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FRANÇAISE

*Liberté
Égalité
Fraternité*

FRENCH GEOLOGICAL SURVEY 2025 ANNUAL REPORT



Geoscience for a sustainable Earth

brgm

BRGM, the French geological survey, is the French institution entrusted with expert appraisal for ground and subsurface issues. Its work contributes both to the sustainable development of regions by taking into account all associated risks, and to the optimal use of subsurface resources and properties. Through partnerships with several public authorities and private stakeholders, it combines scientific research, support for public policy-making and international cooperation.

Strategy

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Fluorite vein in the Massif Central. Classified by the European Union as a substance of high criticality, fluorspar is used as a source of elemental fluorine in numerous chemical industries, as a flux in metallurgy, and in the glass and ceramics industries.
© Rémi Flament / STRATES





“BRGM will continue to play its vital role in the ecological and energy transition, in building the resilience of regions and in safeguarding national sovereignty by pursuing its bold and ambitious strategy”

CATHERINE LAGNEAU

Chair and CEO

In a world undergoing profound upheaval, faced with climate change that is taking a heavy toll on our planet, and against a national backdrop that is placing a lasting strain on public policy, BRGM continued to play its part in 2025, remaining true to its commitment and its public service mission. Amid an internal reorganisation, which involved the relocation of more than 500 of them, its employees maintained their high level of productivity to carry out a revised scientific strategy, drive the exceptional growth of our business – up 50% in six years! – and meet the heightened expectations of the French government, local authorities and society.

Through our research projects, our work in support of public policy and our commercial activities, the results speak for themselves: major scientific contributions, such as our investigation of the seismic and volcanic context of Mayotte; the provision of decision-support tools, for example for water management, with the new version of MétéEAU Nappes, and for coastal risks, with the CoCliCo platform; and solutions provided to public sector stakeholders, both in France and abroad, where our business is also growing.

I should also mention the mineral resources inventory, which we began to update in 2025, and the inventory of deep geothermal resources, which was also undertaken last year. The national research programmes (PEPR) in which we are involved have made great strides. Ofremi, which we run, has successfully adapted its work to the current turbulent context. Our work on mine safety and prevention has lived up to expectations, despite budgetary constraints. And projects with the business sector are expanding, supported by the tax credit scheme for collaborative research (CICo).

Excellent performance by our subsidiaries

Our group is also growing stronger thanks to the excellent performance of our subsidiaries and the new investments made through BRGM Invest, which reflect our commitment to providing long-term support for projects that offer solutions to today's challenges. The creation of CaliCO₂, in particular, which is developing a decarbonisation process patented by BRGM, is proof of our ability to apply fundamental research to practical solutions.

Heading into 2026 with “AUDACE”

This review reveals the extent to which the subsurface has returned to the forefront of public policy. BRGM, as the French geological survey and an expert in this field,



is increasingly recognised and relied upon. In the face of increasing demands, we must be proactive and set an example. This is why we are approaching 2026 with “AUDACE” (through a bold strategy): Agility, to enable us to act more quickly; Utility, by prioritising our activities and refocusing on high-impact projects, such as the “national geoscience reference platform”; Digital, to consolidate our position as the national authority on data, knowledge and digital services relating to the ground and subsurface, notably through our integrative digital platform (PNI); Adaptation, to ensure the long-term sustainability of our organisation; Collaboration, to accelerate innovation to achieve transitions; and Excellence, to maintain the quality of our work.

BRGM will continue to play its vital role in the ecological and energy transition, in building the resilience of regions and in safeguarding national sovereignty by pursuing its bold and ambitious strategy.



27 JANUARY

1 QUALIOPI certification renewed

An audit has confirmed BRGM's Qualiopi certification, attesting to the consistent quality of its training services.

13 FEBRUARY

The Minister for Industry and Energy at BRGM

Marc Ferracci, then Minister for Industry and Energy, visited BRGM's scientific centre in Orléans, as well as the premises of its subsidiary, IRIS Instruments. The update of the national inventory of mineral resources (see pages 48-50), which has been entrusted to the institution, was officially launched on this occasion.

19 MARCH

Catherine Lagneau reappointed to her post

The Chair of BRGM's Board of Governors has been reappointed to her post by a decree of the Council of Ministers. Catherine Lagneau, a graduate of the *École des Mines*, has been Chair and CEO of the institution since September 2023.

31 MARCH

2 Closer ties between the French and Norwegian geological surveys

BRGM and the *Norges geologiske undersøkelse* (NGU), its Norwegian counterpart, have entered into a three-year, renewable partnership. The agreement aims to align their expertise in the fields of mineral resources - particularly strategic resources - and energy sources, through technical exchanges, seminars and joint projects.



10 MAY

3 A podcast for young people about mineral resources

BRGM, in partnership with France Inter, has launched a series of podcasts aimed at 7- to 11-year-olds. Enjoyable and accessible, "The Adventures of Professor Caillou" help children discover the vital role metals play in everyday life, as well as the issues surrounding their extraction and recycling.





6 JUNE

4 A new partnership with Brazil

BRGM has signed an agreement with the Brazilian geological survey to support the energy transition (covering critical metals, hydrogen, CO₂ storage, etc.). This partnership will facilitate the exchange of knowledge, capacity-building and the pooling of expertise between French and Brazilian counterparts.

10 JUNE

First scientific collaboration with Vietnam

BRGM has signed a cooperation agreement with the French Development Agency (AFD) and the Vietnamese Department of Geology and Mineral Resources. This ground-breaking initiative marks the start of collaboration focusing on sustainable geology and the management of mineral resources.

20 JUNE

5 New: a water forecasting service!

Thanks to its collaboration with BRGM, France Télévisions has incorporated a "Water Forecast" into its Weather and Climate Bulletin. Based on the organisation's groundwater status report - now published twice a month- this new feature provides an overview of the water situation in France, whilst explaining the challenges facing this resource and its various uses in the context of climate change.



24-25 JUNE

PanAfGeo+: a launch and a second contract

Funded by the European Union and led by BRGM, PanAfGeo+ (2025-2029) aims to develop geoscience on the African continent. The Partnerships and Training component of the project was launched in Dar es Salaam, Tanzania, and the first international training course took place in Entebbe, Uganda. A second agreement, relating to investment, has been signed with South Africa, Namibia and the Democratic Republic of the Congo.

30 JUNE

Strengthened scientific cooperation with CNRS

Building on their partnership in the field of research into the subsurface, natural resources and major environmental issues, CNRS and BRGM have signed a new framework agreement. In particular, the agreement sets out the terms of their collaboration within the Orléans Earth Sciences Institute (ISTO) and the MACLE-CVL support and research unit.



1 JULY

6 A focus on geothermal energy and geocooling

The Renewable Energy Union (SER) and BRGM jointly organised a press conference in Orléans on geothermal energy, focusing in particular on sustainable cooling. The journalists were also able to visit BRGM’s geothermal platform.

7 JULY

7 The Minister for Ecological Transition visits Orléans and La Réunion

Agnès Pannier-Runacher, then Minister for Ecological Transition, Biodiversity, Forests, the Sea and Fisheries, was hosted at BRGM in Orléans during a visit focusing on drought and water stress. The minister had also visited La Réunion on 12 April to gain a better understanding of the risks associated with ravines, particularly with respect to cyclones.

18 JULY

Submission of the Court of Auditors’ report

Following a year-long audit, the Court of Auditors has published its report on BRGM, setting out three key recommendations: to restore sustainability, which has been compromised by available resources not keeping up with increasing demands; to maintain the quality of expertise despite changing priorities; and to upgrade digital tools to enable the precise management and monitoring of operations.

8 SEPTEMBER

BRGM joins the French Water Committee

The BRGM now sits on the National Water Committee, a key body for the management and protection of this natural resource in France.



22-23 SEPTEMBER

Innovating to meet energy challenges

Supported by experts, around 50 undergraduates and PhD students took part in TInnov, BRGM's annual open innovation event. This year's competition focused on major energy challenges relating to subsurface resources, and the winner, the Condens'Hy concept, centres on the recovery and utilisation of air-conditioning condensate to produce green hydrogen.

7 OCTOBER

8 The first issue of *BRGM mag!*

BRGM has launched its *BRGM mag*. The magazine, which can be read at brgm.fr, is aimed at anyone interested in the solutions that the institution - and, through it, the subsurface - can offer in response to the challenges posed by global changes. The first issue, featuring a special report entitled "The subsurface: a key to the future of our regions", was previewed at the Pollutec trade fair.

7-10 OCTOBER

9 Pollutec: BRGM showcases its solutions

As an exhibitor at the environmental innovation fair for a sustainable world, held in Lyon, BRGM presented its lessons learnt and the solutions it is developing in relation to risks and resources associated with the ground and subsurface. To open the event, Catherine Lagneau, BRGM CEO, held a discussion with mathematician Cédric Villani on the theme "Protecting science and rebuilding trust".



13-14 OCTOBER

Natural hazards: BRGM at the National Conference

Strengthening risk awareness and preparing regions for adaptation are the aim of the National Conference on Natural Hazards (ANRN), organised every three years by the Ministry for Ecological Transition. As a member of the science committee for the 2025 event, which took place in Toulouse, BRGM also made a significant contribution there, notably with 23 posters.





14-17 OCTOBER

10 The mining industry trade fair in Orléans

BRGM played an active role in the 2025 edition of the Society of the Mineral Industry (SIM) conference in Orléans, taking part in the opening session and technical workshops, and organising tours of its scientific centre. The institution had also organised an event focusing on the mineral resources inventory.

29 OCTOBER

11 Publication: a novel method to help predict volcanic activity

A BRGM team, together with its partners, has published an article in the journal *Nature* entitled "Magnetotelluric evidence for a melt-rich magmatic reservoir beneath Mayotte". The article presents a study which, by employing an electromagnetic method rarely applied to molten material in the Earth's crust and by comparing these observations with laboratory analyses of lava, has made it possible to determine the proportion of liquid magma in the reservoir located 23 km beneath the island of Mayotte. This magma is thought to be linked to the formation of the underwater volcano Fani Maoré.

24 NOVEMBER

A landmark framework agreement for French overseas territories

BRGM and the Ministry for Overseas Territories wished to strengthen their collaboration in the field. They have committed, for a period of three years, to optimising the geological and environmental initiatives carried out in the overseas territories in order to address the major challenges relating to groundwater, natural hazards and man-made risks, and subsurface resources.

4 DECEMBER

12 The revival of the Mines medal

Extended in 2025 to include the industrial and energy sectors, the Mines medal was awarded by Marc Ferracci, a former minister and the driving force behind its revival, to eight BRGM recipients. It recognises the quality of services and the exemplary nature of initiatives undertaken to manage or harness subsurface resources.

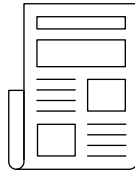


Read the article "Magnetotelluric evidence for a melt-rich magmatic reservoir beneath Mayotte" in the journal *Nature*



2025 key figures

213

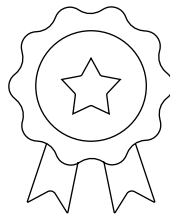


**scientific articles published
by BRGM in international journals
indexed by Web of Science¹**

57

**joint publications
with BRGM
partners at
its sites¹**

3



**patent
applications
filed¹**

43

**projects financed
by the European Union
(Horizon Europe),
including
4 coordinated
by the institution²**

14

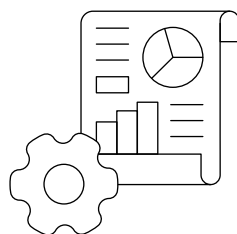
**projects
involving BRGM
in the national
research
programmes PEPR²**

16

**projects
coordinated by
BRGM, submitted
for funding by
the ANR¹**

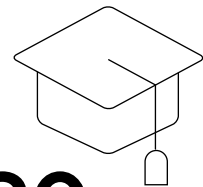
230

**expert assessment
reports produced
by BRGM¹**



137

**PhD students
enrolled, including
8 CIFRE theses
and 4 international
collaborations²**

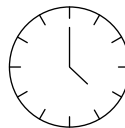
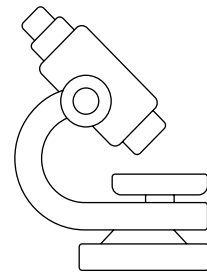


20

**post-doctoral
researchers hosted²**

44

**BRGM scientists
authorised
to lead research²**



82,910

**student-hours³ delivered
in higher education¹**

900

**trainees trained
by BRGM Formation¹**



-7%



**reduction in the carbon footprint
of the institution¹ compared with 2024**

Modelling the subsurface

Towards a French geoscience reference platform

BRGM has launched an ambitious programme with the aim of acquiring a comprehensive and predictive understanding of subsurface characteristics over the coming years. This “national geoscience reference platform” will further our knowledge of the subsurface in order to support the development of sustainable activities.

BRGM has been working towards a national geological model for over thirty years. In 1995, it launched the GéoFrance 3D programme, followed in 2011 by the programme for the French geological reference platform (RGF) – still in use today – with the aim of making the transition from a 2D representation (the geological map) to a 3D representation of geology in France. This work paved the way for future studies while also adapting the overall approach, which is now focused more broadly on the creation of a national geoscience reference platform (RGN). “The aim is to develop a tool accessible to everybody, bringing together all the different ways of representing the subsurface across France, for a range of subject areas (water, natural hazards, etc.) and on any scale,” explains Caroline Ricordel. “As a result, this geoscience reference platform will be more than just a 3D geological model. It could even be a 4D model, taking account of changes over time.”

A concurrence of favourable circumstances is currently contributing to this endeavour. Specifically, the development of the RGN could benefit from the resources and results of two closely linked scientific programmes led by BRGM: one focusing on the improvement, representation and dissemination of geological knowledge; the other on the development of digital tools and services – drawing on the latest technologies – to be used for this purpose, with the aim of strengthening predictive capabilities.

Bringing the geoscience community together

BRGM has already modernised its modelling tools and made them interoperable. It also plans to carry out extensive work on its numerous databases in order to optimise and link them. The implementation of its integrative digital platform (PNI, see pages 64–66) will also facilitate data integration and transfers between tools.

Another key initiative in this area is the development of digital platforms supporting scientific communities in various fields (subsurface, risks, water), as part of the national research programmes (PEPR) in which BRGM is taking part. The national geoscience reference platform could be accessible via these platforms, alongside the InfoTerre portal managed by BRGM.

Further, through the RGF, BRGM has already demonstrated its ability to bring together the geoscience community, not only to pool data but also to exchange ideas on knowledge and how it is disseminated. As Simon Lopez explains, “We will continue to develop these practices in order to determine the knowledge to be disseminated and the services to be provided by the national geoscience reference platform, establishing a strategy that allows us to meet the differing needs and expectations of our three target audiences: the academic and scientific community, central government and local authorities, and civil society”.



**SIMON
LOPEZ**

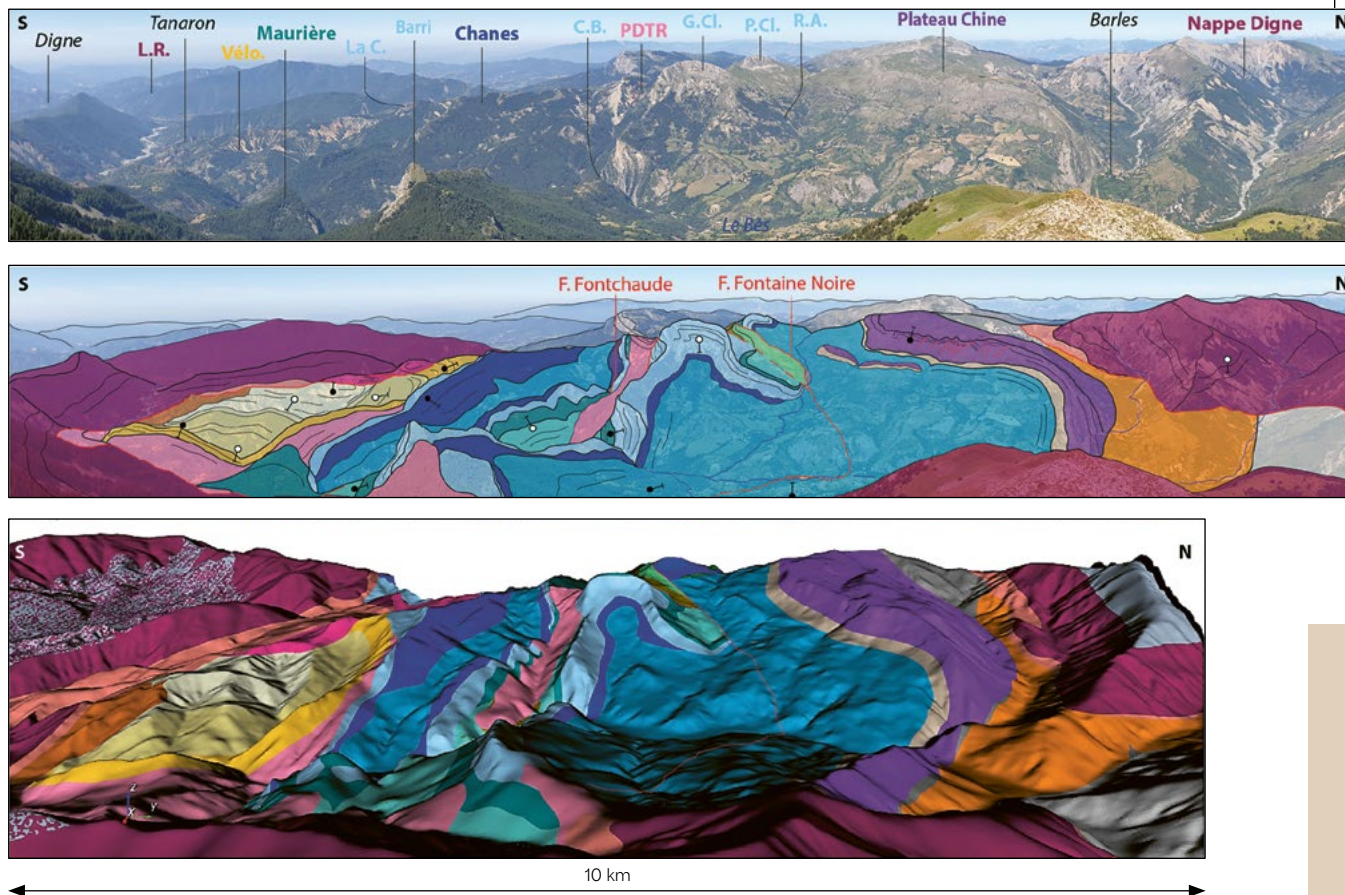
Project Director
for the National
Geoscience
Reference Platform



**CAROLINE
RICORDEL**

Director
of Subsurface
Knowledge and
Geomodelling

3D model of the Barles half-window and Digne aquifer, produced as part of a PhD thesis by Agathe Faure - the Alps project for the French geological reference platform and the national geological nature reserve of Haute Provence. A comparison between the geological map derived from the 3D geological model and overlaid onto the topography (bottom) and an interpretative view of the landscape (centre). © BRGM



Assessing the cost-benefit ratio

The RGN will offer data-processing based services, allowing the generation of a map or model for a specific purpose. “The challenge,” continues Simon Lopez, “is to implement a ‘living’ structure able to automatically update maps and models with the latest data and knowledge. This would be a huge breakthrough compared with the existing system.”

To develop the national geoscience reference platform, BRGM will draw on various research projects focusing on subsurface modelling, such as the RGF or METROSED. Launched in mid-2025 as part of the Subsurface PEPR programme (Digital Earth), this last project involves creating a national model of sedimentary basins by merging historical models. “This work on sedimentary basins – which cover over 70% of mainland France – will pave the way for the RGN,” says Simon Lopez.

The method for modelling the subsurface in a way that addresses multiple issues on multiple scales will be tested in the Orléans metropolitan area (Loiret region) in 2026 and could be fully deployed in operational form by 2028 across the southern part of the Paris Basin. France would then be on track to have a 3D model – like other European countries – allowing it to widely disseminate knowledge of its subsurface. The undeniable cost of this initiative is largely outweighed by the benefits, particularly in terms of risk reduction. “We plan to assess the cost-benefit ratio of geological knowledge,” says Caroline Ricordel. “The aim is to raise awareness of the need to improve and disseminate this knowledge, notably through the national geoscience reference platform.” ●

“The aim is to develop a tool which is accessible to everybody, bringing together all the different ways of representing the subsurface across France, for a range of subject areas and on any scale”

Climate ambitions

BRGM committed to the ecological transition

As a leading public institution in Earth sciences, BRGM is a key player in the ecological transition. Through its activities and capacity for innovation, it is helping to advance knowledge and develop responses to environmental and climate issues. It is also transforming its own practices in order to meet the highest standards in its environmental and social approach.

In response to climate change and the current upheavals in the Earth system, BRGM is fully committed to answering scientific questions, raising awareness of issues and opening up new possibilities, in order to provide society with the understanding and resources necessary to address current and future challenges. To this end, it is carrying out ambitious research projects, providing independent expertise to public authorities, and deploying training and scientific outreach initiatives aimed at civil society.

“Our work is guided by a scientific strategy revised in 2024, in line with the national reference pathway for climate change, based on a 4°C rise in temperature in France by 2100,” says Frédéric Glanois. *“We are committed to doing more, whether in supporting efforts to adapt to climate change and reduce net greenhouse gas emissions, or in addressing the other major issues raised by the ecological transition, all of which are intrinsically linked.”* At the same time, and in line with its scientific output, BRGM has initiated a wide-ranging plan to maximise its impact on society and, more particularly, to reduce its environmental footprint: the master plan for Sustainable Development & Social and Environmental Responsibility, a transformation project for the period 2025–2030 involving all activities and all staff (see pages 68–69).

Taking action to mitigate climate change

BRGM is calling for the subsurface to be recognised as a lever for the energy transition and decarbonisation, with its energy resources and storage capacities. Through its work, BRGM is seeking to contribute to the emergence and consolidation of solutions that could be implemented on specific sites or at the regional level.

→ ***Supporting the development of geothermal energy in all its forms / Enabling secure underground storage of energy, carbon and radioactive waste / Exploring natural hydrogen resources / Securing the supply of the mineral resources required for the transition.***

Taking action to adapt to climate change

BRGM's work on water and natural hazards provides fundamental input for policies on adaptation, as well as contributing to research efforts to overcome scientific barriers. These initiatives cover the entire cycle: preparing for adaptation, assessing risk, identifying options, implementing actions, monitoring and assessing measures, and are supported by BRGM's digital infrastructure, enabling the development of climate-related services.

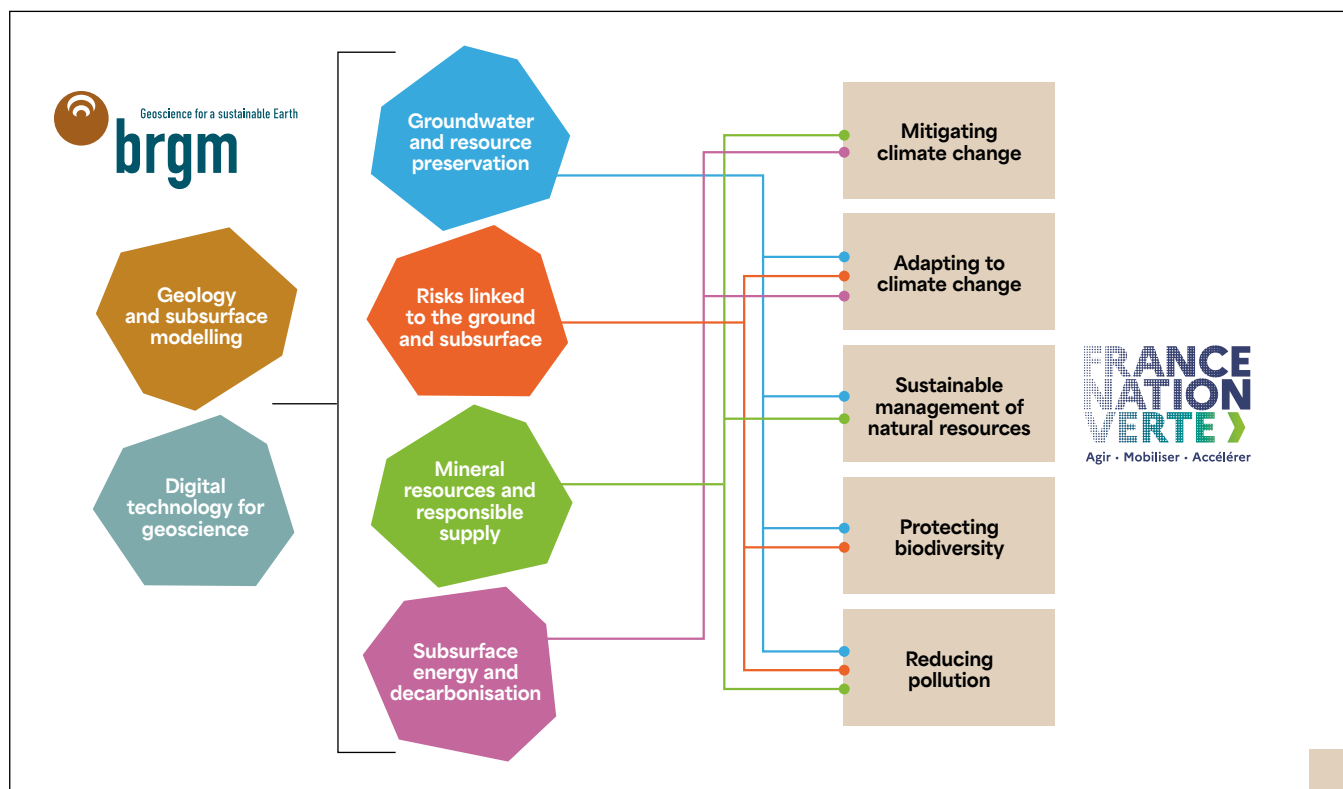
→ ***Planning and acting for better water management/ Improving knowledge of the subsurface/ Modelling risks / Preparing for extreme events / Developing nature-based solutions.***



**FRÉDÉRIC
GLANOIS**

Director of Energy
and Decarbonisation
Delegate for Climate
Strategy

“Our work is guided by a scientific strategy revised in 2024, in line with the national reference pathway for climate change, based on a 4°C rise in temperature in France by 2100”



Taking action for the sustainable management of natural

Water resources

As co-pilot of the national research programme "OneWater - Water as a common good", and the government's delegated project coordinator for the management of the national piezometric network, BRGM is the leading player in the field of groundwater management. Committed to scientific research and support for public policy, as well as to international cooperation, it is seeking to develop our understanding of the hydrogeological and biogeochemical behaviour of aquifers, with a view to implementing better quantitative and qualitative management of groundwater and the associated environments.

→ ***Understanding and managing groundwater resources / Taking action at local level through research and data analysis.***

Mineral resources

By monitoring the entire life cycle of mineral raw materials – particularly in its capacity as coordinator of Ofremi (French Observatory of Mineral Resources for Industrial Sectors), BRGM is involved at key stages: identifying ore deposits; promoting responsible mining; developing innovative and cost-effective resource extraction processes; and recovering waste, including mining waste, through recycling. In this way, it is seeking to promote responsible sourcing in economic activities.

→ ***Managing the life cycle of mineral resources / Ensuring transparency and traceability in the supply chain / Promoting the development of a responsible European mining sector.***

Taking action to protect human health and to conserve and restore biodiversity

BRGM is committed to promoting more responsible use of land and groundwater, in order to minimise the impact of future activities on human health and ecosystems. It is also studying current and "legacy" pollution, with the aim of developing remediation techniques to conserve or rehabilitate urban soil and restore the ecosystem services they provide.

→ ***Preserving groundwater quality / Remediating degraded soil and decontaminating polluted environments.*** ●

The six scientific and societal issues underpinning the work of BRGM allow it to act on all aspects of the ecological transition. © BRGM

Innovation

CaliCO₂: from laboratory to start-up

Following over twenty years of research at BRGM, a patented, sustainable and competitive carbon capture technology cleared a decisive milestone in 2025 with the founding of a start-up dedicated to its development. This breakthrough demonstrates BRGM's ability to foster promising solutions for the decarbonisation of industry through its support for innovation.

The history of CaliCO₂ takes us back to the early 2000s. Alain Seron, a process engineering researcher working on the treatment of pollutants, became interested in layered double hydroxides (LDHs) owing to their affinity for anionic substances, particularly carbonate anions. “That’s when I had the idea of using LDHs to capture carbon dioxide,” he explains, “because when CO₂ dissolves in water, it forms carbonate species that can be captured by these materials through an anion-exchange process.” This discovery was followed by a series of projects, in partnership with industry in particular, to develop this alternative decarbonisation process. “We demonstrated its high potential for CO₂ capture and also its adaptability to a wide variety of gases and carbon dioxide concentrations.”

