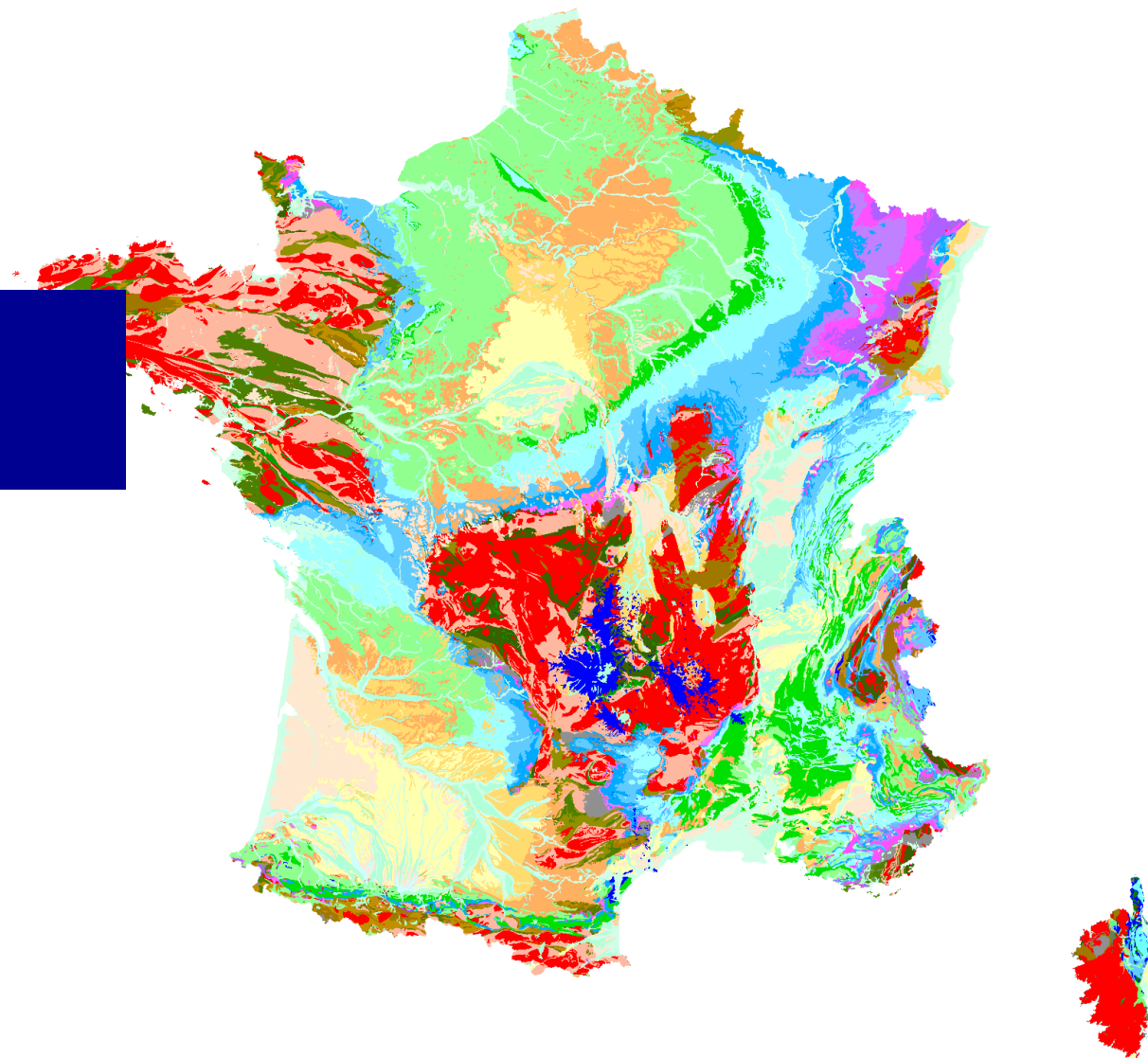


PC12 AquiBeat Revu/bilan Janvier 2026

JP Callot-O Serrano, pour le projet



Aquitaine Basin gEology Analogue for the energy Transition



- **Etablissement coordinateur : UPPA, JP. CALLOT**
- **Coordination BRGM O. SERRANO**
- **9 partenaires**
- **Budget total subvention ANR : 2.034 M€ (60%CNRS – 40% BRGM)**
- **Durée : 5 ans (2024→ 2028)**

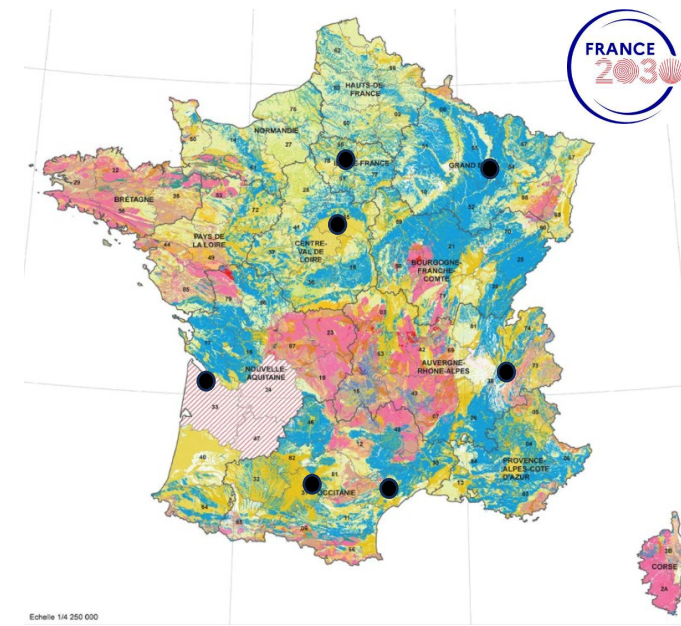
2. Organisation scientifique

Workpackage 0: Coordination and dissemination (Y1-Y5)

