

Technological Services Catalogue 2010

Instituto Geológico y Minero de España (IGME)
Geological Survey of Spain (IGME)



TECHNOLOGICAL SERVICES
CATALOGUE 2010

Instituto Geológico y Minero de España
(IGME)
Geological Survey of Spain
(IGME)

© GEOLOGICAL SURVEY OF SPAIN

c/ Ríos Rosas, 23, 28003 Madrid

Tel.: +34 91 349 57 00. Fax: +34 91 442 62 16

Realization and Composition: Transfer Office of Research Results

<http://www.igme.es/>

INDEX

INTRODUCTION.....	5
RESEARCH LINES	
Geoscientific mapping	9
Geodiversity, geological-mining heritage and scientific culture	17
Geology of the subsoil and geological storage of CO ₂	27
Hydrogeology and environmental quality	31
Mineral resources and environmental impact of mining	39
Geological risks, active processes and global change	45
Geoscientific information systems	51
LABORATORY	57
INDUSTRIAL AND INTELLECTUAL PROPERTY.....	71
PRODUCTS, FACILITIES, ACTIVITIES AND STANDARD SERVICES –	
RETAIL PRICES	75
IGME – GENERAL DATA	86

INTRODUCTION

The purpose of the Spanish Geological Survey (IGME) is to provide the Spanish Government, the regional assemblies and society in general, on request, the knowledge and information required concerning geological science and technology for all activities to be carried out within Spain (Royal Decree 1134/2007 of 31 August, amending the Statutes of the IGME, approved by Royal Decree 1953/2000, of 1 December).

This is made specific in the creation, application and diffusion of geoscientific knowledge regarding the land surface, its environmental conservation, the risks arising and the available natural resources impacting on the economy and welfare of Spanish society as a whole.

The IGME, as well as its central headquarters in Madrid and the Tres Cantos building, currently has 13 Project Offices in Spain, which facilitate the territorial presence of the IGME's activity. These play a double role: on the one hand, they bring the organization closer to the regions and, on the other, they carry out geoscientific work through the projects that are approved and implemented. The distribution of these Offices has arisen in accordance with the demand corresponding to each Autonomous Community (region) in Spain; at present, the IGME has:

- ▶ 3 in Andalusia (Sevilla, Granada, y Almería)
- ▶ 2 in the Levante region (Valencia and Murcia)
- ▶ 2 in the centre (Salamanca and León)
- ▶ 2 in the north, (Oviedo and Santiago de Compostela)
- ▶ 1 in Aragón (Zaragoza)
- ▶ 1 in the Balearic Islands (Palma de Mallorca)
- ▶ 1 in the Canary Islands.(Las Palmas de Gran Canaria)

As well as the Project Offices, the IGME has a Drill Core Repository, a Library, Laboratories and a Geomining Museum.

The functions of the IGME's Office for the Transfer of Research Results (OTRI) include the following:

- ▶ Identifying the results produced by research groups.
- ▶ Extending the IGME's scientific knowledge.

- ▶ Evaluating its potential for knowledge transfer and diffusion to other organizations and to society as a whole.

In this second edition of the Catalogue, for 2008-2009, revised and enlarged by the OTRI, improvements have been introduced regarding the number of activities detailed in the first edition. As before, a brief description is provided of the scientific and technological knowledge acquired by the IGME from the various projects and activities carried out.

Much of this knowledge contributes to the specialised, exclusive nature of the IGME's skills in specific areas of Earth Sciences, making it a focal point of reference.

This technological catalogue is intended for the scientific community, companies, technological centres and other interested bodies, to illustrate the scientific and technological capabilities possessed by the IGME and which it can communicate.

None of this would have been possible without our personnel, skilled in the use of complex techniques, and our high-level research groups.

We hope this Catalogue will be of use and that it will contribute to disseminating the IGME's role in the chain of technology transfer, thus enabling greater future collaboration with other agencies involved in research, development and technological innovation.

GEOSCIENTIFIC MAPPING

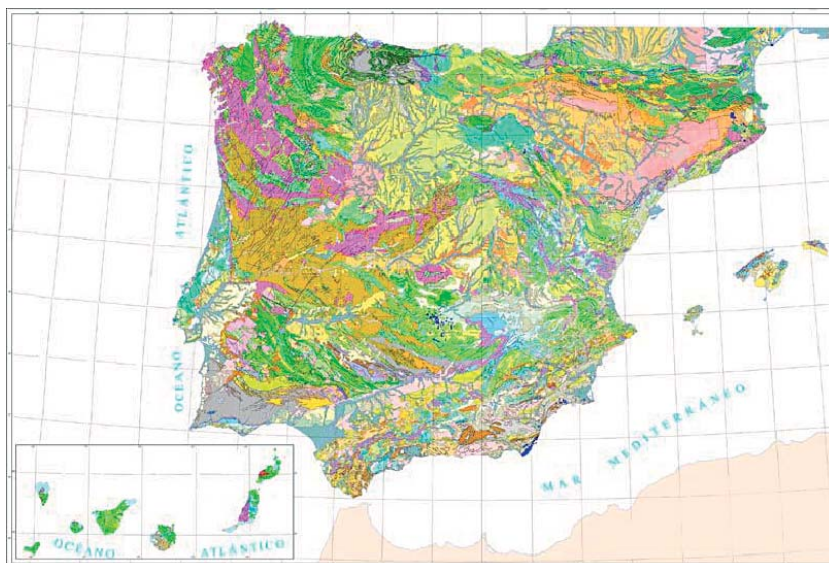
GEOSCIENTIFIC MAPPING

Recognition and study of geological processes and materials in Spain and its exclusive maritime economic zone, as well as the infrastructure necessary for a rational use of the land and its resources; the development of research lines regarding the exploration, treatment and assessment of geological resources, viewed as an element of development. Production of geoscientific maps; geological land mapping (Action Plan for the National Geological Map, MAGNA; Continuous Geological Mapping Plan, GEODE); geological mapping of the continental shelf (Plan GEODMAR); geomorphological mapping of active processes; geological risk mapping (Plan PRIGEO); mapping of mineral resources

(map of industrial rocks and minerals, metallogenetic maps); hydrogeological mapping; as well as geochemical, geophysical, soil mapping, etc.

EQUIPMENT

- Remote sensing laboratory (PCI image processing programs, installed on an HP 735/99 Workstation with 48 MB RAM and 2 GB hard-drive memory, and ERDAS for PC.
- HP 7600 Plotter
- Phocus camera.
- Hardware and peripherals (plotter, digitizing table, colour printers, etc.).
- Software developed for geophysical studies, for digital filtering, continuation of potential fields,



National Geological Map

GEOSCIENTIFIC MAPPING

polynomial fitting by least squares, reduction to pole of the total intensity values of the magnetic field.

- Commercial software for graphic image processing (Arc/Info, CPS/PC (Radian) SURFER (Golden Graphics), UNIMAP, RTI (Geopak).
- Il-951 Atomic absorption spectrophotometer, with cold vapour and graphite chamber accessories.

SERVICES

- Basic geological mapping: continental, marine
- Geothematic mapping
- Geotechnical mapping
- Regional geological studies
- Stratigraphic correlations and dating
- Hydrogeological mapping
- Metallogenetic mapping and the mapping of industrial rocks and minerals
- Regional geochemical exploration and mapping
- Inventories of mineral resources
- Characterization and evaluation of mineralizations
- Modelling of deposits
- Development of databases of mineral resources
- Regional studies of mining potential
- Methodological studies of mining prospection
- Economic analysis of mineral resources
- Geophysical mapping
- Deep-level geophysical testing
- Remote sensing and geophysical studies

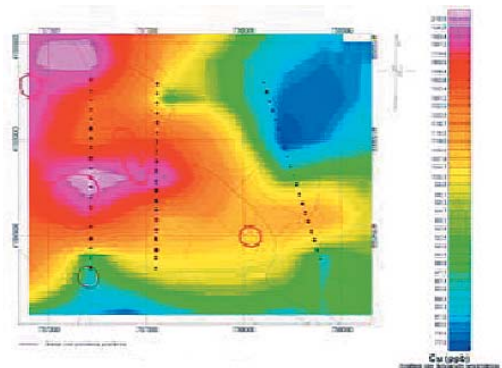
- Hydrogeology

APPLICATION

- Geological infrastructure

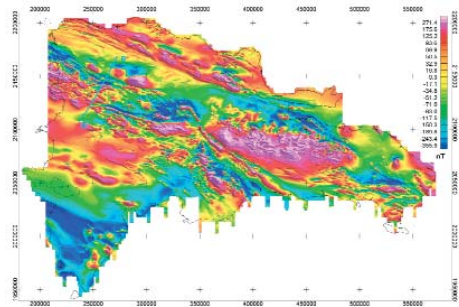
ACTIVITIES

- **Mapping of mineral resources; Metallogenetics and Geochemical Mapping:** Thematic mapping linked to mineral resources, due to its infrastructure-based nature, constitutes a fundamental, essential tool for knowledge of a territory and its mining potential. Multielemental geochemical mapping in the field of mineral resources constitutes the most appropriate technique for the direct identification and evaluation of anomalies concerning mineralizations and/or metallogenetically significant structures.
- **Mapping of Geological Risks:** This activity encompasses various fields,



such as landslides, flooding, seismicity, erosion, etc. This mapping is fundamental for authorities and technical experts to be able to make appropriate decisions on questions in their domain, such as in drafting laws and regulations, in land management, civil defence and the prevention of catastrophes. Hazard mapping studies include such as geotechnical maps, maps of natural hazards and of vulnerability in cities and municipal areas, as well as studies of hazards and natural dangers at a regional level.

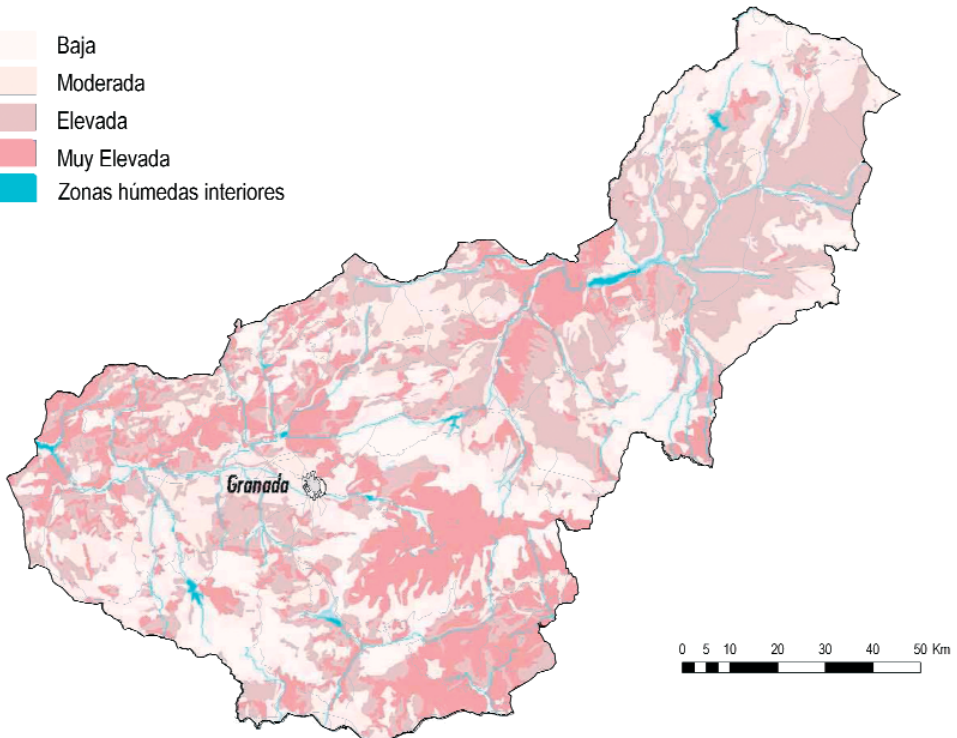
Geophysical mapping and databases. Methodological research and development. Remote sensing studies.



