

PS Reservoir Characteristics of Lower Cretaceous Sequence Crossed by the G_{Eo}-01 Well: Potential for Direct Heat Production and Heat-Storage*

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Abstract

During the last years geothermal energy has attracted great interest in the Swiss territory. Many investments have been made in order to develop geothermal exploration throughout the country. In a context of high demand for clean generation of electricity and heating/cooling, the State of Geneva and the Services Industriels de Genève (SIG, water and energy utility of the Geneva Canton), developed the GEothermie 2020 geothermal exploration program. This multi-phased program aims at validating the results of a preliminary study (PGG, 2011), and furthermore investigating the medium to deep subsurface of the Greater Geneva Basin (GGB). The first exploration phase of the project was able to prove that geothermal potential exists in the Mesozoic and Cenozoic series of the GGB, although the reservoir quality can exhibit important lateral variability. In this context, the second exploration phase allowed to set up the first medium-depth exploration well of the GEothermie 2020 program, the Satigny well (G_{Eo}-01). The purpose of G_{Eo}-01 is to explore the Mesozoic units and to identify and characterize the geological and hydrogeological conditions of the subsurface units. G_{Eo}-01 went through 407 meters of Tertiary Molasse, 241 meters of Cretaceous limestones, and reached the Tithonian limestones at a final depth of 745 meters. Hot water was found at 744 meters depth. This water naturally rises to the surface at a temperature of 33 °C with a flow rate of more than 50 litres/second.

A complete petrographic and mineralogical characterization has been done using QEMSCAN analysis and optical microscopy, coupled with a whole-rock (cuttings) down-hole geochemical profiles obtained by ICP-MS. This is aimed to have a better understanding of the composition and repartition of the sedimentary facies and to help correlate the stratigraphy of G_{Eo}-01 with other reference wells in the GGB (HU2; TH1; GRY1; CRO1).

The comparison of the sedimentological and geochemical aspects will establish a correlation between the different wells, thus, provide new data on the distribution and continuity of the units studied in the GGB. The strike-slip fault systems and associated fracture corridors crossing the study area are considered to be the main structural features potentially enhancing reservoir porosity and permeability. We have studied key

seismic reflection lines close to GGeo-01 and the image logs from the well to characterize the fault and fracture systems, as well as the role of lithological heterogeneity in these structures.

This study provides new subsurface data in an area of great interest in the GGB. The integration of previous data and new research techniques generated key data that can be used to populate the numerical models currently in development as well as help in the decisions making processes that will shape the future geothermal exploration in the Greater Geneva Basin.