Workpackage 1: Aquitaine basin: building an integrated knowledge of reservoir storage potential (Y1-4)

Workpackage 2: Exploration of frontier resources (Y1-Y4)

Workpackage 3: Key questions for secured geologic storage and monitoring (Y1-Y5)



UPPA

Bordeaux 1 et 3

Paris Saclay

Grenoble Alpes

Orléans

Nancy 1

Toulouse PS-OMP

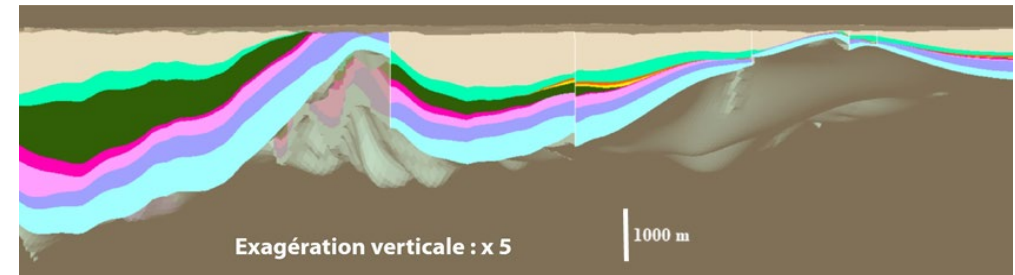
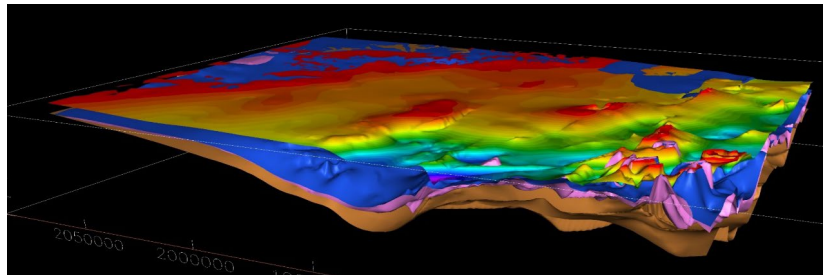
Montpellier

2. Organisation scientifique

WP 1 – Geology of the Aquitaine Basin: construction of an integrated database

→ **Geological synthesis and deterministic modelling of the Mesozoic-Cenozoic series of the Aquitaine basin – BRGM, ENSEGID** : (1) implement the existing dataset, (2) harmonize the mapping of the main times lines of the basin infill and (3) perform a geological model at the Basin scale for the whole Meso-Cenozoic strata. *PI: E. Lasseur*

- **Geological models and reservoir capacities for the Aquitaine Mesozoic sequence: application to geothermal energy. - ENSEGID, Univ Paris Saclay, BRGM:**
- Improve the geological model of the Cretaceous of the northern Aquitaine Basin, targeting future applications on deep aquifers for geothermal energy. *PI: P. Razin – BRGM referent: A. Bordenave*
 - Reservoir capacities of the Jurassic formations of the Aquitaine basin and understanding of the episodes of burial dolomitization and associated fluid circulations on a regional scale. *PI: J Barbarand – BRGM referent: A. Ortiz*



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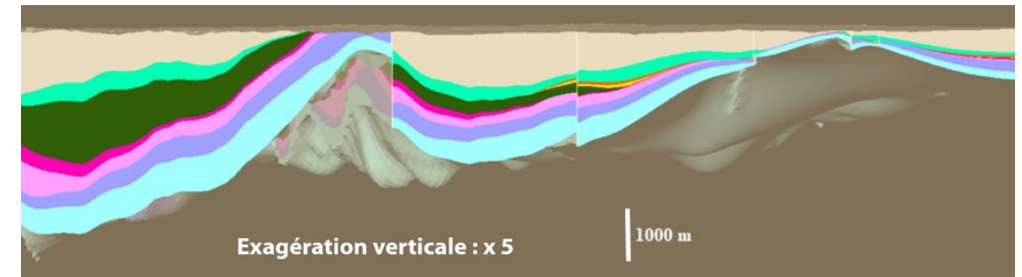
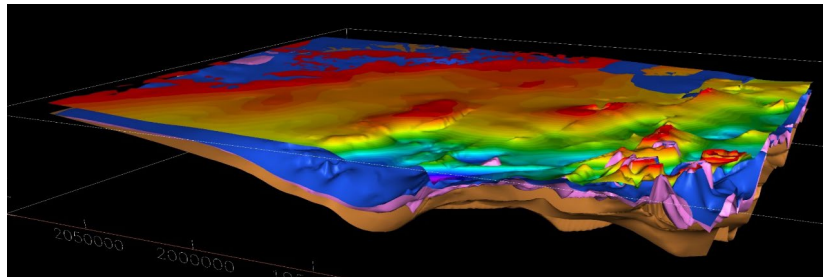