Geoscientific mapping. Map of magnetic fields

• **Geophysics and remote sensing:**
Geophysical backup studies.

- Baja
- Moderada
- Elevada
- Muy Elevada
- Zonas húmedas interiores



Hazard map of the province of Granada

GEOSCIENTIFIC MAPPING

• **Hydrogeological mapping.** Hydrogeological mapping seeks to represent all the characteristics and phenomena related to groundwater and surface water, regarding the water-land interaction, in diverse aspects, including the quantity, quality and use made of water, geodynamic processes that occur within the medium and the protection of the environment.



• **Geological infrastructure:** Geological mapping and the fundamental studies on which it is based (stratigraphic, petrographic, sedimentological, remote sensing, etc.) provide



Hydrogeological map

the basic knowledge and infrastructure necessary for the exploration, investigation and evaluation of geological resources:

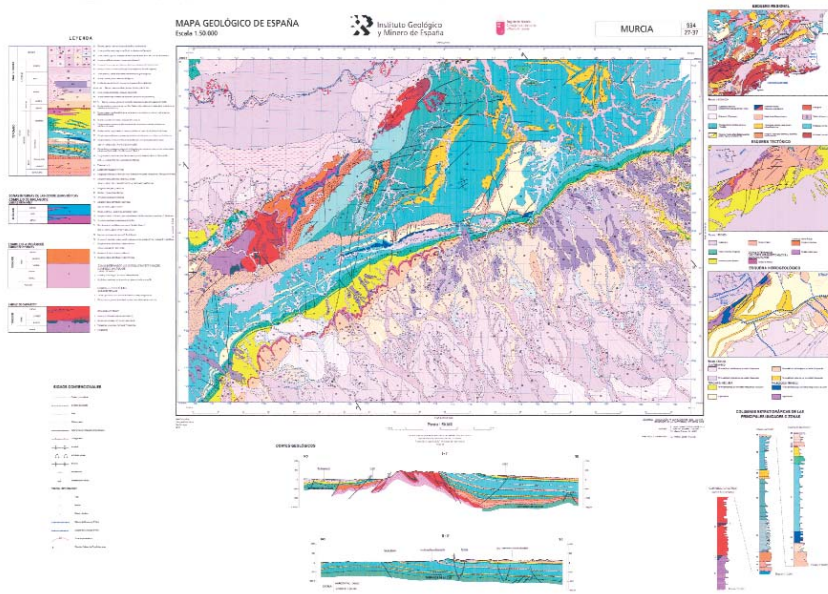
- Terrestrial geological mapping
- Geomorphological mapping
- Geological and marine mapping

• **Geological research and studies:**

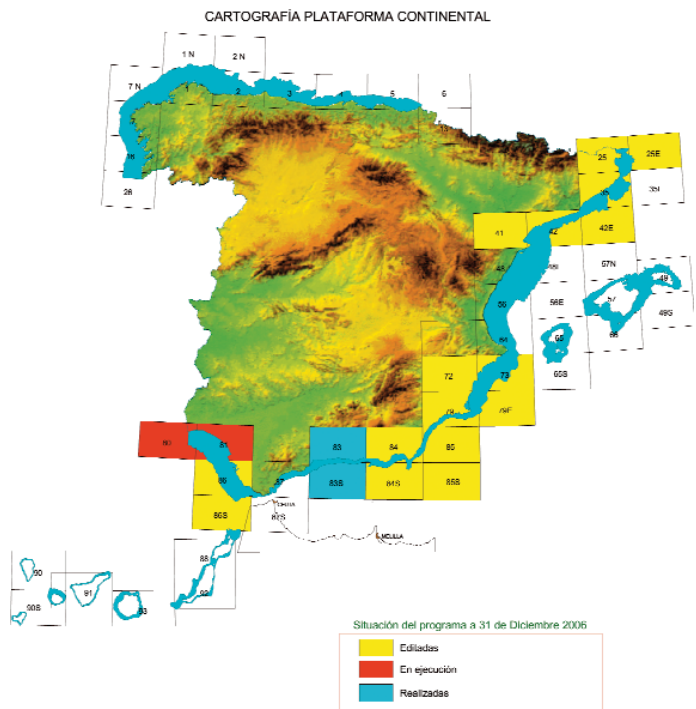
- Stratigraphic correlation and of geological events
- Geologically active processes
- Geoindicators and palaeoclimatic records
- Studies of marine and Antarctic geology
- Geological surveying and modelling



Antarctica



1:50.000 Geological map



**GEODIVERSITY, GEOLOGICAL-MINING HERITAGE
AND SCIENTIFIC CULTURE**

GEODIVERSITY, GEOLOGICAL-MINING HERITAGE AND SCIENTIFIC CULTURE

IGME carries out studies to define and characterize the geodiversity of Spain, to inventory, study and publicize its geological and historical-mining heritage, and to establish and develop the relationships between natural stone and the conservation of the historical-architectonic heritage.

Geoscientific studies of outstanding natural spaces, particularly those included in the Natura 2000 Network.

Mineralogic and palaeontologic research studies to maintain, update and make known the movable heritage of the Geomining Museum, and all that concerns scientific culture, especially that related to the conservation and dissemination of geological-cultural

resources and their meaning, including the historical bibliographic and cartographic archives.

EQUIPMENT

- Vacuum dessicator
- Vibrating table
- Polishing table
- DMT Corescan Colour II for scanning core samples from boreholes.
- Equipment to measure:
 - apparent density
 - water absorption
 - resistance to crystallization of salts
 - resistance to ageing and elasticity.

SERVICES

- Geological and mining heritage inventory and studies



Dinosaur footprint

GEO-DIVERSITY, GEOLOGICAL-MINING HERITAGE AND SCIENTIFIC CULTURE

- Studies and analysis for geoarchaeology and archaeometry
- Studies of the alterability of rocks and remediation analysis
- Inventory of historical quarries and mines
- Palaeontologic, micropalaeontologic, mineralogic and petrographic studies
- Laboratory for the restoration of palaeontologic and mineralogic materials
- Replication and elimination of geological materials
- Earth sciences data bases
- Documentary archives
- Development of information systems
- Conventional and digital publications
- Core repository and associated techniques
- Training courses
- Scientific and technical meetings
- Scientific dissemination (design and production of exhibitions and all types of informative materials)
- Technology transfer
- Library

APPLICATION

- Plans for the management of natural resources
- Conservation of ornamental rocks and of the architectonic heritage
- Conservation and dissemination of palaeontologic, mineralogic and petrologic materials
- Study and characterization of geodiversity

- Identification and evaluation of the geological heritage
- Support for proposals to declare protected natural spaces and geological parks
- Design and implementation of actions aimed at the divulgation of science
- Geological-mining historical studies.

ACTIVITIES

- **Library:** Specialized in Earth Sciences. Contains a documentary archive dating from the foundation of the IGME (1849). Access to the archives is unrestricted and free of charge, but in view of its characteristics as a research library, its collections are highly specialized and thus most suitable for researchers, technical experts and advanced university students; and to all who require information in this branch of science.

The library has books, journals, maps, access to electronic publications that are subscribed to by the IGME,



Library Reference Room

GEO-DIVERSITY, GEOLOGICAL-MINING HERITAGE AND SCIENTIFIC CULTURE

bulletins on new findings in various areas of Earth Sciences, access to the Science Citation Index and other WoK databases.

- **Borehole Core Archive:** This facility safeguards, manages (by cataloguing, classifying and computerizing), disseminates and provides access to borehole core archives, debris and samples from boreholes, both those obtained by the IGME and those from research studies, prospections, etc., by oil companies and other mining concerns. This information is available to researchers and other interested parties.

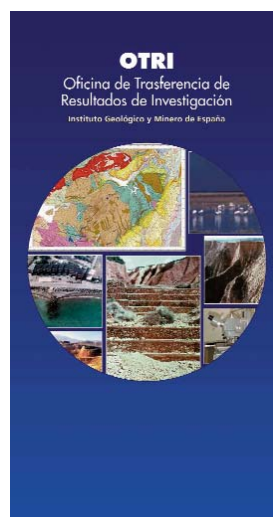


Borehole core archive (Peñarroya)

- **Office for the Transfer of Research Results:**

- This Office advises researchers on the preparation of R&D contracts and of proposals for R&D projects, as well as grant applications and patent documentation. It also manages and implements projects.

- It identifies the results obtained by research groups, evaluates their transfer potential and disseminates this to other bodies. It informs and advises researchers working in the programmes and about the calls for participation forming part of the National Plan, the EU Framework programme, the programmes promoted by the Spanish regional authorities, international programmes, etc.
- It maintains a database of knowledge, infrastructure and technological possibilities.
- It promotes relations with companies and other bodies.
- It promotes a research-oriented and pioneering spirit among the staff of new technology-based firms.
- It organizes seminars and courses for researchers in the above fields, in order to promote the transfer of technology to other sectors of society.



Informational leaflet published by the OTRI

GEODIVERSITY, GEOLOGICAL-MINING HERITAGE AND SCIENTIFIC CULTURE

• **Publications:** The IGME Publications Service publishes, distributes and sells scientific and technical publications, basically concerning research projects carried out by IGME itself, but also covering projects of interest carried out in other spheres, such as doctoral theses and studies performed in collaboration with other public administrations. The publishing list comprises over 3000 titles, including the work of the Commission to Draw up a Geological Map of Spain, dating from 1845. The sales catalogue currently contains over 1600 titles, two specialized journals and seven collections. An annual Catalogue of Publications is published, and this may be consulted on the internet at www.igme.es



Publications Hall.

• **Conservation and divulgation of the collections of the Geomining Museum:** Disseminating the wealth and diversity of the geological and mining heritage, through the permanent exhibition of representative collections of minerals, rocks and fossils.

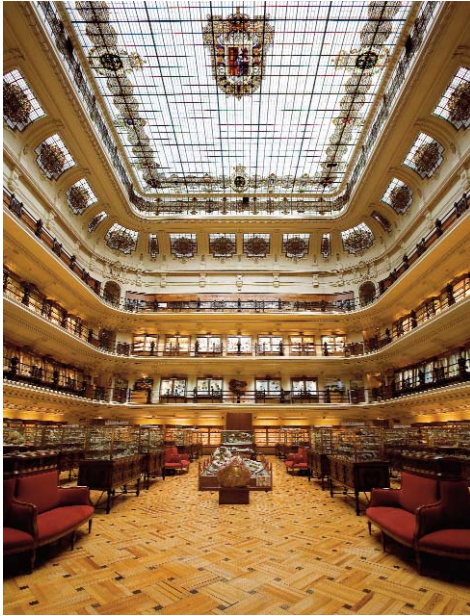


Arctinurus boltoni, trilobites from the Lower Silurian, from New York (USA)



Crystallized gypsum

GEODIVERSITY, GEOLOGICAL-MINING HERITAGE AND SCIENTIFIC CULTURE



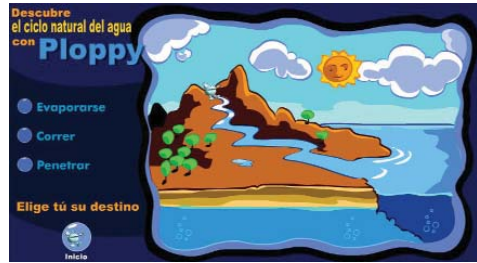
Museum Hall

- **Geological conservation and divulgation:** Conservation, management and investigation of collections. Development of new educational programmes at the Museum.