Research is continuing with electrochemist Stéphanie Betelu. The aim is to optimise the process, and in particular the electrochemical regeneration of LDHs to enable their reuse over repeated cycles. By combining several techniques in a new way, the researchers describe the mechanisms and kinetics of ion transfer both on the surface and inside these materials. Their work is paving the way for the implementation of CALICO, electrolysis-assisted technology to capture and release dissolved CO₂, for purposes of recovery. “Unlike existing processes, CALICO is based on an ingenious concept that significantly reduces electricity consumption by using renewable materials made from recyclable components,” points out Stéphanie Betelu.

Six patents filed

Following a process involving several scientific publications and the filing of six patents, “the idea of setting up a company began to take shape, the aim being to take this disruptive technology from the laboratory to proof-of-concept and then bring it to market. It’s a technology likely to interest industries emitting high levels of CO₂ in their flue gases, such as the cement, steel and waste incineration sectors,” points out Victor Liger. CaliCO₂ was founded in March 2025 as a joint venture between the start-up studio 4elements, the two researchers – shareholders but still BRGM employees – and BRGM Invest, BRGM’s investment arm. Bénédicte Pesset explains: “This commercialisation initiative is based on an innovative set-up: the involvement of a start-up studio to found and manage the company CaliCO₂, an exceptional investment by BRGM Invest at the seed stage, an exclusive licencing agreement covering past and future patents, and a two-year collaborative R&D contract to facilitate the transfer of skills.”



**STÉPHANIE
BETELU**

Researcher, co-inventor
of the CALICO process



**ALAIN
SERON**

Researcher, co-inventor
of the CALICO process



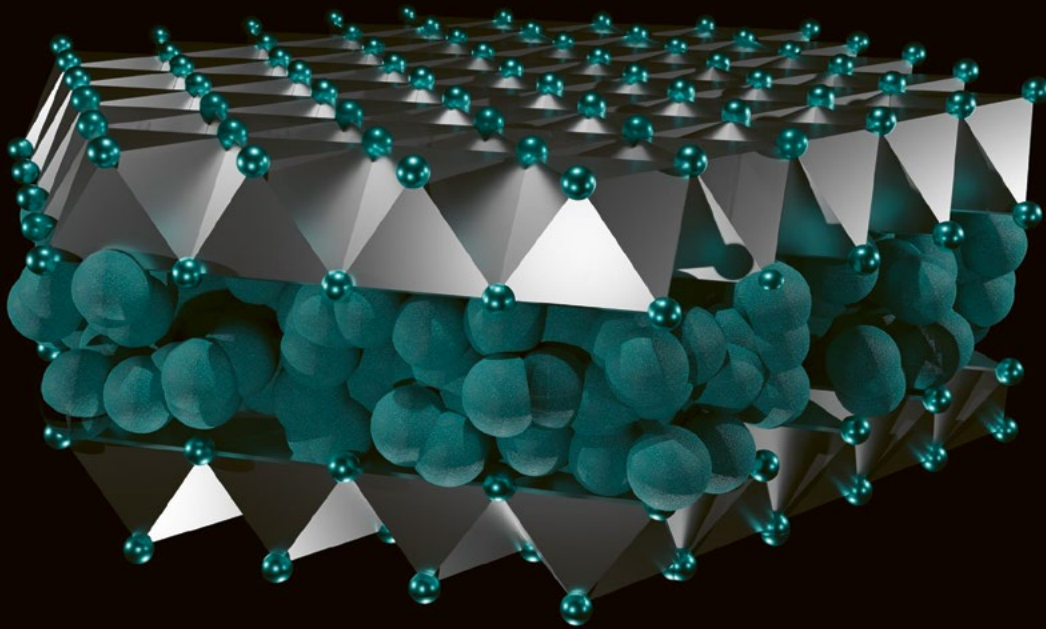
**VICTOR
LIGER**

Head of Innovation,
Knowledge Development
and Transfer



**BÉNÉDICTE
PESSET**

Head of Technology
Maturation and
Transfer



The process developed by the start-up CaliCO₂ is based on electrolysis-assisted CO₂ capture using layered double hydroxides. © ADOBE STOCK



Based at BRGM, the start-up won Bpifrance's i-Lab 2025 innovation competition and has raised €1.5 million in funding. *"This funding will allow us to accelerate the industrial roll-out of this innovative technology and to build a team able to support our future partners,"* say Vanessa Amaral de Oliveira and Jean-Baptiste Goffart, managers of CaliCO₂. Research is continuing in order to improve process performance and increase maturity. ●

3 Mt

OF CO₂ CAPTURED:
CALICO₂'S OBJECTIVE BY 2037

PERSPECTIVES

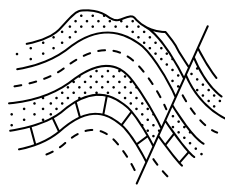
Lyncée Traçabilité, a trusted third party for the responsible sourcing of mineral resources

The Trace Group and BRGM Invest joined forces in October 2025 to set up Lyncée Traçabilité. The founding of this jointventure follows over two years of collaboration between BRGM and the Trace Group - an expert in digital supply chain traceability. Working with manufacturers in the aerospace, automotive, luxury and cosmetics sectors, it provides a mature and innovative service to guarantee the origin and integrity of supplies of strategic materials such as lithium, gold, copper, alabaster, titanium and mica. Bringing an innovative idea to fruition, this initiative is supported by a hybrid approach combining advanced geochemical analyses to establish each mineral's digital fingerprint, the deployment of blockchain technology to record every stage in its journey, and the use of artificial intelligence.

The development of Lyncée Traçabilité's services is underpinned by BRGM's analytical capabilities, and ability to identify mineral traces and assess their purity. © BRGM

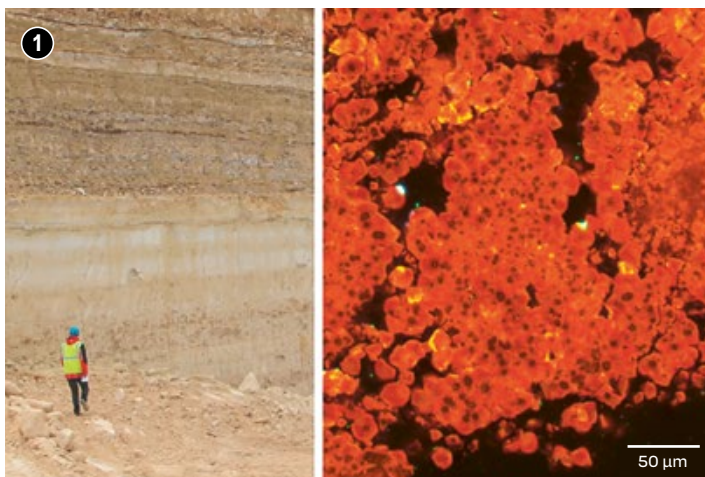






Understanding the subsurface to manage resources and optimise their use

Knowledge of the subsurface is at the core of BRGM's remit and is a matter of strategic sovereignty. Essential for the sustainable or responsible management of natural resources – water, minerals and underground spaces – it provides the necessary basis for decisions on spatial planning and the protection of land areas. To address these challenges, BRGM is gathering and analysing a considerable volume of geoscientific data in order to gain a better understanding of the properties and behaviour of the subsurface. From field observations to numerical models, via measurements, analysis and data processing, this chain of knowledge is used to produce and disseminate reliable and accessible information to support public policy, local authorities and economic stakeholders.



Left: Lutetian strata in a quarry at Saint-Maximin (Oise), with the top of the Coarse Limestone at the bottom and the *Marnes et Caillasses* (marl and hard limestone rubble) facies at the top. Right: small dolomite crystals with dark centres, newly formed in the *Marnes et Caillasses*, probably as a result of microbial activity during the late Lutetian period.

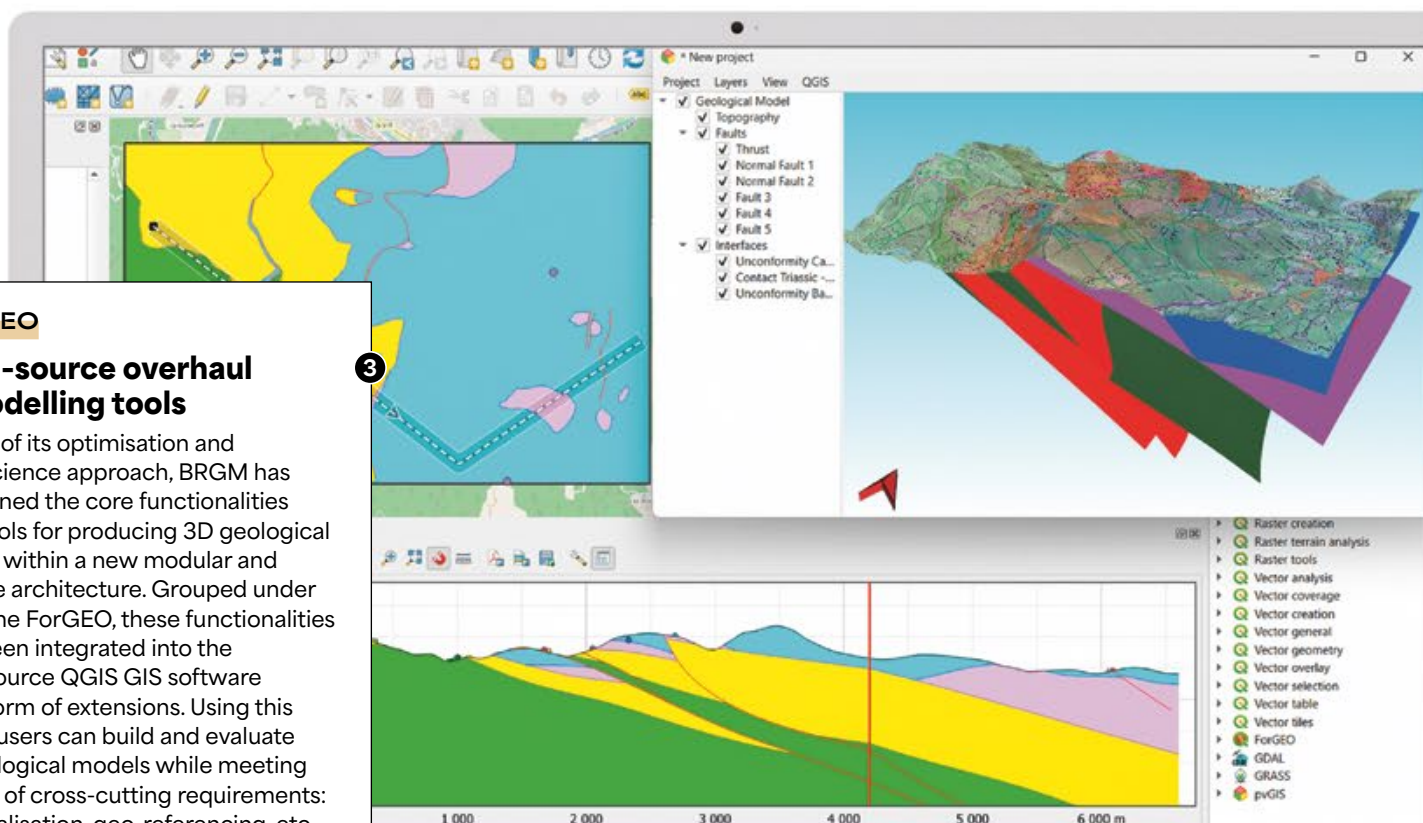
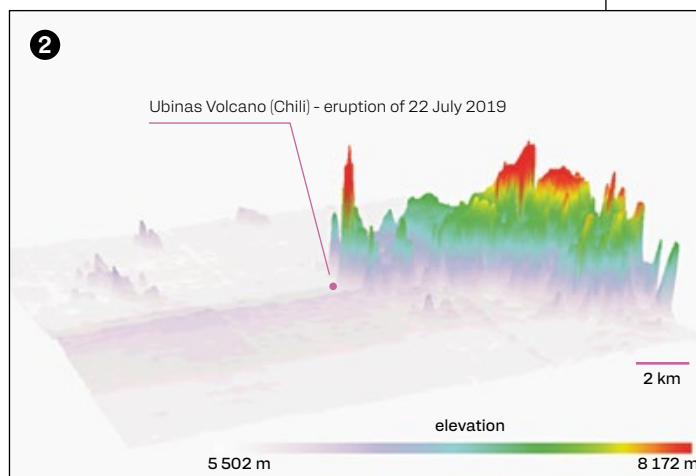
© JULIEN TALON



Read the article “A model for the concomitant early formation of dolomite and fibrous clays in coastal bay systems: Evidence from the Eocene (Paris Basin, France)” in the journal *Sedimentology*



3D visualisation of the volcanic plume elevation model produced by the 2019 eruption of Ubinas (Chile), created using images processed from data acquired by the CNES Pléiades satellite. © BRGM



FORGEO

Open-source overhaul of modelling tools

As part of its optimisation and open science approach, BRGM has redesigned the core functionalities of its tools for producing 3D geological models within a new modular and scalable architecture. Grouped under the name ForGEO, these functionalities have been integrated into the open-source QGIS GIS software in the form of extensions. Using this toolkit, users can build and evaluate 3D geological models while meeting a range of cross-cutting requirements: 3D visualisation, geo-referencing, etc. These developments are available as open source on the gitlab.com platform.

Creation of a 3D model of the Rochessadoule area (Gard) using ForGEO. © BRGM

The AQG quantum gravimeter undergoing measurement tests at the site of the Earth Sciences Institute of Orléans (ISTO) Observatory for Transfers in the Unsaturated Zone (O-ZNS) in the Loiret, under the EQUIP-G project. © BRGM



FRENCH GEOLOGICAL REFERENCE PLATFORM

1 Progress on the Paris Basin and the Alps and Surrounding Basins projects

Led by BRGM, the French geological reference platform (RGF) aims to provide digital 3D geological information that is uniform and consistent across the whole of the country. The RGF 2025 conference, held on 24 and 25 March in Orléans, focused on the Paris Basin and the Alps and their surrounding basins. This conference was an opportunity for the parties involved to present the progress they had made. An interdisciplinary study carried out under the Paris Basin project has put forward a new model to explain the simultaneous formation of dolomite and fibrous clays during the Middle Eocene. This work led to the publication of a paper in the scientific journal *Sedimentology*.

FROM SPACE TO EARTH

2 Making the most of satellite data

BRGM is developing a research and service infrastructure based on Earth observation data from space, for use in a range of areas: natural hazards, water resources and mineral resources. This project is governed by a contract setting out objectives, resources and performance targets, which saw significant progress in 2025. Satellite data from CNES and the European Copernicus programme (Sentinel) were used to map floods, including those caused by rising groundwater levels, to expand the inventory of landslides and to detect and characterise wetlands and river flow rates. A 3D model of the surface of volcanic clouds was also created and a study was carried out on coastal subsidence in the context of climate change.

MASSIF CENTRAL

New horizons in Limagne

The Massif Central project under the national research programme (PEPR) entitled “The Subsurface: A Common Good”, jointly coordinated by BRGM and the CNRS, applies a multidisciplinary approach to investigate the conditions under which this region could contribute to ongoing transitions. The research focuses primarily on critical metals and the potential for a mining revival, as well as deep geothermal energy. In this context, a new study of the Limagne of Allier shows that it features a structural network consisting mainly of strike-slip faults. These findings call for a reassessment of this sedimentary basin and open up new avenues for understanding and exploring the region’s geothermal potential.

TOWARDS THE FIRST 3D MODEL OF FRENCH SEDIMENTARY BASINS

Drawing on its numerous geological models developed since the 1980s, BRGM has started work on producing an initial geometric model of France’s sedimentary basins, which cover more than 70% of mainland France. The principle behind METROSED 3D is to combine certain modelled areas to represent the geometry of the main Mesozoic and Cenozoic stratigraphic sections in sedimentary basins. The first stage, completed in 2025, involved collecting and archiving data on nearly 200 historical models, identifying their footprints and extracting the calculated surface areas. Supported by the Subsurface national research programme (PEPR) under the Digital Earth project, this initiative will contribute to the development of the national geoscience reference platform (see pages 8–9).

EQUIP-G

4 Towards a network of quantum gravimeters in Europe

Launched in 2025, the EQUIP-G project (Horizon Europe), with 19 partners from 11 countries, aims to promote the adoption of quantum gravimetry in Europe. It involves deploying a network of quantum gravimeters and establishing a pool of shared equipment, managed by an organisation that also facilitates the sharing of data, results and expertise. BRGM and the Orléans Institute of Earth Sciences (ISTO) have the task of using hydrogravimetry to study variations in water reserves in the unsaturated zone of the Beauce limestone aquifer. For this purpose, the project is based at the O-ZNS platform in the Loiret, where quantum gravimeters will be installed both on the surface and at depth.

GEOPHYSICS

Assessing rainwater infiltration

In collaboration with the National Radioactive Waste Management Agency (ANDRA), BRGM is running a project at its Meuse/Haute-Marne centre to measure and analyse variations in the water content of a Callovo-Oxfordian claystone spoil tip during rainfall events. This research is based on the use of non-destructive geophysical methods, primarily electrical resistivity tomography (ERT), to visualise the infiltration of rainwater over several days by measuring the electrical resistivity of the catchment. The project has entered the testing phase.

Outstanding result

Mayotte: major advances in understanding the local and regional context

Since the eruption of the Fani Maoré underwater volcano in May 2018, research has been carried out in Mayotte to gain a better understanding of the phenomena involved. The COYOTES project has yielded valuable geological, geophysical, geodynamic and seismological data, which are already being used for other projects in the region.

On Thursday 10 May 2018, a tremor was felt in Mayotte. It was the first in a long series: over 2,700 earthquakes with a magnitude of more than 3 were recorded over the course of 10 months! The cause was an eruption of the underwater volcano Fani Maoré, which took place 50 kilometres off the coast of Mayotte at a depth of 3,500 metres. From its base on the island, BRGM took immediate action to help government departments manage the crisis. BRGM also set up a research project that was to be funded by the ANR to run from February 2020. “*The purpose of COYOTES was to address the need for knowledge about the subsurface below the seabed of the Northern Mozambique Channel, where the Comoros archipelago – including Mayotte – is located, and about past regional and local events,*” summarises Isabelle Thinon. “*The purpose was to understand the context of the ongoing seismic-volcanic crisis and to better assess the hazards.*”

A vast amount of data was collected from bathymetric, seismic, gravimetric and magnetic surveys, seismic reflection and refraction profiles and sediment and rock samples taken both onshore and at sea, in order to determine the depth and morphology of the seabed and the structure of the subsurface, to identify faults, large-scale landslides and volcanic structures and to determine the nature, origin and age of volcanic events. Interpretation of these data led to a series of workshops involving geologists, geophysicists, seismologists, sedimentologists, structural geologists, geochemists, vulcanologists, etc.

First seismic image of Fani Maoré

“*What makes this research project unique,*” says Anne Lemoine, “*is the multi-disciplinary nature of the expertise involved in the study of a region for which there are almost no data.*” More than 30 scientists and experts from 14 French and European institutions and laboratories were involved, along with 4 PhD students, 1 post-doctoral researcher and 7 Masters students. They all helped to characterise the seabed and substrata of the North Mozambique Channel and to gain a better understanding of the processes and phenomena that have occurred throughout the region’s geological history, from the formation of the oceanic basin and the emergence of the Comoros archipelago right up to the 2018-2020 eruption.

The results have been shared with the scientific community through 13 international papers (with others currently being drafted) and several maps. In particular, the ...



**ISABELLE
THINON**

Researcher
in geology and
geophysics,
specialising in
marine sciences



**ANNE
LEMOINE**

Seismology
researcher

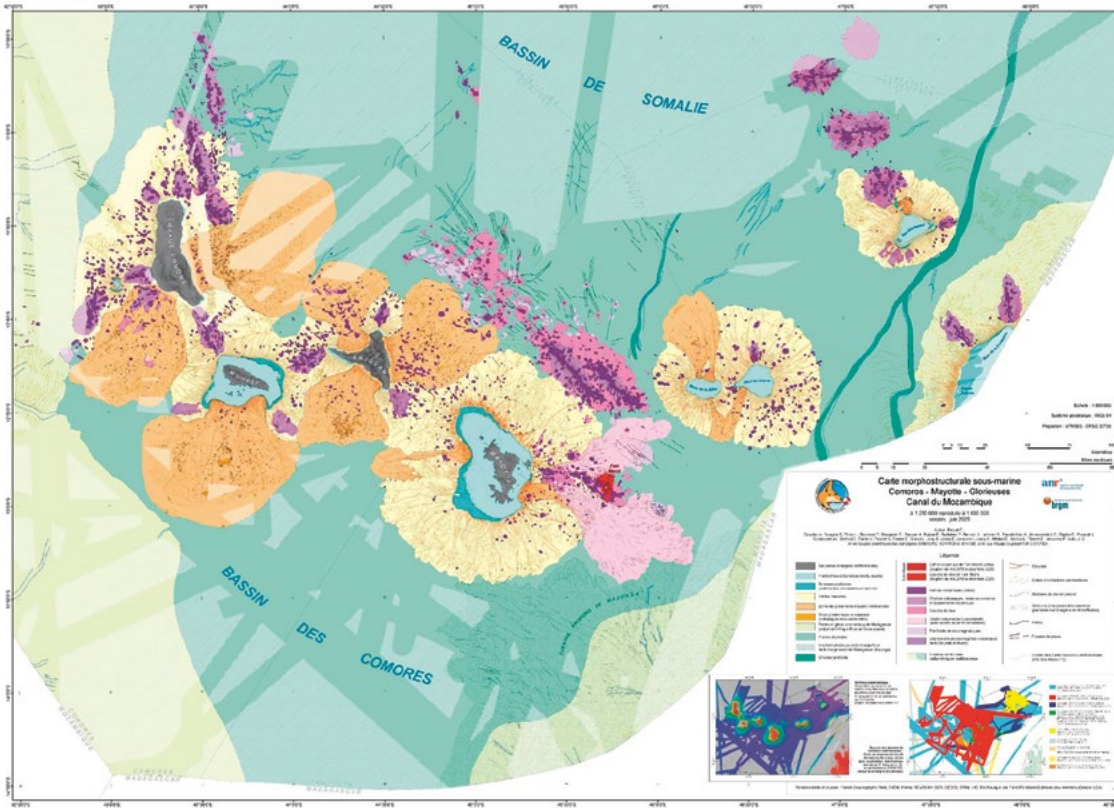
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**TOP-TIER INTERNATIONAL
SCIENTIFIC PAPERS TO DATE**



Geophysical and geological data around Mayotte and the other islands of the Comoros archipelago were collected in the course of the SISMAORE oceanographic survey from 23 December 2020 to 11 February 2021. © BRGM

Outstanding result



On the basis of work carried out on the COYOTES project, a 1:250,000 morphostructural map of the seabed across the entire Comoros archipelago was produced. © PAQUET ET AL. 2025

The Hippoquiz Mayotte board game, an educational game about the island's geology, designed by BRGM. © BRGM



... COYOTES project provided the first seismic image showing the internal structure of Fani Maoré and its substrata. A seismicity catalogue for the region has been compiled, listing the earthquakes recorded over the last hundred years. Scientists have also revised the timeline of the undersea volcano's eruption, identifying the precursor events. Another major finding is that the entire Comoros archipelago must now be regarded as volcanically active. All of this regional expertise feeds into and benefits from the discussions in the Mayotte Vulcanological and Seismological Monitoring Network (REVOSIMA) established in 2019, which BRGM coordinates jointly with the Paris Institute of Earth Physics.

Raising awareness amongst the people of Mayotte

Several information sessions have been organised for the general public. BRGM even created an educational game which has been distributed to schools, universities and community organisations to raise awareness of geology and volcanic activity among the people of Mayotte. Finally, this first project could lead to several others. Under the national risk research programme (PEPR Irima) jointly coordinated by BRGM and others, work has already begun on modelling the impacts of tsunamis that could affect Mayotte. Work has also begun on creating a 3D geological model of the island. However, knowledge of the area and of the phenomena taking place could be refined to improve understanding of the risks and resources. ●

“What makes the COYOTES project unique is the multidisciplinary nature of the expertise involved in the study of a region for which there are almost no data”

– What is the role of the *Société des grands projets* (Major Projects Agency - SGP)?

Jean-François Monteils – Established in 2010, SGP is developing the Grand Paris Express project: 200 kilometres of underground railway – the same length as the existing network – 90% of which is underground; 68 stations to be built, some of which will be more than 50 metres below ground level. From the very beginning, a major concern for SGP engineers has been the precise identification of the geological formations through which the project with its tunnel-boring machines passes. This identification has involved extensive geotechnical reconnaissance surveys since 2012, with nearly 12,000 boreholes drilled to date. No other project has achieved as much. SGP is a company with extensive expertise and experience in the construction of complex underground structures.

– Why did you enter into a partnership with BRGM?

J.-F. M. – The Paris Basin, known to experts for its sedimentary and hence diverse geological composition, held some surprises for us despite this survey work, involving significant changes to our construction methods: the presence of pockets or lenses of sand in the Ypresian formations, steeper stratigraphic dips and the flooding of a station when a tunnelling machine bored into an aquifer. We therefore felt that a partnership with BRGM was crucial in order to benefit both from its database and from its researchers, PhD students and undergraduates who can provide an independent analysis of the project's geological context using a 3D model, with which we can better understand the vast amount of information collected and hence the geological and geotechnical risks involved and the behaviour of the aquifers.

– What can be gained from the data collected during the construction of the Grand Paris Express?

J.-F. M. – Apart from helping us carry out the project, the use of the samples is the second objective of our collaboration. The vast amount of data accumulated by

“We felt that a partnership with BRGM was crucial in order to benefit both from its database and from an independent analysis of the geological context of the Grand Paris Express”

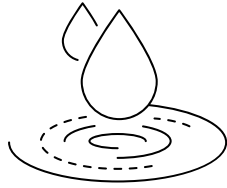


JEAN-FRANÇOIS MONTEILS

Chairman of the Executive Board of the *Société des grands projets*

the SGP is a legacy of the Grand Paris Express project which will provide valuable insights for many planners, developers and project sponsors. It is in the public interest to gradually share these data with BRGM's France Géotechnique database, which is intended to be publicly accessible, and to use it for various research programmes with a view to working with academic partners to build a 3D geological model of the subsurface of Paris. This is what drives the work of our two institutions.

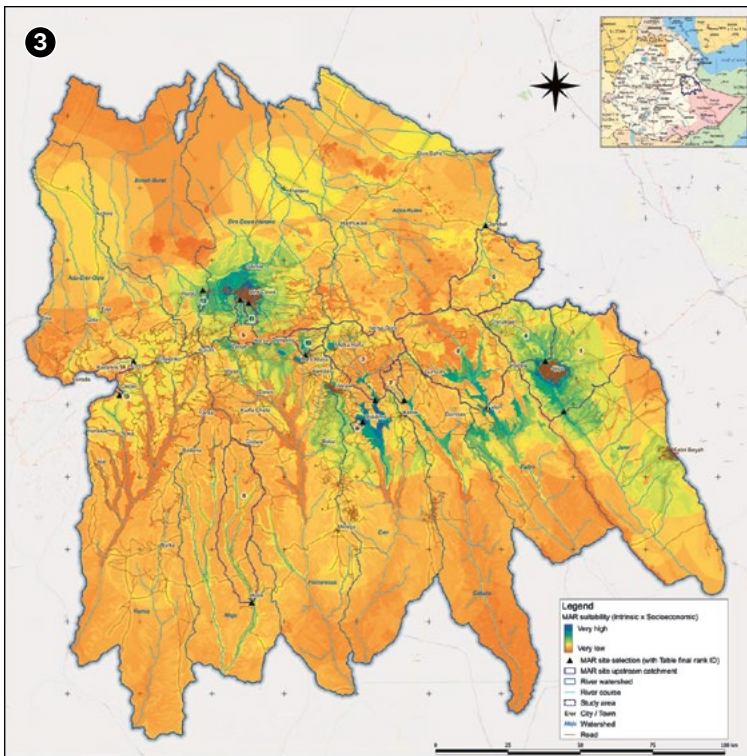




Protecting groundwater in the face of climate change

Climate change and the growing demand for water for various purposes are putting increasing pressure on groundwater resources. In France, the prospect of global warming by up to +4°C by the end of the century could profoundly alter the water cycle and the behaviour of groundwater bodies, leading to an increased risk of conflicts over water use between sectors, between regions, and even internationally. In response to this major challenge, BRGM provides support for public policies on sustainable water management in all regions. BRGM research aims to gain a better understanding of the resilience of aquifers to the effects of climate change and human pressures, while evaluating innovative, and particularly nature-based solutions to ensure the long-term conservation of this vital resource.

◀ The source of the Sorgue at Fontaine-de-Vaucluse (Vaucluse)
© GETTY IMAGES



Map of the region around Dire Dawa and Jijiga in eastern Ethiopia, showing the suitability of the land for managed aquifer recharge.