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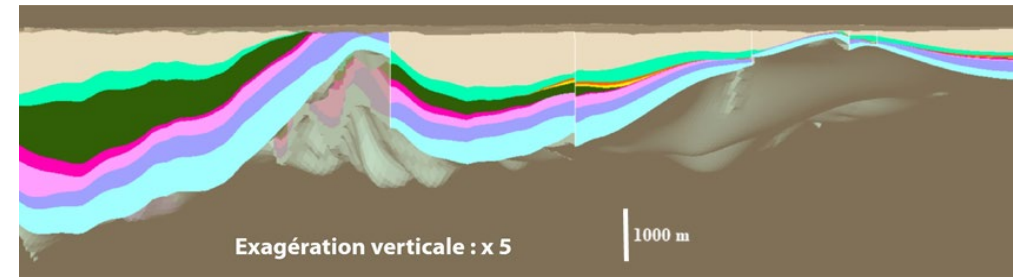
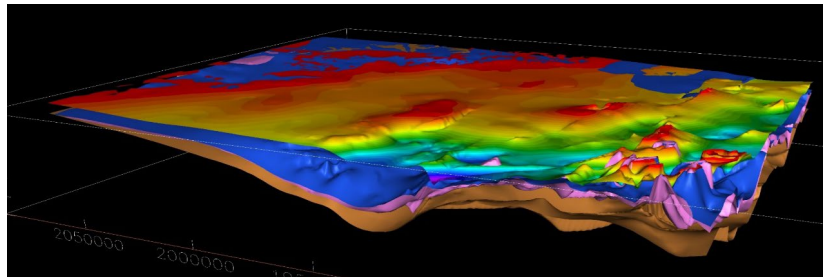


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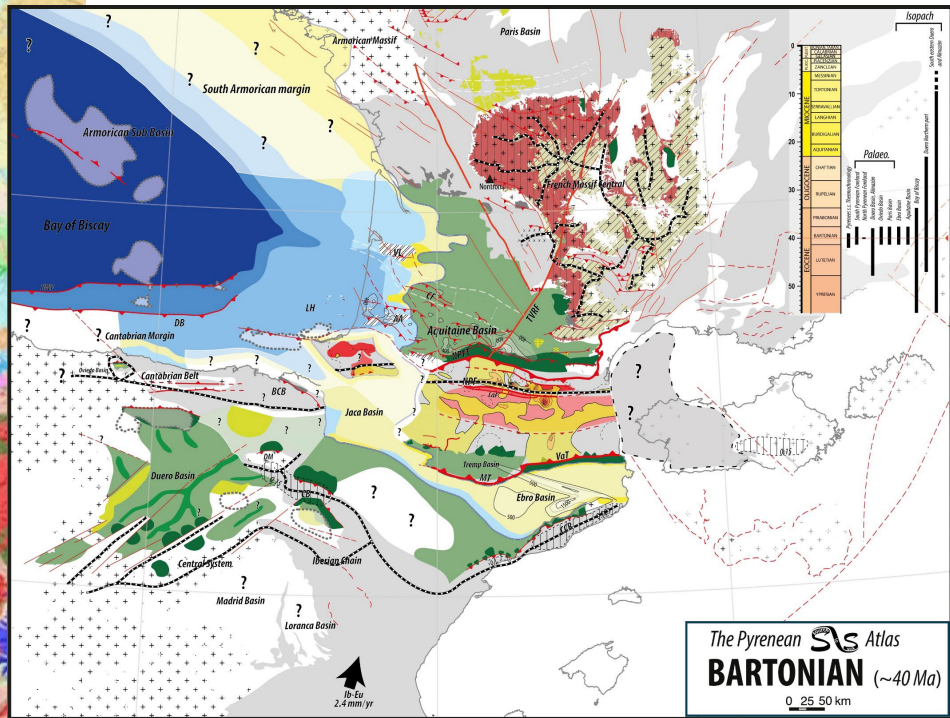
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WP1 Tache 1.2.2 Réservoirs Jurassiques



Choix du candidat postdoc: Tarik Kernif PhD Rennes1

- Début prévu 1er Novembre (souci contractualisation)