GEA

Geological guides to natural spaces and to protected self-guided itineraries. Extension of the roaming exhibition "Treasures in rocks". Geological heritage.



Ploppy: computer game for children

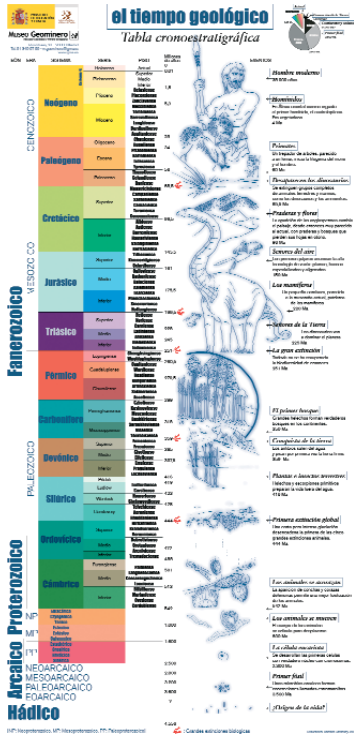
- **Discover with GEA the types of rocks that make up our planet, and how ornamental rocks are formed:**
- **Environmental education and hydrogeological publications:** books, guides, publications for children, Freshwater Rights, Getting to Know Groundwater.



Activities for children at Christmas and in summer

2008 has been designated the **International Year of Planet Earth**, in order to raise awareness of the relation

GEO-DIVERSITY, GEOLOGICAL-MINING HERITAGE AND SCIENTIFIC CULTURE



School visits to the Geomining Museum

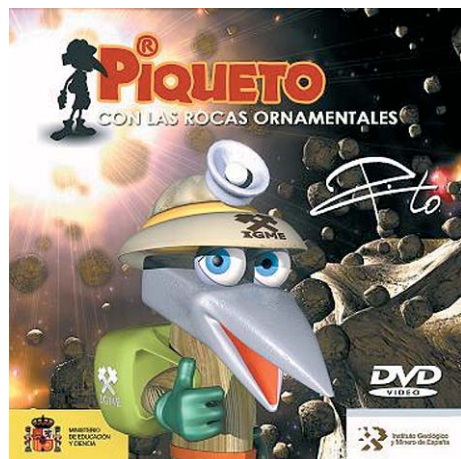


Photo of the Earth, from a satellite

between humankind and planet Earth, and to highlight the importance of Earth Sciences in helping us achieve a balanced, sustainable future, with rising living standards, while at the same time safeguarding the dynamics of our planet.

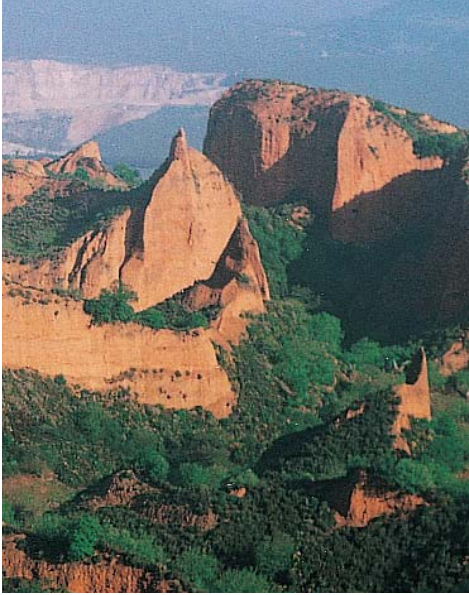
With these aims, the IGME has produced DVDs, leaflets and children's games, and has organized conferences in this respect.

- **Piqueto with Mineral Resources and the Environment:** Description of the processes involved in obtaining ornamental rocks.



DVD for children

- **Geological heritage and geodiversity:** Study and characterization of geodiversity, identification and evaluation of the geological heritage. Support for proposed new protected natural spaces and archaeological parks.



Las Médulas (Romanas-León mines)



Mining remains at the Serafina mine, 1899. Torre.

Characterization of the decay of stone in historical monuments.

- **Historical and Mining Heritage:** Studies of the physical heritage in relation to the geological and mining heritage, including deposits and surrounding installations, as well as documentary archives from the companies that have been active in

the principal mines and quarries in the country.

- **Natural Stone and the Monumental Historical Heritage:** Studies focused on the restoration of historical monuments, to replace elements that have disappeared or



been damaged or destroyed. The problem is considered of the uncertainty concerning the rocks used in the original construction. The IGME has databases on stone quarries, and these might constitute a valuable instrument for clarifying this question.

- **Palaeontologic Heritage:** Characterization of the palaeontologic heritage. Palaeobiologic evolution.

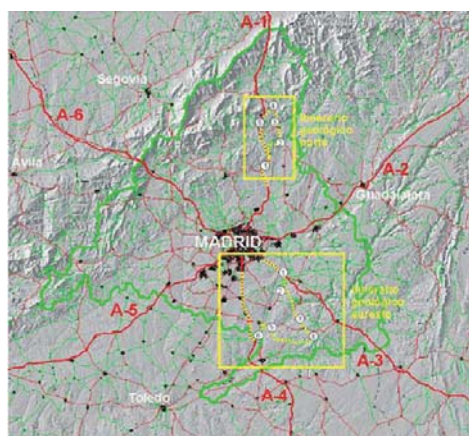


Stratigraphic borehole at the M-2 lower Palaeolithic (Plio-Pleistocene-lower Pleistocene) deposit, at Fonelas (Granada).

Stratigraphic boreholes with archaeological sampling. Identification of deposits with fossil remains and other objects. Studies on extinctions in past epochs (the Jurassic, the Cretaceous, etc.). Palaeoclimatic studies.

• **Publications and dissemination of the geological-mining heritage:**

Creation of signposted paths. Preparation and publication of field guides (national and regional), educational materials for information centres, booklets and guides to points of educational interest.



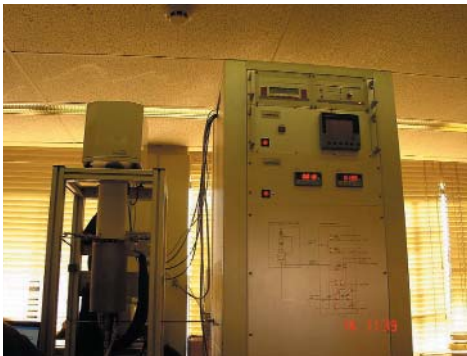
Map of points of interest in the Madrid Autonomous Community (publication created by the Madrid Autonomous Community, with the participation of the IGME and other organizations).

**GEOLOGY OF THE SUBSOIL AND THE GEOLOGICAL
STORAGE OF CO₂**

GEOLOGY OF THE SUBSOIL AND THE GEOLOGICAL STORAGE OF CO₂

The IGME contributes to:

- Investigating the structure and physical properties of the subsoil in Spain, incorporating multidisciplinary information, e.g. geological, hydrogeological, geophysical and borehole data, and employing state-of-the-art technologies in Earth Sciences research.
- Determining the spatial location and the geometric and hydraulic characterization of geological formations that might be used as a CO₂ store and thus contribute to reducing the greenhouse effect, and also that of other substances potentially harmful to the environment.
- Establishing the behaviour of the land as a geological reservoir with respect to any given substance.
- Research and development of methods for 3D geological modelling, structural analysis, geophysical exploration, etc.



EQUIPMENT

Electromagnetic balance and mass chromatograph to calculate and plot CO₂ adsorption isotherms (the capacity of a rock formation to capture CO₂, at different pressures), and to analyze gases.

SERVICES

Measuring the capacity of different rock formations to store CO₂ according to different pressure and temperature conditions in the subsoil, controlling input and output gases by chromatography.

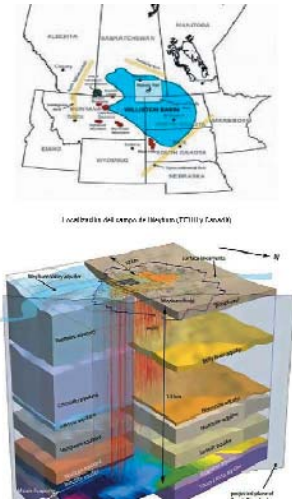
APPLICATION

Determining the storage capacity of a given rock formation, by analyzing samples at different pressures. This is particularly useful for carbon.

ACTIVITIES

Geological storage of CO₂: The process of the geological storage of CO₂ is perhaps the most complex of all those involved in the confinement of carbon dioxide within geological formations. Before compression and transport can take place, it is necessary to perform a complex task deposit site selection, which in turn requires a detailed study of numerous parameters that determine the

GEOLOGY OF THE SUBSOIL AND THE GEOLOGICAL STORAGE OF CO₂



suitability or otherwise of a formation. The IGME is currently developing a methodology for research in Spain, examining different types of storage site.

Capture and storage of CO₂ in geological structures: Before carrying

out any kind of geological CO₂ storage, a capture process must be performed in order to obtain the purest possible CO₂ for injection into the subsoil. The origin of the CO₂ emitted into the atmosphere is very diverse, although most emissions come from these three sectors: electricity generation, transport and industry. Due to the diverse nature of emissions from means of transport, it is not considered feasible to perform capture and storage operations from this source, and so research has been focused on the sectors of industry and electricity. Various CO₂ capture methods are currently being investigated, with the two most commonly studied being pre-combustion and post-combustion. However, the IGME is not involved in developing these technologies, which are included here solely for information purposes.

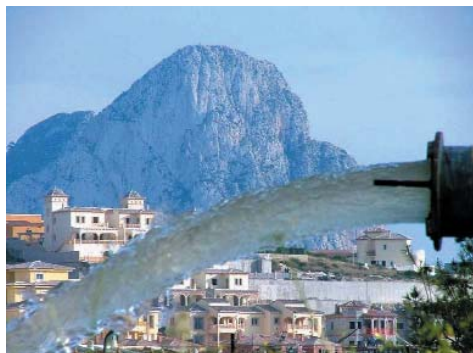


Map of areas of interest for the geological storage of CO₂

HIDROGEOLOGICAL AND ENVIRONMENTAL QUALITY

The IGME seeks to expand scientific knowledge related to the following:

- The water cycle, concerning both evaluation of the quantity of groundwater resources available for consumption and for maintenance of the associated ecosystems, and also the natural water quality and the pressures and impacts to which it is subjected.
- Characterizing groundwater masses in Spain, making use of geological modelling and the determination of hydrogeological behaviour, as well as the protection and rehabilitation of groundwater systems (Water Framework Directive).
- Research, study and characterization of contaminated soils; developing decontamination methodologies and techniques; identifying factors limiting applications (under the National Plan for the Recovery of Contaminated Soils).



EQUIPMENT

IGME possesses materials for field surveys, sampling, measurements in situ, and a Mobile Unit comprising two vehicles for determining hydraulic parameters within areas of low permeability.