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Website Cited

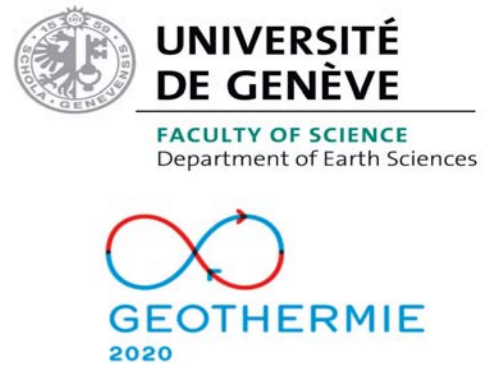
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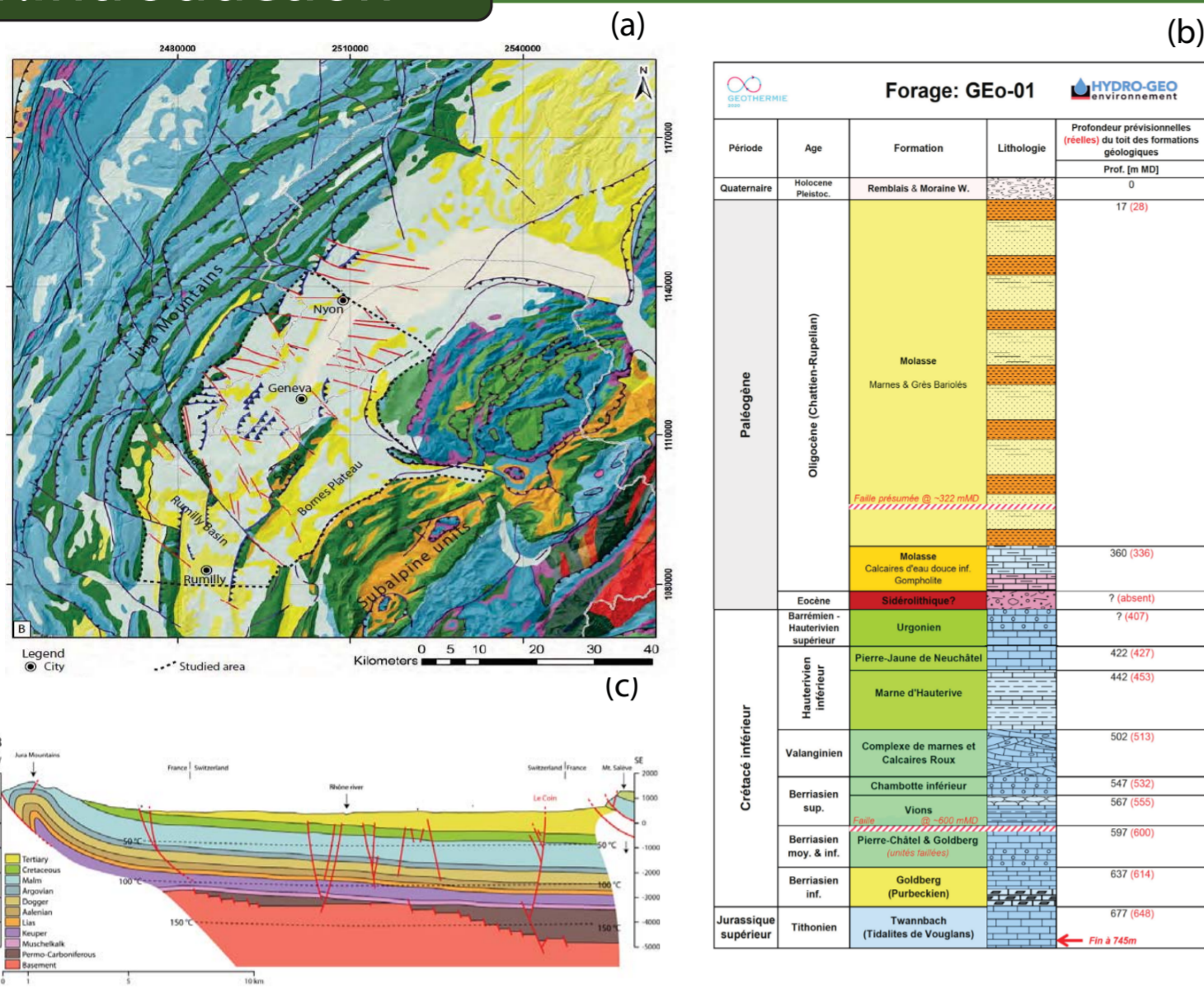
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1. Introduction