Kick off avec partenaire

- 22 septembre
- Urennes 1, BRGM Paris Saclay

Work in progress

2. Organisation scientifique



WP 2 – Exploration of frontier resources

- **Passive Hydrogen Monitoring (PHyM) – UPPA : Coupling passive seismic monitoring (background noise) and novel geochemical sensors to monitor the Bénou plateau and Rébénacq domain for H₂ (Vallée d'Ossau). PI: D. Brito**
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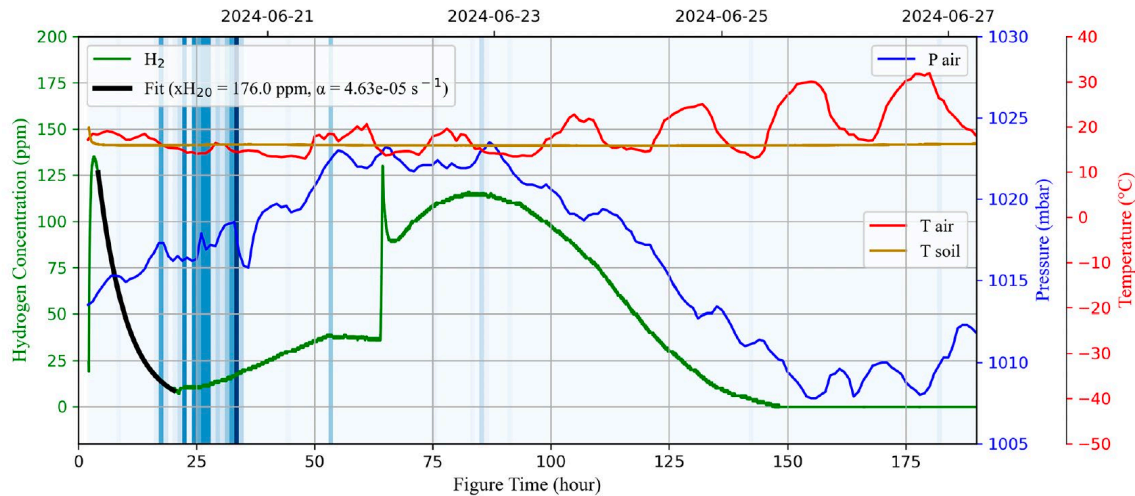
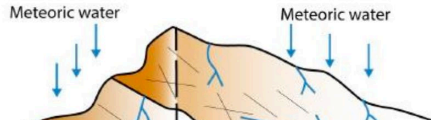
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- H₂ Comminges
- Paleozoic H₂ Source

WP 3

- Saline Hydrothermal systems
- H₂ storage: the role of clays
- Mixed H₂/CO₂ storage

WP2 Tache 2.1 Sonde hydrogène



(Loiseau et al., 2024 including data from Lejeune, 2022).

First measurements on the Turon

Thèse Niko Adjie débuté printemps 2025

- Développement d'une sonde de terrain
- Recherche d'un site: comparaison sismique passive et emission H2

Compilation des premiers résultats de monitoring

- Publication : In-soil hydrogen concentration monitoring using MONHyTOR: application for natural hydrogen exploration

Travaux sur carrière Rébénacq envisagés

Travaux test labo en préparation Work in progres...

Adv. Geosci., 67, 57–67, 2025
<https://doi.org/10.5194/adgeo-67-57-2025>
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Advances in Geosciences 

In-soil hydrogen concentration monitoring using MONHyTOR: application for natural hydrogen exploration

Niko Adjie¹, Clarisse Bordes¹, Daniel Brito¹, Djamel Nasri¹, and Éric Normandin²

¹Université de Pau et des Pays de l'Adour, CNRS, LFCR, Pau, France

²Université de Pau et des Pays de l'Adour, CNRS, IPREM, Pau, France

Correspondence: Niko Adjie (niko.adjie@univ-pau.fr, adjie.niko@gmail.com)

Received: 19 June 2025 – Revised: 13 October 2025 – Accepted: 22 October 2025 – Published: 21 November 2025

2. Organisation scientifique



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WP2 Tache 2.2 Exploration Comminges

Résultats saillants

- Géochimie des eaux: l'échantillonnage des sources thermales n'a pas révélé d'anomalie de concentration en hydrogène et en hélium (gazeux ou dissous) des 20 sources thermales de la région du Comminges
- Gaz du sol: des anomalies de concentrations en hydrogène et en radon ont été détectées le long du chevauchement frontal proche de Lannemezan, mais il n'est pas possible de relier ces anomalies de concentration en hydrogène à un flux profond.
- Transect Géophysique de 30km (10 stations, MT, sismique passive et gravimétrie) recoupant l'anomalie gravimétrique de Saint Gaudens. Des mesures de sismique passive (Vp/Vs) ont été réalisées grâce à des capteurs tri-composantes Stride installés sur une superficie de 900 km² dans la région (données en cours de traitement).

Embauche:

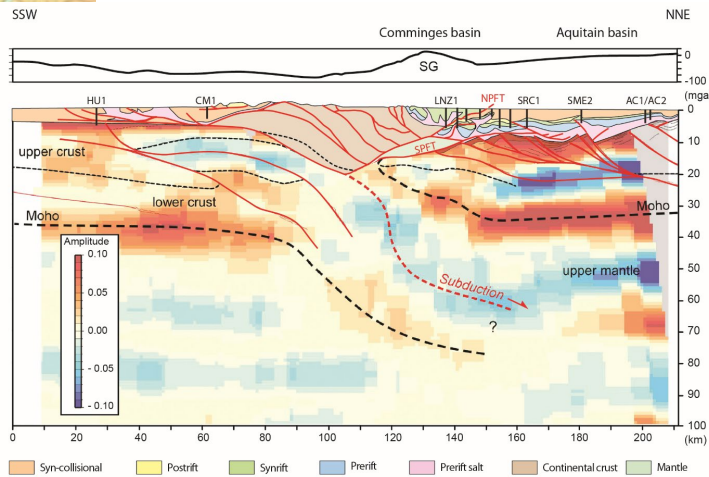
- Anaïs Lavoué, postdoc sur 12 mois: géophysique. Début de contrat = mai 2025
- Stage M2 en cours pour carte de favorabilité

Publication et communication

- un rapport interne BRGM (ayant vocation à devenir public) sur les gaz dissous de la région explorée

Autres:

- La société Mantle8 a déposé un permis exclusif de recherche pour l'hydrogène et les substances connexes dans la région