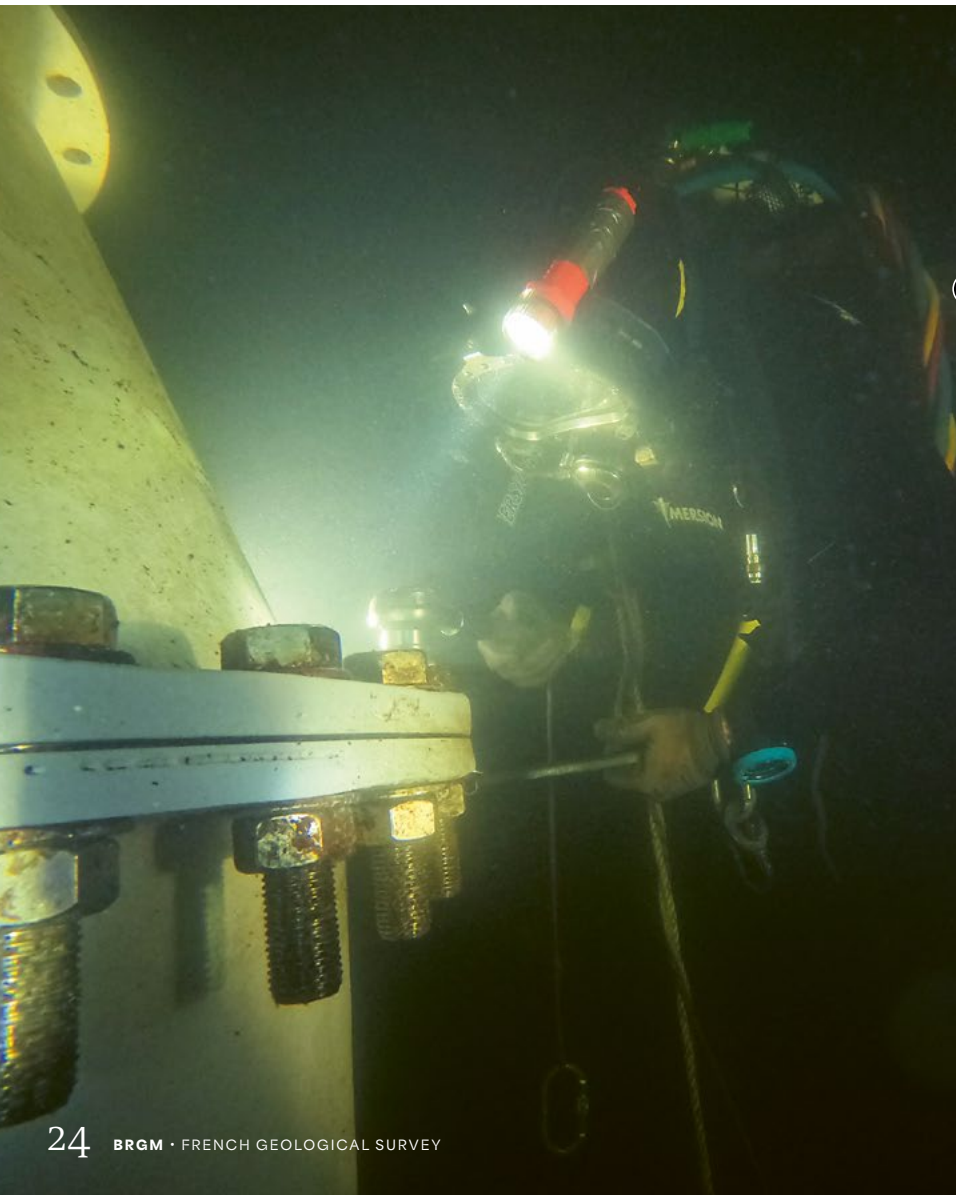
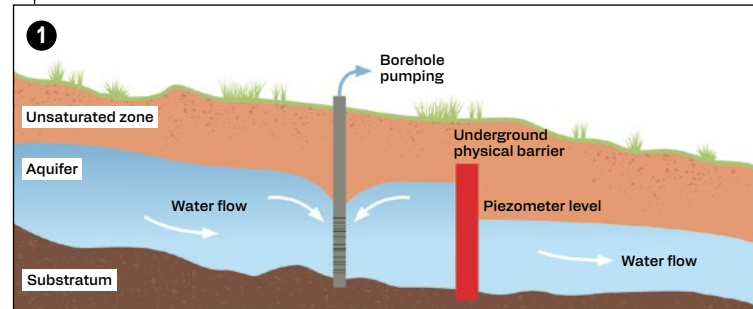
© BRGM

Operating principle of an underground physical barrier (UPB) in a continental environment for water storage purposes, with a pumping system.

© FRISANT-DEWANDEL-GOUY



Read the BRGM report on underground physical barriers



THAU LAGOON

2 Tackling reverse flow to preserve water resources

The BRGM has joined forces with its partners to tackle the reverse flow phenomenon which, in the Thau lagoon (Occitania), regularly affects the source of the Vise and exposes freshwater resources to salt water. A novel monitoring system was first put in place in order to understand and monitor this phenomenon and its impact on the karst aquifer. A paper was published in the journal *Nature Communications Earth & Environment* showing that the phenomenon was caused by the difference in pressure between the aquifer and the lagoon, as salt water is denser. An innovative system was then installed in the summer of 2025 at the point where the source of the Vise flows into the lagoon, in order to limit saltwater intrusion into the aquifer while maintaining natural freshwater flows. This unprecedented trial is planned to run for three years and could be replicated at other sites affected by this phenomenon.



1 WHAT IF WE STORED WATER UNDERGROUND?

Underground physical barriers (UPBs) have been used for decades in regions with significant variations in rainfall. In particular, these structures are for storing water in its natural environment, protected from evaporation and without any risk of micro-organism proliferation, while allowing it to be replenished so that it is available for future use. Could UPBs be used for adapting to severe droughts? At the request of the Gardons Territorial Public Basin Authority (EPTB), BRGM carried out a survey of the various types of UPB around the world, developed modelling tools to analyse the impact of some of them and in particular studied the one at Massillargues-Attuech (Gard), the only known example in France. The survey report is available online on the InfoTerre portal.

MANAGED AQUIFER RECHARGE

3 BRGM expertise is making its mark abroad

BRGM was among approximately 170 participants from around thirty countries represented at the International Symposium on Managed Aquifer Recharge (ISMAR), held from 28 April to 2 May in Stellenbosch, South Africa. The team presented an overview of the implementation in France of this solution for sustainable water resource management in the context of climate change, along with the results of a project carried out in Ethiopia and funded by the French Development Agency (AFD). Against a backdrop of increasing climatic and demographic pressure, this research resulted in the production of a map showing the suitability of land around Dire Dawa and Jijiga for managed aquifer recharge.

A system designed to limit the reverse flow phenomenon has been installed on the bed of the Thau lagoon at a depth of 27 metres. © ANTEA

MAYOTTE

4 Mobilisation for new drinking water resources

Having identified new underground drinking water resources between 2023 and 2025, BRGM was commissioned by *Les eaux de Mayotte* (the Mayotte water authority - LEMA) to assist with the drilling of 24 boreholes. Supported by the *Eau Mayotte* (Mayotte Water) 2024-2027 plan launched by the French Government, this seventh campaign is intended to diversify the island's sources of supply and drinking water production capacity. The scientific data collected in this way will be shared and put to good use, also providing information to back up discussions on Mayotte's future water strategy.

NUTRI-KARST

Restoring the rivers of the Franche-Comté region

In response to the chronic deterioration in water quality in the Jura Mountains, under the NUTRI-Karst project, BRGM has analysed and quantified the multi-factor sources of the nutrients found there (mainly nitrogen and phosphorus), highlighting the impacts of certain agricultural practices, sewage discharge and climate change. In collaboration with the Doubs-Territoire de Belfort Interdepartmental Chamber of Agriculture, BRGM has also identified which agricultural practices should be prioritised and which pose a risk. It has shared these recommendations with the relevant stakeholders. More than 100 initiatives were proposed in this way.

PYRÉNÉES-ORIENTALES

Water-oriented Living Lab

Adversely affected by the multi-year drought of 2022-2025, the Pyrénées-Orientales department has launched a resilience plan to adapt the region. In this context, and as part of the European Water4All partnership, in March 2025 BRGM spearheaded the joint development of a Water Oriented Living Lab (WOLL). This is a forum for cooperation and innovation dedicated to water resource management in the face of climate change. Reflecting the widespread interest in this initiative, meetings held in July and then in November involved dozens of researchers, local authorities, socio-economic stakeholders and organisations. These discussions helped to identify priority research areas, the activities to be carried out and the governance and operating procedures of AQUALAB 66.

JUNON

A digital twin for regional water management

Led by BRGM and co-funded by the Centre-Val de Loire regional authority, the ARD Junon programme aims to establish a digital hub dedicated to natural resource management. A prototype digital twin of the Beauce aquifer was developed in 2025. It continuously simulates and forecasts changes in groundwater levels over a 3 to 6-month period. With around twenty partners, Junon is also developing other digital twins: water quality, air quality, satellite-based approaches and wetlands. All are based on a robust architecture and a methodological framework designed to be extended to other use cases.

Outstanding result

MétéEAU Nappes: a strategic groundwater management tool

Developed by BRGM, MétéEAU Nappes is used to monitor and predict the behaviour of aquifers in France, providing a range of online services that make it a valuable decision-making tool for water resource management throughout the country. The website was updated in 2025 to provide easier access to information and to improve its forecasting capabilities.

In the face of increasingly extreme weather events, predicting the behaviour of groundwater bodies has become a major issue for regional water resource management. Nearly two-thirds of the water abstracted for the drinking water supply in France comes from groundwater. The MétéEAU Nappes web platform was developed in this context to provide assistance to all local public water authorities, in particular local authorities, territorial public basin authorities (EPTBs) and drinking water associations. It also serves as an operational tool for government departments and water agencies, supporting strategies to ensure the availability and sustainability of water resources on both local and national levels.

Originally launched online in 2021, MétéEAU Nappes has been completely redesigned to better meet users' needs and improve its impact on groundwater management. Since June 2025, the website has featured a modernised interface to make it easier to use on mobile devices. Access to information is further facilitated, with the immediate display of the groundwater monitoring bulletins (BSN) made available to the public. Users can browse the platform without having to create an account. As a management tool, MétéEAU Nappes is also becoming an established means of communication and awareness raising among the general public.

Real-time monitoring of groundwater levels

Starting from the current situation, users can easily navigate back and forth through time to view changes in groundwater levels over the last few months, or access future projections based on modelling carried out by BRGM. Dynamic maps and charts are updated continuously. The data used comes from the national piezometric network, which is managed by BRGM in partnership with the State Directorate for Water and Biodiversity; this network comprises 1,700 monitoring points, 1,600 of which monitor aquifer levels in real time. MétéEAU Nappes provides an up-to-date overview of the groundwater situation across the whole of France, while also serving as an archive of past conditions.

"This development is in response to the situation arising from the severe drought of 2022, which caused difficulties for many groundwater resource management stakeholders," explains Anne-Valérie Hau-Barras. "This episode highlighted the importance of sharing the information collected in real time in the field more quickly and efficiently ..."



**ANNE-VALÉRIE
HAU-BARRAS**

Deputy Director
of Project Support,
Production and
Performance



**BRUNO
MOUGIN**

Hydrogeological
engineer

600

**WATER EXTRACTION POINTS
MODELLED IN MÉTÉEAU
NAPPES: 2027 TARGET**

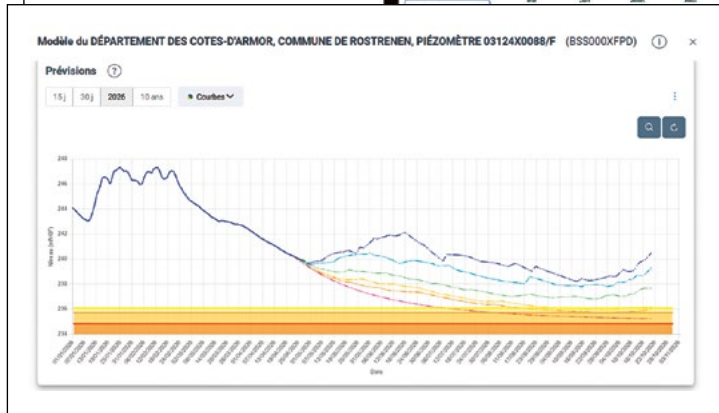
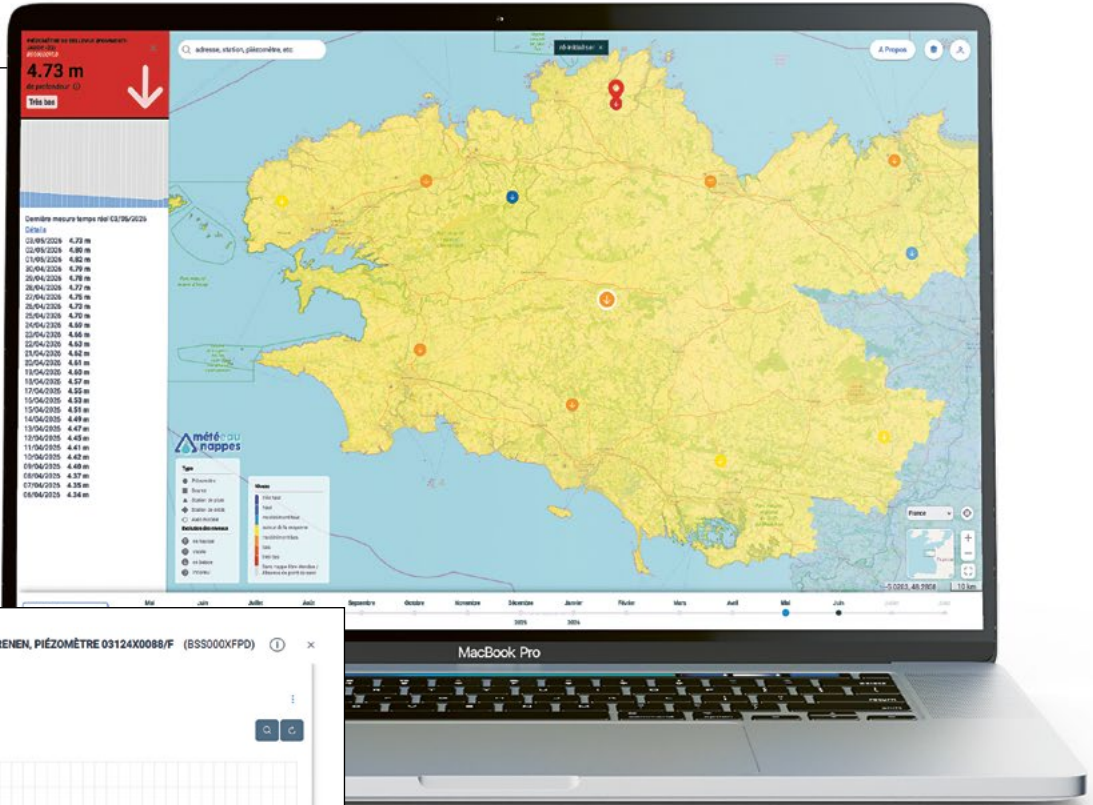


The national piezometric network, which includes MétéEAU Nappes, has 1,600 real-time groundwater level monitoring points, as shown here in the Pays de la Loire region. © BRGM

Outstanding result

Clicking on a piezometer in MétéEAU Nappes such as the one shown here, located in the commune of La Roche-Jaudy (Côtes-d'Armor), displays the groundwater level in real time and its recent trends. © BRGM

Depending on their account settings in MétéEAU Nappes, some users can view up to six months of forecasts for modelled locations, such as the one shown here for Rostrenen (Côtes-d'Armor). © BRGM



... and of sharing seasonal forecasts on changes in groundwater levels. Brittany was particularly hard hit during this episode,” adds Bruno Mougin. “Following this event, the Regional Authority decided to commit to rolling out MétéEAU Nappes throughout the region. In January 2025, it signed a partnership agreement with BRGM to extend the monitoring of local aquifers in the tool by increasing the number of forecast points from 1 to 25.”

More robust forecasts of aquifer changes

By increasing the number of monitoring points, changes in groundwater levels can be monitored in more detail and more reliable forecasts can be made. Since June 2025, MétéEAU Nappes has also improved its performance and forecasting capabilities by integrating a new open-source calculation code called Rameau, which resulted from BRGM research projects. “We can now predict how groundwater levels will change over the next six months by providing several forecasts based on different climate scenarios,” explains Anne-Valérie Hau-Barras. These forecasts warn decision makers about potential droughts and help them take preventive measure.

Building on the development of partnerships with local authorities including in the overseas territories, which are also facing water shortages, the expansion of the Rameau code and the increasing integration of artificial intelligence, BRGM has set itself the ambitious target of modelling 600 water extraction points in MétéEAU Nappes by the end of 2027. This would be a first in Europe in terms of national coverage. ●

“We can now predict how groundwater levels will change over the next six months by providing several forecasts based on different climate scenarios”



Found out more about MétéEAU Nappes

– What is BRGM’s role in relation to the French Development Agency (AFD)?

Stéphanie Lanfranchi – AFD implements France’s international partnership policy by funding and speeding up development transitions in emerging and vulnerable countries and in France’s overseas territories that relate, for example, to climate risks and to reducing inequality, particularly between women and men. For this purpose, our group applies and showcases French expertise on the international stage, with a view to promoting practical and positive solutions available in our public sector ecosystem, which combine research, innovation, engineering and administrative, technical and financial expertise. In this context, BRGM is one of our main partners and the lead operator of the Technical Expertise and Experience-Sharing Fund (Fexte), which we have set up for the benefit of our partners.

– What areas does your partnership cover?

S. L. – Our track record reflects the quality of the analyses and solutions we have provided to various local stakeholders under numerous projects, for example, in Jordan, Kazakhstan, South Africa and Ethiopia on water resource management, particularly groundwater; in Mauritius and Rodrigues on coastal risk prevention; in Mexico on the lithium potential of geothermal waters; and in Indonesia on the rehabilitation of former mining areas. Our collaboration with BRGM, whose Île-de-France regional office has been based at our premises since 2025, is going from strength to strength. In 2026, our partnership will develop into a strategic agreement covering all of the AFD Group’s subsidiaries.

– How does BRGM contribute to your work?

S. L. – Together with BRGM, we work in the public interest and share the same commitment to partnership-based collaboration and long-term engagement. Moreover, the internationally recognised

“The internationally recognised expertise and reputation of BRGM are real assets for missions in our partner countries”

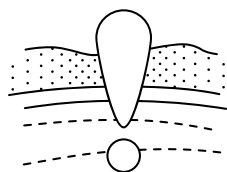


STÉPHANIE LANFRANCHI

Director of Mobilisation and National Partnerships at the French Development Agency

expertise and reputation of BRGM are real assets: they give our partners a high level of confidence, high-quality studies and practical results that meet their needs. In addition, our joint international efforts contribute to our expertise and strengthen our capacity to operate in France, particularly in the overseas territories. The partnership between the AFD Group and BRGM generates useful and practical solutions and outcomes at an international level, which can be replicated in France.





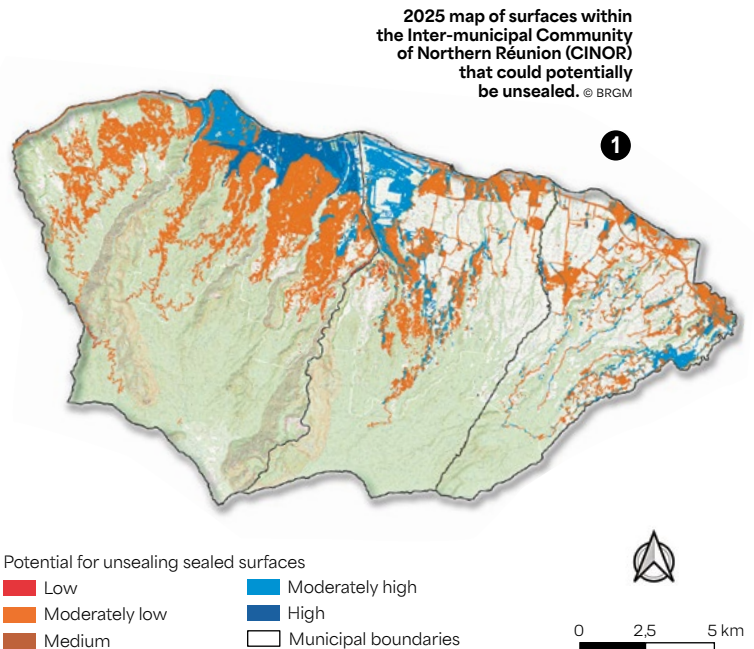
Managing ground and subsurface risks to increase regional resilience

Climate-related risks, geological instabilities and pollution resulting from human activities: the risks that threaten large parts of the country are increasing, and can occur in combination. In the face of these challenges, it is crucial to understand and anticipate ground and subsurface-related risks in order to protect people, infrastructures and resources. Through its research and missions aimed at supporting public policy decision-making, BRGM works on every aspect of the risk chain: prevention, proactive preparation, crisis management, adaptation and reinforcing the resilience of every region. Protecting the health of soils degraded by erosion or pollution is another pressing challenge. To this end, BRGM has developed specific expertise in monitoring and managing former mining or industrial sites and also in the remediation of polluted soil and water.

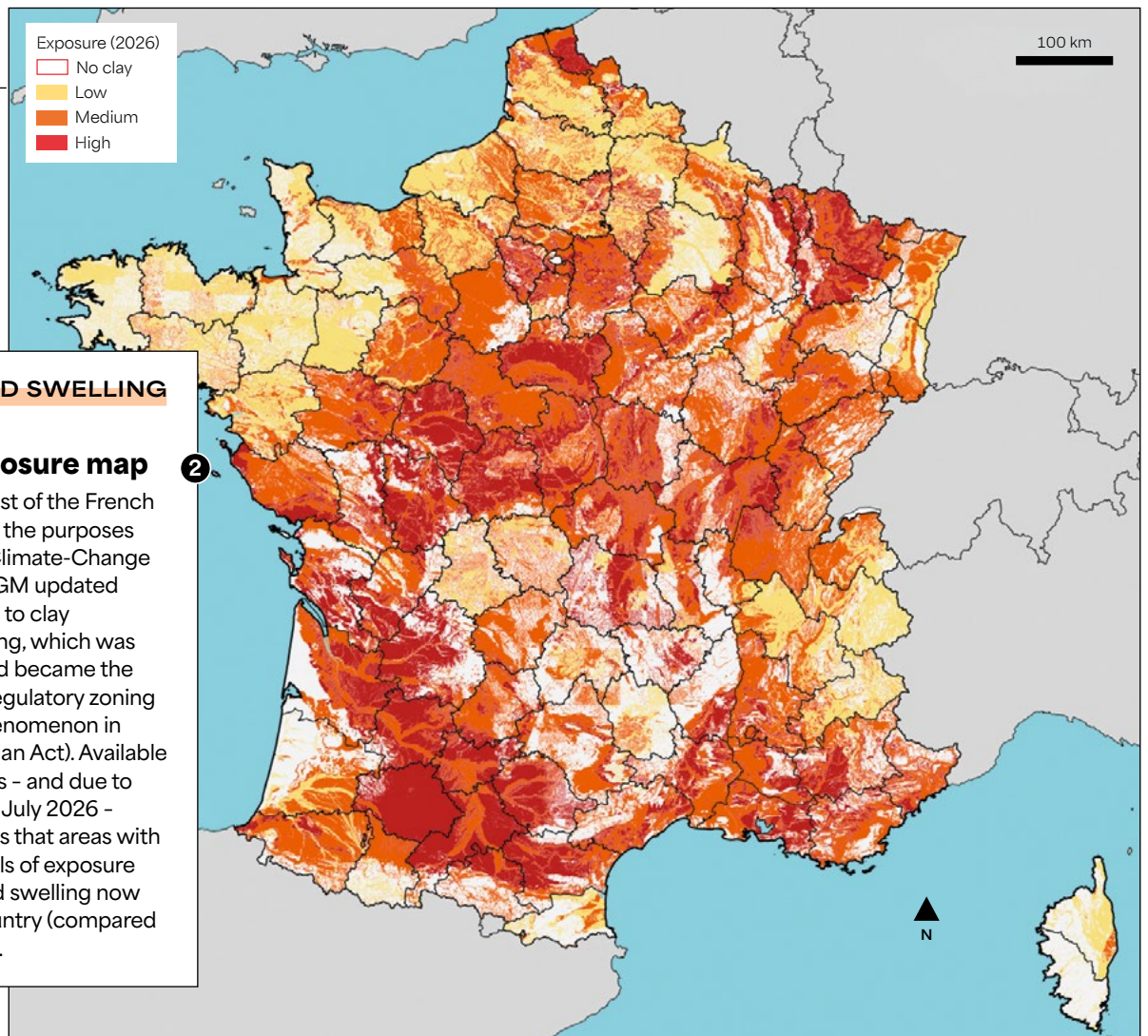
◀ Investigating an underground karst cave, the *Grotte des Cavottes*, located in Montrond-le-Château (Doubs). © BRGM - SILVAIN YART



The effects of coastal erosion at Mourouk bay in the south of Rodrigues Island. © BRGM



The map of exposure to clay shrinkage and swelling has been updated to include data from recent incidents and claims and to incorporate methodological improvements. © BRGM



SHRINKAGE AND SWELLING OF CLAY SOILS

A new risk exposure map 2

In 2025, at the request of the French Government and for the purposes of the 3rd National Climate-Change Adaptation Plan, BRGM updated the map of exposure to clay shrinkage and swelling, which was drawn up in 2019 and became the reference base for regulatory zoning in relation to this phenomenon in 2020 (through the Élan Act). Available online on Géorisques - and due to come into force on 1 July 2026 - this document shows that areas with medium or high levels of exposure to clay shrinkage and swelling now cover 55% of the country (compared with 48% previously).

LA RÉUNION

1 A region with significant potential for surface unsealing

How can we improve rainwater infiltration, restore the ecological functions of the soil and protect groundwater resources? To provide data and input for an informed debate on these issues, the Inter-municipal Community of Northern Réunion (CINOR), which comprises Saint-Denis, Sainte-Marie and Sainte-Suzanne, launched the ZAN CINOR project, within the framework of the national Zero Net Artificialisation (ZAN) plan. To support the local authorities in their "unsealing" initiatives (aimed at reducing impermeable surfaces), BRGM applied the DésiVille method – which it had developed for the Nantes metropolitan area – while adapting it to the context of La Réunion, by using a hybrid multi-criteria GIS approach and, notably, by re-qualifying the weighting applied to the slope of the ground. The results identified significant potential for unsealing, representing 86.61% of the region's impermeable surfaces.

A MULTI-RISK APPROACH TO REINFORCE REGIONAL RESILIENCE

Coordinated by NORSAR, the Norwegian Seismic Monitoring Network, the European MEDiate project (2022–2025) worked on developing a multi-risk approach to resilience, taking into account the evolution of each risk over time, depending on the levels of exposure and vulnerability. In this context, BRGM developed multi-risk vulnerability models for buildings, incorporating, for example, the interaction between earthquakes and flooding. A pilot area was set up in the Nice metropolitan area (a partner in the project), in order to jointly establish multi-risk scenarios. Several workshops were held locally, including a serious game developed by BRGM based on Storm Alex in 2020, which highlighted the importance of the decision-making process involved in identifying remediation solutions based on different criteria.

MAURITIUS AND RODRIGUES

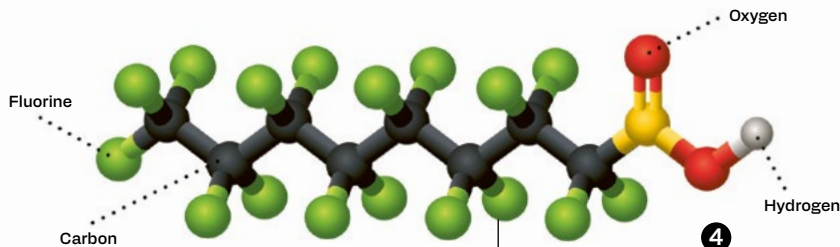
3 Improving our understanding of coastal risks in order to adapt to them effectively

Conducted in partnership with the French Development Agency (AFD) and the Republic of Mauritius, the MauRisCot project was completed in 2025. Its objective was to assess coastal hazards and the associated risks in Mauritius and Rodrigues, as well as how these might evolve due to the (expected) effects of climate change. Various studies were carried out on the coasts of the two islands, focusing in particular on coastline retreat, coastal erosion and coastal flooding in cyclone situations. Based on the results, a map was drawn up showing the risks and hazards in each coastal area, along with an assessment of the various adaptation options, particularly through nature-based solutions. These results will help establish action plans for protecting people and property, as well as remediation plans.

