



PREVIEW

IAHS-AISH Scientific Assembly 2022

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## **Petrophysical characterisation of a karstic carbonate aquifer, with implications for saltwater and brine intrusion into hydrothermal resources. The DEM'EAUX THAU project, Balaruc, France.**

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The Balaruc hydrothermal system is fed both from surrounding karstic carbonates with fresh water outpouring in the nearby Thau lagoon with the Vise source, and at depth along deep regional faults with local springs up to 50°C. This hydrothermal system was cored and logged in 2020-2021 down to 765m depth at Balaruc-les-Bains, 200m to the NE of the Vise source. During the project, the Vise source underwent a reversal in November 2020, with the Thau lagoon salty water being drained deep into the subsurface, shedding light into the complex processes affecting the Balaruc hydrothermal system. The DEM'EAUX THAU project is aiming at a better understanding of this complex geological and hydrological system for a more sustainable use of this resource.

A set of downhole geophysical data and borehole wall images was recorded from near surface to 756m depth in 4 vertical holes, only a few meters apart at surface. While mm-scale images reveal the detailed geological structure, petrophysical data (acoustic velocities, electrical resistivity and natural gamma) contribute to better define the penetrated structure, yielding porosity and permeability. Acoustic velocities provide a base to analyze the vertical (VSP) and walk-away seismic profiles shot to replace these holes in the regional geological structure. In turn, core petrophysical measurements are being made to support these analyses and, in particular, to provide a dm-scale description of the subsurface pore fluid salinity.

In addition, the physical and chemical properties of the borehole fluid were characterized with an Idronaute probe, showing the impact of the Vise source reversal from measurements before and after. Similarly, electrical resistivity profiles were recorded over time and during downhole pumping tests, emphasizing the hydraulic vertical connectivity. On that basis, pore fluids dynamics are being described from time-lapse downhole logging measurements and the emplacement of permanent downhole geophysical observatories consisting in (i) an optical fiber for temperature and (ii) a flute for electrical resistivity of the formation. In the future, a second optical fiber already in place will be used for acoustic probing of subsurface fluid flow from Digital Acoustic Scanning (DAS).