Technical Workshop
on Core Analysis

Date: Friday September 19th 2025

Location: SGF, 77 rue Claude Bernard, 75005 Paris

Start time	End time	Presenter	Presentation	Company
09:30	09:40		***Welcome and introduction***	SPWLA
09:40	10:10	Matthieu Mascle	The role of limestone micro porosity on dissolution pattern during carbonated water injection	IFPEN
10:10	10:40	Théo Briolet	Investigation of the acoustic response associated to the different dissolution patterns observed in carbonate rocks	ENS
10:40	11:00		**BREAK**	
11:00	11:30	Pascal Debec	How karsts presence changes seismic velocities: combining digital and physical experimentations	TotalEnergies
11:30	12:00	Samuel Chapman	Frequency-Dependent Elastic Properties of partially saturated Tournemire Shale	ENS
12:00	13:30		**Lunch BREAK (at Celina)**	
13:30	14:00			
14:00	16:30	ENS	Rock physics lab visit	ENS
16:30	16:40		***Conclusion remarks***	SPWLA

The role of limestone micro porosity on dissolution pattern during carbonated water injection

Matthieu MASCLE, IFPEN

Abstract: In this work, we have investigated the effect of two different limestone textures (namely Lavoux and Euville limestone) on the reactive transport. These two rock-types have a similar chemical composition (pure calcite) but differ by their macro- and micro-structures. An extensive workflow of experiments has been carried out to characterize the macro- and micro-porous systems of the cores, and to understand the interaction between the different properties that are relevant for the reactive transport. It includes 5 µm pixel resolution 3D scans of the cores and miscible tracer injections conducted before and after the alteration. Core alteration has been conducted using carbonated water to be more representative of CO_2 storage conditions. Experiments have been conducted at ambient temperature (25°C) and at 10 bar of pore pressure. Results have shown that Lavoux limestone has higher micro-porosity and better-connected grains than Euville limestone. Mass transfer of the reactive fluid in the micro-porosity, where most of the reactive surfaces are, is limited for Euville. Consequently, Lavoux limestone showed a more homogeneous and sustained dissolution front, while Euville developed early breakthrough and localized. The two cores initial flow properties have been altered to a completely different extent. The absolute permeability has been multiplied by more than 100 for Euville core, while it has been increased by less than 2 for Lavoux core.

Speaker

Matthieu Mascle is holds an engineering degree in petroleum engineering and works as a scientist working at the research institute IFP Energies Nouvelles in Paris (France). His focus of interest is the understanding of complex multi-phases flow in porous medium, especially in the context of CCUS.

Investigation of the acoustic response associated to the different dissolution patterns observed in carbonate rocks

Théo BRIOLET, ENS

Abstract: Understanding the processes involved in carbonate rock dissolution is essential in the context of karst environment formation and CO2 storage.
The circulation of an acidic fluid in a carbonate rock induces different dissolution patterns, controlled by the properties of the rock (mineralogy, porosity, permeability) and environmental conditions (chemical composition and pH of the solution, flow rate, temperature).
This experimental study demonstrates that the complex microstructure of carbonate rocks plays a major role in the development of these different dissolution regimes. This work also highlights the specific impact of each of these dissolution regimes on the elastic properties of rocks.

Speaker

Théo Briolet recently graduated from a PhD conducted in collaboration between IFPEN and Laboratoire de Géologie de l'ENS, he specialized in the experimental study of the impact of reactive transport on the hydromechanical properties of rocks.

How karsts presence changes seismic velocities: combining digital and physical experimentations

Pascal DEBEC

Cyril AGUT, Didier RAPPIN, Antoine SAILLARD

TotalEnergies

Abstract: Chemical dissolution affects many carbonates worldwide, often creating fascinating yet complex karst networks. While their presence is sometimes detectable on seismic amplitudes, quantification remains a challenge. To explore the impact of epigenic karsts on seismic velocities, this paper presents a two-phase (and two-scales) workflow: a digital approach followed by physical sample measurements.

Speaker

Pascal Debec is a Seismic Reservoir Characterization Senior Specialist within TotalEnergies. He started in 1993 as sedimentologist, seismic stratigrapher, and 15 years ago as acoustician. He teaches various classes in all branches of TotalEnergies (Acoustic Logging, Rock Physics, AVO, 4D) and some school like IFP School. Pascal is also heavily involved in SPWLA society.

Frequency-Dependent Elastic Properties of partially saturated Tournemire Shale

Samuel Chapman (a), Manon Sonnet (a), Audrey Bonnelye (b), Jerome Fortin (a)

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(b) GeoRessources, Université de Lorraine, 54000 Nancy, France

Abstract: Understanding hydraulic effects on fault zones in shale formations is essential for assessing the safety of nuclear waste storage. Within the CHENILLE project, fluid injection experiments were conducted in the Tournemire (France) underground research laboratory and monitored with acoustic emission and broadband seismic sensors. Interpretation is complicated by the transverse isotropy of the shale and the frequency dependence of stiffness at elevated water contents. To complement the field work, we measured the dispersion and intrinsic attenuation of elastic properties in core samples.

Stress–strain responses were recorded under axial sinusoidal loading (0.1–1000 Hz) at strains $<10^{-5}$. Frequency-dependent Young's moduli were determined for three bedding orientations (0°, 45°, 90°), with Poisson's ratios measured for 0° and 90°. From these, five stiffness components of TI anisotropy were derived. P-wave velocities were also measured at ultrasonic frequencies. Initial tests assumed ~90% water saturation; subsequent conditioning at 97–98% relative humidity enabled comparison of saturation effects.

Results show marked dispersion and intrinsic attenuation, peaking at 100–200 Hz, matching the frequency range of CHENILLE seismic surveys. Higher water content reduced elastic moduli and increased attenuation. Incorporating these viscoelastic effects could improve seismic tomography and acoustic emission location accuracy.

Speaker

Samuel Chapman is a CNRS research engineer at the Laboratoire de Géologie, École Normale Supérieure (LG-ENS), where he designs and develops experimental equipment to investigate the poromechanical properties of rocks. His work aims to combine laboratory experiments, imaging techniques such as X-ray CT, and numerical simulations to study elastic and viscoelastic behavior of rocks. He is particularly interested in applying these insights to improve subsurface monitoring techniques, with applications to enhanced geothermal systems and CO_2 storage.