEN  
*Years:* 2009-2012  
*PI:* M. J. Jurado

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

**Project Title:** Estudio geofísico para la caracterización de límites estructurales en Tenerife y la Palma (ESTEPA)  
*Financed by:* PNIDI-CGL2011-15139  
*Years:* 2013-2014  
*PI:* S. Barde-Cabusson and A. Geyer

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**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
Sodium chloride (NaCl), the main component of table salt, is the archetypical ionic compound of chemistry textbooks. The large electronegativity difference between the participating elements drives salt formation. Metallic sodium transfers electrons to chlorine, and the resulting positively and negatively charged ions are held together by electrostatic attraction—ionic bonds. At ambient conditions, NaCl crystallizes in the so-called rocksalt structure, a cubic array of Na and Cl atoms in equal proportions (1:1 stoichiometry) and with six-fold coordination.

With increasing pressure, a structural phase transition to the cubic, eight-fold coordinated NaCl-B2 phase is observed at ~30 GPa [(1) and references therein]. Theory suggested that complete metallization of NaCl should occur above ~300 GPa, and no Na-Cl compounds other than NaCl were known to exist. However, it has recently been shown that stable Na-Cl phases with stoichiometries different from 1:1 and intriguing properties can be synthesized in the lab with high-pressure techniques.

Reference
Correlation of magma evolution and geophysical monitoring during the 2011-2012 El Hierro (Canary Islands) submarine eruption

The application of petrography, mineral chemistry, geochemistry, and experimental petrology, including mineral–melt thermodynamic and diffusion modelling, on quenched basanitic magma samples from the recent (2011–2012) submarine eruption of El Hierro (Canary Islands) has permitted the identification of major physico-chemical variations prior to and during magma eruption that correlate in time with monitored geophysical changes. After nearly 3 months of seismic unrest the eruption of El Hierro started on October 10, 2011 and ended by late February 2012. We studied 10 lava balloons and pyroclastic fragments collected floating on the sea surface between October 15 and late January. Based on petrological and geophysical data we distinguish two main eruptive episodes. Magma erupted from the beginning of the eruption until late November 2011 was an evolved basanite (≈5 wt % MgO), changing to more primitive compositions (≈8–9 wt % MgO) with time, thus suggesting extraction from a compositionally zoned magma system.

Experimental data and mineral–melt thermodynamic modelling indicate that the erupted magma equilibrated at a pressure of about 400 MPa, which corresponds to a depth of 12–15 km. This depth is consistent with the location of the crust–mantle discontinuity beneath El Hierro and with the hypocentral location of seismicity during the unrest episode. Preliminary modelling of the olivine chemical zoning of crystals erupted in this first episode suggests that the time scale for basanite fractionation and magma replenishment in the shallower reservoir was of the order of a few months. This is within the same time frame as the duration of the unrest episode preceding
the eruption. The first eruption episode coincided with intense seismicity mostly located north of the island, first at a depth of 20–25 km and a few days later also at 10–15 km depth, with strong seismic tremor beneath the vent site. An abrupt change in magma composition and crystal content was observed at the end of November 2011. After that, more primitive and less viscous magma erupted contemporaneously with a change in the frequency and intensity of seismic events. During this period, seismicity was mostly north of the island at depths of 10–15 km. At the same time the tremor intensity at the eruption site significantly dropped. This marked the onset of the second eruption episode, which is correlated with an intrusion of fresh, more primitive magma into the shallow magmatic system that raised the temperature of the remaining magma. Experiments reveal that subtle changes in temperature of about 50°C (i.e. 1100–1150°C) were enough to produce large changes in the crystal content (10–60 wt %). This non-linear behavior between crystal content and temperature had important effects on magma dynamics during transport and cooling. Our results suggest the existence of two interconnected mafic magma reservoirs during the El Hierro eruption, which agrees with the pattern shown by the seismicity. Stress readjustments of the plumbing system, caused by decompression during the eruption, influenced the thermodynamic evolution of the erupting magma and facilitated the intrusion of the deeper magma into the shallow reservoir, thus forcing a change in its rheological characteristics and eruption dynamics.