- Hydrosamplers
- Stereoscope
- Flow meter
- Portable laboratory
- Analogue altimeter
- Limnigraph
- Portable conductimeter
- Orpheus 120m, 170m, 300m
- Pantograph
- Oximeter
- Planimeter
- Ph meter
- Probe - 100 200, 300, 500
- Thalimides
- Portable turbidimeter
- Desktop stereoscope
- Mirror stereoscope
- Binocular magnifying glass
- Water level gauge
- Spectrophotometer
- Laser distance measurer
- Digital camera
- Filtering equipment
- Salinity and conductivity equipment
- Vacuum pump
- Boorset soil sample extractor
- Humidity probe
- Pressure transmitter
- Water yield meter
- Mobile System

SERVICES

- Inventory of groundwater and geothermal resources
- Evaluation and protection of mineral waters
- R&D and proofs in hydrogeology
- Characterization and study of contaminated aquifers
- Protection and recovery of over-exploited and contaminated aquifers
- Hydrogeology in wetlands and urban areas
- Mathematical modelling and simulation of water flow and transport within aquifers
- Artificial recharge and joint use
- Use of the soil and subsoil in waste processing
- Injection techniques in deep-lying geological structures
- Technical advisory service to national and regional public authorities, as well as to other public and private organizations, for the development of programmes and studies

APPLICATIONS

- Understanding groundwater resources
- Environmental protection of the groundwater domain
- Environmental protection for territorial management
- Acquisition of groundwater
- Supply of water for human consumption
- Aquifer recharge

- Analysis of mineral-medicinal and thermal waters
- Prevention and correction of problems arising from the contamination of groundwater from agricultural, industrial and livestock farming activities

ACTIVITIES

- **Understanding and evaluation of aquifers:** Characterization of aquifers. Evaluation of exploitation. Coastal aquifers.
- **Mineral and thermal waters:** IGME carries out studies to inventory mineral-medicinal and thermal waters, and to characterize the exploitation of hydromineral resources. In addition, it is responsible for the procedures concerning the following:
 - Requests for authorization to exploit water resources
 - Declarations of water conditions



Mineral water spring



Water mill



Water pumping

- **Hydrogeological studies:** Basic recharge and flow processes. Hydrogeochemical processes. Environmental hydrogeology. Urban supply. Pumping studies.
- **Hydrogeology and wetlands:** The study, inventory and characterization of wetlands in Spain.
- **Study and characterization of contaminated soils:** Soil contamination is currently one of the most pressing environmental problems, especially in urban areas. The IGME



Tablas de Daimiel

HIDROGEOLOGÍA Y CALIDAD AMBIENTAL



Fuente de Piedra Lagoon

provides advisory services to public authorities on issues related to soil contamination.

It has been designated by the Ministry for the Environment as a National Soil Reference Centre in the framework of the EIONET network, part of the European Environment Agency. It maintains an inventory of potentially soil contaminating activities, and establishes criteria and standards for declaring contaminated soil status. It is involved in the design and development of a computerized system for the management of contaminated soils in Spain, and is



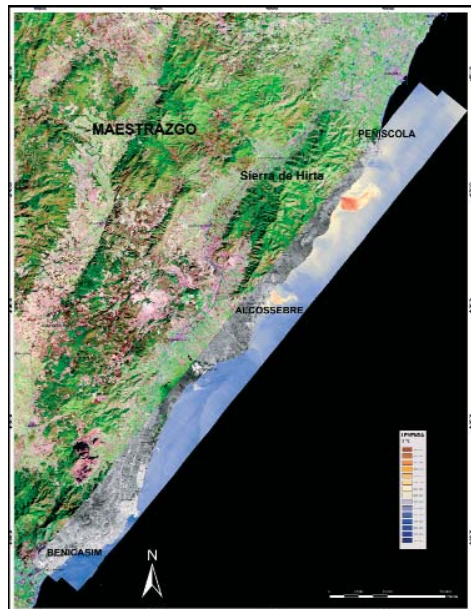
Sampling contaminated soils



Laboratory installation for electrodiagnosis treatment of contaminated soils

actively interested in the recovery and treatment of contaminated soils.

- **Hydrogeological and service-oriented techniques:** The IGME is concerned in the following areas:



Identification of groundwater springs towards the sea, using thermal images of the Benicassim-Peñíscola coastal sector.



As Burgas (Ourense)

- Territorial management.
 - Preventive measures.
 - Techniques for the inclusive management of aquifers.
 - Determining hydrogeological parameters.
 - The protection and restoration of aquifers.
 - Quality and contamination.
 - Observation, measurement and hydrogeological data.
 - Contamination by nitrates and metals.
- **Environment quality:** Areas of interest include:

**MINERAL RESOURCES AND THE ENVIRONMENTAL IMPACT OF
THE MINING INDUSTRY**

MINERAL RESOURCES AND THE ENVIRONMENTAL IMPACT OF THE MINING INDUSTRY

The following areas are addressed:

- Studying the lifecycle of mineral resources, from the geological processes that determine their presence, to mineral-environmental management and the recovery and restoration of mining spaces, under criteria of sustainability and of interaction with the natural world.
- Geological modelling of the processes that give rise to mineral deposits and rocks of economic interest. Studying and characterizing such processes.
- The multielemental geochemical coverage of the territory.

- Minerallurgic research into the exploitation of mineral seams or other resources of high economic potential.
- Carrying out environmental organization studies to alleviate the effects of the mining sector on the environment.

EQUIPMENT

- Hydrolab® Quanta and Hydrolab® Datasonda S5 multiparametric probes for measuring pH, Eh, T, OD and CE, PAR radiation, chlorophyll-a, turbidity and depth.
- Conventional portable probes: HANNA (models HI 9025 (pH, Eh, T), HI 9145 (DO) and HI 9033 (EC)) with calibration solutions.



Corta Atalaya. Río Tinto Mines



Mine belonging to Magnisitas Navarra S.A. in Eugui

- Conductivity – Temperature – Depth sensors (CTD Diver® by Van Essen
- Instruments for continuous monitoring.
- Opaque PVC BetaPlus® bottle (2.2 L capacity) by Wildlife Supply Company, for deep-level water sampling.
- Wildco® K-BTM unconsolidated sediment gravity core sampler.
- Garmin FF160C echosounder for depth measurements, with GPS for geographic positioning.
- RQflex10 (Merck) reflectometer (reflectance photometer) and Reflectoquant® analytical strips for measuring dissolved ferrous iron (Fe(II)).
- Digital titrator (HACH Instruments Company) to determine alkalinity (8203 method) and acidity (8201 method).
- ILLIPORE ultrafiltration system (1000 daltons).

- Laptop computer for immediate data storage (in the field).
- Nautical equipment: motorboats (rigid and pneumatic) with lifejackets.
- Reflected and transmitted-light microscopes, with coupled digital camera.
- Disks for determining the optical axes of minerals.
- Microthermometric disk for studying fluid inclusions in minerals, with custom software.
- Leitz reflectometer.
- Vickers microdurimeter.
- Binocular magnifying glass with coupled digital camera.

SERVICES

Prevention and correction of geoenvironmental impacts in mining, public works and urban and industrial land.

APPLICATION

Environmental land management

ACTIVITIES

- **Mining economics.** IGME promotes studies aimed at a better understanding of resources and reserves of different minerals. For this purpose, as well as geological and metallogenetic information, it is necessary to study and analyze the underlying technical

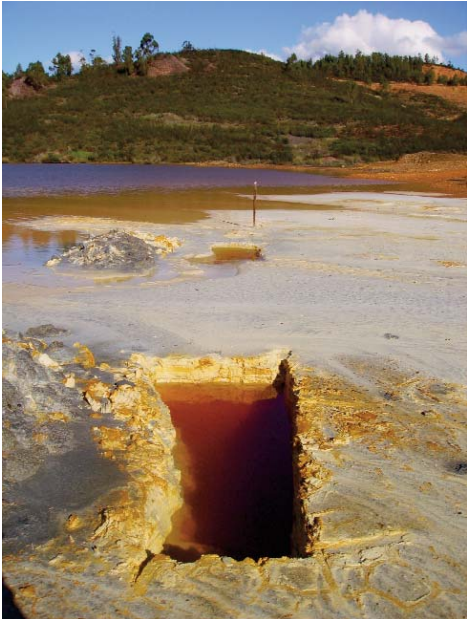
MINERAL RESOURCES AND THE ENVIRONMENTAL IMPACT OF THE MINING INDUSTRY

and economic factors. IGME publishes the Annual Mining Outlook and the Annual Mining Audit.



•**Environment and Restoration.**

Research studies and projects aimed at the evaluation and correction of environmental impacts, at characterizing and recovering



Decantation pool at the Reocín pit lake after treatment

contaminated land, at environmental geochemistry and at the mineral-environmental management of the exploitation of mineral resources and industrial rocks.



Pit lake flooded with acidic water at the Cueva de la Mora mine in Huelva

•**Environmental Geochemistry:** IGME contributes to the development of geochemical research methods for application to the geographic understanding and environmental characterization. On occasion, these methods may be applied in conjunction with work for the characterization and recovery of contaminated soils, as part of specific projects. Particular importance is given to the development of urban environmental geochemistry.

•**Studying and Understanding Mineral Resources:** Activities in this line are, in general, oriented toward

extending our understanding of the mining potential of specific territories, through the development of knowledge and information infrastructure, together with the study and development of new methodologies and techniques for the exploration, analysis and evaluation of deposits of industrial rocks and minerals. Studies of the latter have highlighted the mining potential of different territories, both in the field of ornamental rocks and in that of certain industrial minerals. Evaluation studies of mineral resources provide essential documents, containing the infrastructure information necessary for the sustainable development of mining activity in the framework of territorial management. Other activities include the evaluation of subsoil resources, including geothermal energy.

Geothermal energy

• **Evaluation and Correction of Environmental Impacts:** Involving activities including:

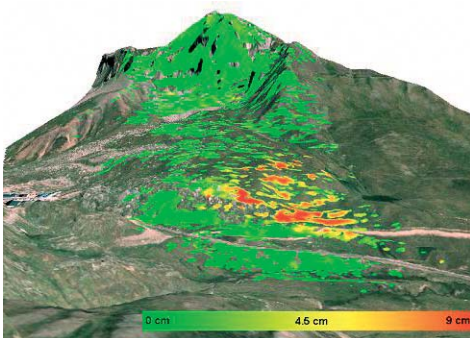
- The characterization, study and correction of the environmental impacts caused by mining, energy installations, high-tension power lines, gas pipelines, industrial installations, public works, etc.
- The provision of scientific and technical assistance to environmental offices within government bodies, concerning procedures for the evaluation of environmental impact.
- The implementation of specific studies of environmental effects and means of correction, in order to determine the conditions to be fulfilled in order to reduce environmental incidence to acceptable limits.
- Promoting R&D studies and projects concerning the reduction of environmental impacts, together with monitoring and assessing the real effectiveness of impact correction measures.