DECONTAMINATION OF POLLUTED SOIL

Spectral induced polarisation as a monitoring method

A PhD thesis jointly supervised by BRGM explored an innovative and sustainable approach to monitoring the decontamination of soil polluted with hydrocarbons: it uses spectral induced polarisation (SIP) to monitor the biodegradation of toluene by bacteria in real time. It provides an environmentally friendly and cost-effective alternative to conventional methods for monitoring soil decontamination. Two scientific articles were published: the first demonstrates the ability of SIP monitoring to detect the electrochemical signatures of bioremediation; the second presents a state-of-the-art Bayesian inversion method capable of directly estimating key biogeochemical parameters, along with their uncertainties.



PFAS are characterised by their persistence in the environment, due to their highly stable and resilient carbon-fluorine bonds. © BRGM

PFAS

4 Resources for learning about “forever” chemicals

BRGM is committed to addressing the issue of PFAS and is heading up several projects aimed at gaining a better understanding of these highly diverse per- and polyfluoroalkyl substances and their behaviour in the environment, and developing remediation solutions. As a participant in the French inter-ministerial action plan launched in 2024, BRGM has developed a tool for visualising data from operations aimed at monitoring these substances in water across the country. The “Info PFAS” map allows users to locate sampling points and view the results of the associated measurements. In July 2025, when the map went online, more than 2.3 million analyses were already available to everyone. An extremely comprehensive list of frequently asked questions (FAQ) about these so-called “forever” chemicals has also been published on brgm.fr.



Access the Info PFAS map

Anthropogenic risks

InfoSols, an optimised platform for information about polluted soils

InfoSols, the digital platform created by BRGM to improve the management of data about polluted sites, was completely updated in 2025. Government authorities – who are the platform's main users – now benefit from a more user-friendly interface, more reliable data and improved functionalities. A valuable tool for implementing the European Directive on soil monitoring and resilience.

The management and monitoring of polluted sites and soils is a major challenge for public authorities, since it affects policy-making in many key areas, notably spatial planning, public health and environmental protection. This mission, primarily overseen by the Regional Directorates for Environment, Planning and Housing (DREAL), notably involves populating databases to create and update records of polluted sites and to provide administrative, historical and technical information. In order to optimise the process for inputting this information, BRGM developed InfoSols, a national platform dedicated to the management and organisation of data relating to polluted or potentially polluted sites. Launched in October 2020, this application addressed the need to consolidate and unite existing databases, notably BASOL (a database of polluted or potentially polluted sites and soils), SIS (soil information sectors) and CASIAS (a historical inventory of former industrial sites and service activities). This fragmented structure meant that information might be duplicated and made it more difficult for the parties involved to manage the data effectively.

Smart management of duplicates

In the current social climate, with growing pressure on building plots and increased concern about pollution, InfoSols' value was quickly acknowledged. Moreover, it is now a strategic tool for implementing the European Directive on soil monitoring and resilience in France. This document, which reflects a growing awareness of the importance of this ecosystem to society, due to the essential services it provides, aims to improve the understanding and monitoring of the state of soils throughout the European Union. By centralising and organising data on polluted sites and soils, InfoSols improves the traceability and availability of the information needed to assess environmental risks.

In 2025, the platform underwent a major overhaul. “InfoSols had become outdated, largely due to the merger of old databases, which created several complications,” explains Virginie Vincenti. “So, the teams from the DREALs, who are the platform's primary users, informed us about some of the difficulties they encountered when using the platform.” This new version was designed to improve the user experience and speed up administrative tasks, while also improving data reliability, including ...



**VIRGINIE
VINCENTI**

Engineer specialising
in polluted sites
and soils



**ALEXANDRE
VRAIN**

Engineer specialising
in polluted sites
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**JULIE
PHILIBERT**

Engineer and
Information Systems
Project Manager

1,500

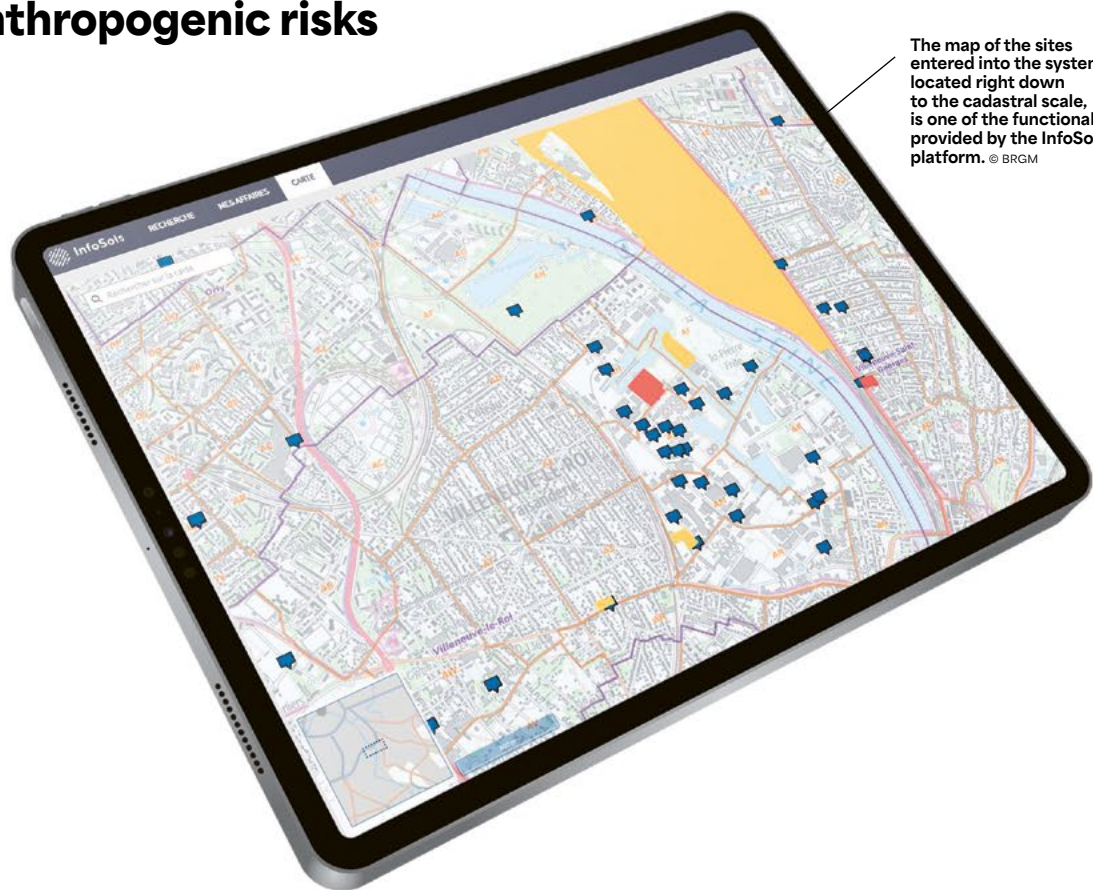
**INFOSOLS USERS
TO DATE**



RISKS LINKED TO THE GROUND AND SUBSURFACE

InfoSols helps to keep a record of the locations and activities of former industrial sites, for example, the Union brownfield site in Roubaix (Hauts-de-France) shown here. © BRGM

Anthropogenic risks



The map of the sites entered into the system, located right down to the cadastral scale, is one of the functionalities provided by the InfoSols platform. © BRGM

- ... smart duplicate management. *“Whilst the main aim of this upgrade was to simplify the visual interface and the workflow, this version also has new features, responding to the expectations of the DREALs, such as filters and search engines, as well as automatic uploading of public utility easements to the urban planning geoportal,”* explains Alexandre Vrain.

A satisfaction survey to be conducted in the near future

The development of InfoSols was decided jointly by the General Directorate for Risk Prevention (DGPR) and BRGM, which managed its implementation and brought together two teams with complementary expertise: one specialising in information systems, which carried out a user survey and defined the technical specifications for the digital platform; the other with expertise in polluted sites and soils, which led working groups with the DGPR and the DREALs, trained users on the new version of the tool and helped organise communication about the upgrades. However, this does not mean the current version of the platform is set in stone. *“A satisfaction survey will soon be carried out among the DREALs to gather their feedback on this new version,”* says Julie Philibert. *“The results will enable us to fine-tune certain aspects and continue to improve this platform so that it meets users’ needs effectively.”*

InfoSols is, first and foremost, a management tool for various government departments. However, in keeping with the principles of environmental transparency and the conservation of historical records, the platform also feeds data directly into Géorisques, the main public website for location-specific information about natural and anthropogenic risks, which is managed by BRGM. *“The improved data quality in InfoSols has a knock-on effect on Géorisques, which has also become more reliable,”* explains Virginie Vincenti. Consequently, this initiative contributes to improving the information that is available to both the public and stakeholders involved in spatial planning concerning potential soil pollution and the associated risks. ●

“The improved data quality in InfoSols has a knock-on effect on Géorisques, which has also become more reliable”

– What are the main natural risks in La Réunion and how can they be prevented?

Patrice Latron – La Réunion is an exceptional but highly vulnerable territory, which is exposed to seven major risks: cyclones, floods, landslides, volcanic eruptions, forest fires, earthquakes and tsunamis. Its steep terrain and heavy tropical rains exacerbate the risks associated with gravity-related hazards, such as landslides. Prevention measures are based first and foremost on scientific knowledge and good spatial planning, notably through the creation of risk prevention plans (PPRs) and the deployment of monitoring systems, but also by ensuring a responsible approach to land use and planning. Recent crises have shown that a significant proportion of landslides are linked to human activities, notably due to failing infrastructures or poor rainwater management. Adapting construction practices is therefore a priority.

– Can you explain how BRGM helps to prevent these risks and manage cyclone-related crises, such as during Hurricane Garance in 2025?

P. L. – BRGM’s expertise is essential for providing factual data for public decision-making and ensuring safety. During Cyclone Garance, the organisation responded in exemplary fashion to the crisis: 135 on-site assessments led to recommendations being made for 116 homes, including 20 permanent evacuations and 77 precautionary evacuations. A satellite survey identified 521 areas of instability. This work enabled the Government to target specific safety measures and support local authorities in relocating homes at risk.

– BRGM has had a branch in La Réunion for over fifty years and has significantly improved the geological understanding of the island. Which areas of work are priorities today?

P. L. – In the face of increasingly extreme weather events linked to climate change, the priorities are: protecting the population by drawing on the lessons learnt from cyclones Belal and Garance and integrating the data into the Risk Prevention Plans (PPRs), anticipating coastal risks and managing existing threats; improving

“The synergies with BRGM must be maintained and consolidated in order to make La Réunion a model in terms of risk management and sustainable development”



PATRICE LATRON
Prefect of La Réunion

the management of water resources through better assessment and protection of groundwater; the energy transition and the continuation of deep geothermal exploration programmes; sustainable development, and notably the consolidation of the circular economy through the regional quarrying plan and by combating soil erosion in order to protect our coral reefs and our biodiversity. The synergies that exist between BRGM and the local authorities, local councils and research organisations must be maintained and consolidated in order to make La Réunion a model in terms of risk management and sustainable development.

Natural risks

Anticipating coastal risks with the CoCliCo and Life Adapto+ projects

In response to increasingly severe coastal risks associated with climate change, BRGM is developing scientific tools to support public decision-making and adaptation measures in coastal regions. With this in mind, the CoCliCo project aims to study various spatial planning scenarios, whilst Life Adapto+ aims to promote a more flexible management of the coastline.

The rise in mean sea level is one of the consequences of climate change that can already be observed. Around the world, many coastal areas are exposed to risks that are progressively becoming more and more intense, such as coastal flooding, erosion and increasingly frequent extreme events. In this context, the development of adaptation strategies based on scientific knowledge is essential to help coastal regions manage these risks in the long term. According to several European forecasts, a growing proportion of the population and infrastructures in coastal areas could be exposed to these risks by 2050. This reality highlights the importance of developing tools to anticipate and plan the necessary adaptation measures.

To address these challenges, the CoCliCo (Coastal Climate Core Services) project, funded by the European Horizon 2020 programme and coordinated by BRGM, has led to the development of an open web platform, designed to provide information and support decision-making adapted to the rapidly changing context of the European coastline. “CoCliCo stands out from existing initiatives on coastal risks due to its European scope and the fact that it is based on open datasets,” explains Gonéri Le Cozannet. “The project aims to help public decision-makers, urban planners and researchers assess coastal risks, and particularly the exposure of populations and infrastructures, while also exploring future scenarios in order to facilitate the planning of coastal protection strategies.”

Comparing different adaptation strategies

The platform provides interactive maps that allow users to access high-resolution projections of sea-level rise, analyse flood and erosion risks, and compare different adaptation strategies, incorporating cost-benefit analyses. A workspace enables users to exploit these models at different scales, in particular by importing external data for specific case studies. “CoCliCo does far more than simply supply data; it provides a genuine decision-making support service,” explains Gonéri Le Cozannet. The platform gives users access to a tool capable of cross-referencing scientific data, climate forecasts and socio-economic indicators in order to plan coastal resilience measures more effectively.

The platform is therefore designed as a scientific demonstrator, with scope for further development in the years to come. “We have drawn up a solid plan for upgrading CoCliCo, notably with a view to using it as the foundation for a European coastal



**GONÉRI
LE COZANNET**

Engineer
specialising in the
effects of climate
change



**OLIVIER
BRIVOIS**

Project Manager
for Coastal Risks

1.75

**MILLION EUROPEANS
POTENTIALLY EXPOSED TO
COASTAL RISKS BY 2050**



**Explore
the CoCliCo platform**



Coastal marshes in the Bay of the Somme. The Life Adapto+ project promotes the flexible, integrated management of coastal areas.

© ADOBE STOCK

monitoring service within Copernicus Marine,” says Gonéri Le Cozannet. Rather than acting as a demonstrator, this integration would turn the project into a genuine European decision-making support service, drawing on marine reference data that are regularly updated and standardised across Europe. It would also consolidate interoperability with other European services and facilitate the dissemination of information to local authorities and coastal managers.

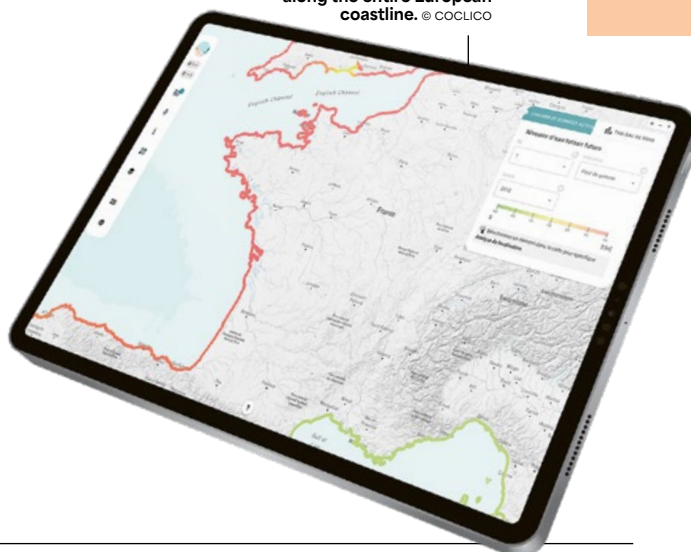
Joint development with local stakeholders

Alongside the development of CoCliCo, BRGM is contributing to several other initiatives focused on adapting coastal areas to climate change. One of these initiatives is the Life Adapto+ project, managed by the Coastal Conservatory and continuing on from the Life Adapto project (2017–2022). Here, the aim is to help local authorities to implement flexible coastal management policies, drawing on the experience of pilot sites in France and developed in collaboration with local stakeholders. *“This concept refers to a coastal management approach that aims to preserve and support the mobility of the coastline, drawing on the different mechanisms via which the land and sea interact,”* explains Olivier Brivois. *“It is based on natural processes aimed at generating benefits for society and ecosystems and involves an integrated approach across a broader coastal area.”*

CoCliCo and Life Adapto+ therefore represent two complementary approaches to the same issue. *“One of CoCliCo’s objectives is also to raise awareness about the reality of coastal risks and to view this issue as a key aspect of national and European resilience and sovereignty,”* says Gonéri Le Cozannet. ●

“CoCliCo does far more than simply supply data: it provides a genuine decision-making support service”

The CoCliCo web platform notably enables users to display quantified projections of sea-level rise along the entire European coastline. © COCLICO



Post-mining

Le Pradal: a mine that has been partially filled in to ensure the village's safety

In 2025, BRGM filled in a very old mine in Le Pradal, in the Hérault département. Spanning the entire centre of the village, this project was facilitated by the efficient collaboration between all the parties involved, in terms of performing the actual work as well as providing the temporary rehousing required by the residents concerned.

For more than ten years, the mine in Le Pradal had been closely monitored in order to assess the risks and protect the 325 inhabitants of this village, whose centre is situated above the site of this former silver-lead mine. In 2018, a high risk of collapse was identified around the main chamber (10 metres below ground), which resulted in the narrow tunnels in the upper part of the mine being filled in.



FLORENCE
RIVET

Director of the
regional Post-
Mining Unit (UTAM)
for Southern
France

Archaeological excavations

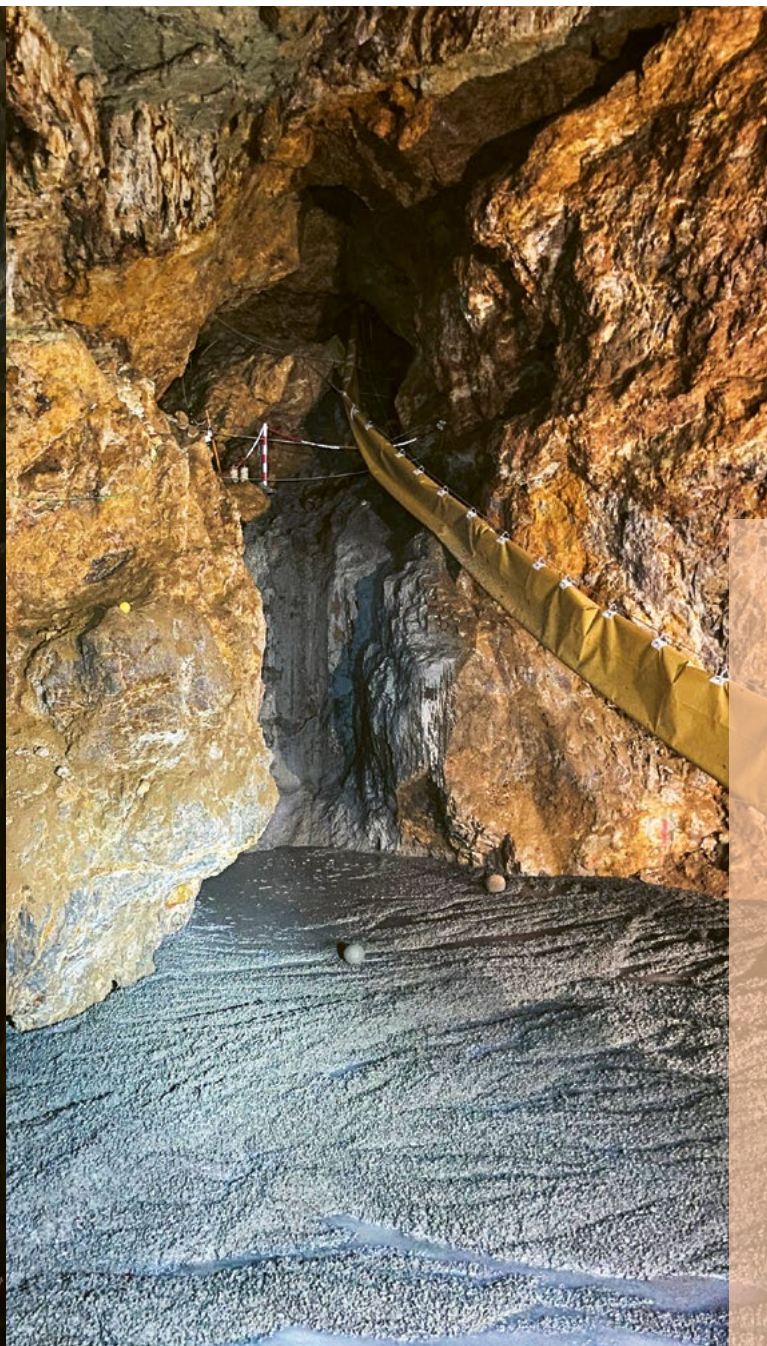
But then, “the roof of the main hall was in danger of collapsing due to shearing, a movement that could not be detected by the monitoring system we had put in place and which, therefore, could not have been foreseen,” explains Florence Rivet. Consequently, the decision was taken to conduct further infilling, following the completion of the archaeological excavations.

“Since we were unable to continue monitoring the mine whilst the archaeologists were carrying out their work, we rehoused the seven families living directly above the area to be filled in, as soon as the excavations began. In consultation with the families, of course, and with the support of the sub-prefecture, the DREAL and the town hall,” says Florence Rivet. A temporary car park was also set up on a sports ground; the latter was restored to its original state at the end of the works and even features a new pump track!

“The roof of the main hall was in danger of collapsing due to shearing, a movement that could not be detected by the monitoring system we had put in place and which, therefore, could not have been foreseen”

Watertight barriers

The work started in March 2025. High-density fibre-reinforced concrete was first injected into the main chamber via the entrance, in order to stabilise the base of the pillar that risked collapsing. Watertight barriers were then installed at the entrances to the tunnels leading off from this area. They were closed in order to



A view of the interior of the main chamber of the mine in Le Pradal, before (left) and during (right) its infilling with concrete. © IGECAV

prevent any loss of material, but also to regulate the ventilation system in place in order to limit operators' exposure to radon, which is naturally present in the mine.

No damage

The operation to fill in the 16-metre-high cavity then continued with a lighter foam concrete, to reduce the load on the deeper, unfilled tunnels. By May 2025, the work had been completed. A few weeks later, after a surveyor had checked that no damage had been caused to the houses, the families were able to return to their homes. ●

15

RESIDENTS RELOCATED
FOR 6 MONTHS



1
Installation of jet grouting columns in the backfill of the former mine shaft located beneath the Saint-Étienne motorway bypass. © BRGM

A muon telescope installed in a former iron mine in Thil. © BRGM



In Abbaretz, a tipper truck being loaded with material extracted from the lagoon during dredging operations aimed at restoring its retention and settling capacities. © BRGM

SAINT-ÉTIENNE

1 Work to improve safety on the bypass road

At the end of July 2025, the backfill at the former "Machine Anglaise" mine shaft subsided beneath the right-hand lane of a slip road between the RN 488 highway and the A72 motorway. During rush hour, up to 2,200 vehicles an hour travel along this key road, which bypasses Saint-Étienne (Loire department) and runs alongside a high-speed fibre-optic network. Since it had been established that the problem was caused by a mine, BRGM carried out urgent work on the shaft-head to enable traffic to resume on the road. The final road stabilisation and safety works were carried out the following autumn and were facilitated by the effective coordination between the various parties involved. Traffic returned to normal before the Christmas holidays.

VIEUX-VY-SUR-COUESNON

2 Work to secure a deteriorated former mine shaft

In September 2025, BRGM carried out work in Vieux-Vy-sur-Couesnon (Ille-et-Vilaine) to secure a shaft head at a former lead and silver mine. A farm tractor had driven over the closing slab of the shaft head, damaging it and leaving a hole of about 50 centimetres in width, open over a 6-metre-deep chasm. The slab was first dismantled so that the shaft-head could be opened up. A conical plug was then built, consisting of blocks of rock (80-100 cm) grouted together with concrete. Finally, a mound of loose stones was created, covered with earth and seeded so that it would blend into the agricultural landscape.

Construction of a conical plug by grouting blocks of rock together with concrete, in order to secure "Shaft 8" at a former mine in Vieux-Vy-sur-Couesnon. © BRGM



ABBARETZ

4 Erosion control and restoration of a lagoon

Mining operations at the former tin mine in Abbaretz (Loire-Atlantique) left behind deposits of processing residues and mine tailings. In response to hydraulic erosion in the lagoon, which had reduced its retention capacity, BRGM conducted works to reduce the transfer of sediments from the lagoon to natural environments further downstream and facilitate maintenance of the site. To start, weirs were built with rocks at the bottom of the ravines to slow down the water flow and trap pollutants. A reinforced track was constructed to enable dredging machinery to access the lagoon more easily. Finally, two steel sheet-pile walls were installed to create three settling basins. Due to certain technical difficulties that required methodological adjustments, the work was not completed until early 2026.

ENSURING HYDRAULIC SAFETY IN FORMER MINING AREAS

On 11 June 2025, BRGM awarded Saur France a six-year contract to manage the hydraulic safety installations (IHS) in the coal-mining basin of Nord-Pas-de-Calais. This public contract covers the operation and maintenance of the 52 pumping stations that regulate rainwater and run-off that can accumulate in subsidence basins caused by mining, thereby helping to prevent flooding across an urban area of 6,000 hectares.

EXPERIMENTATION

3 Muon telescopes for underground monitoring

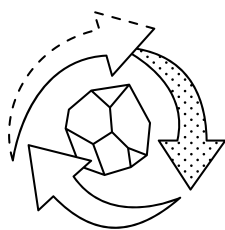
A test programme aimed at monitoring a former mining site in the Lorraine iron ore basin using a muon telescope was launched in July 2025. The programme will run for several months. Muography makes it possible to identify areas of weakness within an object by analysing variations in density derived from the speed at which muons travel through it. Funded by BRGM Invest, this collaborative project involving BRGM, IRIS Instruments and Muodim will conduct tests in Thil (Meurthe-et-Moselle) in a cavity that is prone to collapses. It should enable the covering terrain to be characterised in order to determine the backfilling work required, as well as to validate this method of non-destructive testing in subsurface environments proposed by Muodim.

MOYEUVE-GRANDE

Using a drone to explore inaccessible tunnels

The discovery that air in homes in Moyeuvre-Grande (Moselle) was contaminated with CO₂ and radon led BRGM to investigate the possibility of reopening access points to former mining sites. During the field investigations, the team's progress was halted in one area by high concentrations of CO₂ and the presence of water resulting from the flooding of the reservoir. A drone was therefore used to explore a further 250 metres of straight tunnels, above the submerged section. Thanks to this innovative underground solution, BRGM was able to make recommendations about how to improve the ventilation of these former mining sites.

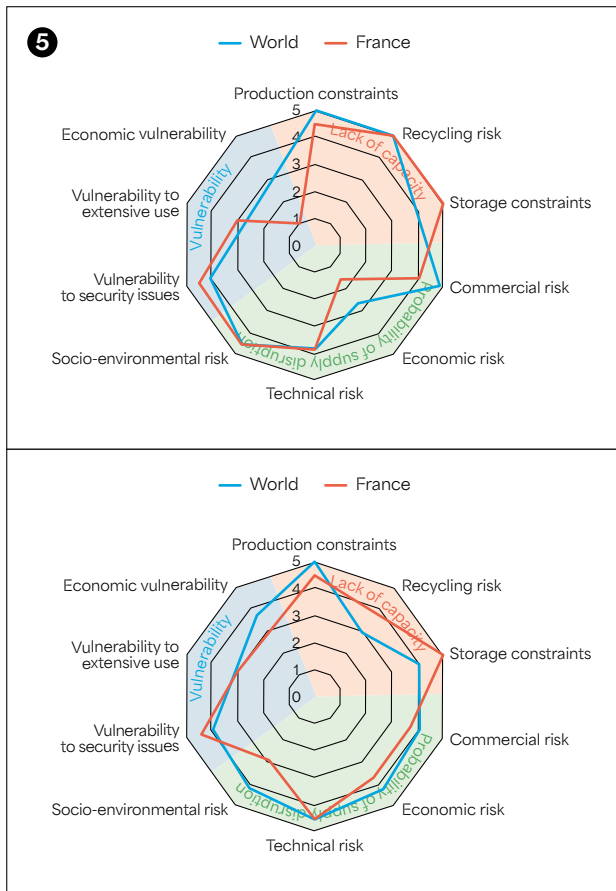




Supporting a secure and responsible supply of mineral resources

To support the digital and energy transition, the European industrial sector requires continued access to metals that have become strategic. Recent crises have exposed the vulnerability of supply chains and the need to ensure sovereignty for critical raw materials. Amid these concerns, the European Union has introduced the European Critical Raw Materials Act, which aims to support secure and sustainable raw material supply. As part of this effort, BRGM is carrying out a mineral resources inventory of France's subsurface. The institution's expertise spans the whole life cycle of mineral materials and also involves value chain analysis and technological innovation to improve mineral extraction, processing and recycling, both of which are key to ensuring environmental sustainability and industrial sovereignty.