Reference

In the present study, and taking into account the microanalytical capability of total reflection X-ray spectrometry (TXRF), we explored the possibilities of hollow fibre liquid-phase microextraction (HF-LPME) and dispersive liquid-liquid microextraction (DLLME) combined with TXRF for the determination of low amounts of inorganic Sb species in waters. For each of the LPME configurations aforementioned, experimental parameters affecting Sb extraction but especially the proper sample preparation process (deposition volume on the reflective carrier and drying mode) and measurement conditions for subsequent TXRF analysis have been carefully evaluated.

The best analytical strategy for the determination of Sb(III) and Sb(V) in the low micrograms L(-1) range was found to be the application of the DLLME mode before TXRF analysis. The developed methodology was successfully applied to the determination of inorganic Sb speciation in different types of spiked water samples.

Reference

Marguí, E., Sagué, M., Queralt, I., Hidalgo. Analytica Chimica Acta. DOI: 10.1016/j.aca.2013.05.006.
Evidence for slab rollback in westernmost Mediterranean from improved upper mantle imaging

We image the western Mediterranean upper mantle with improved resolution through the use of a large teleseismic dataset, a crustal velocity structure derived from surface wave modeling iterative 3-D ray tracing and finite-frequency kernels. Our main conclusions are:

1. The dominant upper mantle feature is the 4–5% high-velocity, slab-like structure shown in. This structure is connected to the surface and extends to the bottom of the transition zone.

2. Its form, when restored to the surface, fills the area occupied by the Alpine Tethys ocean lithosphere and embedded continental Alborán domain at 30 Ma.

3. We interpret the high-velocity structure as a slab of lithosphere composed of subducted Alborán mantle lithosphere and the surrounding Alpine Tethys ocean lithosphere.

4. This lithosphere is thought to have been subducted during ~30 m.y. of generally
westdirected subduction rollback, which continued beneath the Alborán domain by delaminating its mantle lithosphere.

5. A more drip-like delamination of the Middle Atlas mantle lithosphere may be evidenced by the irregular but pronounced zone of low velocities beneath these mountains at 50–125 km depth and an underlying high-velocity body at –400–500 km depth.

Reference

The oldest human fossil in Europe, from Orce (Spain)

The Orce region has one of the best late Pliocene and early Pleistocene continental paleobiological records of Europe. It is situated in the northeastern sector of the intramontane Guadix-Baza Basin (Granada, Andalusia, southern Spain). Here we describe a new fossil hominin tooth from the site of Barranco León, dated between 1.02 and 1.73 Ma (millions of years ago) by Electron Spin Resonance (ESR), which, in combination with paleomagnetic and biochronologic data, is estimated to be close to 1.4 Ma.

While the range of dates obtained from these various methods overlaps with those published for the Sima del Elefante hominin locality (1.2 Ma), the overwhelming majority of evidence points to an older age. Thus, at the moment, the Barranco León hominin is the oldest from Western Europe.

Reference


DOI: 10.1016/J.JHEVOL.2013.01.012.
Climate, catchment runoff and limnological drivers of carbon and oxygen isotope composition of diatom frustules from the central Andean Altiplano during the Lateglacial and Early Holocene

Diatom-based carbon and oxygen isotope analyses ($\delta^{13}C_{\text{diatom}}$ and $\delta^{18}O_{\text{diatom}}$) were performed on diatom-rich laminated sediments of Lake Chungará (Andean Altiplano, northern Chile) deposited during the Lateglacial and Early Holocene (12,400–8300 cal years BP) to reconstruct climate change and environmental response across this major climate transition. The $\delta^{13}C_{\text{diatom}}$ data show both centennial-to-millennial scale changes related to fluctuations in lake productivity and CO$_2$ concentration in the lake water, and variations in carbon sources to the lake through time. The $\delta^{18}O_{\text{diatom}}$ data reflect changes in lake hydrology and climate.

The combination of $\delta^{13}C_{\text{diatom}}$ and $\delta^{18}O_{\text{diatom}}$ data reveals interactions between the internal lake processes and its catchment runoff. During wet periods (low $\delta^{18}O_{\text{diatom}}$ values) $\delta^{13}C_{\text{diatom}}$ indicates an enhanced contribution of allochthonous carbon, whereas during dry periods (high $\delta^{18}O_{\text{diatom}}$) $\delta^{13}C_{\text{diatom}}$ values suggest more autochthonous carbon production and recycling.