GEOLOGICAL RISKS, ACTIVE PROCESSES AND GLOBAL CHANGE

GEOLOGICAL RISKS, ACTIVE PROCESSES AND GLOBAL CHANGE

The following areas are addressed:

- Investigation, analysis and characterization of the geological risks and processes most relevant to Spain, both in the emerged area and in littoral and submarine zones.
- Studies of potentially damaging processes, such as flooding, earthquakes, volcanic activity and landslides.
- Studies related to climate change: palaeoclimatic studies, based on the interpretation of sedimentary records and of the evolution of the carbon, nitrogen and sulphur cycles; palaeohydrologic and prospective studies of the possible impact of climate change on the water cycle, on groundwater resources and on ecosystems associated with the evolution of the carbon, nitrogen and sulphur cycles.



Comparison of two digital models of flash flooding and geomorphologic delimitation

EQUIPMENT

- Differential GPS
- Pluviometers
- Limnimeters
- TDR probes
- Optical probes
- Infiltrimeters
- Tensiometers
- Work stations and PCs with GIS and numerical modelling systems.

SERVICES

- Analyses and studies of natural and human risks
- Statistics of natural disasters
- Prevention and mitigation of natural risks
- Risk theory and forecasting
- Climate change and desertification

APPLICATIONS

- Design and application of projects and actions for the structural prevention of natural disasters (screens, walls, meshes, reinforcements).
- Design and application of instrumental networks for the monitoring and control of potentially hazardous geological processes.
- Creation of territorial management plans for the prevention of natural hazards (guidelines, urban development plans, partial plans, special plans, etc.)

GEOLOGICAL RISKS, ACTIVE PROCESSES AND GLOBAL CHANGE

- Establishment of private insurance schemes to provide coverage against situations of geological risk.
- Preparation of plans and systems for civil protection against natural hazards.

ACTIVITIES

- **Studies of Hazards and Geological Risks:** The development of specific methodologies to evaluate the risks and economic and social liabilities arising from potentially damaging or catastrophic geological processes affecting working areas. Abroad, studies have been carried out in Argentina, El Salvador, Guatemala, Honduras, Italy, Nicaragua and the Dominican Republic. Analysis of the impact of geological risks in Spain, including the evaluation of the damage and losses caused during the last 15 years, together with an estimate for the next 30 years.

- **Integrated Risk Studies:** Integrated risk and hazard maps highlight the importance and the relative effects of all the risks and hazards affecting a given area. Geographic Information Systems, which have been widely developed and used within the IGME, constitute the basic instrument for compiling data on the risks and hazards characterized in each study or project. GIS enable large volumes of information to be processed, and from the subsequent analysis of the variables and factors relevant to risk processes, new maps can be obtained. In this field, after carrying out hazard studies addressing issues such as landslides, seismicity, meteorological phenomena, flooding, erosion, the expansion of clays and subsidence, integrated hazard maps are plotted, by means of which defence measures may be planned to minimize the risks posed by such geological activities.



Obtaining pluviometric data



The Venero Claro river. Effects of torrential flooding. 1997

•Characterization and Modelling Techniques:

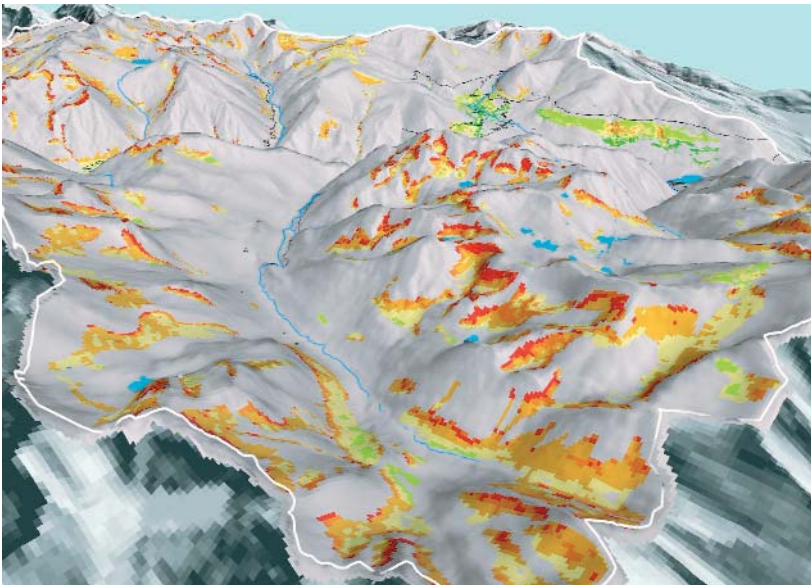
- Monitoring and instrumental control of land use in metropolitan areas.
- Mapping landslide hazards, using geographic information systems and geotechnical modelling.
- Studies of land subsidence phenomena related to falling phreatic levels, complemented with data from direct (instrumental) observation, from which geotechnical models may be calibrated to analyze the land use implemented in study areas.
- Field surveys and laboratory assays provide the data needed for modelling and then analyzing the study zones.



Dangers of large-scale landslides in the island of Tenerife

•Glaciation and global warming:

- Research into the influence of climate and human activities on National Parks and wetlands.

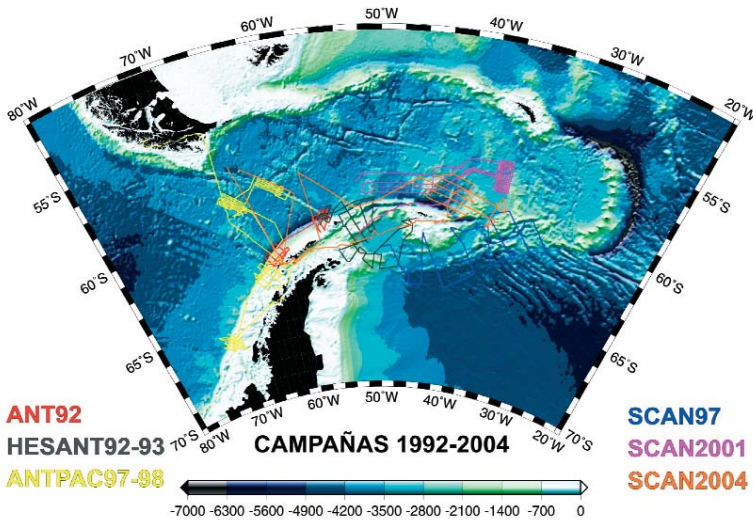


Representation on a digital geographic model of susceptibility to superficial landslides

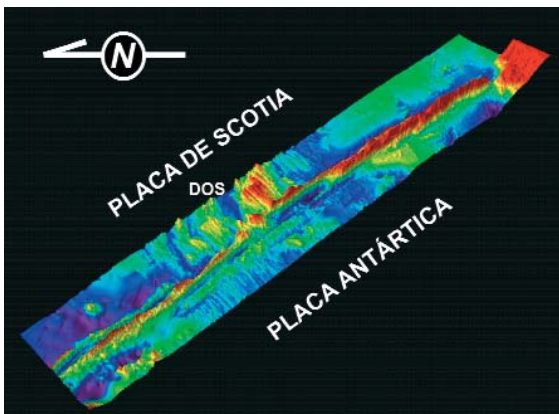
GEOLOGICAL RISKS, ACTIVE PROCESSES AND GLOBAL CHANGE

- Studies of seismic characterization and submarine emissions.
- Studies of geomorphologic dynamics, peri-glaciarism and tectonics in Antarctica.
- **Glaciation and global warming in the past:** The IGME establishes

models to identify the evolution of climate change from earlier periods of glaciation, and examines palaeo-environmental and palaeoclimatic reconstruction, in the short, medium and long term.



Bathymetric map of the Scotia Sea (Antarctica), showing previous field studies carried out by the SCAN research group, and marked in red, the next study area, scheduled for January 2008



Multibeam image of the Shackleton Fracture Zone that joins and separates South America from Antarctica

GEOSCIENTIFIC INFORMATION SYSTEMS

GEOSCIENTIFIC INFORMATION SYSTEMS

Research and development of data models, on platforms suited to current technology, to be made available to users of the IGME's geoscientific information, including access via Internet.

EQUIPMENT

- Computer servers with dedicated Windows OS for scientific and technological support
- Servers for geoscientific databases
- Archives, FTP
- Geographic Information System
- Library, Mining Register
- National Centre for Polar Data
- Topo-Iberia Project
- Satellite photograph library
- Institutional website
- Desktop and portable computers for use by scientists and technicians.
- Workstations dedicated to scientific applications, simulation models and GIS, including ARC Info, ARC View and Intergraph Geometry.
- Microstation for the massive capture of mapping data, and for projects.
- Masks for the treatment, modelling and interpretation of seismic profiles.
- Instruments for image manipulation, and Geosoft software for processing geophysical and geochemical data.
- Office-oriented operating systems and software.
- Systems for maintaining SQL, SERVER and ORACLE databases.

- 15 graphic plotters and 3 large format scanners (size UNE-ISO A0) for printing out geoscientific mapping.
- Local area networks interconnected with extended area networks, to communicate the main IGME complex with the other Madrid office, at Tres Cantos, and with the project offices in various Spanish regions.
- Wireless network enabling access to Internet and other sources of information, for IGME personnel and for members of the scientific community working there and using their own computers.
- Videoconferencing facilities



Servers at the IGME

GEOSCIENTIFIC INFORMATION SYSTEMS

SERVICES

Documentary Information System

APPLICATION

Documentary records

ACTIVITIES

- **Database:** The IGME has a large catalogue of databases, including Meta-gen, available for consulting and documentary purposes. These are multi-disciplinary databases with information on geology, geophysics, mineral traces and remote sensing, on the metallogenetic regions of Faja Pirítica and Ossa Morena, and with information on the mineral evidence in the Metallogenetic Map of Spain.

- **National Centre for Polar Data:** The National Centre for Polar Data (CNDP) maintains the Spanish Polar Archive and was set up at the initiative of the Spanish Polar Committee (CPE), whose Technical Secretariat is responsible for coordinating all the activities corresponding to the National Antarctic Authority. The CNDP headquarters is located at that of the IGME. Among other activities, it administers the metadata generated from Spanish research into polar issues, and is responsible for the storage, management and diffusion of documentary

materials, under the supervision of the CPE.

- **Groundwater information system:**

This system compiles and makes available to users the institutional databases on groundwater, concerning both topical and long-term information, together with hydrogeological and thematic spatial databases, in digital format, and created more recently. The latter are available stored in diverse systems and file types.