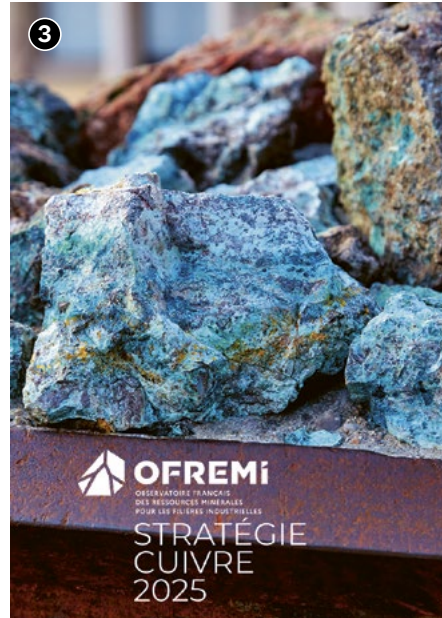
◀ Network of mineralised fractures in the San Miguel open-pit mine, Spain
© BRGM - JOHANN TUDURI



2025 assessment of the criticality of mined (top) and refined (bottom) cobalt. © OFREMI



Read the article “Life cycle inventories of global metal and mineral supply chains: a comprehensive data review, analysis and processing” in the journal *Resources, Conservation and Recycling*



A summary of the national strategy for copper, developed by Ofremit in collaboration with relevant French stakeholders, is available on the ofremit.fr website.

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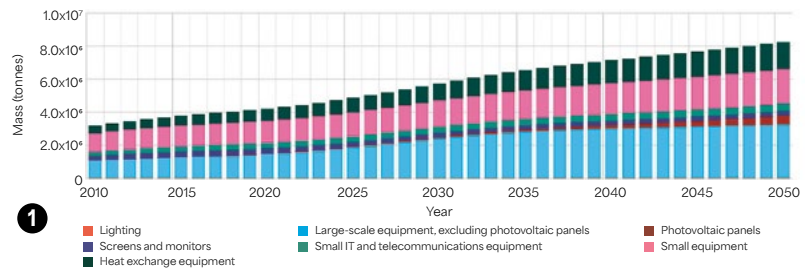


LITHOS

② Promoting responsible lithium production in Europe

In 2025, BRGM conducted a large-scale experiment at its Plat'inn testing platform as part of the LITHOS project. The aims of this European project were to fully realise the potential of Europe's hard-rock lithium deposits and develop sustainable and responsible processing methods. A test rig was set up to produce several hundred kilograms of spodumene concentrate from three tonnes of ore. The plan is for the project partners to then use this concentrate to develop an innovative lithium extraction process, which can be adapted to suit the processing of concentrates containing other lithium-bearing minerals.

Trends in waste electrical and electronic equipment in France. © FUTURAM



1 URBAN MINE PLATFORM NOW LIVE

As a partner in the European FutuRaM project, BRGM has developed a new version of the urban mining portal (www.urbanmineplatform.eu). The platform is accessible to the public, and users can get a detailed overview of the availability and recyclability of secondary and critical raw materials found in seven waste streams in the European Union, Iceland, Norway, Switzerland and the United Kingdom. Data on batteries, vehicles, wind turbines, electrical and electronic equipment, construction products, mining waste, plus slag and ash were derived from detailed research, and include basic mineral compositions, stocks, and current and future flow predictions based on three pathways to 2050.

OFREMI

3 Recommendations for a copper strategy

How can we ensure that end users have a continuous supply of copper going forward? Ofremi*, an entity coordinated by BRGM, has formulated France's copper strategy in collaboration with relevant public and private stakeholders. This strategy consolidates the country's short-, medium- and long-term vision into a concrete action plan to guide policy-makers and industry leaders. The report published in 2025 provides four key recommendations: structuring the French copper industry around a dedicated entity; securing the primary copper supply for French manufacturers; improving copper recycling and recycled copper use in France; and promoting and improving resource efficiency and diversification.

Plat'inn is a testing platform for conducting pilot operations in mineral processing, hydrometallurgy and biohydrometallurgy. In June 2025, it was made available for the LITHOS project. © BRGM

UNDERCOVER

Transforming mining exploration

The Horizon Europe UNDERCOVER project was launched in 2025 to develop non-invasive, environmentally friendly exploration methods for identifying untapped deep mineral resources. Bringing together 16 scientific, academic and industrial partners from across Europe, this project stands as a strategic building block for securing EU control over its mineral resources. A partner in this consortium, BRGM is working on implementing innovative geophysics based on next-generation electromagnetic and seismic data acquisition and intelligent data integration using AI.

PUBLICATIONS

4 Reliable data for life cycle assessments

In 2025, BRGM partnered with 34 international co-authors to publish a leading article on metal and mineral life cycle assessments (LCAs) in the journal *Resources, Conservation and Recycling*. This study provides access to datasets developed from publicly available life cycle inventories (LCIs) through extensive data processing. The work involved developing 220 high-quality LCI datasets, covering 53 metals and minerals and including 163 different production pathways. These datasets are provided with open access to support supply chain modelling for different metals and minerals and to help improve LCA quality.

CRITICALITY

5 Refining assessments by metal form

Ofremi*, an observatory coordinated by BRGM, has developed a methodology for evaluating the criticality of a substance at any given time by combining three dimensions: probability of supply disruption, national or global system vulnerability to disruption, and system resilience to disruption. Since 2025, this methodology can be applied to different forms of individual metals (e.g. ore and refined metal) depending on data use needs and availability, as the criticality of each form may vary. Last year, the criticality of six materials was reassessed as a result: platinum group metals, zinc, cobalt, vanadium, tantalum and synthetic graphite.

URBAN MINE

Applied research for Sovamep

BRGM has signed a four-year R&D contract with Sovamep under the collaborative research tax credit (CICo) scheme. This collaborative effort is part of the Motris project on modernising the processing and innovative recycling of critical and strategic metals, in which CNRS and CEA are also partners. BRGM's work will involve designing and implementing sampling methodologies to reduce uncertainties in determining metal concentrations in titanium turnings mainly from the aerospace industry, and from used electronic circuit boards - two of the waste streams processed by Sovamep.

* French Observatory of Mineral Resources for Industrial Sectors.

Outstanding result

A new inventory to better understand France's mineral resources

In early 2025, BRGM began updating the mineral resources inventory (IRM) of the French subsurface in its quest to ensure national and European sovereignty. All the institution's regional directorates and its subsidiary BRGM Explore came together to investigate where in France there could be areas containing economically valuable mineral materials.

The technologies required for the energy and digital transitions use vast quantities of mineral resources, such as lithium, cobalt, nickel, copper and rare earths, and alert us to the urgency of securing mineral supply to improve economic resilience and support the need to reindustrialise. This involves making efforts to not only reduce mineral use but also develop recycling of mineral-rich waste and explore France's subsurface mineral resources, with the aim of reducing our reliance on imports.

BRGM is recognized for its long-standing expertise in this field – the institution carried out France's first mineral resources inventory from 1970 to 1995 – and has been commissioned by the French Government to update our knowledge of France's subsurface mineral resources. This five-year national inventory aims to identify areas that are likely to contain valuable materials. *“As many as 55 mineral resources are now considered strategic or critical and are being identified as part of this inventory, compared with just 22 in the final years of the previous campaign,”* says Blandine Gourcerol. This goal aligns with the provisions of the Critical Raw Materials (CRM) Act, an EU regulation on implementing and monitoring national exploration plans in each EU Member State.

Artificial intelligence for data analysis

Five priority prospective areas have been identified in mainland France and French Guiana. The work involves first collecting geophysical information, including gravimetric, magnetic/spectrometric and electromagnetic data, and geochemical information by working on the ground and using airborne instruments. *“We are maximising efficiency in this phase by using the very latest mineral exploration technologies and the samples we kept from the last mining inventory,”* explains Blandine Gourcerol.

BRGM's subsidiary BRGM Explore (see pages 84–85) and other expert companies are helping us with the field work, including geophysical and geochemical surveys. Due to French Guiana's difficult terrain, an innovation competition was organised to collect geophysical data there, and nearly 14,000 stream sediment samples were collected in 2025 across more than 1,650 French municipalities. A laboratory ...



**BLANDINE
GOURCEROL**

Director of the
Mineral Resources
Inventory (IRM)

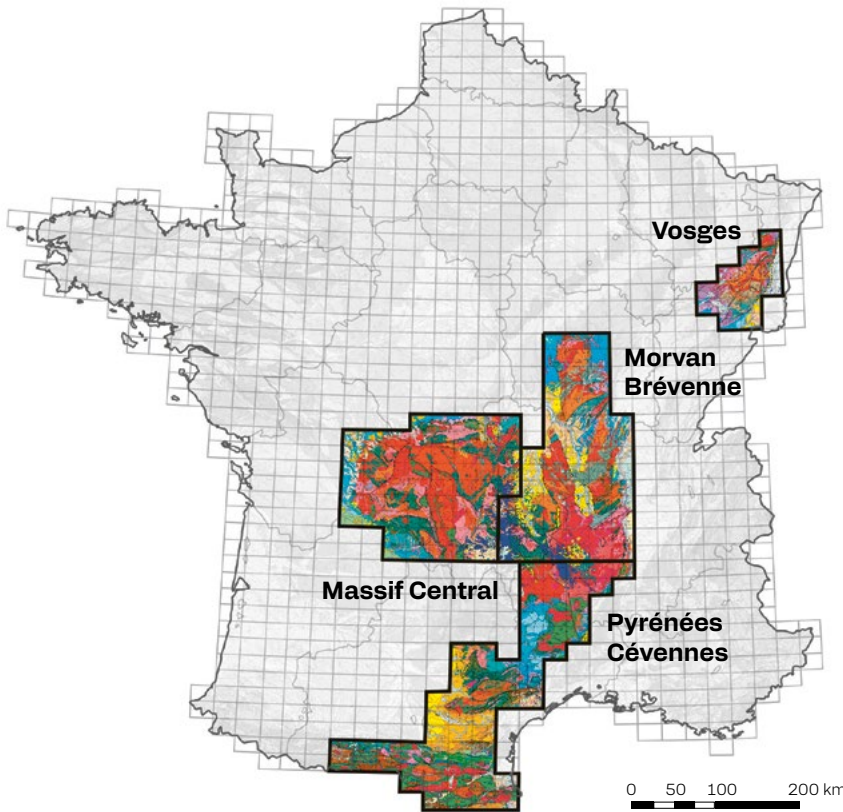
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**SEDIMENT SAMPLES
COLLECTED IN 2025
FROM 1,654 MUNICIPALITIES**

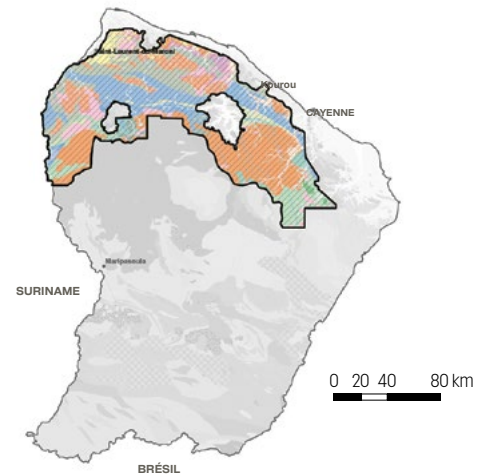


Geophysical data are collected primarily through airborne surveys like this one in the Massif Central. © ALEXANDRE MAGNAN

Outstanding result



Five areas in mainland France and French Guiana are being investigated as part of a project to update the national mineral resources inventory. © BRGM



... complying with the standards of the mining industry was also established to ensure that samples were prepared appropriately and could undergo multi-element analyses to detect mineral “defects”.

The mineral exploration data were then interpreted, drawing on the full range of expert knowledge within the BRGM group. In addition to its cross-disciplinary expertise, the institution is calling on innovative companies to deploy other technologies such as artificial intelligence. *“Using the mineral defects we have identified and new solutions, we are working towards a systematic, consistent interpretation across all areas while improving quality where possible,”* says Blandine Gourcerol.

Scientific outreach to help people understand what’s at stake

In each area covered by the inventory, we are focusing on regional engagement with Government departments, local and regional authorities and communities, and conducting scientific outreach to make people aware of the project’s economic and societal implications and technical aspects. A comprehensive “Frequently Asked Questions” (FAQ) section has also been published on the brgm.fr website. Furthermore, the IRM is an exceptionally effective platform for professional training aimed at people in or seeking geoscience careers, attracting many recent graduates. In French Guiana, the IRM will lead to the implementation of a certification scheme for mining exploration in tropical forest environments.

The findings of the mineral resources inventory will be published as maps of prospective areas for mineral deposits, as and when the surveys are completed, according to the following plan: Vosges in July 2026, Massif Central in September 2027, Morvan-Brévenne in December 2027, Pyrénées-Cévennes in September 2028 and north-eastern French Guiana in February 2029. ●

“As many as 55 mineral resources are considered strategic or critical and are being identified as part of this inventory”

– Why have you embarked on updating the inventory of France’s subsurface mineral resources?

Marc Ferracci – Securing supply of critical and strategic mineral resources is essential to our industrial, energy and digital sovereignty. The survival of the industrial sector and many jobs are at stake. This is why the French President commissioned BRGM in 2023 to carry out the new inventory. As Minister for Industry and Energy, I was responsible for officially launching the project in February 2025. The goal of this 53-million euro project lasting five years is to keep on exploring our subsurface for scientific advancement. This inventory also forms the cornerstone of the Government’s broader four-pronged approach: understanding our resources better, revitalising the mining sector, supplementing supply through strategic partnerships, and building up our industrial capacity for processing rare earths.

– Why is BRGM best placed to carry out this task?

M. F. – BRGM is the flagship of our mineral exploration programme, and the last inventory it carried out dates back to 1995. We therefore need to renew our approach to geophysical, geological and geochemical data collection by using more modern exploration methods. This way we will be able to identify areas that are likely to contain valuable mineral resources. Scientific progress opens up a wide range of opportunities and BRGM has a solid foundation of competencies and recognised expertise in exploration, which is highly valued across the world. The inventory therefore marks the resumption of mining development, this time with viable and responsible mining projects.

– BRGM’s contributions and expertise are therefore addressing current challenges.

M. F. – True, because mineral exploration is made possible through an ecosystem of many actors, including BRGM and the French Observatory of Mineral Resources for Industrial Sectors (Ofremi). These

“To carry out the mineral resources inventory, BRGM has a solid foundation of competencies and recognised expertise in exploration, which is highly valued across the world”

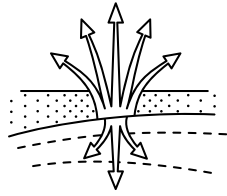


MARC FERRACCI

MP and former Minister for Industry and Energy

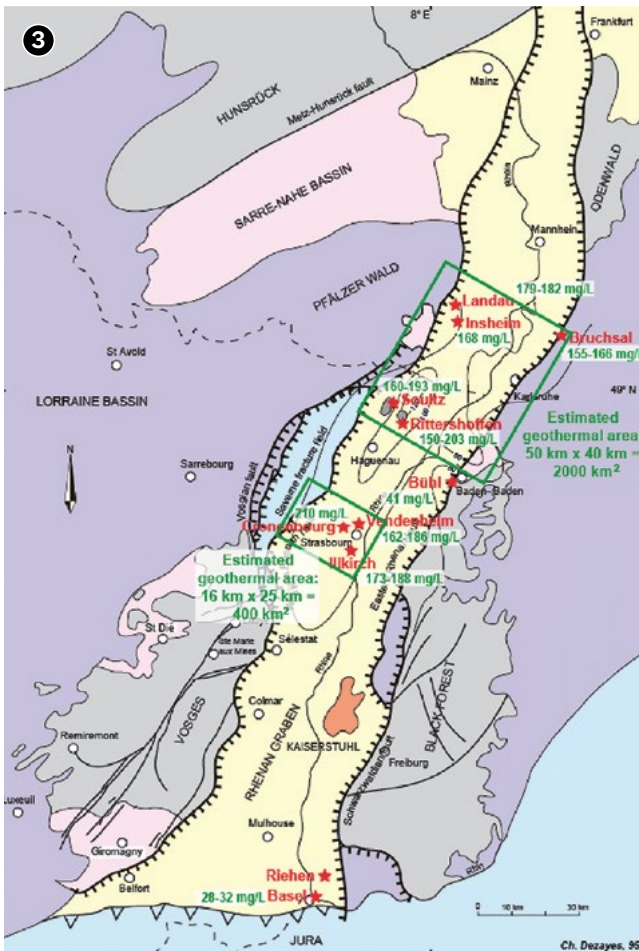
institutions play a major role both in improving our understanding of metal value chains and in guiding exploration in the most effective and beneficial way possible to increase France’s control over the raw materials it needs. Identifying our vulnerabilities is key to guiding our industrial and trade policy decisions and forging strategic partnerships through diplomatic efforts.





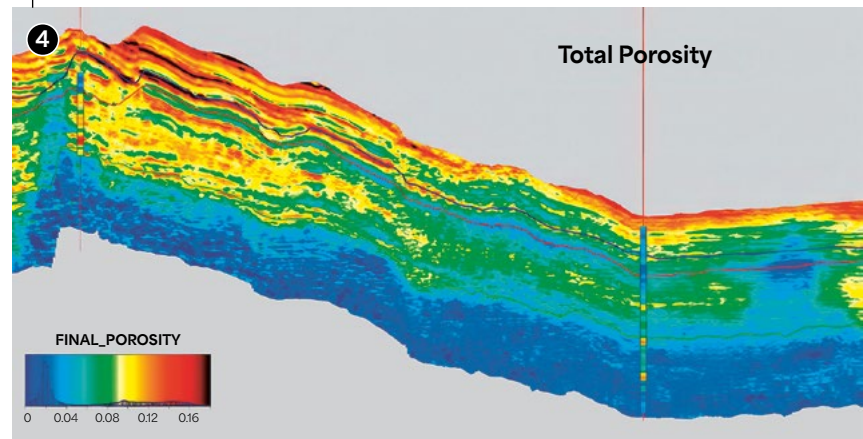
Making the subsurface a lever for the energy transition and decarbonisation

As the energy transition gathers pace, the subsurface is emerging as a key lever to support the decarbonisation of energy systems. It is a source of energy derived from geothermal energy, heat storage and natural hydrogen, and is also able to store CO₂, synthetic hydrogen and radioactive waste. This versatility makes it a key component of the future low-carbon energy mix, complementing other renewable energy sources as part of the ambitions set out by the EU in the Net-Zero Industry Act. BRGM is drawing on its scientific and technological expertise in this field to explore, characterise and develop the potential of the subsurface. Through its research and development work, BRGM is supporting local communities in designing viable and reliable solutions with low environmental impact, for a sustainable energy transition.



Map showing current lithium concentrations in deep geothermal brines in the Upper Rhine Graben (in green) and the areas selected for estimating potential geothermal resources in lithium (green boxes), taken from an article published in *Geothermics* (B. Sanjuan et al.). © BRGM

Estimating the porosity of a deep geothermal reservoir by integrating seismic and non-seismic data. © BRGM



Measuring gas flow and concentration in the travertine deposited by the hyperalkaline source known as the northern Yaté lake or "Angelline". © BRGM



NEW CALEDONIA

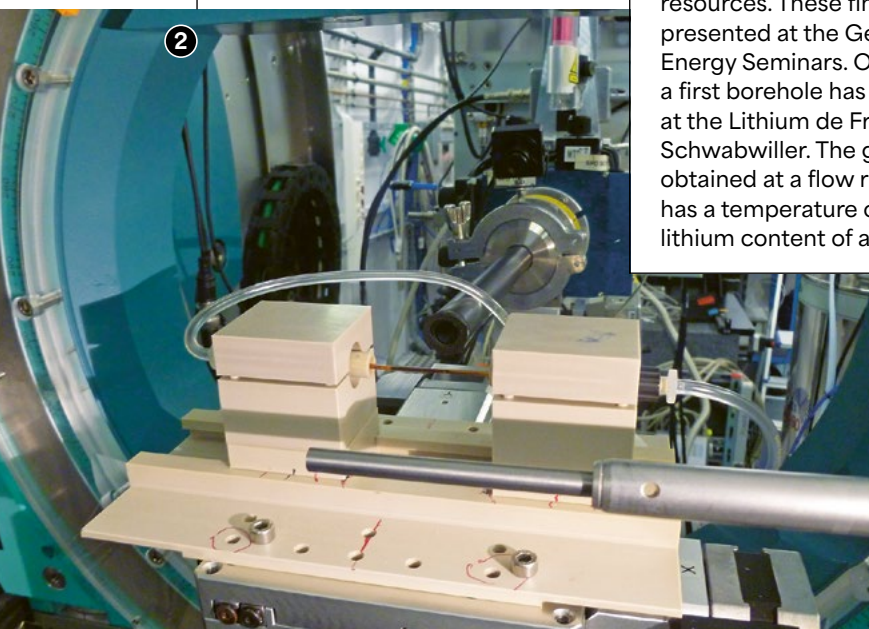
① Initial assessment of natural hydrogen potential

BRGM, in association with Lavoisier H2, conducted a pre-exploratory survey of New Caledonia's potential for native (or natural) hydrogen, generated by serpentinisation processes, on behalf of the CNRTEC (Centre for Nickel - Research, Technology, Environment and Competitiveness). Local production of carbon-free energy could provide a boost for New Caledonia's nickel industry. Based on the compilation of existing data and the implementation of geochemical field measurements, this research has led to a clearer understanding of the fate of near-surface gas and the characterisation of hydrogen-emitting zones. Further investigations will be necessary, particularly in the geophysical field, to increase knowledge and assess resources.

2 PREDICTING CHANGE IN A HIGH-LEVEL NUCLEAR WASTE STORAGE CELL

As part of its collaboration with Andra in the storage of high-level long-lived radioactive waste (HLW-LL), BRGM has launched the VERMEA II project, building on its experience in the original VERMEA project (2019-2024). The project has two main aims. The first is to predict the geochemical and mineralogical changes to the annular space filling poured between the lining of the HLW-LL storage cell and the geological formation. The second is to study the behaviour of a type of glass similar to the type used to vitrify the waste, when it comes into contact with the solution at equilibrium with the filling material. By shedding further light on the processes of ageing, weathering and multi-material interactions, VERMEA II will seek to enhance capacities for modelling the behaviour of HLW-LL cells.

The VERMEA II project combines analyses - primarily using the synchrotron (pictured) - with modelling and artificial intelligence techniques. © BRGM



INDUCED SEISMICITY

Machine learning for better modelling and prediction

In March 2025, the partners in the Franco-German project Artificial Intelligence for Induced Seismicity (AIS) presented their progress to the scientific community gathered in Davos for the fourth Schatzalp Workshop on induced seismicity. AIS is seeking to expand the use of artificial intelligence through the detection and location of induced earthquakes using machine learning, the development of seismic sensors with embedded machine learning algorithms, and the use of machine learning to predict induced seismicity. This last aspect has been tested successfully in France and the United States.

RHINE GRABEN

3 Towards the co-production of lithium and heat

Initiated by BRGM, the GLITER project supports the exploration and co-production of lithium and heat in the Bas-Rhin region. The purpose of the research is to develop a comprehensive model illustrating the operation of the deep geothermal system of the Upper Rhine Graben, and also to map the areas where heat and lithium are available on a sustainable basis. In 2025, the characterisation of reservoir rocks and geothermal fluids made it possible to identify sources of lithium and assess their potential resources. These findings were presented at the Geothermal Energy Seminars. On the ground, a first borehole has been drilled at the Lithium de France site in Schwabwiller. The geothermal fluid obtained at a flow rate of 275 m³/h has a temperature of 145°C and a lithium content of around 180 mg/l.

SIMGEO

4 Innovative methodology for deep geothermal imaging

As part of the SIMGEO project, supported by Ademe, BRGM has developed a multi-physical, multi-scale subsurface imaging solution that improves the characterisation of deep geothermal reservoirs. Associating seismic and electromagnetic data with borehole and laboratory measurements, this methodology combines innovative approaches borrowed from geophysics, petrophysical modelling and artificial intelligence. It provides a more accurate estimate of the porosity and properties of the reservoir, with a mean error of less than 2.5% in the tests carried out. These advances pave the way for more efficient deep geothermal exploration.

MININGBRINES

An innovative European project for the geoscientists of the future

A collaborative, multidisciplinary programme was set up in 2025 to train a new generation of European experts in the exploitation of geothermal resources. Able to welcome 19 PhD students, the MiningBrines programme fosters interaction between different communities by incorporating research activities with academic and industrial partners across all related fields (geology, geochemistry, petrophysics, modelling, AI, economics, etc.). BRGM is a training partner and is also involved in nine PhD theses, two of which it is supervising.

Outstanding result

Deep geothermal energy: a national inventory to reveal French potential

BRGM has been tasked by the French Government with conducting a national inventory to develop knowledge of underground resources in order to support the development of deep geothermal energy. This work aims to identify the areas most suitable for exploring this renewable energy source, which could play a significant role in the energy transition in France.

A local, continuously available and renewable resource with low greenhouse gas emissions, deep geothermal energy could be a key driver in decarbonising our energy systems and reducing our dependence on fossil fuels. This energy source, harnessed from the subsurface, remains underdeveloped in France. At present, most geothermal sites in operation in France are located in the Paris region and Nouvelle-Aquitaine, even though other regions could hold promising resources.

However, characterising this potential requires a detailed understanding of the subsurface, in particular the geometry and the geological and hydrogeological properties of the geothermal reservoirs. Against this backdrop, BRGM was tasked by the French General Directorate for Energy and Climate with conducting a national inventory of deep geothermal resources. The objective is to better assess the potential of this renewable energy source in France, in order to promote its development.

A pilot programme in Loiret

A project with the name of Geoscan Hexagone was launched in 2023. It involves gathering, summarising, reprocessing and exploiting – on the basis of new analyses – all the data available on the various sedimentary basins. As Virginia Hamm explains: “The target area lies at a depth of between 500 and 3,000 metres, so the data we need is obtained mainly from oil exploration or previous deep geothermal projects. This means it involves boreholes or seismic surveys. Depending on the quality of these data, reprocessing makes it possible to extract new information about the structure of the reservoir and its petrophysical characteristics, such as lithology and porosity.”

The first phase of the inventory focused on Loiret (Centre-Val de Loire region), a department known for its geothermal potential, and which has extensive seismic coverage. Also, BRGM signed a scientific agreement with the department in 2024 to strengthen research into the management of its subsurface. This made Loiret the ideal candidate as a pilot area for the roll-out of the inventory methodology and the development of proof of concept.



