

DEPARTEMENT  
DE LA GUYANE



MAIRIE  
DE  
GRAND-SANTI



Vingtièmes journées techniques du Comité Français d'Hydrogéologie  
de l'Association Internationale des Hydrogéologues.

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Géosciences pour une Terre durable

**brgm**

# Hydrogeological prospection feedback of a hard rock aquifer in Grand Santi - French Guyana

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## Grand Santi : a case study

- Village located along the Maroni river surrounded by equatorial forest
- Only joinable by plane or pirogue sailing along the Maroni river
- Population growth = 5,5% (5500 hab., 2011)

- A first water prospection has been carried in 1996, concluded by two water boreholes (F1 – F2)
- A new one has been done in 2013-2014 concluded by 5 water boreholes (FE1, FE2, FE3, FE4, FE5)



Photo Maroni Fret Line

**After 7 water boreholes drilled at Grand Santi, let's take stocks of this experience.**

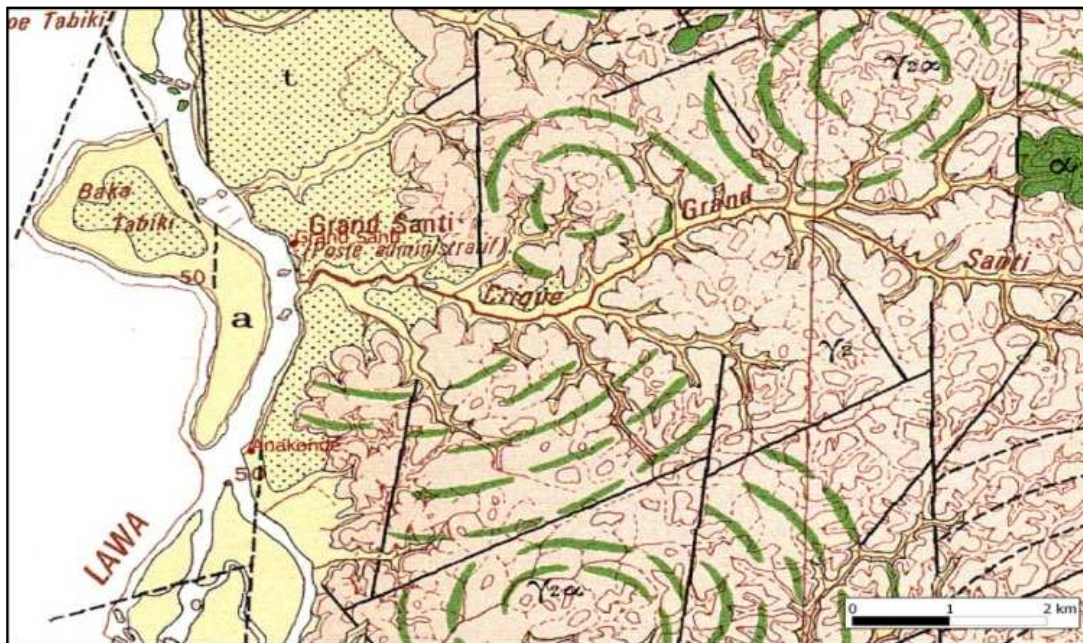


# Grand Santi Geology

- Surrounding area of Maroni river is covered by alluviums which have a low permeability, surimposed to weathered hard rocks.
- Hard rocks are composed by Migmatites.
- Limited outcrops.
- Principal structural orientations are N340 to N20 and N100 to N140



Photo A. Gutierrez



## LÉGENDE

### TERRAINS SÉDIMENTAIRES RÉCENTS

#### QUATERNAIRE FORMATIONS CONTINENTALES

a	Alluvions fluviales
t	Terrasses fluviales

### ROCHES ÉRUPTIVES ET CRISTALLINES

ω	Dolérites
γ <sub>2</sub>	Granite guyanais
γ <sub>4</sub>	Gneiss guyanais
γ <sub>α</sub>	Migmatites guyanais
h / α	Hornblendites (h), amphibolites (sensu lato) (α)
—	Failles
- - -	Directions structurales