	Audinac Grande Source		Audinac Source Louise		Audinac Source des Yeux		Saleich Pyrène		Sentein Source du Mich		Siradan Source du Lac		Lagrange Hount de l'Oulo		Capvern HC2		Capvern Bouridé	
	(mol/L)	(mg/L)	(mol/L)	(mg/L)	(mol/L)	(mg/L)	(mol/L)	(mg/L)	(mol/L)	(mg/L)	(mol/L)	(mg/L)	(mol/L)	(mg/L)	(mol/L)	(mg/L)	(mol/L)	(mg/L)
CO2	1.17E-03	51.45	1.07E-03	47.10	1.27E-03	55.86	1.39E-03	61.21	1.12E-03	49.17	3.96E-04	17.44	1.12E-04	4.93	1.25E-04	5.50	1.48E-04	6.51
Ar	4.03E-05	1.61	3.88E-05	1.55	1.44E-04	5.77	4.36E-05	1.74	3.99E-05	1.59	3.95E-05	1.58	3.75E-05	1.50	3.22E-05	1.29	3.43E-05	1.37
O2	1.13E-04	3.62	1.38E-04	4.43	1.90E-03	60.81	1.43E-04	4.57	4.17E-04	13.34	1.41E-04	4.52	3.83E-04	12.25	1.14E-04	3.64	1.72E-04	5.49
N2	1.32E-03	37.02	1.55E-03	43.45	8.38E-03	234.7	1.47E-03	41.16	2.04E-03	57.20	1.29E-03	36.04	1.46E-03	40.81	1.10E-03	30.70	1.16E-03	32.42
He			7.34E-07	0.0029			1.73E-06	0.0069	1.70E-07	0.0007	1.17E-06	0.0047	6.41E-07	0.0026	1.68E-07	0.0007	1.19E-07	0.0005
CH4	3.45E-07	0.0055	2.19E-07	0.0035	2.03E-07	0.0033	1.39E-07	0.0022			1.54E-08	0.0002						

2. Organisation scientifique



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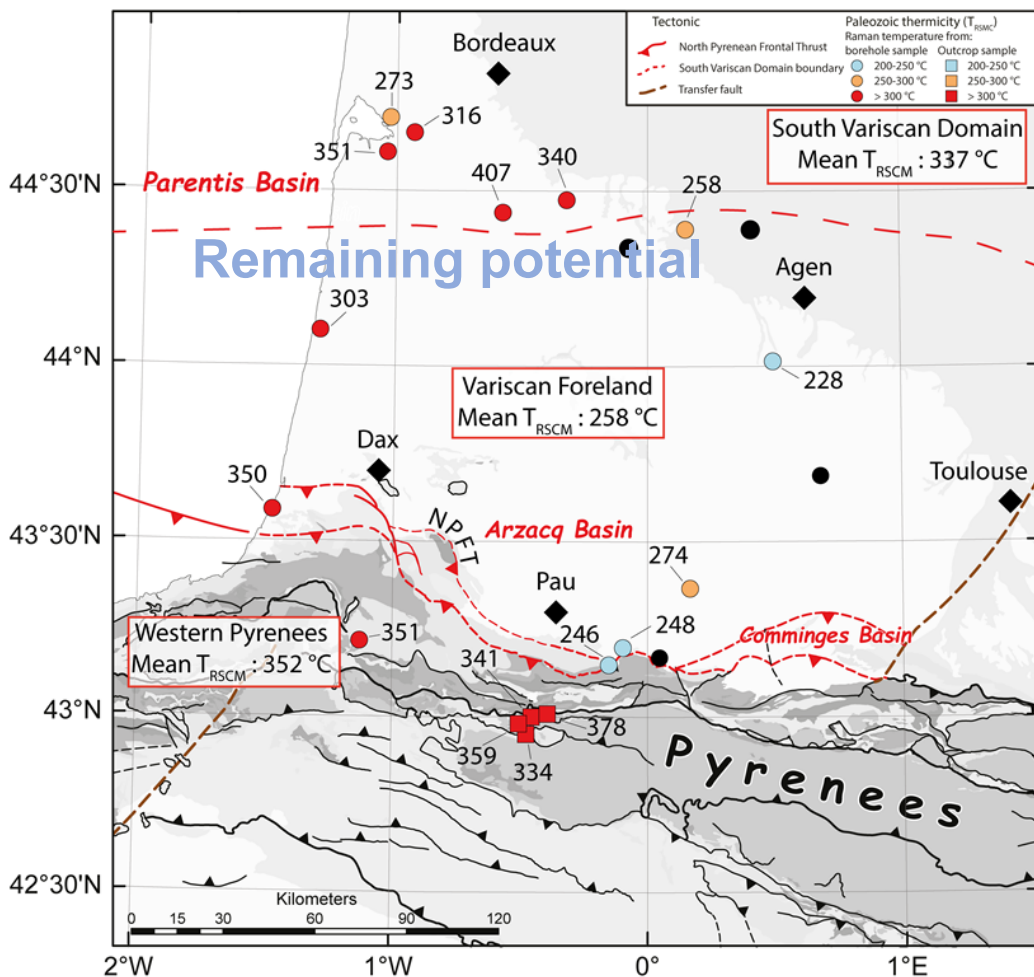
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WP2 Tache 2.3 Potentiel paléozoïque