These decadal-to-centennial oscillations are not recognized after 10,000 cal years BP, possibly as a result of ENSO-like phenomenon weakening. Humid conditions during the Lateglacial–Early Holocene transition (12,400–10,100 cal years BP) were possibly due to the establishment of
La Niña-like conditions in the tropical South Pacific. Whereas, dry conditions in the Early Holocene (10,100–9100 cal years BP) may be caused by the northward migration of the ITCZ due to both ENSO-like weakening and an insolation minimum. Finally, a return to humid conditions at the end of the Early Holocene (9100–8300 cal years BP) is coincident with an increase in summer insolation.

Reference

Vegetation changes and human settlement of Easter Island during the last millennia: A multiproxy study of the Lake Raraku sediments

Earlier palynological studies of lake sediments from Easter Island suggest that the island underwent a recent and abrupt replacement of palm-dominated forests by grasslands, interpreted as a deforestation by indigenous people. However, the available evidence is inconclusive due to the existence of extended hiatuses and ambiguous chronological frameworks in most of the sedimentary sequences studied. This has given rise to an ongoing debate about the timing and causes of the assumed ecological degradation and cultural breakdown. Our multiproxy study of a core recovered from Lake Raraku highlights the vegetation dynamics and environmental shifts in the catchment and its surroundings during the late Holocene.

The sequence contains shorter hiatuses than in previously recovered cores and provides a more continuous history of environmental changes. The results show a long, gradual and stepped landscape shift from palm-dominated forests to grasslands. This change started c. 450 BC and lasted about two thousand years. The presence of Verbena litoralis, a common weed, which is associated with human activities in the pollen record, the significant correlation between shifts in charcoal influx, and the dominant pollen types suggest human disturbance of the vegetation. Therefore, human settlement on the island occurred c. 450 BC, some 1500 years earlier than is assumed.
Climate variability also exerted a major influence on environmental changes. Two sedimentary gaps in the record are interpreted as periods of droughts that could have prevented peat growth and favoured its erosion during the Medieval Climate Anomaly and the Little Ice Age, respectively. At c. AD 1200, the water table rose and the former Raraku mire turned into a shallow lake, suggesting higher precipitation/evaporation rates coeval with a cooler and wetter Pan-Pacific AD 1300 event. Pollen and diatom records show large vegetation changes due to human activities c. AD 1200.

Other recent vegetation changes also due to human activities entail the introduction of taxa (e.g. *Psidium guajava*, *Eucalyptus* sp.) and the disappearance of indigenous plants such as *Sophora toromiro* during the two last centuries. Although the evidence is not conclusive, the American origin of *V. litoralis* re-opens the debate about the possible role of Amerindians in the human colonisation of Easter Island.

**Reference**

Electrical resistivity tomography revealing the internal structure of monogenetic volcanoes

Eruptive activity of individual monogenetic volcanoes usually lasts a few days or weeks. However, their short lifetime does not always mean that their dynamics and structure are simple. Monogenetic cones construction is rarely witnessed from the beginning to the end, and conditions for observing their internal structure are hardly reached. We provide high-resolution electrical resistivity sections (10 m electrode spacing) of three monogenetic cones from northeastern Spain, comparing our results to geological observations to interpret their underground continuation. The 100 m maximum depth of exploration provides information on almost the entire edifices, highlighting the relationships between Strombolian and hydromagmatic deposits in two multiphase edifices. A main observation is a column of distinct resistivity centered on the Puig d’Adri volcano, which we interpret as the eruptive conduit. This method can provide valuable information on the past volcanic dynamics of monogenetic volcanic fields, which has real implications for the forecast of future activity.

Reference
Contrasting exhumation P-T paths followed by high-P rocks in the northern Caribbean subduction-accretionary complex: Insights from the structural geology, microtextures and equilibrium assemblage diagrams

The Río San Juan metamorphic complex exposes a segment of a high-pressure subduction-accretionary complex built during convergence between the Caribbean island arc and the North America continental margin. It is composed of accreted arc and oceanic-derived metaigneous rocks, serpentinized peridotites and minor metasediments forming a structural pile. Combined structural geology, microtextural relations, multi-equilibrium calculations and thermodynamical modelling, together with published isotopic ages, allow reconstructing the metamorphic P-T-t paths of each nappe/unit and their links to the structural evolution. In all units of the complex, three major stages (M1 to M3) in the tectonothermal evolution have been distinguished. The M1 stage corresponds to the prograde evolution towards the pressure peak of metamorphism under blueschist or eclogite-facies conditions.