# Water prospection methodology

A downscaling approach, developed during the « village des fleuves program », is applied to localise geostructural discontinuities :

- **Phase 1** : geological field observation & structural analysis using photo interpretation
- **Phase 2** : Radon emanometry (gas sampling from the first meter of soil to detect fracture zones)



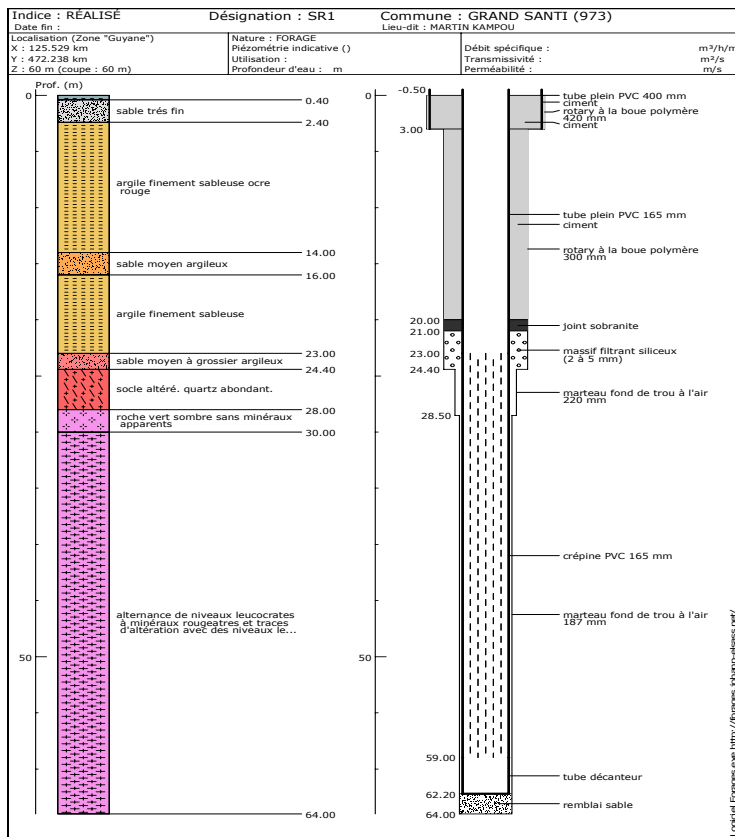
- **Phase 3** : Geophysical investigation :
  - in 1996 : geoelectrical survey (profiles and vertical soundings)
  - In 2014 : geoelectrical survey + electrical resistivity tomography (ERT)



# Drilling and hydraulic tests

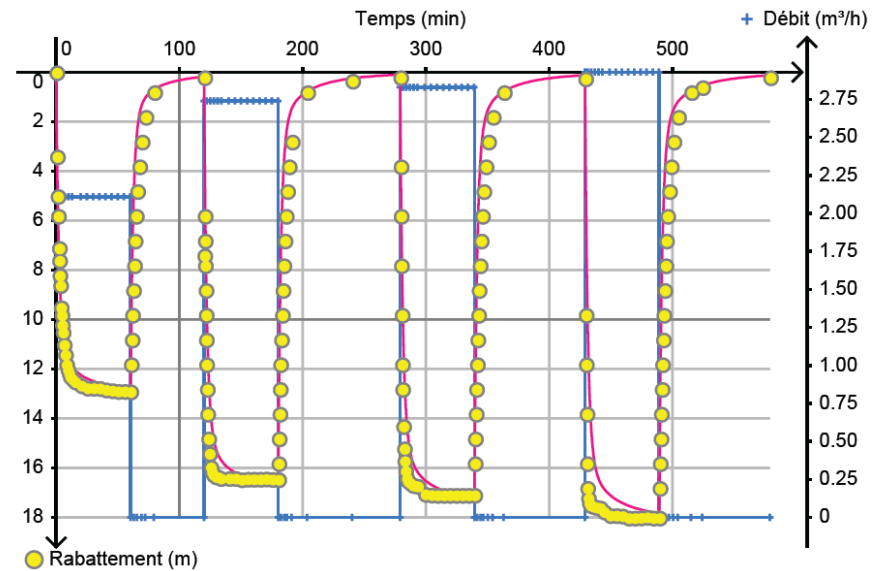
All the boreholes were drilled and equipped in the same way :