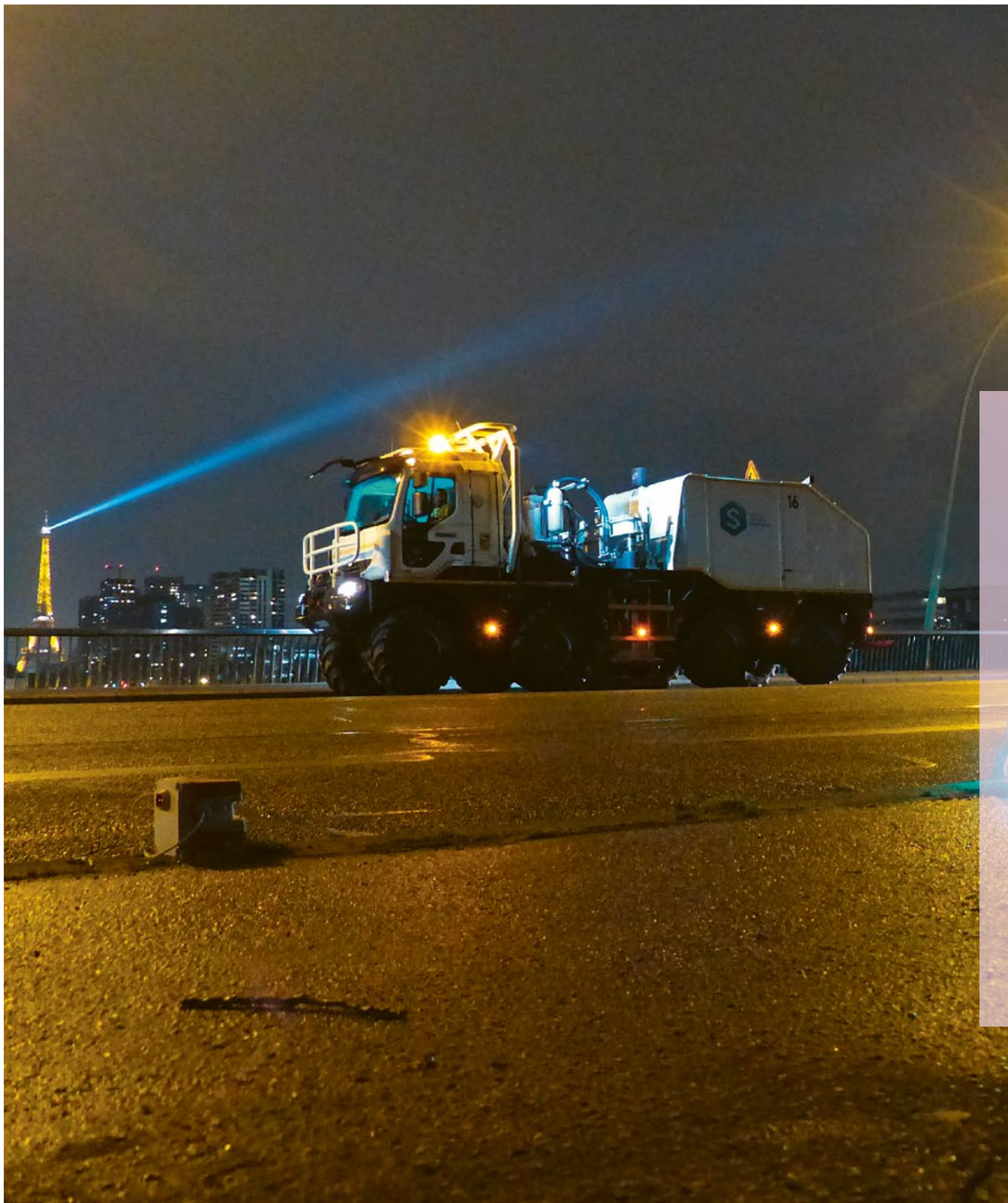
**VIRGINIE
HAMM**

Hydrogeologist
specialising in
geothermal energy

6,000

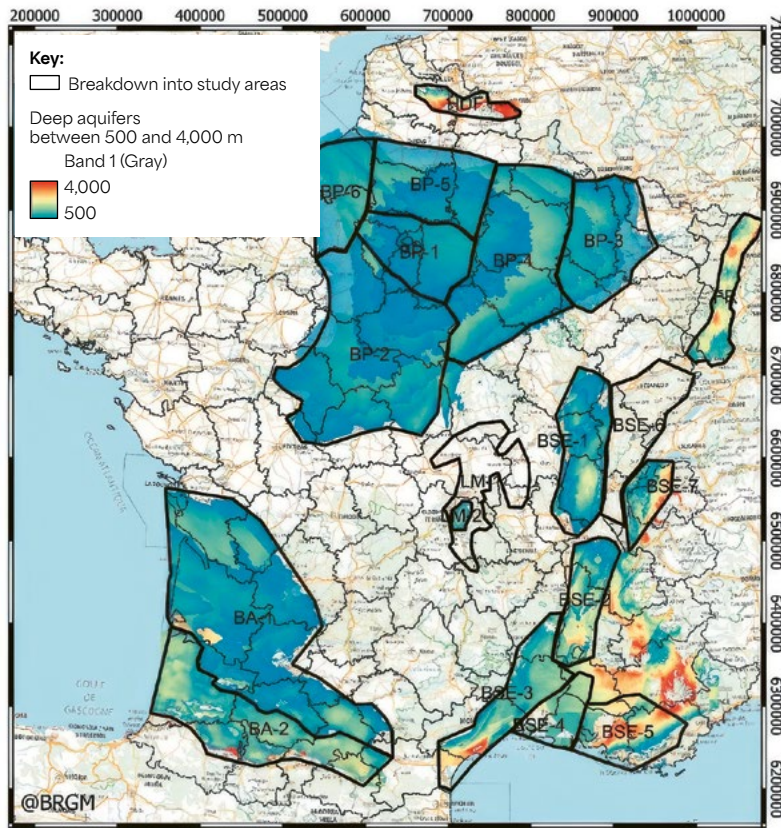
**KM OF SEISMIC PROFILES
AND 160 BOREHOLES
ALREADY REPROCESSED
AND REANALYSED**

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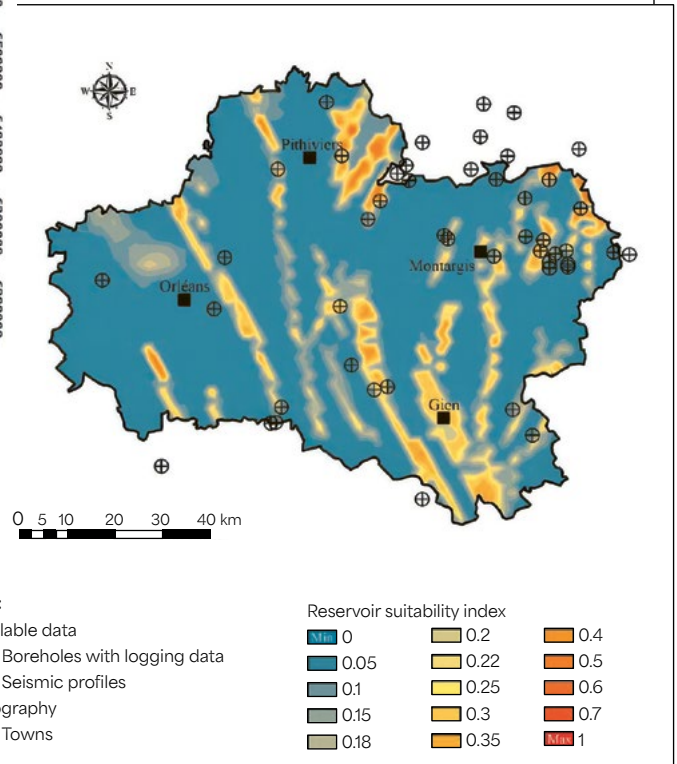
A Geoscan survey was conducted in the Paris region in 2024 in order to obtain seismic profiles of the subsurface using the seismic reflection method. © S3-ROBERT FAMY

Outstanding result



The sedimentary basins of mainland France were divided into study areas for the purposes of the national geothermal inventory.
© BRGM

The study into the potential of deep geothermal energy in the Loiret provided the basis for the production of departmental maps indicating the suitability of the Oxfordian (in this case, mid-Oxfordian), Dogger and Triassic reservoirs. © BRGM



... In 2025, the initiative was extended to the whole of the Centre-Val de Loire region and the former Picardy region. “Around 6,000 kilometres of seismic profiles and 160 boreholes have already been reprocessed and reanalysed,” explains Virginie Hamm. This extensive work has made it possible to characterise the deep geothermal reservoirs in these regions. 3D geological models and maps were produced for each reservoir, providing more precise information on their depth, thickness, temperature and geological suitability – i.e., the probability of finding a facies with reservoir properties.

New data collection initiatives

These studies make it possible to identify areas of interest for geothermal exploration, and even sectors where further data acquisition is warranted. “Thanks to these results,” continues Virginie Hamm, “we can target specific sites for the roll-out of the next seismic surveys, as was the case of the Geoscan survey carried out in 2024 in the Paris region.”

The models and maps produced as part of the national inventory are made available on an ongoing basis through the geothermies.fr website, jointly managed by BRGM and Ademe. They represent a valuable resource for players in this sector and also for stakeholders – including industry, local government and the agricultural sector – who are able to develop new geothermal projects based on this reliable scientific information. The inventory is now continuing in other areas with promising potential. In 2026, a similar project began in the eastern part of the Paris Basin, in the Grand Est region (Champagne-Ardenne and Lorraine). ●

“Thanks to the results of the survey, we can target specific sites for the roll-out of the next seismic surveys”

– What is the role of the French Association of Geothermal Energy Professionals (AFPG)?

Éric Lasne – The AFPG was founded fifteen years ago to bring together all the players in this sector and promote its development in France and internationally. The association now has 160 members representing companies in the field of deep and near-surface geothermal energy. The AFPG also coordinates three clusters: GEODEEP, Alliance Lithium and France Géoénergie. Its expertise makes it a key consultant for the Government.

– What are its links with BRGM and how do the two work together?

É. L. – BRGM is a founding member of the AFPG and sits on its board of directors, so we have close ties and work together in a number of areas. Generally speaking, the work of BRGM is of key importance to this sector as it enables better characterisation of French geothermal resources. The Geoscan geophysical survey, conducted in western Paris and in the South-East by BRGM and Ademe, is a good example of this: the data produced should contribute to the development of many geothermal projects with a lower level of risk. AFPG members are able to make use of BRGM's experimental geothermal platform in Orléans to test equipment. They also have access to databases, which are a valuable resource. BRGM is also helping to establish a framework of best practices, primarily with a view to improving the quality of infrastructure, protecting water resources and the environment, reducing operational risks and planning for geological hazards. It acts as an independent expert on insurance schemes relating to geological risk, for example during drilling operations. Finally, it provides digital models to help size the structures to be designed in line with geothermal requirements.

“Through its scientific expertise and support for public policy, BRGM is a key player in the development of geothermal energy in France”



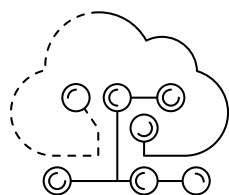
ÉRIC LASNE

Chair of the French Association of Geothermal Energy Professionals

– More broadly, how would you assess BRGM's contribution to the development of the geothermal sector in France?

É. L. – It's essential. In particular, BRGM plays a key role in updating the regulations governing the development of geothermal energy. Its research activities – often conducted in collaboration with our members – help to drive the technologies we deploy in the field. Through its scientific expertise and support for public policy, BRGM is a key player in the development of geothermal energy in France.





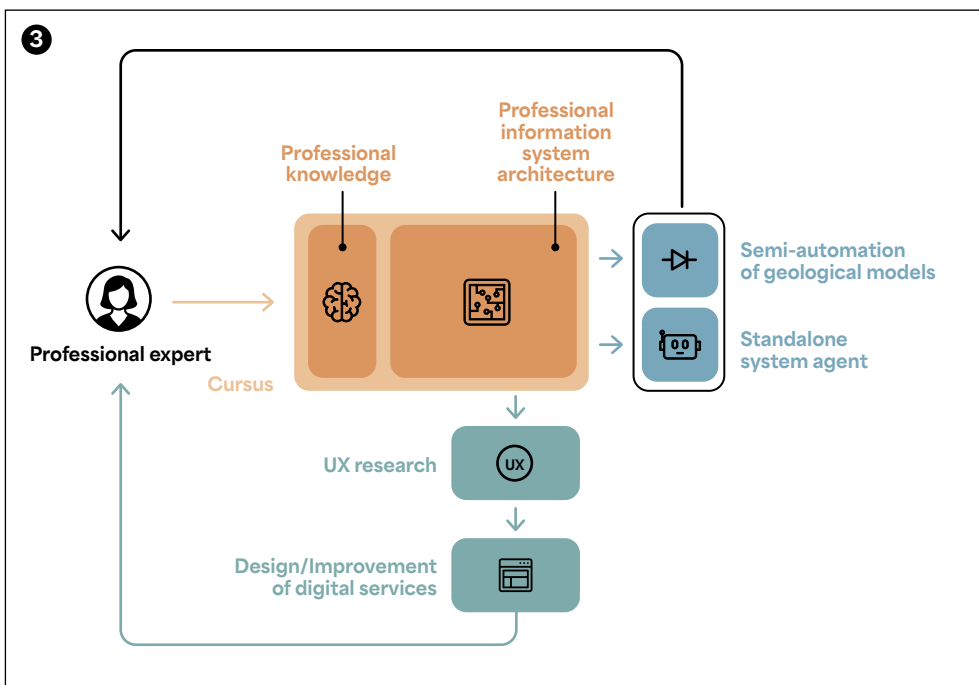
Developing digital, open, reproducible and predictive geoscience

To address the growing challenges relating to the subsurface, it is becoming essential to generate knowledge and strengthen predictive capabilities more quickly. To meet these challenges, we have to organise and make better use of existing data, while developing ever more sophisticated numerical models capable of accurately representing geological systems and how they function. Digital technology and artificial intelligence are emerging as key drivers for achieving these scientific advances and transforming the geosciences. The integration of new technologies helps to improve the storage, interoperability, use and availability of geo-environmental data. In line with its commitment to open science, BRGM is developing tools and services designed to ensure sustainable and shared access to reliable information on the subsurface and its condition, properties and resources, in order to support research, innovation and decision making.

◀ BRGM aims to use scientific and technological advances, particularly artificial intelligence, to integrate all subsurface data regardless of its source or nature in order to improve understanding, modelling and simulation, with a view to enhancing predictive capabilities. © EFIL



1



Since 5 May 2025, excavated soil movements have been reported via the Trackdéchets regulatory platform. © ADOBE STOCK



Interaction between Cursus and the various components and functions provided by an information system.
© PEPR SOUS-SOL, BIEN COMMUN

The aim of the “Augmented Geologist” challenge is to develop tools that can be used in the field in real time for collecting, querying, visualising and modelling geological data. © BRGM



TRACKDÉCHETS

1 Coordinated waste tracking

In 2025, BRGM supported the integration of the National Register of Waste, Excavated Soil and Sediments (RNDTS) into the *Trackdéchets* application. This development simplifies the tracking of hazardous and non-hazardous waste streams by bringing all the procedures together within a single, more user-friendly and interoperable system. BRGM has helped to integrate data standards and harmonise data models, thereby ensuring continuity of service for public sector bodies, waste producers and waste operators.

CVL DATA CENTRE: THE RENATER NETWORK HUB FOR ORLÉANS

Serving the education and research community, Renater is a reliable and secure network that facilitates collaboration and the convergence of scientific and academic projects. In 2025, the connection hub for the Orléans region, which had previously been hosted at the university, was relocated to BRGM as part of the certification by the Ministry of Higher Education and Research (MESR) of its regional data centre, the CVL (Centre-Val de Loire) Data Centre, which is also a hub in the Data Terra national research infrastructure. This change helps to improve the performance of the national digital network and to support the development of scientific applications requiring large-scale data exchanges (environmental modelling, land observation, etc.). The launch of the Renater hub also enables interconnection with MESR-accredited data centres in other regions.

2 Providing digital support in the field

AUGMENTED GEOLOGIST

As part of their partnership, BRGM and INRIA officially launched the “Augmented Geologist” challenge in Paris on 17 September 2025. The aim of this four-year research project is to develop the digital tools of the future for geologists in the field to record their observations, compare them with existing data and sketch out terrain models. It is also intended to make it easier to prepare a survey and make use of the results, for example using artificial intelligence.

GENERATIVE AI

A charter to balance responsibility, rigour and innovation

In 2025, BRGM adopted a generative artificial intelligence charter, which sets out its commitment to regulating its use while promoting innovation. Drafted collaboratively, this document sets out the ethical, legal and technical principles to be observed when using generative AI tools in the institution and specifies the requirements regarding data protection, model transparency and human validation of the content produced. This initiative aims to make sure best practices are applied in the use of AI to support BRGM’s role in the public interest. At the same time, a cross-functional, secure and sovereign AI solution was selected for in-house deployment.

PEPR

3 Tools for resource research and management

In 2025, BRGM consolidated its leading role in national research programmes (PEPR) on water and the subsurface on the basis of significant progress in the development of open-source, interoperable and shared digital infrastructure at the European level. Under the OneWater PEPR, the organisation launched the first version of a portal called OneWater Data to facilitate the access, sharing and reuse of water data in accordance with the FAIR principles. As part of the Subsurface PEPR, BRGM helped to set up the CURSUS platform, a “repository” of business processes and practices that promotes mutual understanding between the various areas of subsurface expertise.

MOROCCO

BRGM expertise for a risk management information system

Morocco aims to improve its understanding and management of natural hazards across the country by streamlining the collection, management and dissemination of natural hazard data (earthquakes, floods, landslides and coastal flooding). As a partner in this project, BRGM took part in the feasibility study for a national natural hazard information system. In particular, BRGM helped to establish its architecture, the data repositories and the governance and interoperability arrangements between the various stakeholders.

Outstanding result

The integrative digital platform (PNI): a sharing platform for science

As a modular and scalable infrastructure, BRGM's integrative digital platform (PNI) provides researchers with data, tools and processing capabilities in a secure and sustainable framework. By providing easier access, it frees up time for scientific innovation and can set an example for other public bodies facing the same challenges.

The integrative digital platform (PNI) is the cornerstone of a major transition for BRGM. Its aim is to centralise, secure and simplify access to the scientific data, tools and workflows (processing) used by the organisation and its partners, while promoting the sharing and publication of results in the scientific community. With the growing importance of digital projects, it addresses a strategic challenge: avoiding data silos and ensuring long-term interoperability between the various initiatives. “Rather than coming up with a series of piecemeal solutions,” Pascal Delaporte points out, “BRGM has opted for a common platform, capable of developing in line with scientific and technological needs.”

One of the key components of this architecture is the data access module (MAD). By “linking” to catalogues structured around a wealth of standardised metadata such as BRGM's Cupidon and other external catalogues, it helps in finding resources and speeds up the provision of the requested data in analysis environments (Galaxy, Saphir, etc.). “The revolution brought about by the data access module is data virtualisation: this module retrieves data from where they are stored without moving them elsewhere,” explains Pascal Delaporte, who is encouraging all BRGM scientists to enter all their data, including work data, into the Cupidon catalogue so that it can be made available.

Creation of digital twins

Another advantage of the PNI is the seamless management of workflows, with the “containerisation” of processing codes to enable their interoperability and sequencing. “The PNI,” says Pascal Delaporte, “is intended for two types of users: developers who upload their processing code onto it, and scientists who select and combine these different building blocks to create complete workflows.” A module called GHOST also uses the existing processing chains in the PNI at remote sites or platforms.

“The ongoing introduction of the Orison project into the integrative digital platform will provide access to the technologies and building blocks needed to create digital twins, regardless of the subject area: hydrogeology, geochemistry, mineral resources, geothermal energy, risk management, etc.,” says Romain Chassagne. The purpose of this BRGM-led research project is to develop and provide a predictive digital environment dedicated to data assimilation. In particular, it is based on the integration and merging of multi-source, multi-scale data and on the (semi-)automatic updating and calibration of multi-physical models, using hybrid approaches that incorporate artificial intelligence.



**PASCAL
DELAPORTE**

IT Project
Manager



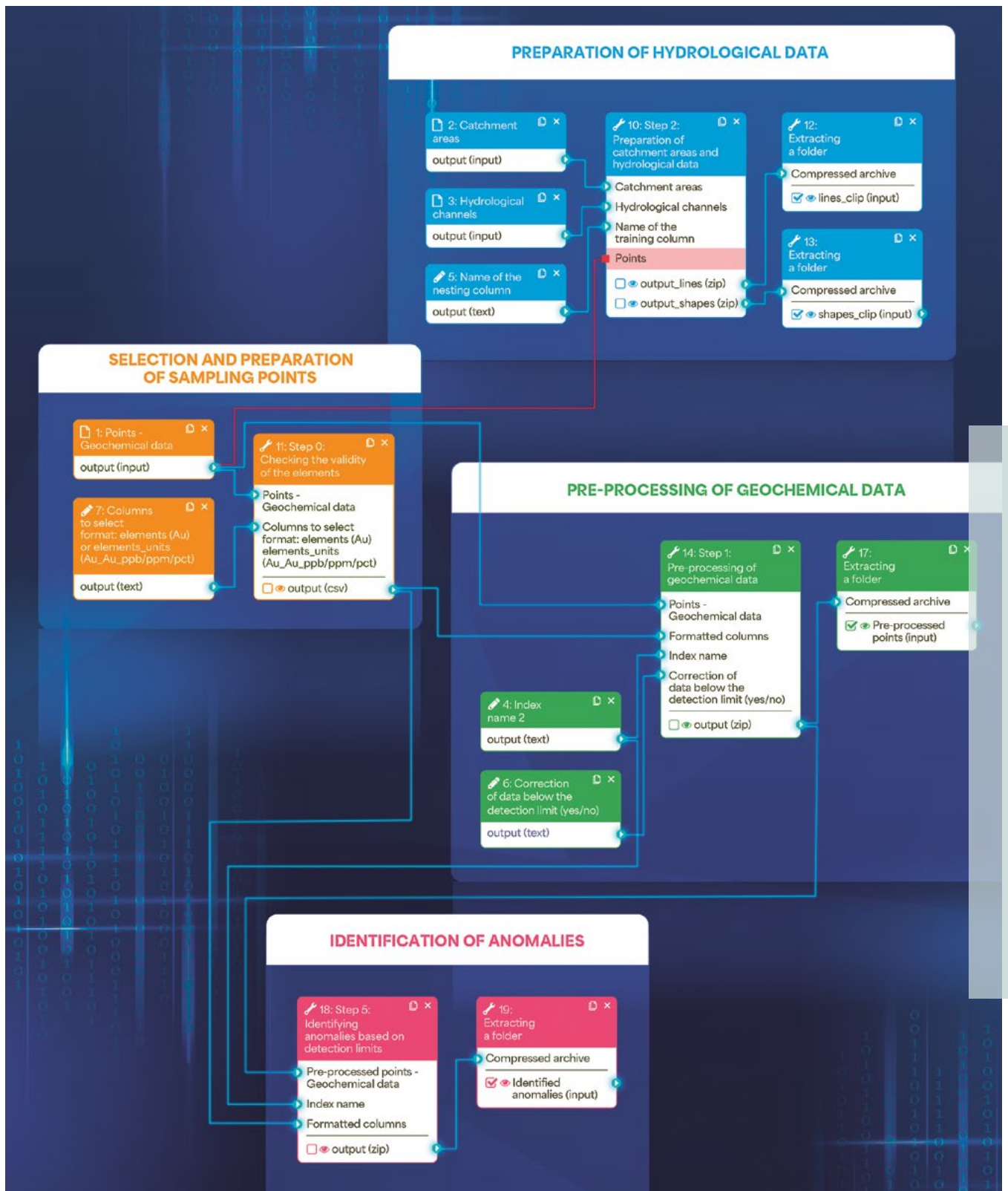
**ROMAIN
CHASSAGNE**

Head of the
Digital Twins sub-
programme

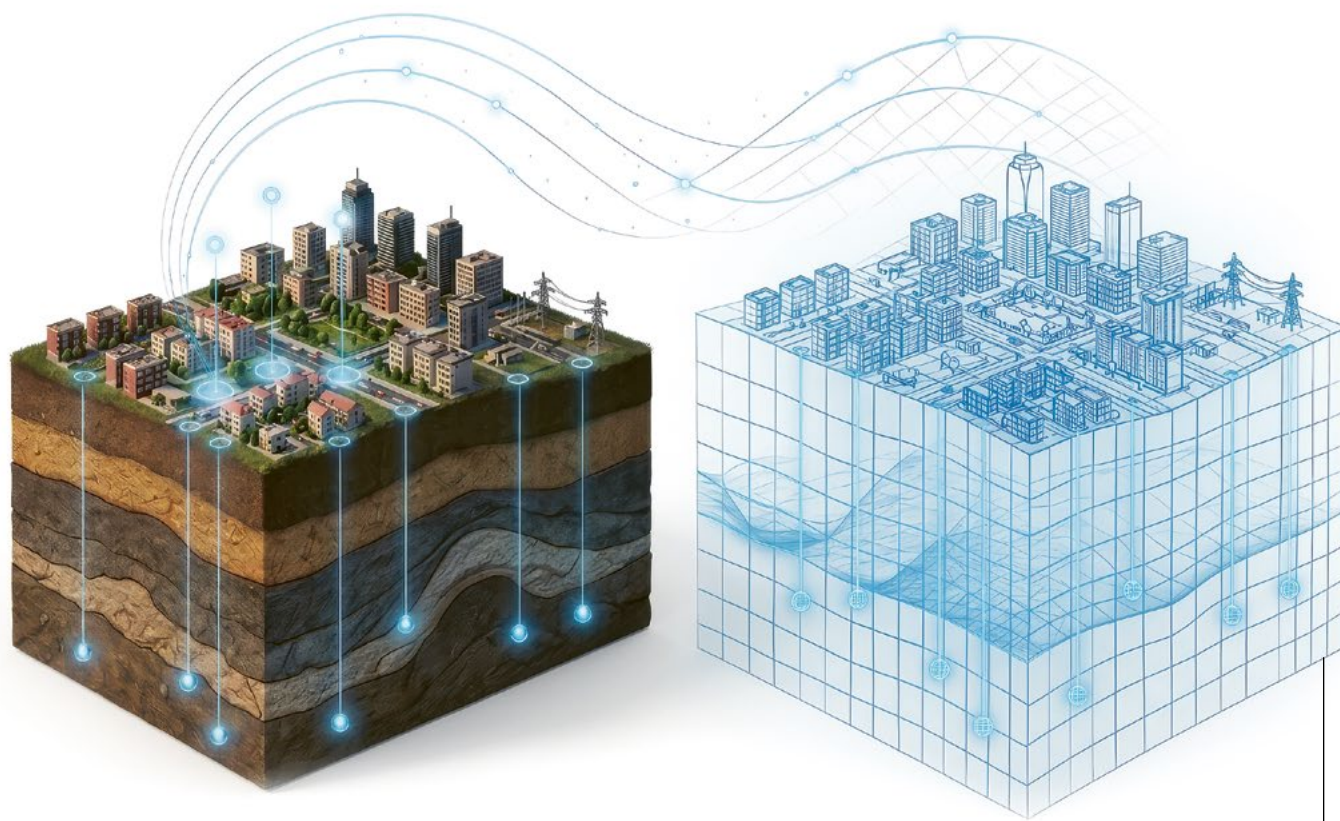
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PILOT USERS
OF BRGM'S INTEGRATIVE
DIGITAL PLATFORM IN 2025

...



Outstanding result



Graphic representation of a digital twin of an area, combining both surface and subsurface information. On the left, the real world; on the right, its digital twin. © BRGM

... The aim is to improve prediction for systems and for systems of systems (such as coupling the surface with the subsurface) and to simulate future scenarios while quantifying uncertainties as accurately as possible. More broadly, this tool is intended to promote the development of digital twins. As Romain Chassagne explains, “it is a virtual representation of a physical system such as a city, a natural environment or even a machine, which is dynamically linked to its real-world counterpart.”

A key player in ground and subsurface data infrastructure

The PNI is in line with the national data sharing strategy for sharing geological, hydrogeological and environmental data in accordance with the FAIR (Findable, Accessible, Interoperable, Reusable) principles. It is closely linked to Data Terra, a national research infrastructure that pools Earth system observation data. The PNI is also linked to national research programmes (PEPR) and their data platforms, with a view to ensuring their long-term sustainability and optimum use beyond 2030. Finally, it forms part of a European framework, notably by aligning with the requirements of the EOSC (European Open Science Cloud) and by collaborating with initiatives such as EuroGeoSurveys. This positioning strengthens BRGM’s role as a key player in ground and subsurface data infrastructure both in France and across Europe.

With the online launch in 2025 of an alpha version of the integrative digital platform, “pioneer” users could test its technical aspects, but could also start contributing content. It is currently being rolled out across the whole of BRGM. “Far more than just a technical solution, the PNI is a driver of cultural transformation,” emphasises Pascal Delaporte. “It encourages teams to carefully consider their data and data processing right from the outset and to document and share them. It is backed up by a comprehensive change management programme involving PNI ambassadors, training sessions, tutorials and feedback.” ●

“Far more than just a technical solution, the PNI is a cultural transformation factor backed up by a comprehensive change management programme”

– What is the role of the Interministerial Digital Technology Department (DINUM) in addressing data-related issues, particularly those relating to the environment?

Stéphanie Schaer – DINUM coordinates the Government’s digital policies, promotes interoperability between information systems, facilitates data sharing between Government departments and leads efforts to reduce the environmental footprint of the public digital sector. Environmental data have an increasingly important role in public decision making. In particular, those relating to critical metals guide policies to extend the service life of equipment and equipment procurement strategies. The collaboration with the General Commission for Sustainable Development illustrates this convergence between digital transformation and the green transition.

– In this context, what are your expectations of BRGM?

S. S. – BRGM provides essential information for Government departments on the ground, the subsurface and natural resources. In particular, these data are used to provide information for the life cycle assessments carried out in NumÉcoÉval to measure the environmental footprint of digital technologies. They also provide insight into ministerial roadmaps on critical resources and industrial dependencies. In this context, BRGM must continue its efforts to develop its data dissemination infrastructure, which must also interface effectively with the national catalogue and major public platforms (data.gouv.fr, Géoplateforme, etc.) for easier data integration and large-scale re-use of data. We also expect the organisation to continue to improve the accessibility and geographical coverage of its data, so that it becomes increasingly comprehensive and consistent and can be used directly by public sector bodies.

– How would you assess the organisation’s role in relation to geoscientific and environmental data?

S. S. – The work of collecting, storing and disseminating data via InfoTerre and Géorisques is an essential foundation for public policy. It is also part of a European initiative driven in particular by the

“The geoscientific and environmental data produced by BRGM serve as a means of strengthening European sovereignty and competitiveness”



STÉPHANIE SCHAEER
Interministerial Director
for Digital Affairs

High-Value Datasets Directive, which identifies certain public data as strategic due to their potential to contribute to innovation, economic growth and the provision of information to citizens. The geoscientific and environmental data produced by BRGM fall squarely within this category and serve as a factor that strengthens European sovereignty and competitiveness.

Sustainable development

Pulling together to achieve a more positive impact

BRGM's 2025–2030 Sustainable Development & Social and Environmental Responsibility (SD&SER) master plan organises and accelerates the reduction of its environmental footprint and the improvement of its social impact. The efforts undertaken are already beginning to bear fruit, encouraging the entire institution to continue along this positive path.