Overmature due to
Variscide collision



Overmature due to
hyperextension

Résultats saillants

- **Echantillonnage:** roches riches en matière organique du Paléozoïque (Ordovicien, Silurien, Dévonien) dans la zone axiale des Pyrénées et dans 19 puits (carottes disponibles à BousSENS)
- **Mesure Raman:** températures d'enfouissements maximales s'échelonnant entre ~250°C et ~400°C. Il reste un potentiel significatif de production d'hydrogène dans la couverture Paléozoïque
- Modélisation Temis 1D a permis d'établir l'existence de 2 pics thermiques, l'un au Paléozoïque, l'autre au Crétacé supérieur
- Modélisation Temis2D à venir

Embauche:

- Nicolas Lefeuvre (09/24-10/25), postdoc sur 12 mois: géophysique. Début de contrat = mai 2025

Publication et communication

- Thermal Evolution and Hydrogen Generation Potential of Paleozoic Rocks in the Aquitanian Basin (SW France). Nicolas Lefeuvre, Charles Aubourg, Claude Gout, Saphir Venet, Isabelle Moretti. Soumis Juin 205. En révision Marine and Petroleum Geology.

2. Organisation scientifique

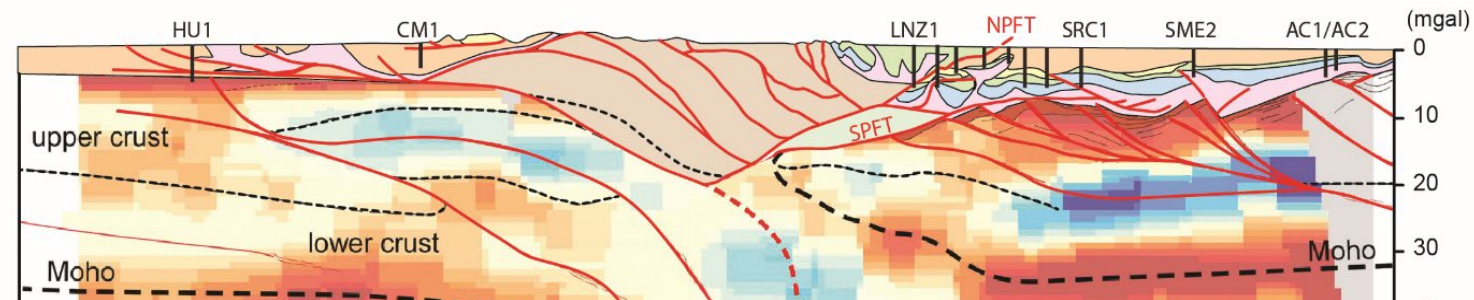
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WP3 Tache 3.1 Redish

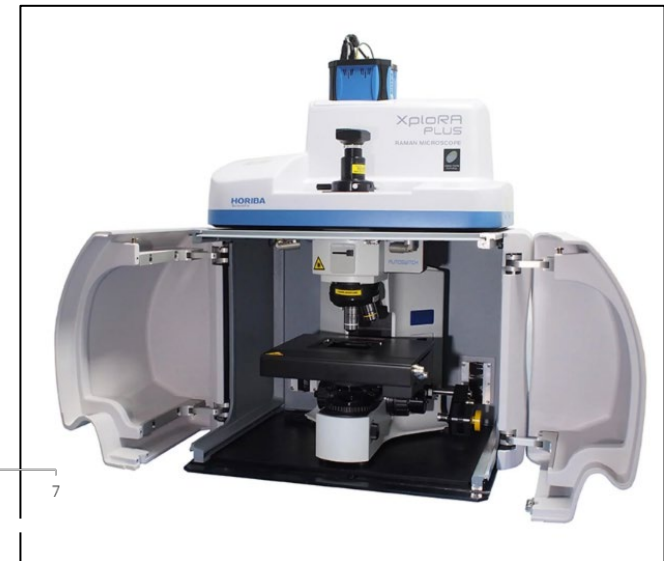
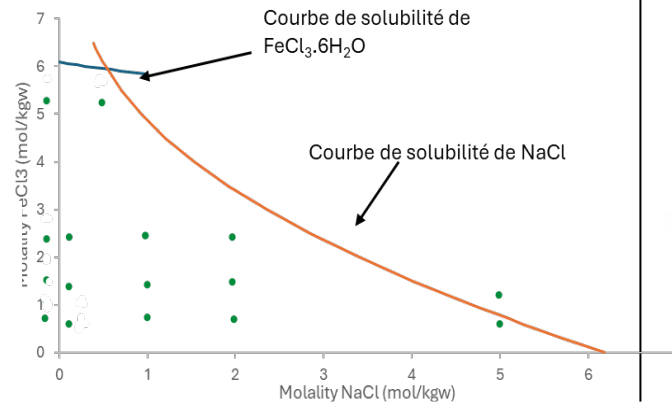
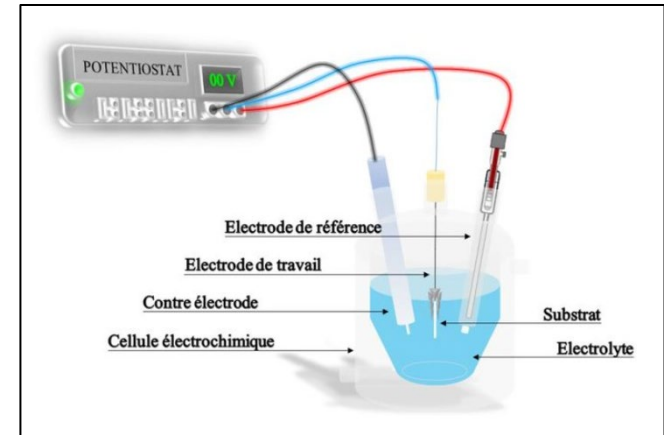
✓ Stage M2 David Selle