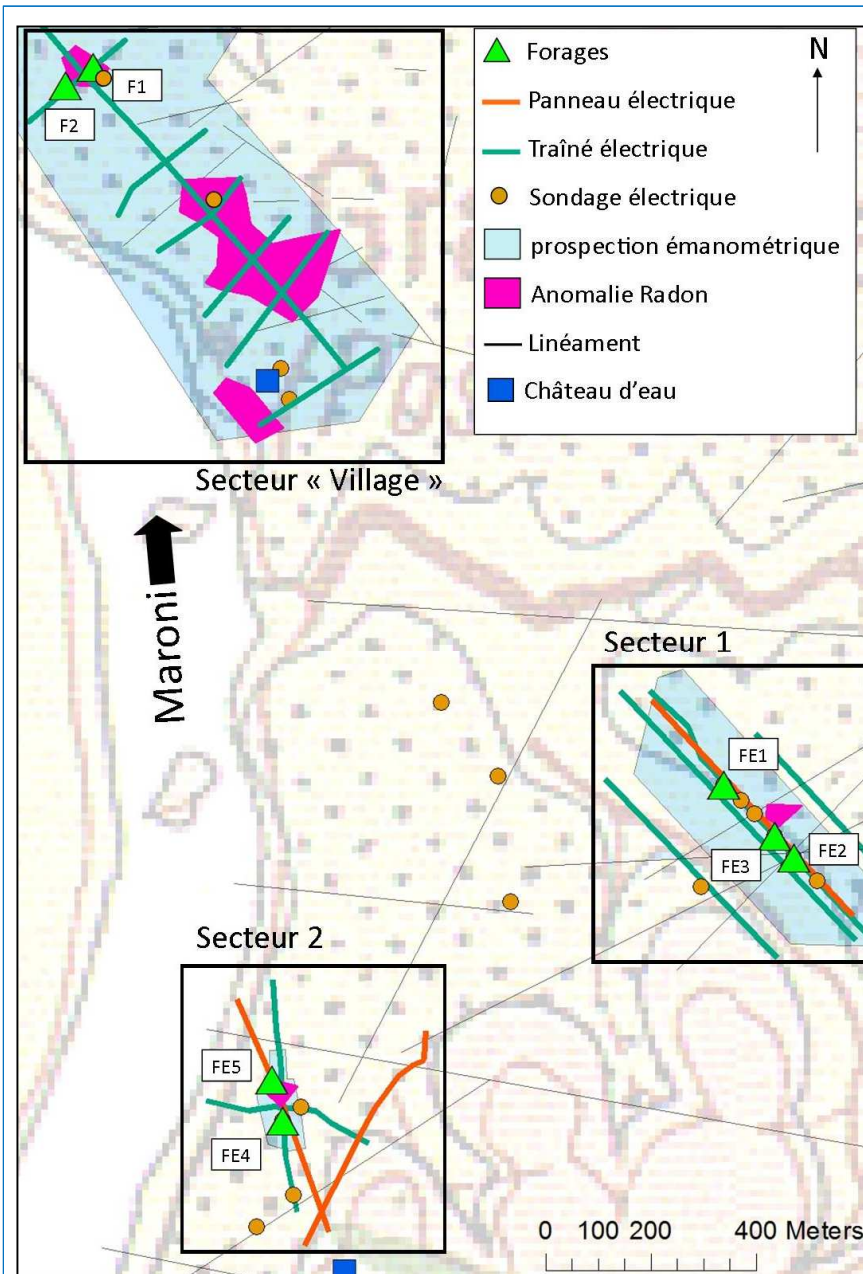
- Rotary with mud was used to drill unconsolidated formations
- Down the Hole hamer was used to drill hard rock
- Interface saprolite/fissured layer and fissured layer are screened.