- **Continuous Geological Mapping Information System (SIGECO).**



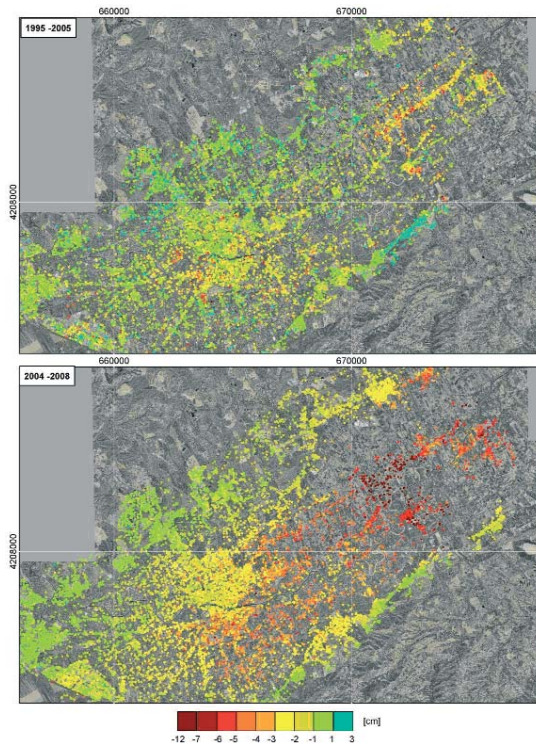
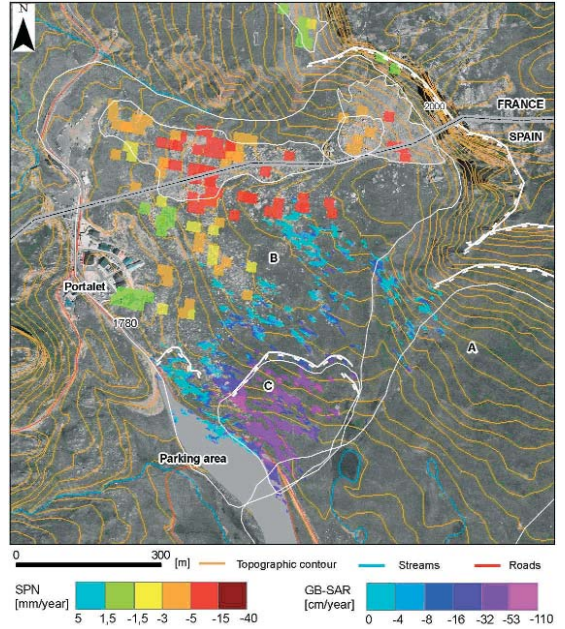
- **Documentary Information System:**

This system compiles and makes available the reports and documents (both periodic and non-periodic) published by IGME's documentation services.

- **Geophysical Information System:**

This is an application providing the visualization, access and downloading of geophysical data obtained in Spain. The home page functions as a map server,

providing a set of visualization instruments. It also includes powerful utilities for browsing using localization criteria, as well as for creating complex search procedures by setting conditions for the data properties.



LABORATORY

LABORATORY

IGME's analytical and mineralurgic laboratories have advanced equipment to carry out a wide range of chemical assays and analyses, such as the chemical analysis of water samples, petrographic, geotechnical and mineral process analyses. The laboratories are also responsible for the official characterization of natural mineral waters.

EQUIPMENT

- Spectra FS220 atomic absorption spectrometer
- UV/VIS: lambda EZ210 spectrometer
- SHIMADZU total organic carbon analyzer
- ALLIANCE integral plus continuous flow autoanalyzer
- ALLIANCE 10 channel continuous flow autoanalyzer
- DIONEX 600 ionic chromatograph
- BERTHOLD low energy proportional counter
- QUANTULUS liquid scintillation counter
- VARIAN gas/mass chromatograph
- VARIAN VISTA MPX inductively coupled plasma atomic emission spectrometer (ICPAES), with an axial arrangement (simultaneous multielement analysis)
- Inductively coupled plasma time-of-flight mass spectrometer (ICPTOFMS) and Quadrupole. Leco Renaissance equipment with CETAC and AGILENT lasers.
- Atomic absorption



LABORATORY

spectrophotometer in flame, graphite chamber and hydride (cold vapour) generator modes. UV/VIS spectrophotometry to determine F.

- LECO and ELTRA elemental analysers (carbon and sulphur) by oven drying
- PANALYTICAL XPERT x-ray diffractometer with Xcelerator Detector. Copper tube. Graphite monochromator and automatic divergence slit.
- PANALYTICAL XPERT Quantify and XPERT High Score software (Version 2004), together with the ICDD database (Sets 1-47). Microdiffraction system.
- PANALYTICAL MAGIX spectrometer. Wavelength dispersion technique. Rh tube.
- Sample preparation:
 - Fusion with lithium tetraborate in a PERLËX3 fused bead machine.
 - Pressed pastille with Elvacite (polymethylmetacrylate)
 - Discoplan-TS polisher
 - Dupérier-Dürener lead polishing disc
 - G. Brot S.A. lamina crusher
 - Rotopol-35 cutter
 - Wendt cutter
 - Great Western Lapidary Equipt. oil cutter
 - EPOVAC vacuum impregnation equipment
 - Dupérier-Dürener millstone
 - H. Dupérier - Dürener mill
 - Olympus SZH binocular magnifying glass
 - Carl Zeiss Jena JENAPOL petrographic microscope

- LEITZ LABORLUX 12 POL S petrographic microscope
- Wild MPS 05/12 photographic equipment
- Water chamber
- Granulometric sieving
- Granulometric sedimentation
- Triaxial soil testing equipment
- Edometric worktop (11 edometers)
- Direct soil sectioning
- Consolidation workbench
- Electric presses
- Lambe apparatus
- Normal and modified Proctor
- CBR index
- Bernard calcimeter
- Casagrande liquid limit apparatus
- Baking ovens (to 1350°C)
- Direct sectioning
- Triaxial equipment
- Franklin test
- Cutters
- Perforators
- Compression presses of 500, 120, 100 and 20 t
- Load application equipment for the Brazilian test
- Young and Poisson module
- TIMS mass spectrometer
- BIOTECK MSCL equipment
- CORESCAN II

SERVICES

Laboratory for:

- Water analysis
- ENAC accreditation
- Chemical and geochemical analyses



- X rays
- Mineralogy and petrography
- Soils
- Rock mechanics
- Characterization of ornamental rocks

APPLICATION

- Physical and chemical characterization of natural waters
- Geochemical and mineralogic analyses
- Technological characterization of industrial rocks and minerals
- R&D in mineral treatment and profitability processes
- Soil research
- Studies of contaminated soils

ACTIVITIES

- **Physical and chemical characterization of natural waters:** The IGME has a water-analysis laboratory, equipped with the material means necessary to perform analyses, to appropriate levels of sensitivity and precision, of the physical and chemical parameters that current regulations require to be monitored.
- **Soil assay laboratory:** Edaphological tests (pH, cationic exchange, electrical conductivity, active limestone, percent saturation in water, exchange acidity. Soil mineralogy. Granulometric analyses (sedigraph and laser)

LABORATORY

- **Geochronology laboratory:** U-Pb dating, using isotopic dilution and TIMS mass spectrometry

- **Minerallurgy laboratory:** Minerallurgic and metallogenetic studies to optimize mining production from



existing installations, developing new technologies for the treatment and recycling of residue and/or waste from prior treatments. R&D into processes of mineral treatment and concentration.

- **Natural stone laboratory:** Making available to the stone-processing industry a comprehensive range of



tests for the characterization of products and for the development and introduction of new techniques.

- **Multi-parametric geophysical testing laboratory:** GEOTECK MSCL equipment. Determination of apparent density, ultrasound velocities, magnetic susceptibility, electrical resistance. Acoustic impedance. Scanning of borehole core samples (Corescan II)

- **Analytical and Assay Laboratories:** Physical and chemical characterization of natural waters. Geochemical and mineralogic analyses. R&D into mineral treatment and concentration processes. Studies of contaminated soils. Technological characterization of industrial rocks and minerals.



INDUSTRIAL AND INTELLECTUAL PROPERTY

INDUSTRIAL AND INTELLECTUAL PROPERTY

PATENTED INVENTION Nº. 200501432

TITLE: PROCESS FOR THE REPRODUCTION OF FOSSILS, ROCKS AND MINERALS, AND THE PRODUCTS OBTAINED THEREBY.

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

AUTHOR: ELEUTERIO BAEZA CHICO

STATUS: GRANTED 14/01/2008

PATENTED INVENTION Nº.9101179

TITLE: MULTI-TECHNIQUE POLYVALENT DRILLING EQUIPMENT

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

AUTHORS: JOSÉ F. GONZÁLEZ FERNÁNDEZ, JESÚS CANDIL.GOZALO, JOSÉ SEGOVIA QUIRÓS

STATUS: GRANTED1/01/2005

UTILITY MODEL Nº. 200600236

TITLE: APPARATUS FOR CUTTING QUARRY GRANITE (THERMIC LANCE)

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

AUTHOR: JOSÉ MANUEL BALTUILLE MARTÍN

STATUS: GRANTED1/09/2006

INDUSTRIAL DESIGN REGISTRATION Nº. 504397

TITLE: FIGURE FOR VIDEOGRAPHIC ANIMATIONS: PIQUETO

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

AUTHOR: PAULINO MUÑOZ DE LA NAVA

STATUS: GRANTED

SPANISH TRADEMARK Nº. 2755168

TITLE: PIQUETO

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

AUTHOR: PAULINO MUÑOZ DE LA NAVA

STATUS: GRANTED 21/08/2007

SPANISH TRADEMARK Nº. 2755166
PIQUETO IN CLASSES 9,16,25,28,41 AND 42

TITLE: PIQUETO

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

AUTHOR: PAULINO MUÑOZ DE LA NAVA

STATUS: GRANTED

SPANISH TRADEMARK Nº. 2755167,
GRAPHIC IN CLASSES 9,16,25,41 AND 42

TITLE: PIQUETO GRAPHIC

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

AUTHOR: PAULINO MUÑOZ DE LANAVA

STATUS: GRANTED

SPANISH TRADEMARK Nº. 2755166.
CLASSES: 9-16-25-28-41-42

TITLE: PIQUETO

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

INDUSTRIAL AND INTELLECTUAL PROPERTY

AUTHOR: PAULINO MUÑOZ DE LA NAVA
STATUS: GRANTED 23 ABRIL 2008

AUTHORS: RAFAEL LOZANO, ANA RODRIGO, SILVIA MENÉNDEZ
STATUS: UNDER CONSIDERATION

TRADEMARK AND MODEL REGISTRATIONS:

Application N°. 2.279.342/9 Priority country: Spain

Application N°. 2.279.343/7 Priority country: Spain

Application N°. 2.279.344/5 Priority country: Spain

Application N°. 2.279.345/3 Priority country: Spain

Application N°. 2.279.346/1 Priority country: Spain

Application N°. 2.279.347/X Priority country: Spain

Application N°. 2.279.348/8 Priority country: Spain

Application N°. 2.279.349/6 Priority country: Spain

Application N°. 147.162/7 Priority country: Spain

TITLE: PLOPPY MASCOT
ORGANIZATION: SPANISH GEOLOGICAL SURVEY

AUTHORS: GERARDO RAMOS GONZÁLEZ, EMILIO ALCARÁZ

STATUS: GRANTED

SPANISH TRADEMARK N°. 2.783.216, GRÁFICO, IN CLASSES 9, 16, 25, 41 AND 42,

TITLE: GRÁFICO GEA

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

AUTHORS: RAFAEL LOZANO, ANA RODRIGO, SILVIA MENÉNDEZ

STATUS: GRANTED 28/02/2008

SPANISH TRADEMARK N°. 2.783.219, TRIDIMENSIONAL GRAPHIC

TITLE: GRAPHIC IN CLASS 18

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

AUTHORS: RAFAEL LOZANO, ANA RODRIGO, SILVIA MENÉNDEZ

STATUS: GRANTED 28/02/2008

INDUSTRIAL DESIGN N°. 505.111 DOLL

TITLE: GEA DOLL

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

AUTHORS: RAFAEL LOZANO, ANA RODRIGO, SILVIA MENÉNDEZ

STATUS: UNDER CONSIDERATION

SPANISH TRADEMARK N°. 2.782695 "GEA" IN CLASSES 9,16,25,28,41 AND 42

TITLE: GEA

ORGANIZATION: SPANISH GEOLOGICAL SURVEY

**PRODUCTS, FACILITIES, ACTIVITIES AND STANDARD SERVICES,
WITH RETAIL PRICES CHARGEABLE BY IGME
(IN EUROS)**

PRODUCTS, FACILITIES, ACTIVITIES AND STANDARD SERVICES, WITH RETAIL PRICES CHARGEABLE BY IGME (IN EUROS)