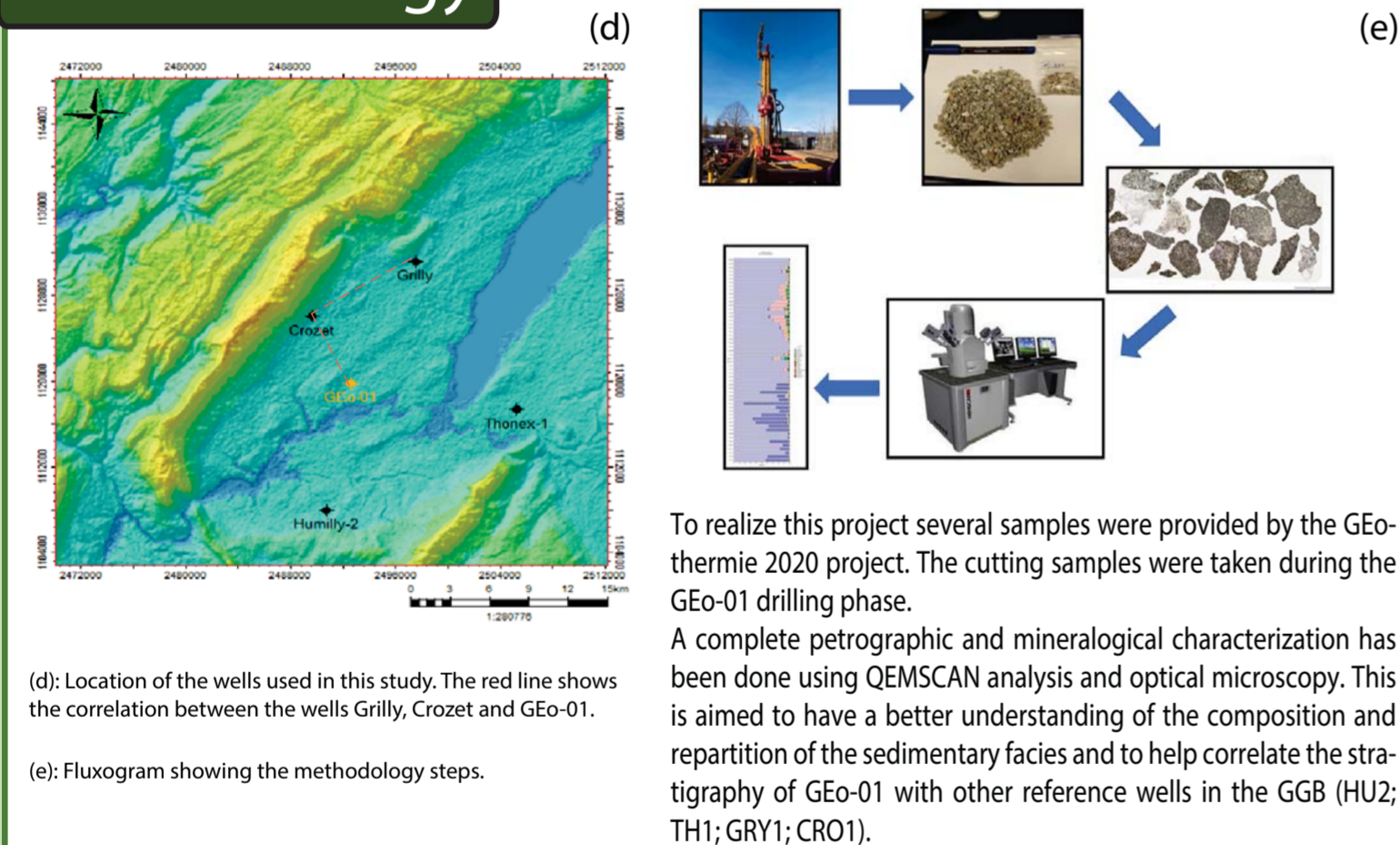
The Satigny well is the first medium-depth exploration well of the GEothermie 2020 program. This pilot project will make it possible to specify the geothermal potential available and to confront the concrete realities on the subsurface. The purpose of GEO-01 is to explore the Mesozoic units and to identify and characterize the geological and hydrogeological conditions of the subsurface units. GEO-01 went through 407 meters of Tertiary Molasse, 241 meters of Cretaceous limestones and reached the Tithonian limestones at a final depth of 745 meters. Hot water was found at different depths. This water naturally rises to the surface at a temperature of 33 °C with a flow rate of more than 50 litres / second.

(a): Location and geology of the Greater Geneva Basin (Rusillon, 2018).

(b): Table showing different informations about GEO-01 well (GEothermie 2020).

(c): Cross-section NW-SE across the GGB (modified after PGG report 2011).