➤ Etude électrochimique du systèmes $\text{FeCl}_3\text{-FeCl}_2\text{-NaCl-HCl-H}_2\text{O}$

→ Comprendre les réactions redox et les processus géochimiques se produisant dans des saumures à haute température et haute pression

➤ Approche : travail sur des systèmes simples pour déchiffrer les mécanismes en jeu et explorer l'effet de la salinité

- Caractérisation par mesures potentiométriques
- Spéciation aqueuse par spectroscopie Raman
- Interprétation par modélisation géochimique
- Etude des systèmes $\text{FeCl}_3\text{-NaCl-H}_2\text{O}$, $\text{FeCl}_2\text{-NaCl-H}_2\text{O}$ et $\text{FeCl}_3\text{-FeCl}_2\text{-H}_2\text{O}$
 - Concentrations 0-5 M, T = 25°C
 - Atmosphère contrôlée (boîte à gants)
 - pH < 2 (HCl)



✓ Recrutement en thèse

- **Walaa Sdiri** (Ingénieure en chimie industrielle, arrivée en cours)

Les avancées attendues du projet sont à venir !

Hydrolyse du Fe(III) et force ionique ⇒ pH ↘
 Nécessité de décrire la spéciation du fer
 Raman : limité par les fortes salinités → FTIR ?
 Calcul du Eh à relier à la mesure par électrode Pt

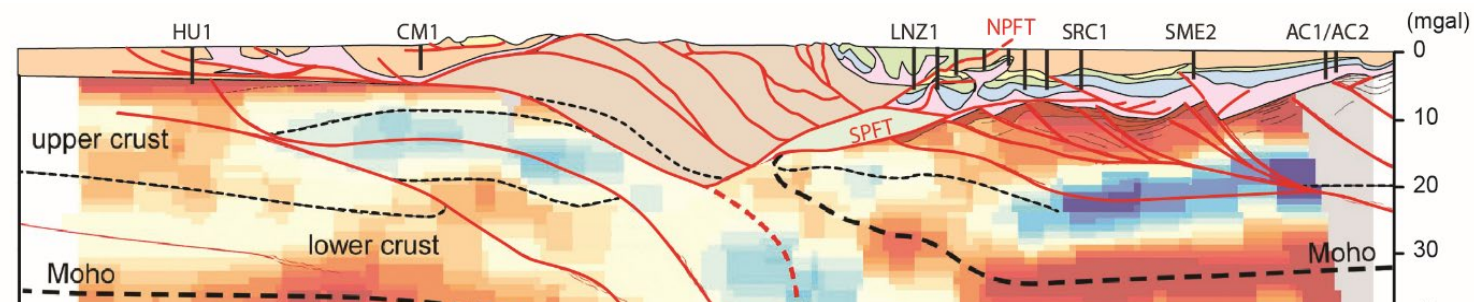
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WP3 Tache 3.2 H2 et argiles

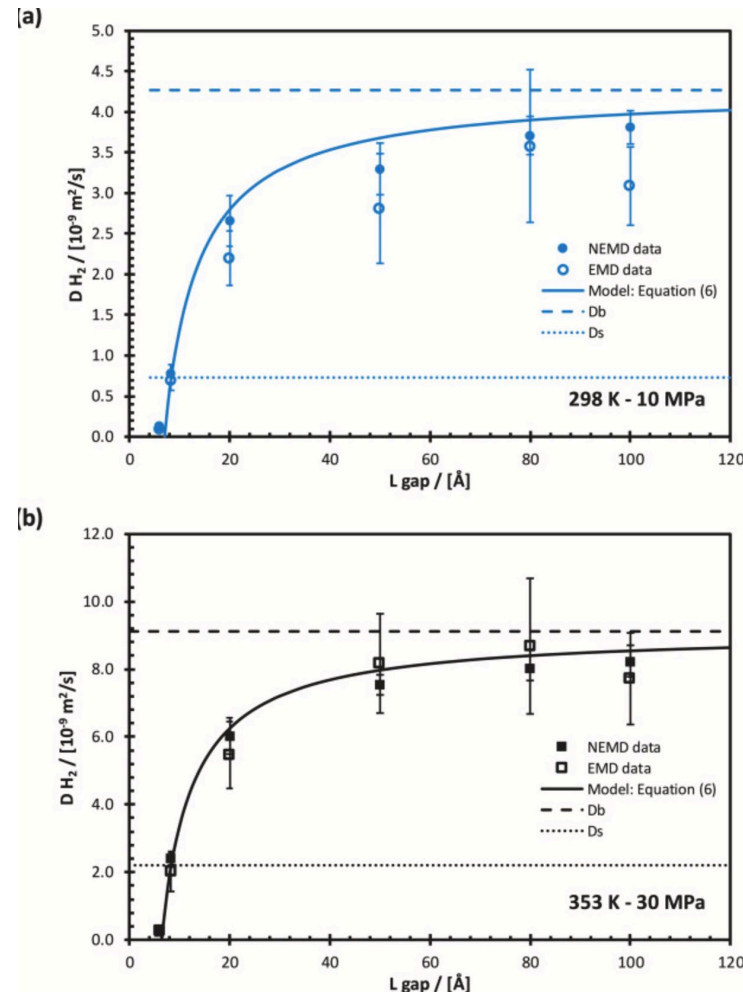


Fig. 10. Self-diffusion coefficient of hydrogen vs. pore sizes. Thermodynamic conditions: (a) $T = 298.15$ K and $P = 10$ MPa; (b) $T = 353.15$ K and $P = 30$ MPa. Solid lines represent the arithmetic model (Equation (6)), dashed lines represent the bulk diffusivity, and dotted lines represent the surface diffusivity. The solid and open symbols represent the results of the NEMD and EMD simulations, respectively.