**PHILIPPE
SABOURAULT**
Head of CSR

**HERVÉ
RIOLLAND**
Head of Risk
Prevention and
Quality Auditing

Implementation of our 2025–2030 SD&SER master plan is off to a good start: BRGM's 2024 greenhouse gas emissions assessment for Scopes 1 to 3* showed a reduction of 5.9% compared with 2023 or, relative to the organisation's workforce, a reduction of 6.5% per FTE. This improvement can mainly be explained by the combined reduction in diesel consumption by the BRGM fleet (-11%), volume of goods transported by air (-29%), number of visitors to the Orléans site (-19%), emissions due to accommodation (-22%) and the number of capital assets, as well as the extension of the useful life of computers (from 5 to 7 years) and the reduction in purchases made (-9% overall), the latter of which accounts for the organisation's main carbon footprint.

As a framework document, the 2025–2030 SD&SER master plan sets out BRGM's commitments to contributing to the ecological transition and an equitable society, and is based on two

key pillars: climate, biodiversity and resources on the one hand, and social progress on the other. *"It encompasses all our activities – research, support for public policy development, post-mining management and support activities – and involves all staff,"* emphasises Philippe Sabourault.

Donations of equipment

This comprehensive, unifying project gives rise to specific initiatives every year, beginning with those that staff consider a priority. In 2025, BRGM signed an agreement with Emmaüs Connect to donate all or part of its unneeded IT equipment. The laptops, computer monitors, smartphones and tablets collected will be refurbished for the benefit of people affected by social and digital exclusion. Monitors that were no longer in use were also offered to any staff who wanted them, in particular to improve their remote-working conditions.

To encourage cycling, new covered bike parking spaces have been created. A partnership has also been signed with BlaBlaCar Daily to promote and encourage car-sharing for employee commutes, using a mobile app designed specifically for this type of short-distance travel.

With regard to buildings, a study was carried out to assess the feasibility of installing a renewable energy production system on the roofs – following the example of the solar panels on the building housing the regional post-mining unit for Eastern France – or covering them with vegetation. The results will be taken into account in the building renovation programme currently



In October 2025, employees were invited to consider how to adapt their practices towards more responsible digital behaviour – in particular through the "Digital Collage" initiative. © BRGM



The building housing the regional post-mining unit for Eastern France, located in Freyming-Merlebach, has been fitted with solar panels with the aim of reducing its carbon footprint and optimising its insulation. © BRGM

“The path has been mapped out: to reduce BRGM’s carbon footprint by 5% each year in order to achieve net zero by 2050”

-6.5%

THIS IS THE REDUCTION IN GREENHOUSE GAS EMISSIONS PER FTE IN 2024 COMPARED WITH 2023 (FROM 14.8 TONNES TO 13.9 TONNES OF CO₂/FTE)

being implemented. Rainwater collection tanks have also been installed at the Orléans site with a view to reusing the water for irrigating green spaces or in the bicycle repair workshop.

Responsible procurement

In the staff canteen, plastic water bottles have been replaced by water in cartons, and more organic produce has been added to the menus. And to raise awareness and increase employee involvement, a CSR training course has been added to the in-house training catalogue, and further information on this topic has been added to the intranet. A workshop on responsible use of digital technology was also organised, during which participants learned about the environmental impacts of digital technology and devised practical solutions to limit them.

Efforts will continue in 2026, with no fewer than 14 priority actions, such as the development of a strategy to promote socially and environmentally responsible procurement. *“The path has been mapped out: to reduce BRGM’s carbon footprint by 5% each year in order to achieve net zero by 2050,”* reiterates Philippe Sabourault. ●

Reinforcing risk prevention

The Quality and Environmental Management System (QEMS) is a key tool in the running of the organisation. It helps to support BRGM’s scientific and technical strategy and achieve the objectives set out in its contract with the Government. In this regard, efforts to simplify procedures continued in 2025, thanks mainly to the customer relationship management (CRM) system, which facilitates and strengthens traceability of the various decision-making steps involved in compiling bids. Feedback has also been reviewed in order to learn more lessons from the strengths and difficulties encountered in project management. Greater efforts were directed to consideration of risks in 2025, with tailored support provided to project managers to underpin the shift towards preventive management of hazards. In addition, integrated mapping has been put in place for accounting and financial risks, as well as those relating to cross-functional processes. These risks are presented to the audit committee each year and are subject to internal monitoring.

* Scope 1: direct greenhouse gas (GHG) emissions - Scope 2: indirect emissions associated with energy consumption, resulting from imported electricity - Scope 3: other indirect GHG emissions, namely goods transport, employee commutes, travel by customers and visitors, business travel, product purchases, capital assets, waste disposal and the use of other services.

Human resources

Supporting employees to meet their individual needs

Against a backdrop of internal reorganisation and changing lifestyles, BRGM seeks to ensure that every employee is able to carry out their work in optimal conditions, while taking their personal constraints into account. This is the key to a high quality of life in the workplace.

**MARIE
BELOSSAT**

Human
Resources
Director

**ANNE
GAUTHIER**

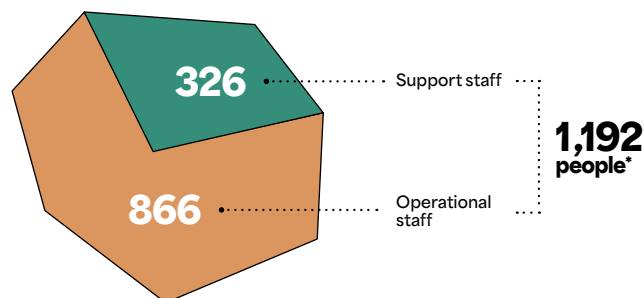
Deputy Human
Resources Director

With more than 900 staff members changing division following the reorganisation in late 2024, BRGM was keen to help operational unit managers develop or strengthen their managerial skills. This comprehensive support programme took the form of group sessions (on management, communication, etc.), themed workshops (on chairing meetings, leveraging emotional intelligence, the art of giving feedback, etc.) and individual coaching on request, tailored to each person's needs. "Thanks to this customised programme, based on peer-to-peer discussions, sharing of best practice and the study of practical cases, the 28 participants were able to identify their strengths and areas for improvement in order to better meet their teams' expectations," explains Anne Gauthier. These sessions, which took place over several months, also helped to foster a sense of collective momentum among all the managers.

Recognition of "worker-carers"

This is an initiative that should help to further improve quality of life and working conditions (QLWC) at BRGM. In the social barometer survey carried out in 2024, 77% of employees reported that they were on the whole satisfied with working at BRGM. Two agreements signed in 2025 should further improve this, granting additional rights to those who need them. One of them introduces recognition of the status of "worker-carer", which entitles the employee to measures designed to help them balance their personal and professional lives (flexible working hours, teleworking, authorised absences from work, donation of paid leave, etc.). Meanwhile, the agreement on QLWC has been updated to make life easier for prospective and new parents. It now provides support for couples undergoing medically-assisted *in vitro* fertilisation by allowing a spouse to take five days' leave to accompany their partner. The rules on working from home have also been relaxed for new parents.

BRGM workforce
on 31/12/2025



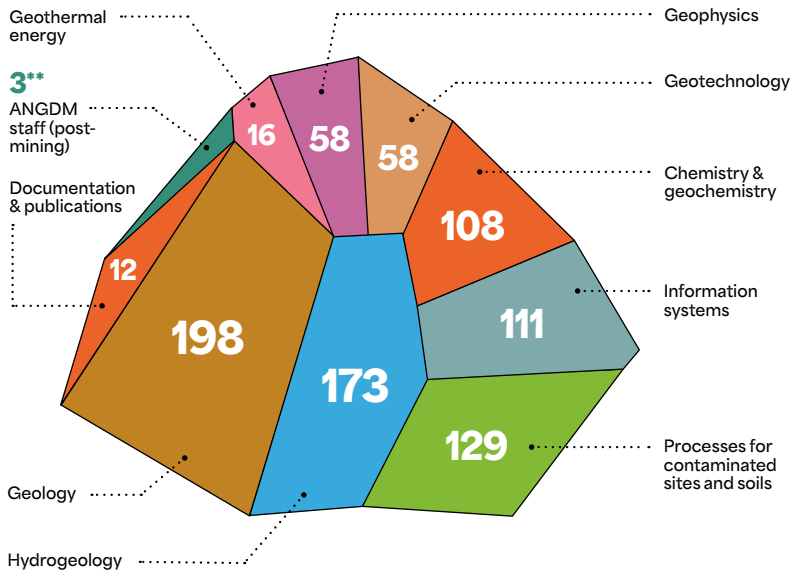
* Including 28 post-doctoral researchers, 45 PhD researchers, 22 staff on short-term project contracts, 12 civic service volunteers (VSC) and 63 sandwich-course students

BRGM: an "Ambassador for inclusion"

Another key focus of BRGM's HR policy is its commitment to diversity and inclusion. In 2024, the organisation exceeded for the first time the 6% employment rate of people with disabilities. "This result is the outcome of a long-term policy that combines personalised, coordinated assistance (occupational physicians, social workers, managers), strong partnerships (Agefiph, Cap Emploi, etc.) and continuous awareness-raising," emphasises Marie Belossat. For example, in 2025, a webinar was organised on the recognition of disabled worker status (RQTH), in order to encourage eligible employees, particularly those with a hidden disability, to apply for this status. In recognition of this proactive policy, in 2025, BRGM received the "Ambassador for Inclusion" award from the ADAPEI 45 association. In particular, BRGM

Breakdown of the workforce by profession

866
people



** Staff provided by the National Miners' Rights Agency (ANGDM) to BRGM for post-mining activities

242

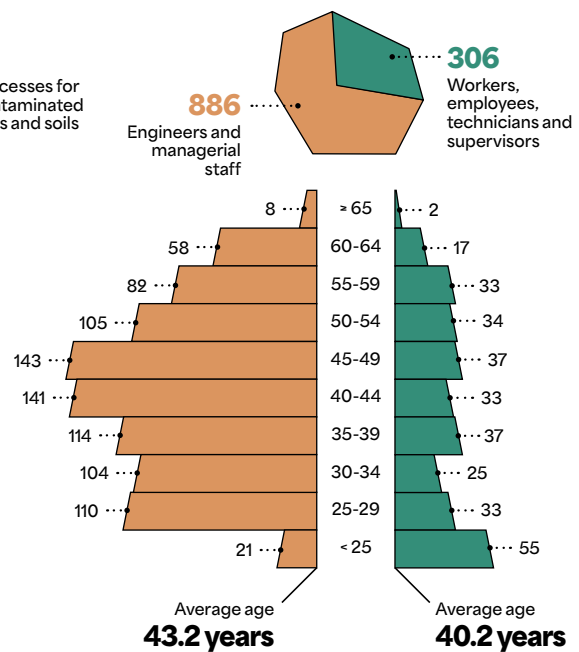
NEW HIRES IN 2025, INCLUDING 73 ON PERMANENT CONTRACTS, MAINLY IN OPERATIONAL DIVISIONS

BRGM staff honoured

BRGM strives to acknowledge its employees' commitment and the value of their work by nominating candidates for official honours: Legion of Honour, National Order of Merit, Academic Palms, Mines Medal (reintroduced in 2025 - see page 6) and even the Order of Arts and Letters. In 2025, 26 people were thus recognised. Congratulations to them!

supported this association's travelling photography exhibition "Differently competent", which highlights the know-how of people with disabilities and was hosted by BRGM in April 2026, shortly after the signing of a new agreement for the period 2026–2028. The aim of this agreement is to strengthen non-discrimination in recruitment and break down stereotypes about disability, in order to maintain employment levels of workers with disabilities. ●

Age pyramid by category on 31/12/2025



“Exceeding the 6% employment rate of people with disabilities is the result of a long-term policy that combines personalised, coordinated assistance, strong partnerships and continuous awareness-raising”

Governance

Board of Directors



**CATHERINE
LAGNEAU**

Chair and CEO



**CHRISTOPHE
POINSSOT**

Deputy CEO

Programme Directors



UNDERSTANDING
AND MODELLING
REGIONAL GEOLOGICAL
FORMATIONS

— **HÉLÈNE TISSOUX**
Programme Director



ENSURING
A RESPONSIBLE
SUPPLY OF MINERAL
RESOURCES

— **JOHANN TUDURI**
Programme Director



USING THE SUBSURFACE
FOR THE ENERGY
TRANSITION AND
DECARBONISATION

— **FRANCIS CLARET**
Programme Director



TRANSFORMING THE
GEOSCIENCES THROUGH
DIGITAL TECHNOLOGY

— **MICHAËL CHELLE**
Programme Director



MANAGING
GROUND AND
SUBSURFACE RISKS

— **OLIVIER CERDAN**
Programme Director



PROTECTING
GROUNDWATER
RESOURCES

— **ALAIN DUPUY**
Programme Director



JEAN-MARC TROUILLARD
Chief of Staff



PHILIPPE FREYSSINET
Scientific Director



MARIE BELOSSAT
Director of
Human Resources



CATHERINE BONIN
Director of Innovation,
Commercial and
International Activities



STÉPHANE ROY
Director of Project
Support, Production
and Performance



CAROLINE RICORDEL
Director of
Subsurface Knowledge
and Geomodelling



ARIANE BLUM
Director of
Water Resources



FRÉDÉRIC GLANOIS
Director of Energy
and Decarbonisation
Delegate for
Climate Strategy



CLAUDIE CARNEZ
Director of Risks
and Risk Prevention



PATRICK D'HUGUES
Director of
Mineral Resources



JEAN-LOUIS NEDELLEC
Director of Prevention
and Mine Safety



FRANCIS GARRIDO
Director of
the Regional Network



NATACHA GIROLD
Financial Director



SANDRINE LEMAL
Director of Technical
and Administrative Services



OLIVIER POUVESLE
Director of Digital Applications
Director of Digital Strategy



JEAN-MARC MOMPELAT
Director of Territorial Strategy
and Public Service

Governance

Board of Governors and committees

BOARD OF GOVERNORS

APRIL 2026

Chair of the Board of Governors

Catherine Lagneau

Government Commissioner

Florence Riou

Representing the Minister for:

.....

Research

Muriel Thibaut, Policy Officer for New Technologies for Energy, General Directorate for Research and Innovation

Alternate member: Marjolaine Chiriaco, Head of the Department of Environment, Earth and Space Sciences, General Directorate for Research and Innovation (Ministry of National Education, Higher Education and Research)

.....

the Environment

Anne-Cécile Rigail, Head of the Technological Risks Department, General Directorate for Risk Prevention

Alternate member: Jean-Luc Perrin, Deputy Director for Chronic Risks and Coordination, General Directorate for Risk Prevention (Ministry for Ecological Transition, Biodiversity and International Negotiations on the Climate and Nature)

.....

Foreign Affairs

Tristan Dufes, Deputy Director for Strategic Sectors, Economic Diplomacy Directorate

Alternate member: Élodie Laugier, Deputy Assistant Director for Strategic Sectors, Economic Diplomacy Directorate (Ministry for Europe and Foreign Affairs)

.....

Cooperation

Valérie Brisset, Deputy Director, Directorate for Cultural, Educational, Academic and Scientific Diplomacy

Alternate member: Delphine Tessier, Head of Unit, Sub-Directorate for Higher Education and Research (Ministry for Europe and Foreign Affairs)

.....

the Economy

Hélène Le Du, Engineer-General for Mines (Paris Tech), General Economic Council

Alternate member: Philippe Laval, General Economic Council, Head of the Schools Oversight Unit (Ministry of Economy, Finance and Industrial, Energy and Digital Sovereignty)

.....

the Treasury

Yoann Geneslay, Deputy Director of the 3rd Sub-Directorate, Budget Directorate, in charge of Industry and Energy - Public Accounts

Alternate member: Simon Pineau, Head of Department for Energy, State Holdings, Industry and Innovation, 3rd Sub-Directorate of the Budget Directorate (Ministry of Economy, Finance and Industrial, Energy and Digital Sovereignty)

.....

Mining

Alexandre Chevallier, Deputy Director for Security of Supply and Energy and Mineral Resources, General Directorate for Energy and Climate

Alternate member: Jean-François Gaillaud, Head of the Mineral Resources Policy Department, Sub-Directorate for Security of Supply and Energy and Mineral Resources, General Directorate for Energy and Climate (Ministry for Ecological Transition, Biodiversity and International Negotiations on Climate and Nature)

Members selected for their particular expertise:

Catherine Lagneau, BRGM Chair and CEO

Anne Besnier, Vice-President for Higher Education, Research and Innovation at the Centre-Val de Loire Regional Council, Member of the European Committee of the Regions

Bernard Doroszczuk, National Energy Ombudsman

Marc Chaussidon, Director of *Institut de Physique du Globe de Paris* (IPGP)

BRGM staff representatives:

Nicolas Frissant (CFDT)

Valérie Guérin (CFDT)

Simon Lopez (CGT)

Élodie Giuglaris (CGT)

Lydie Jeux (CFE/CGC)

Pierre Vassal (CFE/CGC)

Economic and Financial Auditing:

Bruno Rossi, Jean-Louis Tertian

SCIENCE COMMITTEE

APRIL 2026

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Vincent Lagneau, Scientific Director of the French Nuclear Safety and Radiation Protection Authority (ASNR)

Philippe Agard, Professor, Sorbonne University (Paris, France)

Xavier Arnault de Sartre, CNRS Research Director, University of Pau and the Pays de l'Adour (Pau, France)

Hélène Barucq, Research Director at INRIA (France)

Hélène Budzinski, CNRS/INEE Research Director (UMR EPOC) (Bordeaux, France)

Philippe Charvis, Director for Science, IRD (Marseille, France)

Tirza Van Daalen, Director of the Geological Survey of the Netherlands, TNO (Netherlands)

Anne Le Friant, CNRS Research Director, Deputy Director of IPGP (Paris, France)

Stéphane Guillot, CNRS/INSU Research Director, Risk Delegate to the CNRS General Directorate (Paris, France)

Michel Jébrak, Professor Emeritus at the *Université du Québec* in Montreal (Canada)

Patrick Landais, R&D and Strategy Consultant for Nuclonaut, formerly of the CEA (retired) (Paris, France)

Anne Laurent, Professor, Director of ISDM, University of Montpellier (France)

Louis Londe, Technical Director of Géostock (Paris, France)

Christelle Marlin, Professor at the University of Paris-Saclay (Paris, France)

Valérie November, CNRS Research Director affiliated to CERI (Centre for International Research) at Sciences Po (Paris, France)

Judith Sausse, Professor, Director of the *École nationale supérieure de Géologie* (Nancy, France)

Olivier Vidal, Research Director at CNRS/IS Terre (Grenoble, France)

Ralph Watzel, Professor, Director of the German Geological Survey, BGR (Germany)

NATIONAL PUBLIC-SERVICES STRATEGY COMMITTEE

APRIL 2026

Representing the Ministry of Economy, Finance and Industrial, Energy and Digital Sovereignty

By delegation, the General Directorate for Development, Housing and Nature (DGALN)

Representing the Ministry for Ecological Transition, Biodiversity and International Negotiations on Climate and Nature

General Directorate for Development, Housing and Nature (DGALN)/Water and Biodiversity Department (DEB)

General Directorate for Energy and Climate (DGEC)

General Directorate for Infrastructures, Transport and Mobility (DGITM)

General Directorate for Risk Prevention (DGPR)

Representing the Ministry of Higher Education, Research and Space

General Directorate for Research and Innovation (DGR)

Representing the Ministry of Agriculture, Agri-Foods and Food Sovereignty

General Directorate for Company Economic and Environmental Performance (DGPE)

Representing the Ministry of Health, Families, Autonomy and People with Disabilities

General Directorate for Health (DGS)

Representing the Ministry of the Interior

General Directorate for Civil Defence and Crisis Management (DGSCGC)

Representing the Ministry for Overseas France

General Directorate for Overseas France (DGOM)

Representing the Ministry of Culture

General Directorate for Heritage and Architecture (DGPA)

**The Chair of the BRGM Science Committee
BRGM Chair & CEO**

AUDIT COMMITTEE

APRIL 2026

Chair

Marie-Madeleine Mialot-Muller

Simon Lopez

Pierre Vassal

Yoann Geneslay

Nicolas Frissant

Jean-Luc Perrin

Jean-Louis Tertian

Government Commissioner

Florence Riou

COMMITTEE ON PROFESSIONAL CONDUCT, SCIENTIFIC INTEGRITY AND ETHICS

APRIL 2026

Claire Lurin, Delegate for Professional Conduct, Integrity and Ethics on INRAE's Board of Directors

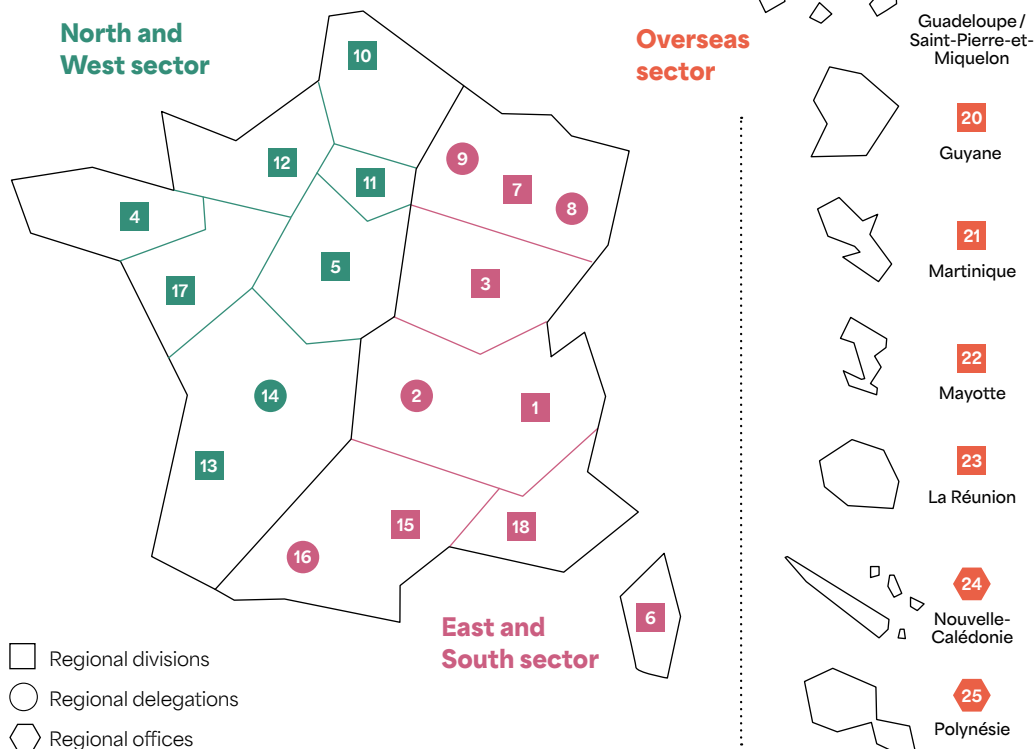
Estelle Jaligot, Delegate for Professional Conduct and Scientific Integrity on CIRAD's Board of Directors

Philippe Merle, Member of the General Economic Council

William Marois, Integrity Officer and former President of the University of Orléans (retired)

Governance

Regional Network



13

Regional divisions in mainland France and Corsica

5

regional delegations in mainland France

5

regional divisions and

2

regional offices in the overseas territories

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La Réunion

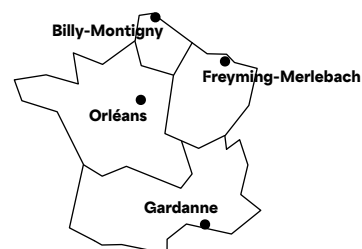
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2025 accounts

A year of transformation and growth

The 2025 financial year again showed a profit in a context of rising business activity, driven in particular by the ramping-up of the mineral resources inventory (IRM), internal reorganisation and the wider scope of the Group's operations. It was also characterised by a significant reduction in cash on hand, linked to the sustained level of investment made during the year.

**NATACHA
GIROLD**

Financial Director

**MURIELLE
LECAILLE**

Deputy Financial
Director

BRGM, along with four other public research institutions (Inrae, Cirad, Ifremer and IRD) is a State operator under programme 172 of the organic law on finance acts (LOLF). It also receives subsidies for public service expenditure (SCSP) under programme 181, in particular for its activities of "support for public-policy development" and "post-mining". Finally, it benefits from an SCSP subsidy under programme 113 to finance the piezometric network.

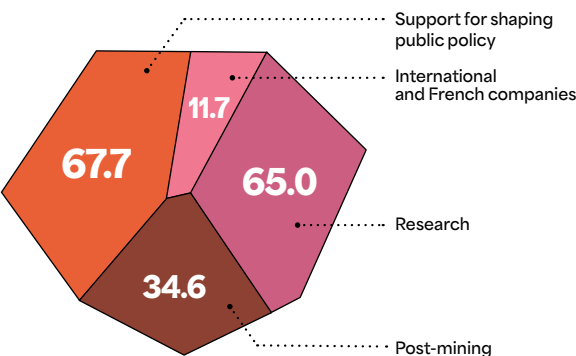
At the BRGM Group level

The net consolidated profit for the group stands at €1.9M compared to €0.9M in 2024. The main contributions of the entities are as follows: €0.9 million for BRGM Epic; €0.6M for BRGM Invest; €0.8M for IRIS Instruments; €0.1M for CFG Géothermal. BRGM Explore's results remain close to break-even.