The M2 stage is related to the main retrogressive event and is characterized by the S2-L2 fabric development in all lithologies and at all scales. The M3 stage represents continuous exhumation from ductile to ductile-brittle deformation regimes. However, the shape of the retrograde P-T path, the age of the exhumation-related D2 structures and the tectonic significance of D2 deformation are different in each structural unit. In the upper structural levels of the Río San Juan Complex, the counter-clockwise P-T path of the eclogite blocks is typical of rocks exhumed in the early stages of intra-oceanic subduction zones. The clockwise P-T path obtained for the lower Cuaba unit is characterized by a strong isothermal decompression from the garnet-epidote amphibolite and eclogite-
facies pressure-peak. This P-T evolution can be explained by rapid exhumation caused by extensional tectonics, in relation to a major modification of convergence conditions across the subduction zone. The P-T path also explains local syn-M2 partial melting processes, because it crosses the wet solidus for IAT mafic compositions. The P-T path obtained for the high-P Guineal Schists, with exhumation trajectory following the burial trajectory, can be related to exhumation during active subduction. This exhumation was most likely driven by a combination of underthrusting of tectonic units and erosion processes. Available geochronological data and T-t/P-t estimates reveal a Late Campanian to Maastrichtian retrograde M2 metamorphism in the lower structural units of the complex during a consistent D2 top-to-the-NE/ENE tectonic transport. A similar tectonic transport has also been recognized in the metasedimentary nappes of the Samaná complex during Eocene to earliest Miocene. These relations indicate a northeastward progradation of deformation during the successive tectonic incorporation of arc, oceanic and continental-derived terrains to the developing Caribbean subduction-accretionary complex.

Reference
Escuder-Viruete, J. and Pérez-Estaún, A. DOI: 10.1016/J.LITHOS.2012.11.028
High-pressure lattice dynamics in wurtzite and rocksalt indium nitride investigated by means of Raman spectroscopy

We present an experimental and theoretical lattice-dynamical study of InN at high hydrostatic pressures. We perform Raman scattering measurements on five InN epilayers, with different residual strain and free electron concentrations. The experimental results are analyzed in terms of ab initio lattice-dynamical calculations on both wurtzite InN (w-InN) and rocksalt InN (rs-InN) as a function of pressure. Experimental and theoretical pressure coefficients of the optical modes in w-InN are compared, and the role of residual strain on the measured pressure coefficients is analyzed. In the case of the LO band, we analyze and discuss its pressure behavior considering the double-resonance mechanism responsible for the selective excitation of LO phonons with large wave vectors in w-InN. The pressure behavior of the L-coupled mode observed in a heavily doped n-type
sample allows us to estimate the pressure dependence of the electron effective mass in w-InN. The results thus obtained are in good agreement with k•p theory. The wurtzite-to-rocksalt phase transition on the upstroke cycle and the rocksalt-to-wurtzite backtransition on the downstroke cycle are investigated, and the Raman spectra of both phases are interpreted in terms of DFT lattice-dynamical calculations.

Reference
Ibáñez, J.; Oliva, R.; Manjón, F.J.; Segura, A.; Yamaguchi, T.; Nanishi, Y.; Cuscó, R.; Artús, L.
DOI: 10.1103/PHYSREVB.88.115202.
# Theses, Seminars and Courses