-Résultats saillants:

- L'hydrogène ne s'adsorbe pas dans les interfeuillets d'illite saturés; Il est possible d'estimer simplement la diffusion du H₂ dans les interfeuillets d'illite saturés en fonction de la taille de pore (voir image plus bas).

-Embauches

- Recrutement de Hai Hoang pendant 3 mois (PDRA) de mai à juillet. Recrutement (1 an) à venir en fin d'année.

-Publi:

- Kerkache H., Hoang H., Van Phuoc N., Chabab S., Galliéro G., Hydrogen diffusion in water-saturated Illite: From molecular simulations to a simple model, (2025) International Journal of Hydrogen Energy, 168, art. no. 151033

-Com:

- Chabab S., Kerkache H., De Souza Buriti M., Hoang H., Poulain M., Cezac Pierre, Galliéro G. Understanding fluids thermophysical properties for underground hydrogen storage: experimental and computational insights, conférence plénière, Colloque GdR HydroGEMM, IFPEN Rueil Malmaison, 2024.

International Journal of Hydrogen Energy 168 (2025) 151033



Hydrogen diffusion in water-saturated Illite: From molecular simulations to a simple model

Halla Kerkache^a, Hai Hoang^{b,c}, Nguyen Van Phuoc^d, Salaheddine Chabab^{a,e,*}, Guillaume Galliéro^{a,*}

^a Université de Pau et des Pays de l'Adour, E2S UPPA, CNRS, LFCR, UMR5150, Pau, France

^b Institute of Fundamental and Applied Sciences, Duy Tan University, Tran Nhat Duat Street, District 1, Ho Chi Minh City, Viet Nam

^c Faculty of Environmental and Natural Sciences, Duy Tan University, 03 Quang Trung Street, Da Nang, Viet Nam

^d Faculty of Applied Sciences, Ton Duc Thang University, Ho Chi Minh City, Viet Nam

^e Université de Pau et des Pays de l'Adour, Laboratoire de Thermique, Energetique et Procédés (LaTEP), Rue Jules Ferry BP 7511, 64075, Pau Cedex, France

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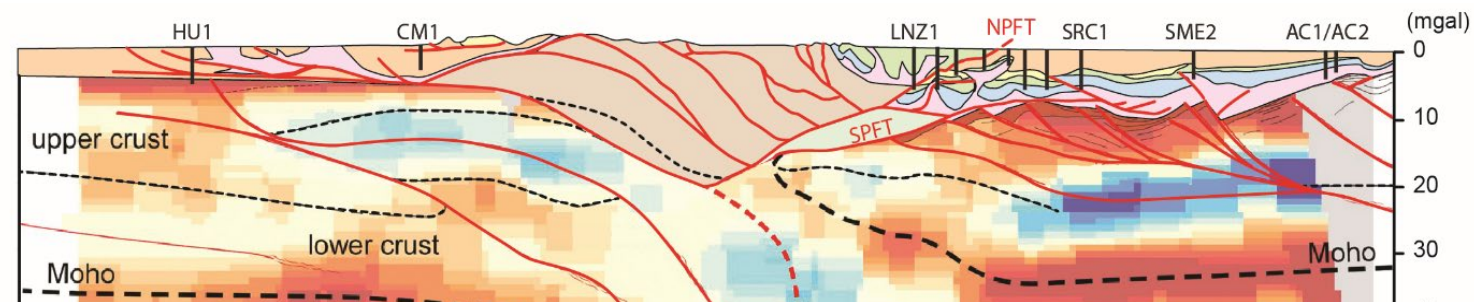
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✓ Opérations engagées à ce jours ou début des opérations si non lancées

- Opération engagée : revue/inventaire des réservoirs du Bassin aquitain présentant un potentiel pour le stockage souterrain d'H₂ et des identifications de la nature des données publiques accessibles (stage de M2)
- Démarrage des expériences en laboratoire dans le cadre du doctorat prévu en 2025

✓ Recrutements réalisés ou prévus si concernés

- Stage de M2 réalisé entre avril et septembre 2024
- Recrutement d'une doctorante en 2025 (Kamilia Clad)
- Prise de poste débutera en novembre 2025 chez l'un des partenaires (ICMCB de Bordeaux), avant de rejoindre le BRGM pendant de sa seconde année de doctorat (fin 2026-2027).

✓ Difficultés ou risques identifiés

- Peu de données géochimiques sont publiques/accessibles pour identifier un à deux réservoirs intéressant (d'un point de vue réactivité microbienne) à simuler en laboratoire
- Besoin de se rapprocher des concessionnaires d'anciens réservoirs pétroliers pour récupérer des échantillons de roches, ce qui prend un certain temps et de nombreux échanges préliminaires. Tout réseautage existant en interne est en cours.