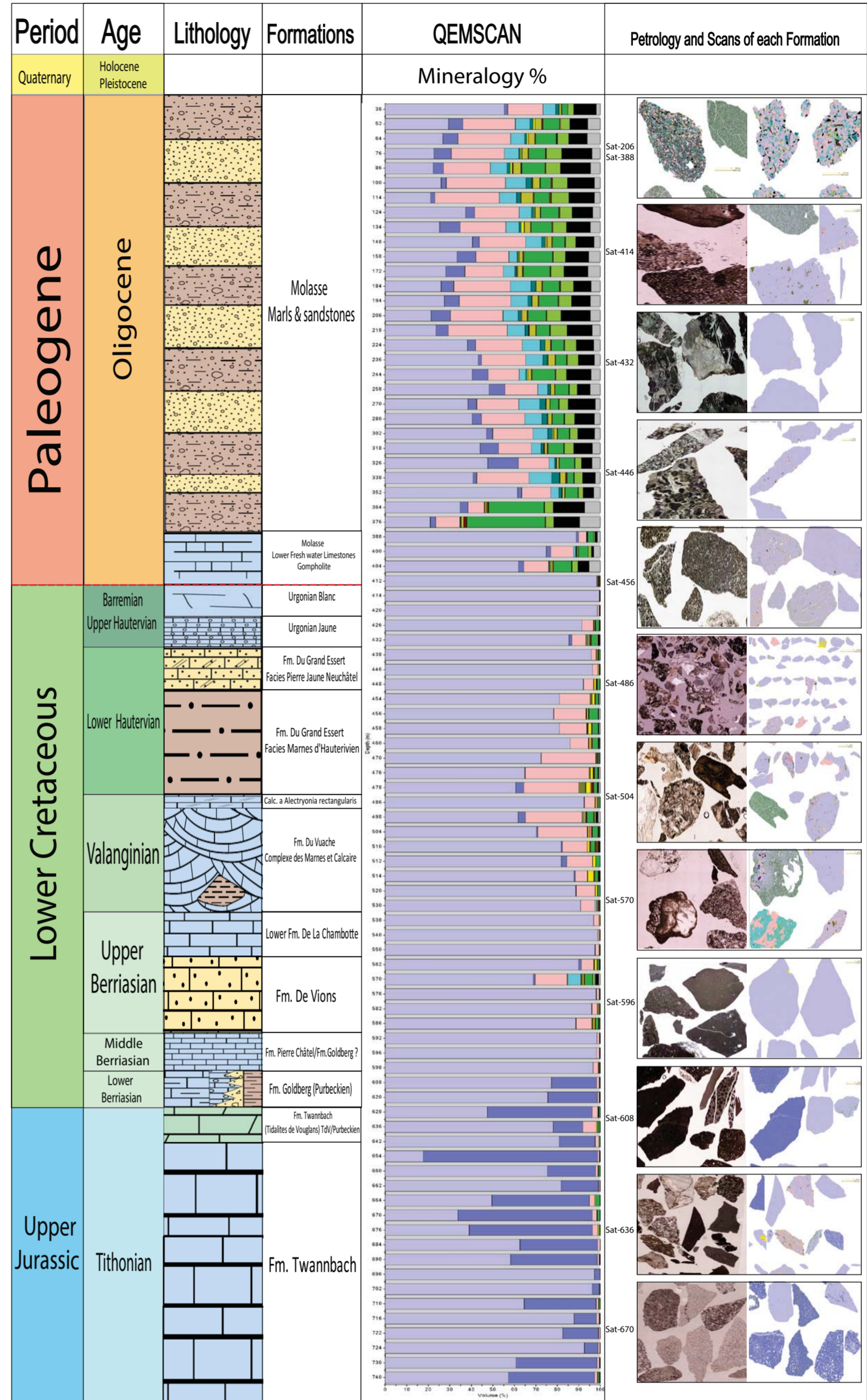
2. Methodology



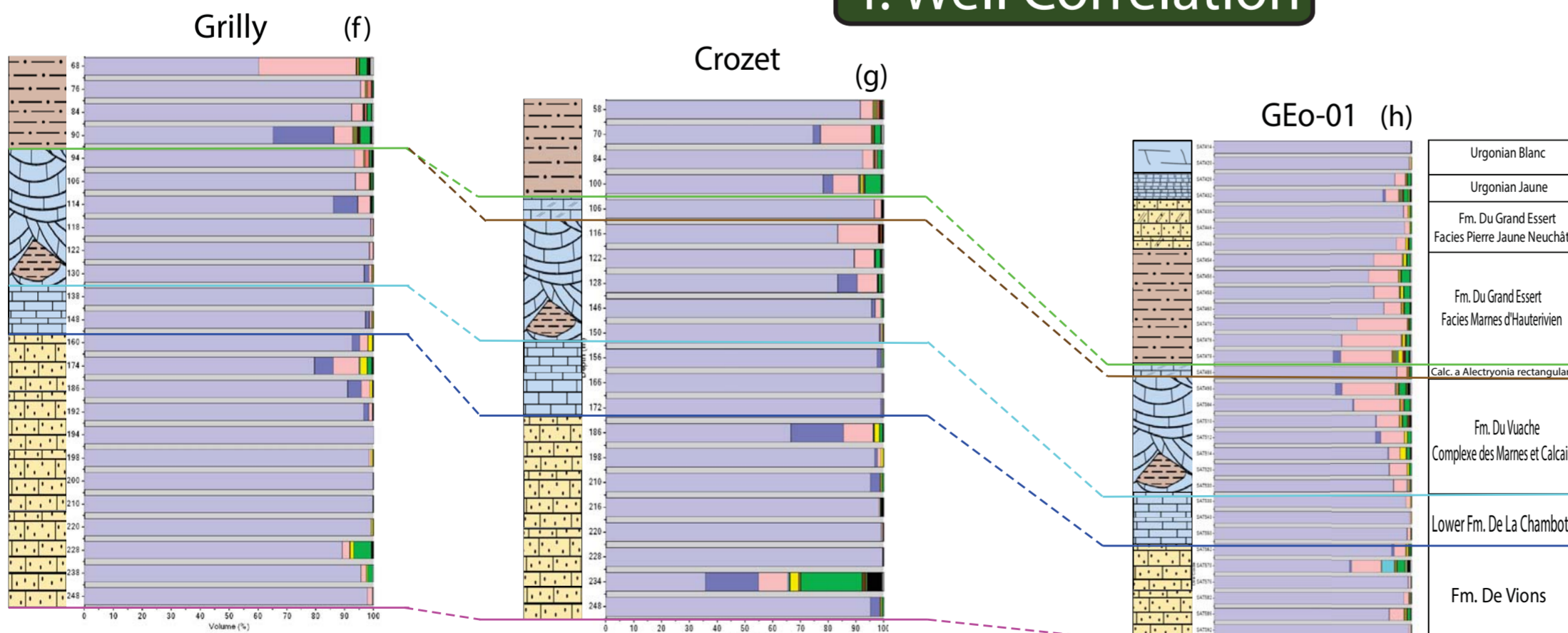
To realize this project several samples were provided by the GEothermie 2020 project. The cutting samples were taken during the GEO-01 drilling phase.

A complete petrographic and mineralogical characterization has been done using QEMSCAN analysis and optical microscopy. This is aimed to have a better understanding of the composition and repartition of the sedimentary facies and to help correlate the stratigraphy of GEO-01 with other reference wells in the GGB (HU2; TH1; GR1; CRO1).

3. Results



4. Well Correlation



After obtaining all the results of the QEMSCAN analyzes performed on the cutting samples of the GEO-01 well, a correlation was performed using the Grilly and Crozet wells to identify the main Cretaceous facies present in the three wells (f, g and h).

In the GEO-01(h) and Crozet(g) well it was identified the formation " Calcaires a Alectryonia rectangularis ", belonging to the Valanginian age, but in the well Grilly(f) it was not possible to recognize this formation.

Minerals



Bibliography:

PGG (2011). Evaluation du potentiel géothermique du canton de Genève – Vol. 1: Rapport final. Technical report, Service cantonal de l'énergie-Services Industriels de Genève.

RUSILLON, Elme. Characterisation and rock typing of deep geothermal reservoirs in the Greater Geneva Basin (Switzerland & France). Université de Genève. www.geothermie2020.ch

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5. Conclusions

- The geochemical and petrological analysis of the sedimentary sequences traversed by the Geo-01, Crozet and Grilly wells allows us to recognize and characterize the main sedimentary facies in the subsurface of the GGB.

- With the new data generated by this type of study it is possible to correlate wells present in the same geological context and to check the lateral continuity and thickness of the sedimentary packages along the basin.