**PRODUCTS, FACILITIES,
ACTIVITIES AND STANDARD
SERVICES, WITH RETAIL PRICES
CHARGEABLE BY IGME (IN
EUROS)**

ANNEXE I

Databases, products, characteristics, activities and standard services: IGME price list

Price
(euros)

I. Data Bases

Data Bases. Formats: paper, pdf, ASCII

Up to 30 records 30.00
Each additional record 0.10

Document images

Up to 10 images 30.00

Each additional image (copies on paper):

DIN A4 B/W 0.20
DIN A3 B/W 0.40
DIN A4 colour 1.80
DIN A3 colour 3.00
DIN A2 colour 7.00
DIN A1 colour 10.00
DIN A0 colour 20.00
PDF Format 0.50

II. Digital Mapping

Copies on Paper

Copies size A1 (Colour) 10.00
Copies size A0 (Colour) 20.00

Digital Copy (raster format)

Any size 15.00

Digital Copy (vector format)

E:1/50.000 30.00
E:1/200.000 30.00
Provincial/Regional 45.00
National E:1/1000000 60.00

Continuous Geological Mapping (GEODE)

Surface equivalent 1:50.000 map sheet 45.00
Surface equivalent 1:200.000 map sheet 300.00
Surface equivalent 25% national land surface 1,750.00
Surface equivalent 50% national land surface 3,000.00
Surface equivalent 100% national land surface 5,000.00

For services provided on an individualized basis, which include data preparation and publishing in a given format, prices are determined with reference to average costs, weighted in accordance with professional categories as established annually by IGME.

Universities and public bodies are eligible for a discount of up to 75%.

Inquiries and downloads of information by the user from the IGME institutional website, for non-commercial use: NO CHARGE

II.I Reproduction of documentation**Photocopies in black & white****DIN A-4**

Set of 1 - 40 photocopies	5.00 Spain
	8.00 Europe
	12.00 Others

Each additional page	0.20
----------------------	------

DIN A-3

Set of 1 - 20 photocopies	8.00 Spain
	11.00 Europe
	15.00 Others

Each additional page	0.40
----------------------	------

Photocopies in Colour**DIN A-4**

Set of 1 - 5	10.00 Spain
	13.00 Europe
	16.00 Others

Each additional page	1.80
----------------------	------

DIN A-3	3.00 per copy
----------------	---------------

DIN A-2	7.00 per copy
----------------	---------------

DIN-A-1	10.00 per copy
----------------	----------------

DIN A-0	20.00 per copy
----------------	----------------

Note: plus shipping costs (3.00 € for Europe and 4.00 € for the rest of the world).

Electronic files (PDF, JPG or others) are subject to the same prices, with each page being considered equivalent to one photocopy.

III Laboratory**III 0. For all Groups**

Budgetary work unit	30.00
Minimum charge per job commissioned	60.00

III.I. Water analysis:**Minimum analysis**

(16 measurements): 155.00/sample
pH, conductivity, oxidability, sodium, potassium, calcium, magnesium, chlorides, sulphates, bicarbonates, carbonates, nitrates, nitrites, ammonium, phosphate, silica

Complete analysis

(32 measurements): 360.00/sample
Includes the minimum analysis of 16 measurements plus dry residue at 180°C, sulphur, fluoride, cyanide, copper, zinc, arsenic, selenium, mercury, cadmium, lead, chrome, iron and manganese, plus total alpha and beta radioactivity

Analysis of natural mineral water

(51 measurements) 760.00/sample
Includes the complete analysis of 32 measurements plus free carbonic anhydride, colour, turbidity, phenols, detergent, suspended matter, bromate, dry matter at 260°C, total organic carbon, aluminium, cobalt, barium, silver, beryllium, nickel, vanadium, antimony, boron and tritium.

PRODUCTS, FACILITIES, ACTIVITIES AND STANDARD SERVICES, WITH RETAIL PRICES CHARGEABLE BY IGME (IN EUROS)

Analysis of organic contaminants

560.00/sample

Includes: volatile organic compounds, polycyclic aromatic hydrocarbons, trihalomethanes, organic chlorate pesticides and polychloride biphenyls (PCBs)

Analysis of metal content by ICP-AES

150.00/sample

Includes: aluminium, antimony, arsenic, barium, beryllium, boron, cadmium, cobalt, copper, chrome, iron, manganese, nickel, silver, lead, selenium, vanadium and zinc.

Analysis of metal content by ICP-MS

180.00/sample

Includes: aluminium, antimony, arsenic, barium, beryllium, boron, cadmium, cobalt, copper, chrome, iron, manganese, nickel, silver, lead, selenium, thallium, thorium, uranium, vanadium and zinc.

Individual analyses: Group 1

25.00/unit

Includes: pH, carbonates, oxidability, conductivity, dry matter at 180°C, dry matter at 260°C, sulphur, fluoride, free CO₂, suspended matter, total hardness French degrees, colour, turbidity.

Individual analyses: Group 2 ñ Molecular absorption - I

28.00/unit

Includes: chloride, sulphates, bicarbonates, phosphates, nitrates, nitrites, ammonium, silica, calcium, magnesium, residual free chlorine, residual combined chlorine.

Individual analyses: Group 3 -

Molecular absorption - II 32.00/unit

Includes: cyanide, phenols, tensioactive agents

Individual analyses: Group 4 Flame photometry

21.00/unit

Includes: lithium, sodium, potassium

Individual analyses: Group 5 Flame atomic absorption

26.00/unit

Includes: copper, zinc, lead, chrome, strontium, iron, manganese

Individual analyses: Group 6 Non-flame atomic absorption

32.00/unit

Includes: arsenic, selenium, mercury, cadmium, lead, chrome, iron, manganese

Individual analyses: Group 7 Proportional counter

52.00/unit

Includes: total alpha radioactivity, total beta radioactivity, other beta radioactivity

Individual analyses: Group 8 Elemental analyzer

41.00/unit

Includes: total organic carbon, total carbon, inorganic carbon, total nitrogen

Individual analyses: Group 9 ICP-AES

41.00/unit

Includes: aluminium, antimony, arsenic, barium, beryllium, boron, cadmium, cobalt, copper, chrome, iron, manganese, nickel, silver, lead, selenium, uranium, vanadium and zinc

Individual analyses: Group 10 ICPMS	Gravimetric determination of water-insoluble residue	26.00
52.00/unit		
Includes: aluminium, antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, chrome, iron, manganese, nickel, silver, lead, selenium, thallium, thorium, uranium, vanadium and zinc	Gravimetric measurement of calcium, magnesium or barium	42.00
	Free acidity	36.00
Individual analyses: Group 11 Ionic Chromatography	Volumetric measurement of soluble chlorides, Kjeldahl or zinc	42.00
22.00/unit		
Includes: bromates, bromides, chlorides, fluorides, phosphates, nitrates, nitrites, sulphates	Volumetric determination of Tin (Sn) or Fe(II)	42.00
Qualitative microbiological analysis	Determination of organic or inorganic carbon	46.00
90.00/sample		
Chemical oxygen demand	Volumetric determination of total iron (Fe)	31.00
48.00/sample		
Tritium liquid scintillation	Edaphological tests: exchange acidity (Al, H)	31.00
155.00/sample		
III.2 Solid samples and mineralometry	Edaphological tests: exchange capacity, ammonium acetate	42.00
6-fraction sequential extraction (Tessier)	Edaphological tests: pH, active limestone, conductivity, limestone requirements (each)	42.00
250.00		
Preparation of 50 g fusion / cupellation pellet	Edaphological tests: cation exchange (Na,Mg,Ca,K)	26.00
42.00		
Gravimetric measurement of silica (SiO ₂) or total sulphur	Determination of W, F or Ge (UV/Vis)	36.00
52.00		
Gravimetric measurement of sulphur (sulphate)	Determination of organic matter	42.00
41.00		
Elemental sulphur or elemental carbon		
41.00		
Gravimetric determination of loss by calcination 950° C		
26.00		

PRODUCTS, FACILITIES, ACTIVITIES AND STANDARD SERVICES, WITH RETAIL PRICES CHARGEABLE BY
 IGME (IN EUROS)

Determination of flame atomic absorption	42.00	X-ray fluorescence analysis: fusion, 5 elements	52.00
Determination of ammoniacal nitrogen or labile phosphorus	36.00	X-ray fluorescence analysis: bead, 9 elements	92.00
Cold vapour / Hydric generation atomic absorption: (1 element)	42.00	X-ray fluorescence analysis: concentrates (REE or Ilmenite)	105.00
Gold: Flame atomic absorption, LD =100 ppb	42.00	X-ray fluorescence analysis: Pro Trace, 38 elements	100.00
ICP-AES Plasma analysis: 1 - 5 elements	46.00	X-ray fluorescence: complete sulphur analysis: 2 beads	92.00
ICP-AES Plasma analysis: 6 - 15 elements	53.00	X-ray fluorescence analysis: pellet, up to 4 elements	50.00
ICP-AES Plasma analysis: 16-28 elements	78.00	Short sweep X-ray diffraction	75.00
		Normal sweep X-ray diffraction	94.00
ICP-MS Plasma analysis: 1-5 elements	52.00	Long sweep X-ray diffraction or microanalysis (> 20 mg)	110.00
ICP-MS Plasma analysis: 6-15 elements. Rare earths	96.00	X-ray diffraction: Quantitative analysis of sepiolite (UNE 22-161-92)	125.00
ICP-MS Plasma analysis: 16-28 elements. Standard EPA 3050-B	130.00	Semi quantitative X-ray diffraction: mineral species (one)	52.00
X-ray fluorescence analysis: IQ+ scan	70.00	X-ray diffraction: semi quantitative clay fraction (AO + ethylene glycol + thermal)	120.00
X-ray fluorescence analysis: fusion, 2 elements	32.00	Extraction, dissolution or attack	20.00
X-ray fluorescence analysis: fusion, 3 elements	46.00		

PRODUCTS, FACILITIES, ACTIVITIES AND STANDARD SERVICES, WITH RETAIL PRICES CHARGEABLE BY IGME (IN EUROS)

Determination of organic compounds (volatile, PAHs, Cl pesticides)	450.00		
		Granulometric tests	
		Granulometric sieving analysis (1 cut)	65.10
Mineralometry tests			
Preparation of thin slide	46.00	8-fraction granulometric sieving analysis (up to 0.062mm)	65.10
Preparation of polished thin slide	62.00	Elutriation granulometric analysis (Cyclosizer)	65.10
	96.00		
Preparation of thin slide for sands	58.00	Sedigraph/Sedimentation granulometric analysis	65.10
Preparation of polished probe	95.00	Laser diffraction granulometric analysis	170.00
Preparation of double-polished slide	120.00	Complete granulometric analysis	65.10
Petrographic study	By estimate	Cyclone concentration assay	65.10
Digital image analysis	By estimate		
Grain count	8.00	Concentration assays	
		Dense liquid separation assay (bromophorm)	120.52
III.3 Minerallurgic tests			
Preparation for analyses		Magnetic separation assay with Franz Isodynamic	130.00
Sample drying	50.22		
Preparation of solid sample for analysis	12.00	Electrostatic separation assay (< 0.5 kg)	95.00
Grinding (< 200 g)	16.87	Wilfley table test(<5 kg)	140.00
Widia grinding (< 200 g)	16.87	Flotation test	
Agate grinding (< 100 g)	49.10	Other tests	
Gold grinding analysis (> 2mm) up to 5 kg	20.00	Acid/Basic leachate analysis (max. 1 Kg)	310.50