## Theses

<table>
<thead>
<tr>
<th>Title:</th>
<th>Análisis y aplicaciones del ruido sísmico en México, Golfo de México y Caribe: tomografía de ondas superficiales Rayleigh y Love.</th>
</tr>
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<tbody>
<tr>
<td>PhD Student:</td>
<td>Beatriz GAITE CASTRILLO</td>
</tr>
<tr>
<td>Phd Advisor:</td>
<td>Antonio VILLASEÑOR</td>
</tr>
<tr>
<td>Place &amp; date:</td>
<td>Madrid – 07/2013</td>
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<th>Title:</th>
<th>Novel technique to detect seismic signals and its application to map upper-mantle discontinuities beneath Iberia.</th>
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<tr>
<td>PhD Student:</td>
<td>Anahí LUCIANA BONATTO</td>
</tr>
<tr>
<td>Phd Advisor:</td>
<td>Martin SCHIMMEL</td>
</tr>
<tr>
<td>Place &amp; date:</td>
<td>Barcelona – 11/2013</td>
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<th>Title:</th>
<th>The explosive volcanism of Teide-Pico Viejo volcanic complex, Canary island.</th>
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<tr>
<td>PhD Student:</td>
<td>Olaya GARCÍA PÉREZ</td>
</tr>
<tr>
<td>Phd Advisor:</td>
<td>Joan MARTÍ</td>
</tr>
<tr>
<td>Place &amp; date:</td>
<td>Barcelona – 11/2013</td>
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## Seminars

ICTJA has co-organized in collaboration with the Faculty of Geology of the University of Barcelona about 20 specialized seminars, conferences and lectures during the year 2013. Among them we would like to highlight:
21/01
"Topographic evolution of the East African Plateau", Dr. Henry Wichura, Universitat de Postdam, Germany.

11/04
"Catastrophes in the Crust: Forecasting Volcanic Eruptions and Giant Landslides", Dr. Christopher Kilburn, University College London, UK.

18/04
"Anticipating the news: Global ShakeMap & PAGER earthquake rapid response system", Dr. Daniel García Jiménez, USGS/GEM External Consultant

08/05
"Recent innovative geophysics techniques applied to defining geology under cover -a global perspective", Dr. D. FitzGerald, Intrepid Geophysics, Victoria, Austràlia.

25/06
"Sismicidad en el Golfo de México: Un análisis preliminar", Dra. Sara Ivonne Franco, Instituto de Geofísica, Universidad Nacional Autónoma de México (UNAM).

27/06
"Geological contribution to seismic hazard assessment for nuclear facilities (NFs)", Dr. Stéphane Baize, Institut de Radioprotection et Sûreté Nucléaire, França.

17/09
"Fluids in the Earth’s interior: from geochemical cycles to super-volcano eruptions", Dr. Carmen Sanchez-Valle, Inst. Geochemistry and Petrology, ETH Zurich, Switzerland

20/09
"Yacimientos españoles de estaño asociados a intrusiones graníticas hercínicas", Dr. José Mangas Universidad de Las Palmas de Gran Canaria. Co-organized together with WORKSHOP ON MINERAL DEPOSITS RELATED TO ACID MAGMATISM. SGA Barcelona Student Chapter

08/10
"Two-dimensional probabilistic inversion of plane-wave electromagnetic data: Methodology, model constraints and joint inversion with electrical resistivity data", Dr. Niklas Linde, Centre de Recherches en Environment Terrestre, Faculté des Géosciences et de l’environnement, Université de Lausanne, Switzerland.

18/10
"Mantle, ocean crust and seawater: where are we, and what’s next in Scientific Drilling", Dr. Benoît Ildefons, ECORD Distinguished Lecturer 2013, Géosciences Montpellier, CNRS/Université Montpellier 2, France.

07/11
"Relative contribution of tectonic inheritance and far field forces on the building of Paleozoic European crust", Karel Schulmann, Institut de Physique du Globe, Université de Strasbourg, France.
12/11
"Magnetotelluric studies in Brazil: Source effects and some application examples", a càrrec de Antonio Lopes Padilha, Instituto Nacional de Pesquisas Espaciais, São Jose de Campos, São Paulo, Brasil

14/11
"Quantitative thinking under the volcano: A special marriage among rocks, numbers and experiments to advance the knowledge of volcanic processes", Antonio M. Álvarez Valero, Departamento de Geología, Facultad de Ciencias, Universidad de Salamanca

20/11
"Geociència, Art, Wikipedia: contribuïnt amb il·lustracions lliures. Iniciativa wikiArS", David Gómez Fontanills i Daniel Garcia-Castellanos (ICTJA)

21/11
"Evolución geodinámica paleozoica del margen sudoccidental del Gondwana: El basamento de los Andes Centrales", Prof. Dra. Graciela I. Vujovich, Instituto de Estudios Andinos “Don Pablo Groeber” (IDEAN), Universidad de Buenos Aires; Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina

26/11
"Exhumation and interactions between a mountain range and its foreland basin: thermochronology and numerical modeling of the Cenozoic Southern Pyrenees", Charlotte Fillon. ICTJA-CSIC

4/12
"Restitución 3D de estructuras complejas, paleomagnetismo y scanner de rayos X", Emilio L. Pueyo Instituto Geológico y Minero de España, Unidad de Zaragoza; Geología Estructural, Dpto. Ciencias de la Tierra, Universidad de Zaragoza

13/12
"Un paleontólogo en la Administración: 20 años de gestión de yacimientos y colecciones fósiles en la Región de Murcia", Gregorio Romero Sánchez, Servicio de Patrimonio Histórico, Dirección General de Cultura, Consejería de Educación y Cultura de la Región de Murcia

Courses
Course: **Curso Teórico-Práctico de Difracción de Rayos X en Polvo 2013**
Date: **May, 27-28, 2013**
Location: **ICTJA-CSIC, Barcelona**

Course: **Curso Teórico Prácticode ICP-MS 2013**
Date: **May, 29-31, 2013**
Location: **ICTJA-CSIC, Barcelona**

Course: **Curso Internacional de Vulcanología**
Date: **October, 14-27, 2013**
Location: **Girona**

Course: **Què podem aprendre d’un sismograma?**
Date: **December, 11, 2013, 16:00-19:00**
Location: **ICTJA-CSIC, Barcelona**
Editorial and Assessment activities

Editorial

Editors-in-Chief
J. Martí: Journal of Volcanology and Geothermal Research
J. Alvarez-Marrón: Geologica Acta

Editorial activities:
D. Brown: Geological Society of America
D. Brown: Journal of Asian Earth Sciences
D. Brown: Solid Earth
R. Carbonell: Tectonophysics
P. Anadón: Geologica Acta

International Committees & Collaboration

Committees


IUGG Commission – GRC: Joan Martí. Member of the Executive Committee of the IUGG Commission on Geophysical Risk and Sustainability (GRC).

European Geosciences Union: Daniel García-Castellanos. Member of the Program Committee for the “Tectonics and Structural Geology división”.

IAL: Pere Anadón. Member of the Board of Directors. International Association of Limnogeology.

Collaboration

Invited scientists


ICDP Science Conference 2013: **Maria José Jurado (Invited speaker)**. ICDP Conference “Imaging the Past to Imagine our Future”. Postdam, 11-14 November.

JAMSTEC-Japan: **Maria José Jurado (Invited Scientist)**. Chief Scientist of geophysical logging at Chikyu IODP 348 Expedition – NanTroSEIZE. December.

**Invited talks**

D. García-Castellanos: Opening of the Scholar Year of the Faculty of Geology. “La gigantesca salina Mediterránea de la crisis messiniense”. University of Barcelona.


The assessment of the probable spatial distribution of new eruptions is useful to manage and reduce the volcanic risk. It can be achieved in different ways, but it becomes especially hard when dealing with volcanic areas less studied, poorly monitored and characterized by a low frequent activity, as El Hierro. Even though it is the youngest of the Canary Islands, before the 2011 eruption in the “Las Calmas Sea”, El Hierro had been the least studied volcanic island of the Canaries, with more historically devoted attention to La Palma, Tenerife and Lanzarote. We propose a probabilistic method to build the susceptibility map of El Hierro, i.e. the spatial distribution of vent opening for future eruptions, based on the mathematical analysis of the volcano-structural data collected mostly on the island and, secondly, on the submerged part of the volcano, up to a distance of _10-20 km from the coast.

The volcano-structural data were collected through new fieldwork measurements, bathymetric information, and analysis of geological maps, orthophotos and aerial photographs. They have been divided in different datasets and converted into separate and weighted probability density functions, which were then included in a non homogeneous Poisson process to produce the volcanic susceptibility map. Future eruptive events on El Hierro is mainly concentrated on the rifts zones, extending also beyond the shoreline. The major probabilities to host new eruptions are located on the distal parts of the South and West rifts, with the highest probability reached in the south-western area of the West rift. High probabilities are also observed in the Northeast and South rifts, and the submarine parts of the rifts. This map represents the first effort to deal with the volcanic hazard at El Hierro and can be a support tool for decision makers in land planning, emergency plans and civil defence actions.