The year 2025 saw a number of changes to the Group's scope and organisation. BRGM Epic acquired the shares in BRGM Explore held by BRGM SA, making the company a first-tier subsidiary. The legal framework for quasi-public management was also consolidated at the end of the financial year, with a view

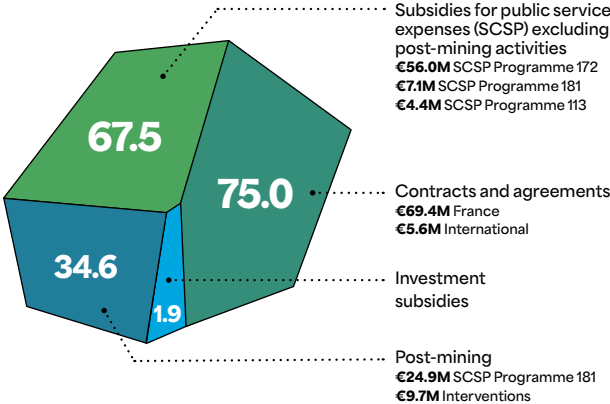
Breakdown of activity by mission

(in millions of euros)



Breakdown of activity by type of funding

(in millions of euros)



+€0.2M

BRGM EPIC
OPERATING RESULT IN 2025

€186.1M

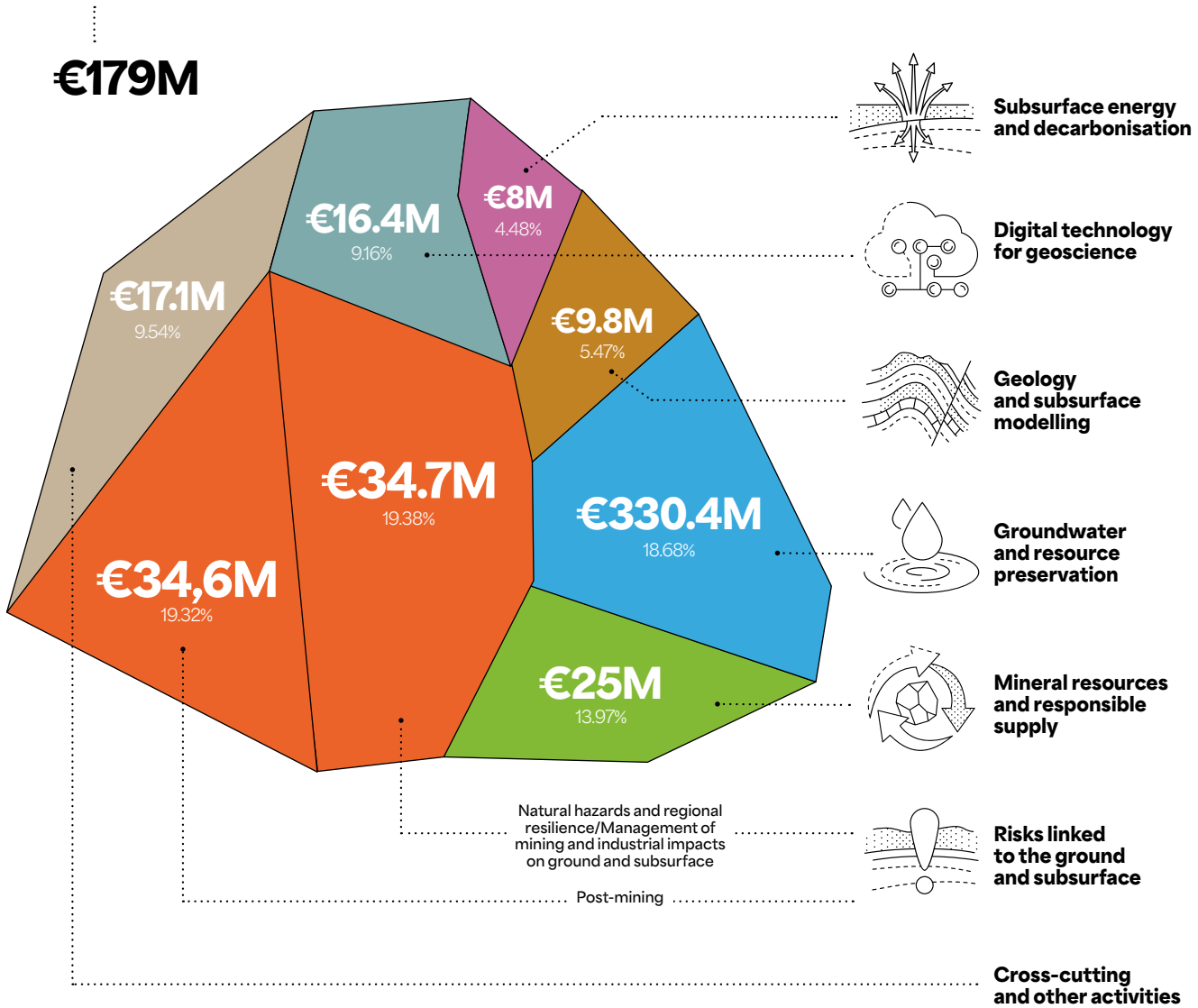
Operating
income 2025

€185.9M

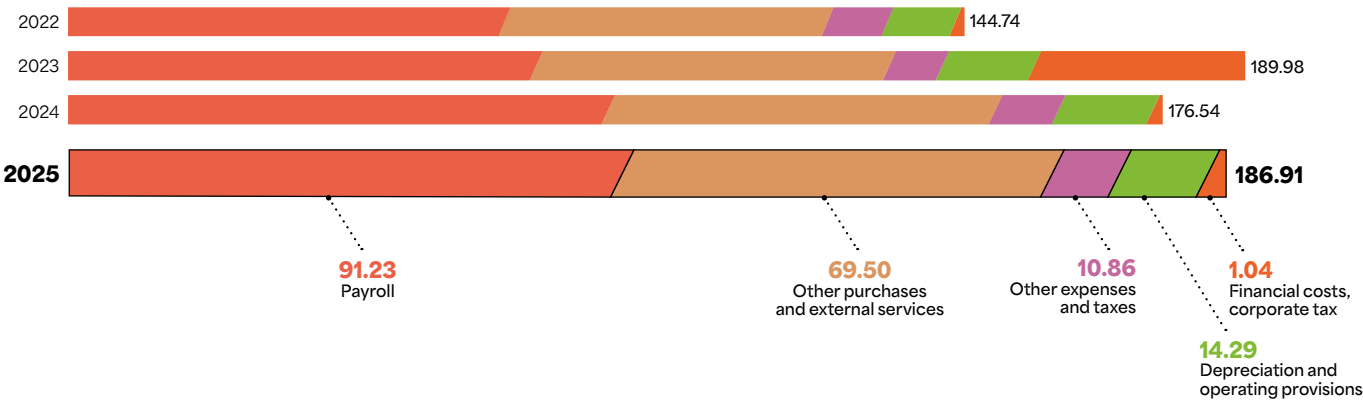
Operating
expenses 2025

Breakdown of income by strategic objective

Excluding capitalised production and the transfer of expenses



Evolution of total expenses 2022-2025 in millions of euros



* Contractual resources including MTE agreements (post-mining and others)
** Including subsidies for public service expenditure (SCSP) and mainly from programmes 172, 181, 113 and 159

to full implementation in 2026. Against this backdrop, BRGM Explore has continued to expand its operations, particularly within the framework of the IRM, by strengthening its resources and carrying out new field campaigns. At the same time, BRGM Invest has acquired further shares in Lyncée Traçabilité, CaliCO₂ and Geolinks.

At the BRGM Epic level

For BRGM Epic, the financial year ended with a net profit of €0.4M, compared with €1.0M in 2024. Operating profit stood at €0.2M and financial profit at €0.3M. Excluding write-backs of reserves and expense transfers, resources related to current activity amounted to €177.8M, i.e. an increase of 6% compared to the previous financial year. This growth is attributable to increases in both non-post-mining activities (€145.2M, up 6%) and post-mining activities (€34.6M, up 8%). Contracts and agreements, excluding investment grants, totalled €75M, up 12% compared to 2024. The financial year thus saw an increase in revenue and funds from current activities.

This growth is primarily driven by the ramping-up of the IRM project, but also by the momentum of activities funded under France 2030, in particular the PEPRs coordinated by BRGM (OneWater, IRiMa and Subsurface), as well as the project on strategic metals as part of the PEPR Recyclability programme. It is also due to the growing importance of European projects, whose contribution to scientific activity continues to increase. Research output thus stands at €65M, whilst public policy support activities amount to €67.8M including the IRM, or €58.3M excluding the IRM. Co-funding rates rose in 2025, both for public policy support and for research: they stand at 83.3% and 53.6% respectively, compared with 78.7% and 51.3% in 2024. This trend can be attributed in particular to the ramping-up of IRM services, which are 100% funded, as well as to the high volume of work on PEPR projects, European projects and contract research.

However, this positive trend must be qualified by the following remarks. International business has fallen by nearly 20%, and sales in France have declined by 27%, due to the teams' heavy involvement in the organisation's other activities.

Similarly, following an exceptional year in 2024, the value of orders signed has fallen sharply, from €92.7M excluding IRM (€145M including IRM) to €54.7M in 2025. Although this decline can be partly attributed to the record high reached in 2024, it, together with the decline in commercial activity, is a cause for concern for 2026, despite the fact that there is still a great deal of work to be done on existing contracts.

Operating expenses, excluding provisions and reversals, amounted to €171.6M, an increase of €10.7M compared with 2024 (up 6.7%). This trend is mainly due to the rise in operating costs, linked to the increase in business activity, as well as the rise in staff costs, which reached €91.2M in 2025, compared with €87.9M in 2024 (up 3.7%). This increase includes an average remuneration adjustment rate for existing staff (RMPP) of 2.5%, as well as the payment of a value-sharing bonus, a profit-sharing bonus and a full employer contribution.

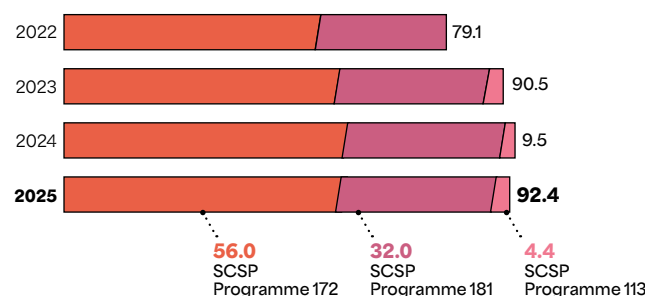
In 2025, the resources allocated to post-mining activities increased by 8%, driven by a combination of monitoring activities and construction work. The monitoring activity, funded by a public service expenditure (SCSP) grant of €24.9M – a slight increase over 2024 – includes €0.3M in appropriations carried over from the previous financial year; however, it is characterised by an underspend of €0.4M, carried forward to 2026, largely as a result of the cost-saving measures implemented. Revenue from construction work, meanwhile, stands at €9.5M, compared with €7.3M in 2024.

The financial result stood at +€0.3M, compared with +€0.8M in 2024. Cash flow from operations remains at a high level of €7.6M for the EPIC. However, it does not cover all the investments made during the financial year, which totalled more than €25M, against a backdrop of rising working-capital requirements. The EPIC's cash position thus stood at €77.6M at the end of 2025, compared with €110.2M at the end of 2024.

The 2025 financial year reflects the continued momentum in BRGM's activities, driven by several key projects, whilst also revealing increased pressure on its financial resources. These developments call for particular attention to ensure the sustainability of the business model and the terms of financing for investments in the coming financial years. ●

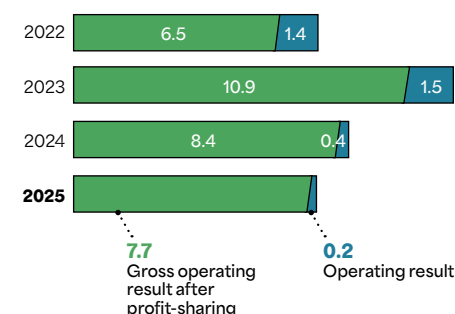
Evolution of Government grants

(in millions of euros)

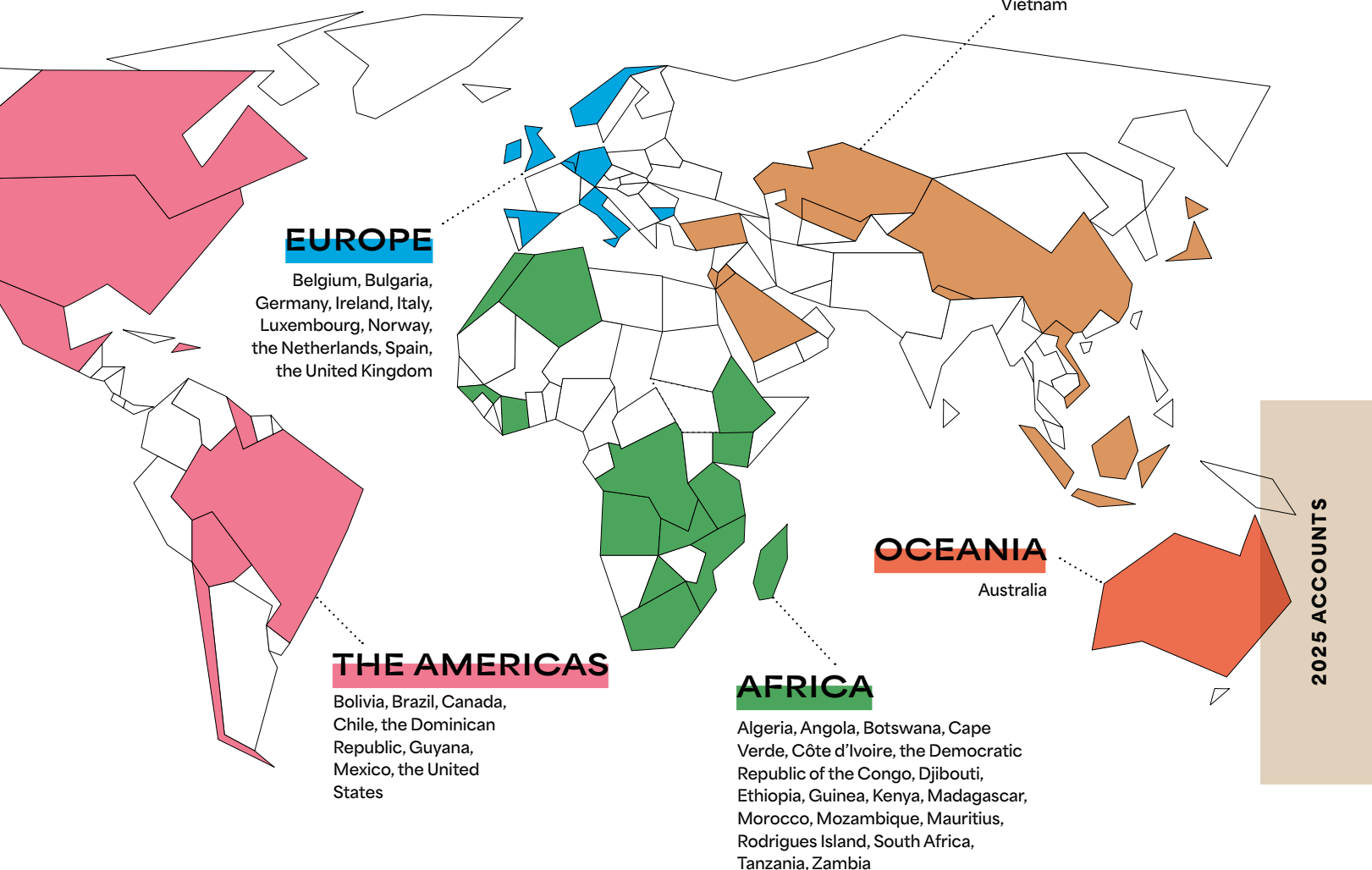


Evolution of operating result

(in millions of euros)



Breakdown of BRGM international turnover in 2025



Evolution of income under contracts for scientific research and public policy development support

(in million euros exclusive of VAT)

Contracts and agreements	2023	2024	2025
Government ministries and departments	20.210	22.722	18.767
France 2030 excluding PEPRs (IRM, Ofremi)	1.360	3.324	11.074
France 2030 PEPRs	0.580	3.525	5.857
ANR + Carnot (excluding France 2030)	2.145	2.319	2.239
Agencies outside the ANR (OFB, AE, Andra, Ademe, etc.)	6.090	5.967	6.504
European Union + ERDF	6.678	6.738	9.704
Local and regional authorities	8.557	7.749	9.719
Companies	1.207	1.946	1.385
Total	46.827	54.290	65.249

Subsidiaries and holdings

An ecosystem built around the geosciences

The BRGM Group, centred around BRGM as a public industrial and commercial establishment (Epic), has subsidiaries and shareholdings in several strategic sectors.

Founded in 2024, BRGM Explore became a top-tier subsidiary of BRGM (the Epic) in 2025, following acquisition of the shares held by BRGM SA. This company, which has replaced Société Minière de Chessy, is specialised in acquiring field data for mineral prospecting. Its semi-in-house status means that it is closely managed by the Epic, which accounts for more than 80% of its business.

Formerly operating as Sageos, BRGM Invest oversees the BRGM Group's holdings in subsidiaries operating in:

- Geothermal energy: 50% of the capital of CFG (the other 50% being held by Beicip-Franlab Groupe IFPEN) and 15% of Géothermie Bouillante (63.75% held by Ormat Systems and 21.25% by Caisse des Dépôts et Consignations).
- Measuring instruments for geophysics, hydrogeology, hydraulics, geotechnics and mining: 51% of the capital of IRIS Instruments (49% held by the Japanese group Oyo).
- Management of excavated soil: 44% of the capital of Soltracing (55% held by Hesus) and 21% of Terra Innova (69%

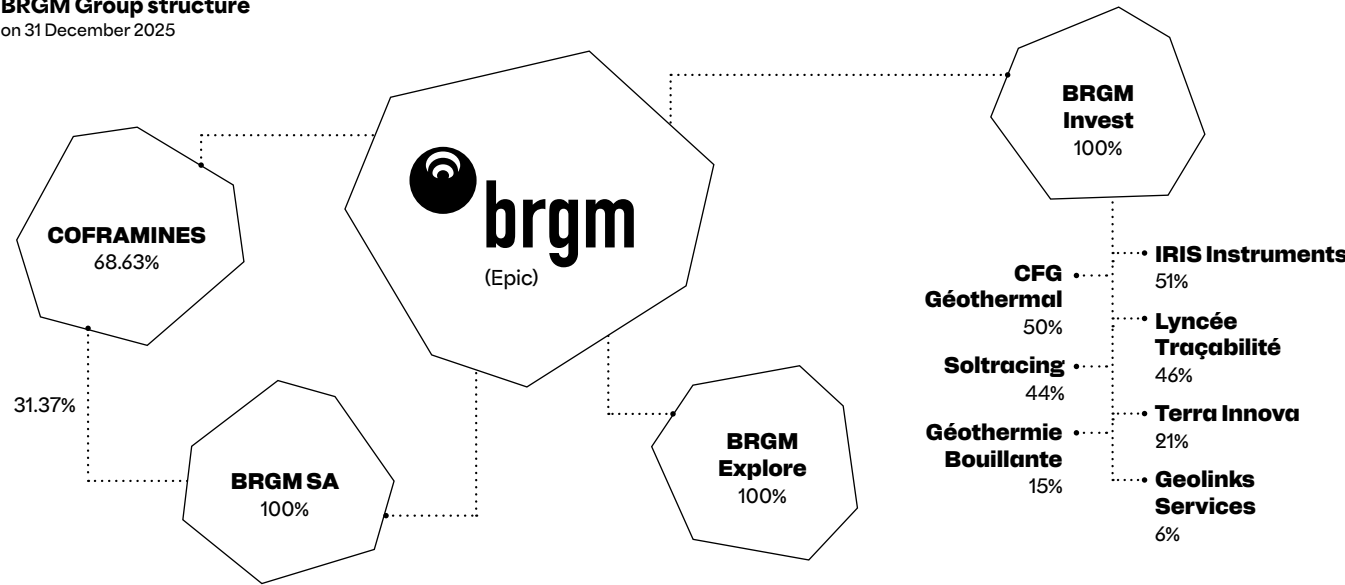
held by long-standing shareholders and 10% by a group of private investors).

- Digital tools for geosciences: 46% of the capital of Lyncée Traçabilité (54% held by Trace Ingénierie Environnement) and 6% of Geolinks Services (9% held by Bpifrance, 17% by EIT InnoEnergy and 12% by a French investment fund).

BRGM Invest also holds bonds convertible into shares representing 31% of the capital of CaliCO₂, an innovative company specialising in decarbonisation for industrial enterprises, which was founded in 2025.

Lastly, Coframines and BRGM SA hold the BRGM Group's remaining equity in the mining sector (dormant companies with no activities or development planned, or companies being wound up). BRGM SA holds receivables from the *Société de Participation Minière du Sud Calédonien* (SPMSC) since 2005, when the BRGM Group transferred its holding in the GORO project in New Caledonia to the SPMSC. ●

BRGM Group structure
on 31 December 2025



Active support for innovation

Revenue €1.5M	Net profit €791,000	BRGM Epic holds 100%	A workforce of 3
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FRÉDÉRIC JORY

Managing Director
of BRGM Invest

For the past four years, BRGM Invest has been pursuing a strategy of acquiring holdings in innovative companies in order to address current and future societal challenges, particularly those relating to climate change, protection of groundwater resources, the pursuit of sovereignty over mineral resources and the development of digital tools for the geosciences.

BRGM Invest has positioned itself as a long-term “deep- and green-tech” investor, focusing its investments mainly on technological and scientific innovations with a level of technical maturity that has brought them to the deployment phase.

Since 2024, this BRGM subsidiary has acquired stakes in four companies operating in very different sectors and at varying stages of development.

- Participation in Terra Innova’s fundraising round alongside three other investor groups (BRGM Invest acquired 21.6% of the capital in late 2024, with a seat on the board of directors), to develop soil reuse projects using excavated soil with a view to combating the effects of rainwater run-off and erosion.
- Creation of CaliCO₂ in September 2025 (see pages 12–13), alongside a start-up studio, to promote BRGM’s scientific findings; in this case, an innovative process for electrolysis-assisted capture and release of CO₂ using layered double hydroxides. This disruptive technology in the field of flue gas treatment, for which BRGM holds a patent, is based on two decades of research. BRGM Invest is devoting €700,000 over two years to this decarbonisation solution, with the aim of bringing it to market by 2030.
- Creation of Lyncée Traçabilité in November 2025, in partnership with Trace Ingénierie Environnement, to develop and market traceability services for mineral resources, using a digital core for document traceability, with the aim of securing the entire supply chain for manufacturers

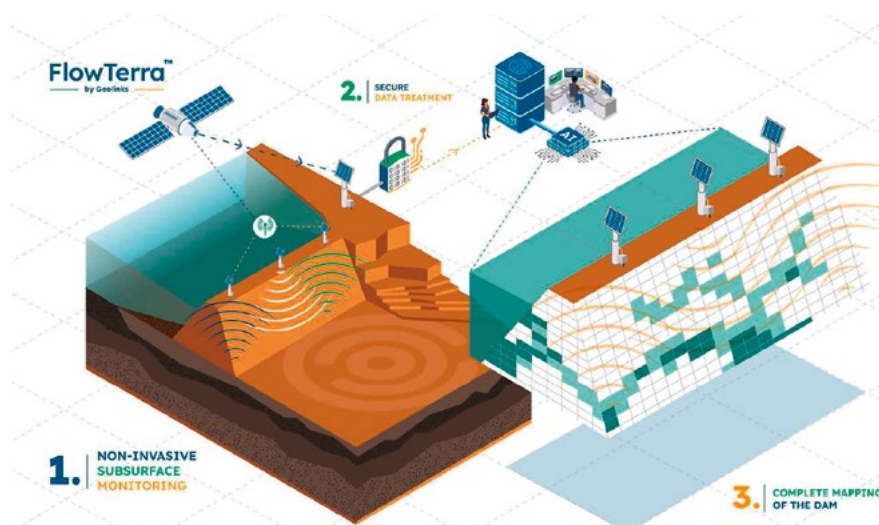
(blockchain for substance traceability). BRGM Invest holds a 46% stake in this company, which is due to begin commercial operations in late 2026.

- Participation in Geolinks Services’ fundraising round in December 2025, alongside Bpifrance, EIT InnoEnergy and a French investment fund, in order to develop a range of digital services using geophysical monitoring of ambient noise for detection, monitoring and prediction of subsoil potential.

BRGM Invest also keeps a close eye on developments at its long-standing subsidiaries (IRIS Instruments, Géothermie Bouillante and CFG Géothermal) and contributes to their growth.

BRGM Invest’s portfolio of shareholdings in late 2025 consisted of eight entities, with an equity value in excess of €15M million and a market value of over €25M. In the coming years, BRGM Invest intends to continue its strategy of acquiring equity stakes and aims to have 15 entities in its portfolio by 2030, with a market value in excess of €40M. ●

Geolinks Services has developed a digital ambient-noise monitoring tool called FlowTerra. © GEOLINKS SERVICES



Sampling stream sediments
in the Ariège, as part of the national
inventory of mineral resources carried
out by BRGM. © BRGM EXPLORE



Growing activity in support of BRGM

Turnover
€5.83M

BRGM Epic holds
100%

A workforce of
15



**SÉBASTIEN
JAFFROT**

Managing Director
of BRGM Explore

BRGM Explore, a semi-in-house subsidiary of BRGM, continued its reorganisation in 2025 and consolidated its human, technical and operational resources. The year saw a significant ramping up of activity, primarily for the inventory of mineral resources (IRM), but also in support of the organisation's different divisions.

In 2025, BRGM Explore continued to consolidate its structure – including a change of shareholder (from BRGM SA to BRGM Epic), conversion to a simplified single-shareholder joint-stock company, transition to semi-in-house status, and a revision of its articles of association – to ensure it has the resources to fully implement its missions. Since the start of this year, it has been part of BRGM's tax group, thereby securing its position within the Epic.

The majority (at least 80%) of BRGM Explore's growing activities consist of services provided on behalf of its single shareholder, BRGM Epic, in accordance with the semi-in-house regime applicable to relations with the public sector in the area of public procurement. These activities encompass studies, expert appraisals and research in the fields of mineral resources, groundwater, natural hazards and risks associated with exploitation and use of the subsurface, both nationally and internationally.

Staff numbers boosted

With regard to the IRM, following an initial start-up phase, BRGM Explore organised and rolled out the annual data acquisition programme across five regions: Vosges, Massif Central, Morvan-Brévenne, Pyrénées-Cévennes and French Guiana's northern furrow. To carry out these campaigns, the subsidiary boosted its workforce, taking on 12 new employees and hiring nearly 80 temporary workers, who were mainly deployed for field geochemistry campaigns. These took place from March to December in French Guiana, and from June to December in metropolitan France (13,367 samples collected). Prior to this, BRGM Explore had worked to keep local stakeholders informed and provided scientific outreach in connection with the field surveys. At the same time, the company began reconditioning historical samples and, in late July,

set up a laboratory dedicated to sample preparation. BRGM Explore also issued and supervised several calls for tenders with subcontractors for airborne geophysical surveys, sample collection, sample preparation in French Guiana and geochemical analyses.

In addition to the IRM, the company began providing support to various BRGM entities: the Energy and Decarbonisation Division as part of the IN SALAH GAS project; the Mineral Resources Division for the CASOR project; the Subsurface Knowledge and Geomodelling Division for management of the Geophysical Imaging Unit's stock of geophysical instruments and also for a data acquisition mission. ●

Breaking up lumps in stream sediment samples - a crucial stage in their preparation - is carried out in Orléans. © BRGM EXPLORE



Activity sets a new record in 2025!



Turnover €9.434M	BRGM Invest holds 51%	OYO holds 49%	A workforce of 24
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CATHERINE
TRUFFERT

CEO of IRIS
Instruments

Now boasting infrastructure suited to its growth trajectory, IRIS Instruments posted impressive growth in 2025, driven mainly by the dynamic mining exploration sector, while its groundwater and environmental activities remained at a strong level.

Building on an exceptional year in 2024, IRIS Instruments maintained this momentum in 2025, setting a new turnover record. Alongside this commercial success, the company completed the second phase of its expansion project. Having adapted its infrastructure to support its growth, it now boasts industrial facilities that are fully suited to its future ambitions.

IRIS Instruments’ international presence has been significantly stepped up, expanding from 50 to 62 countries. While the United States remains the largest single market, more than half of the company’s turnover is now generated

in Asia, Africa and the Middle East. This expansion relies on the mobility of its geophysical experts: through their active participation in major international conferences and events, they can share cutting-edge know-how while drawing on feedback from customers and partners on every continent.

Strategy based on innovation

To stay one step ahead, IRIS Instruments continues to place innovation at the heart of its strategy, while pressing on with its research and development efforts. Each new feature is designed to leverage the efficiency of teams in the field while ensuring that the data collected are faultless. The priority is to offer customers solutions that are fully aligned with their specific issues. For IRIS Instruments, the main challenge lies in designing a unique product capable of simultaneously meeting the distinct requirements of both academic research and the private sector.

In 2025, the launch of new product ranges – Terra resistivity meters and receivers, and TIP high-power transmitters – generated sustained growth, supplementing rather than eating into sales of established product lines. In this regard, the FullWaver unitary receivers also performed impressively. These devices – designed for acquiring extended profiles and 3D models of resistivity and induced polarisation – had already proved to be a great success in 2024, and sales in 2025 exceeded the previous year’s performance.

IRIS Instruments’ success is based, above all, on the unwavering commitment of its in-house teams and its network of partners, suppliers and representatives. These human synergies form the basis of the company’s stellar performance. ●



The Syscal Terra next-generation resistivity meter, used by RDCL in New Zealand.
© ALISTAIR STRONACH

High-power transmitters (12,000 watts,
3,000 volts) operated in series in Peru.
© JESUS GARCIA DE ARCE GEOFISICOS



A broader scope of activities

Executive Director Éric Lasne	Turnover €6.7M	BRGM Invest holds 50%	Beicip-Franlab holds 50%	A workforce of 25
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Forty years ago, BRGM set up the Compagnie Française de Géothermie (CFG) in response to the energy crisis triggered by the first oil shock, and the realisation that the ground beneath the Île-de-France region contained an exceptional geothermal energy resource, the Dogger. With its solid expertise and strengthened project management capabilities, the company now supports the development of all geothermal applications in France and internationally.

CFG was set up with the aim of offering the emerging sector an independent service provider capable of supporting local authorities and their operators in the design, implementation and monitoring of their deep-borehole projects, from drilling engineering to shaft rehabilitation, and from equipment specification to facilities maintenance.

CFG's expertise and reputation have been established project by project, by supporting customers in the construction and maintenance of their geothermal facilities. For the past 40 years, the company's teams have been working on the decarbonisation of heating networks in Île-de-France, acting as a service provider and, very often, as the prime contractor for drilling operations.

However, CFG's history and expertise are not limited to heating networks in the Paris region. It has carried out numerous projects, notably in the Rhine Graben, been involved in international exploration projects and played a key role, for over a decade, in the operations of the Bouillante geothermal power plant in Guadeloupe.

Innovation driven by partnerships

Today, CFG is committed to rolling out various types of geothermal energy in regions throughout France and abroad, with a view to contributing to their energy resilience. With this renewed ambition and the broadening of its expertise following Beicip-Franlab's acquisition of a stake in the company, a new chapter in CFG's history now unfolds, marked by a strengthening of its technical, scientific and operational capabilities.

The past year provides several examples of this dynamism. A number of drilling and rehabilitation operations were carried out in the Île-de-France region, along with several projects on characterisation and numerical modelling of the subsurface



GEOFFROY PAIXACH

CFG Chair and CEO

Equipment being lowered on a site in the Île-de-France region. © CFG

to help with the assessment of new geothermal projects, both in France and internationally.

Moreover, CFG is continuing to grow by attracting new talent and bolstering its partnerships in the field of innovation. At its annual event, the company presented a research project focusing on injectivity in clastic reservoirs. Lastly, the scope of its activities has now been broadened to include near-surface geothermal energy, mainly through projects involving aquifers and vertical probes, confirming CFG's commitment to supporting all types of geothermal energy (very low, low and high temperature). With this renewed commitment, the company will continue to serve its customers in 2026, both in France and abroad, with the support of its shareholders and partners. ●

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ISBN 978-2-7159-8547-6

Design & layout

Efil / +33 (0)2 47 47 03 20 / www.efil.fr

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