PRODUCTS, FACILITIES, ACTIVITIES AND STANDARD SERVICES, WITH RETAIL PRICES CHARGEABLE BY IGME (IN EUROS)

Total humidity	16.00	Standard: UNE-EN 1925:1999	160.25
Apparent specific weight	32.05	Flexion resistance under concentrated load (not including cutting / probe preparation)	
Real density (water pycnometer)	16.00	Standard: UNE-EN 12372:1999	125.20
Real density (helium pycnometer)	32.05	Flexion resistance under constant moment (not including cutting / probe preparation)	
pH	16.00	Standard: UNE-EN 13161:2002	125.20
Index of whiteness/yellowing	32.05	Resistance to compression (not including cutting / probe preparation)	
Smoothing	95.15	Standard: UNE-EN 1926:1999	102.20
III.4 Natural stone tests		Resistance to fracture energy (not including cutting / probe preparation)	
Apparent density and open porosity (not including cutting / probe preparation)		Standard: UNE-EN 1936:1999	160.25
Real density, helium pycnometer (not including grinding to < 63 microns)		Standard: UNE-EN 14158:2004	61.10
Standard : Internal procedure	32.05	Unpolished slip resistance value (not including cutting / probe preparation)	
Chromatic coordinates (1 reading)		Standard: UNE-EN 14231:2004	215.35
Standard : Internal procedure	1.50	Dynamic elasticity module (not including cutting / probe preparation)	
Water absorption at atmospheric pressure (not including cutting / probe preparation)		Standard: UNE-EN 14146:2004	370.60
Standard: UNE-EN 13755:2002	62.10	Fundamental resonance frequency (1 determination)	
Water absorption by capillarity (not including cutting / probe preparation)		Standard: UNE-EN 14146:2004	3.50
		Sound propagation velocity (not including cutting / probe preparation)	

preparation)		Frost resistance (168 cycles)	
Standard: UNE-EN 14579:2005	92.15	(not including cutting / probe preparation) (not including evaluation of alterability apart from weight loss)	
Sound propagation velocity (1 determination)		Standard: UNE-EN 12371:2001	1,390.00
Standard: UNE-EN 14579:2005	2.50		
Resistance to abrasion (not including cutting / probe preparation)		Frost resistance (250 cycles) (not including cutting / probe preparation) (not including evaluation of alterability apart from weight loss)	
Standard: UNE-EN 1341/2:2003	310.50	Standard: UNE-EN 12371:2001	1,900.00
Resistance to salt crystallization (not including cutting / probe preparation) (not including evaluation of alterability apart from weight loss)			
Standard: UNE-EN 12370:1999	368.60		
Frost resistance (28 cycles) (not including cutting / probe preparation) (not including evaluation of alterability apart from weight loss)		III.5 Soil Assays	
Standard: UNE-EN 12371:2001	368.00	Preparation of samples for assays	
		Standard: UNE 103100	12.00
		Granulometric sieving analysis	
		Standard: Internal Procedure	43.00
		Granulometric sedimentation analysis	
		Standard: Internal Procedure	62.00
		Liquid limit	
		Standard: UNE 103103	13.00
		Determination of the plastic limit of soil	
		Standard: UNE 103104	13.00
		Retraction characteristics	
		Standard: UNE 103108	22.00

PRODUCTS, FACILITIES, ACTIVITIES AND STANDARD SERVICES, WITH RETAIL PRICES CHARGEABLE BY IGME (IN EUROS)

Carbonate content		Standard Proctor compaction test	
Standard: UNE 103200	13.00	Standard: UNE 103500	47.00
Quantitative measurement of sulphate content		Modified Proctor compaction test	
Standard: UNE 103201	17.00	Standard: UNE 103501	62.00
Qualitative measurement of sulphate content		CBR index	
Standard: UNE 103202	13.00	Standard: UNE 103502	88.00
Organic matter content		Expansivity (soil PVC meter)	
Standard: UNE 103204	24.00	Standard: UNE 103600	32.00
Humidity		Free swell oedometer test	
Standard: UNE 10330	12.00	Standard: UNE 103601	36.00
		III.6 GEOTEK multiparametric testing	
Apparent density		Determination of apparent density and sonic velocity for any spacing, or for all parameters with spacing > 2 cm.	
Standard: Internal Procedure	146.00		130.20 /sample
Real density		Determination of all parameters with spacing " 2 cm.	190.30/sample
Standard: Internal Procedure	22.00		
Simple compression breaking test			
Standard: UNE 103400	32.00		
Direct cut test		IV. GEOMINING MUSEUM	
Standard: UNE 103401	78.00	Slide duplication	15.00
Triaxial test		Obtaining digital photographs	20.00
Standard: UNE 103402	125.00	Duplicating digital photographs	12.00
Permeability		Taking photographs - Rates for photographs taken by non-IGME personnel, with the prior authorization of the Museum Director, for cultural or commercial purposes.	
Standard: UNE 103403	53.00		
One-dimensional consolidation test (oedometer)			
Standard: UNE 103405	78.00		

PRODUCTS, FACILITIES, ACTIVITIES AND STANDARD SERVICES, WITH RETAIL PRICES CHARGEABLE BY IGME (IN EUROS)

Hall or architectural feature	200.00
Geological samples	30.00
Apparatus	30.00
Documents	30.00

The subsequent use of these photographs must respect the specific purpose for which they were authorized. The source must always be acknowledged and a copy of the publication sent to the Geomining Museum (Ríos Rosas, 23, 28003 MADRID).

V. FILMING

Filming for commercial purposes within the IGME Central Headquarters	2,500.00
--	----------

VI. CORE ARCHIVE

Photocopies:

Size A4 (B/W)	0.10
Size A4 (Colour)	0.50
Size A3 (B/W)	0.25
Size A3 (Colour)	1.00
Large Size A3 (1 metre paper) B/W	3.00
Size (1 metre paper) Colour	5.00

Digitization

Digitization size A4 (+ CD = 1,30 €)	0.15
Digitization size A3 (+ CD =1,30 €)	0.25
Digitization large size A3 (+CD =1,30 €)	1.85
Digitization size A4 (+ DVD = 2,50 €)	0.15
Digitization size A3 (+ DVD= 2,50 €)	0.25

Digitization large size A3 (+DVD =2,50 €)	1.85
---	------

Binding

Spiral or channel	2.00
-------------------	------

Samples

Continuous core sample (10 cm)	30.00
Residue sample	30.00

Various

Data on CD	1.50
Data on DVD	2.50
Sending data on CD/DVD in padded envelope	0.50

Postage costs

CD (weight up to 200 gr.)	1.25
Paper document	By weight
Channel-bound document	By weight

ANNEXE II

SPECIFIC ACTIVITIES AND SERVICES AND NON-STANDARD WORK SUBJECT TO PRIOR ESTIMATE

For the purposes of calculating an estimate of costs, the following criteria are taken into account:

Personnel costs

Determined in accordance with average costs, weighted by the professional categories established annually to this effect by IGME.

Personnel living and travel expenses

Those resulting from application of the current regulations on staff commissions, as stipulated in Royal Decree 462/2002, of 24 May, on reimbursements for occupational expenses (BOE 30 May, 2002) and complementary and extending provisions.

Charges for the use of equipment and inventoriable goods

According to acquisition cost, following

application of the write-off charges applicable to the types of equipment to be employed.

Charges for fungible goods

According to acquisition cost

Other costs associated with the performance of IGME services

According to current price lists or market prices.

IGME GENERAL DATA

IGME GENERAL DATA

Headquarters C/ Ríos Rosas, 23
28003 Madrid - España

Tel - + 34 91 349 5700
Fax - + 34 91 442 6216
E Mail: igme@igme.es



Tres Cantos building
C/ La Calera, 1
28760 Tres Cantos - Madrid

Tel - + 34 91 7287268
Fax - + 34 91 7286150



Laboratories C/ La Calera, 1
28760 Tres Cantos - Madrid

Tel - + 34 91 7287225
Fax - + 34 91 728 6150



ALMERÍA

C/ Real, 115 - 3º A
 04002 - Almería
 Tel - 950 251 166
 Fax - 950 251 984
 E Mail: almeria@igme.es

GRANADA

Urb. Alcázar del Genil, 4-Edif. Zulema,
 Bajo.
 18006 - Granada
 Tels - 958 183 143 - 958 183 146
 Fax - 958 122 990
 E Mail: granada@igme.es

LAS PALMAS DE GRAN CANARIA

C/ Alonso Alvarado, 43 - 2ªA
 35003 - Las Palmas de Gran Canaria
 Tels - 928 366 575 - 928 381 046
 Fax - 928 362 024
 E Mail: canarias@igme.es

LEÓN

Parque Científico de León
 Avda. Real, 1. Edificio 1
 24006 - León
 Tels - 987 262 171 - 987 262 182
 Fax - 987 262 183
 E Mail: leon@igme.es

MURCIA

Avda. Alfonso X El Sabio, 6
 30008 – Murcia
 Tel - 968 245 012
 Fax - 968 245 000
 E Mail: murcia@igme.es

**OVIEDO**

C/ Matemático Pedrayes, 25
 33005 – Oviedo
 Tels - 985 258 611 - 985 258 656
 Fax - 985 276 767
 E Mail: oviedo@igme.es

PALMA DE MALLORCA

Administración Periférica del Estado
 Ciudad Querétaro, s/n
 07007 – Palma de Mallorca
 Tels - 971 467 020 - 971 460 011
 Fax - 971 467 156
 E Mail: mallorca@igme.es

SALAMANCA

C/ Azafranal, 48-1ªA
 37001 – Salamanca
 Tel- 923 265 009
 Fax - 923 265 066
 E Mail: salamanca@igme.es

SANTIAGO DE COMPOSTELA C/

Cardenal Payá, 18-1º
 15703 – Santiago de Compostela -La
 Coruña
 Tel - 981 562 285
 Fax - 981 572 039
 E Mail: santiago@igme.es

IGME GENERAL DATA

SEVILLA

Subdelegación de Gobierno
Pza. de España - Torre Norte
41013 – Sevilla

Tels - 954 236 611 - 954 236 677

Fax -954 236 737

E Mail: sevilla@igme.es

Nave

c/ La Viña, 23

21600 Valverde del Camino - Huelva

Teléfono y Fax 959 550 828

E Mail: valverdedelcamino@igme.es

VALENCIA

C/ Cirilo Amorós, 42 – Entreplanta
46004 – Valencia

Tel - 963 943 474

Fax -96 394 44 36

E Mail: valencia@igme.es

ZARAGOZA C/ Manuel Lasala, 44- 9ºB

50006 – Zaragoza

Tels - 976 555 153 - 976 555 282

Fax -976 553 358

E Mail: zaragoza@igme.es

Borehole core archive

Carretera Badajoz-Granada, Km.192

14200 Peñarroya, Córdoba

Tel: 957 562 511

Fax: 957 560 225

E Mail: litoteca@igme.es



MINISTERIO
DE CIENCIA
E INNOVACIÓN



Instituto Geológico
y Minero de España