**Reference**


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**InGaN alloys** have generated a growing interest for photovoltaic applications, as their band gap can be tuned to cover the full solar spectrum and they show a remarkable resistance to irradiation. This makes InGaN an attractive material system for outer space solar cell applications. Moreover, owing to the higher ionicity of
the bonds and dynamical annealing, GaN is extremely resistant to amorphization. Raman scattering is a powerful tool to characterize structural damage in irradiated crystals. With above band-gap excitation, higher order multiphonon scattering is strongly enhanced by impurity-induced Fröhlich interaction. Whereas close to resonance the strong photoluminescence (PL) signal in pure crystals prevents the clear observation of multiphonon peaks, PL quenching by high-fluence ion-beam irradiation makes it possible to study the multiphonon Raman peaks in implanted samples.

In this work we present a Raman scattering study of multiphonons in InGaN alloys with In content ranging from 17% to 42% using near-resonance visible excitation (514.5 nm) and above band-gap UV excitation (325 nm). The InGaN epilayers were grown by plasma-assisted MBE on sapphire substrates with a GaN buffer. The epilayers were implanted with He ions at 40, 88 and 180 keV with total fluences ranging from 7.5E12 to 1.9E15 cm-2 to produce a homogeneous damage profile over the whole layer. The free electron density and the optical properties of the samples were characterized before and after implantation by means of Hall measurements, PL and optical absorption. In the alloys with higher In composition the electron density increases with irradiation as expected from the location of the Fermi stabilization energy above the conduction band edge. The irradiation effects are corroborated by the shifts in the PL peak and absorption edge. For the highest fluences the generation of trapping defects reverses this trend. Outgoing resonance conditions occur for the InGaN layer with [In]=24% under 514.5 nm excitation. This sample exhibits a one order of magnitude increase of the LO intensity. Upon implantation, both the PL and the LO intensities markedly decrease but up to 4LO scattering can be detected. In the implanted samples the LO peak shows a downshift and an asymmetric broadening which reflects the implantation damage. The higher order multiphonon peaks display frequencies in good agreement with the multiples of the LO frequency. The multiphonon Raman peaks exhibit a substantial asymmetric broadening at the low frequency side, which suggests the participation of large wave-vector phonons in the multiple scattering. The Raman spectra obtained with UV excitation show the typical multiphonon cascade peaks up to 5LO as well as E2+2nLO combinations. The same intensity ratios between successive order peaks are observed for all alloy compositions. The LO/E2 and 2LO/1LO intensity ratios are shown to be sensitive indicators of the irradiation induced damage.

Reference

Outreach Activities

EXPOMINER-2013  November, 14-16
“The 2013 Expominer and Colecciona edition turn Barcelona into a collector’s heaven”

ICTJA has been involved in EXPOMINER both giving advice and actively organizing seminars and workshops. Dr. Ignasi Queralt has been a member of the Advisory Board since 1992 and ICTJA personnel has been actively participating in the section “Living Geology”.
EspaiCiència – 2013  March, 13-17

"Thousands of young people got advice at the fair"

Over 65,000 students, relatives and teachers visited the Saló de l’Ensenyament.

GEOflaix! – 2013

Geoflax! 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!

GEOflaix! is co-organized by the Faculty of Geology of the University of Barcelona, the Institute of Earth Sciences Jaume Almera and the former Institute of Geology of Catalonia of the Generalitat de Catalunya.
WikiArS – 2013

During the Week of Science (“Setmana de la Ciència”) the Wikimedia grantee David Gómez and Daniel García-Castellanos (ICTJA-CSIC) gave a joint conference together with a poster display of illustrations related to the project wikiArS.wikiArS is a pioneer initiative that brings together the Academy and Arts schools into the Wikimedia movement’s projects (Wikipedia, Wiktionary, Commons repository, etc) by contributing scientific illustrations that make human knowledge accessible to everyone.

wikiArS is designed to be useful to students in learning arts skills as well as providing images and content to the Wikipedia and to other free-culture projects.
ICTJA in numbers

Funding (2013 Public & Private Funding)

- Services 66,110 (6%)
- Competitive Public Funds 333,840 (31%)
- R+D Industry 661,140 (61%)
- Public Sector Agreements 16,000 (2%)
Publications

Evolutions SCI Publications (Total 522)

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