All the boreholes were submitted to hydraulic tests:

- Step drawdown test
- 72 hours pumping test





## Results

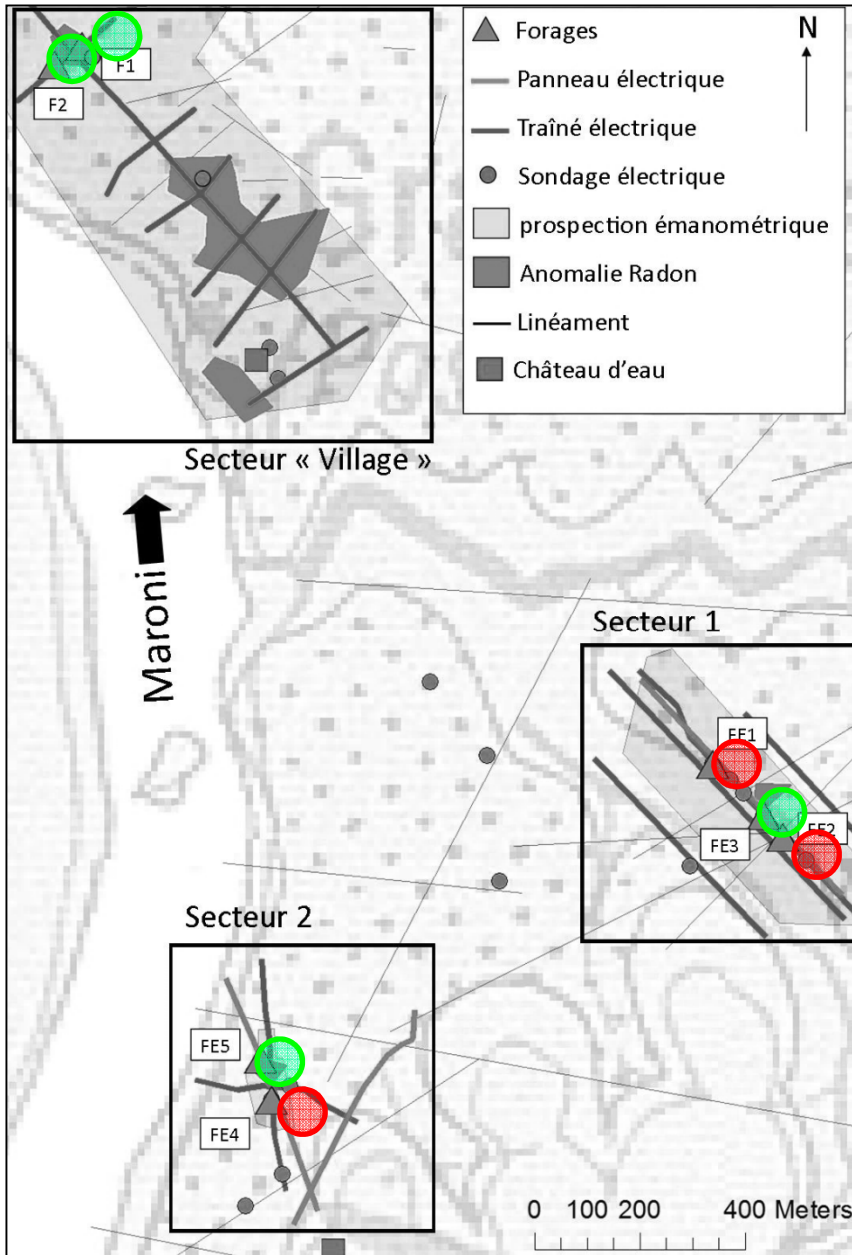
- 553 gas samples,
- 23 electrical soundings,
- 23 electrical profiles
- 3 ERT profiles

lead to the implantation of 7 water boreholes (5 in 2014).

- 1) Geophysics is oriented by Radon anomalies
- 2) Exact drilling location are chosen according to geophysical interpretation



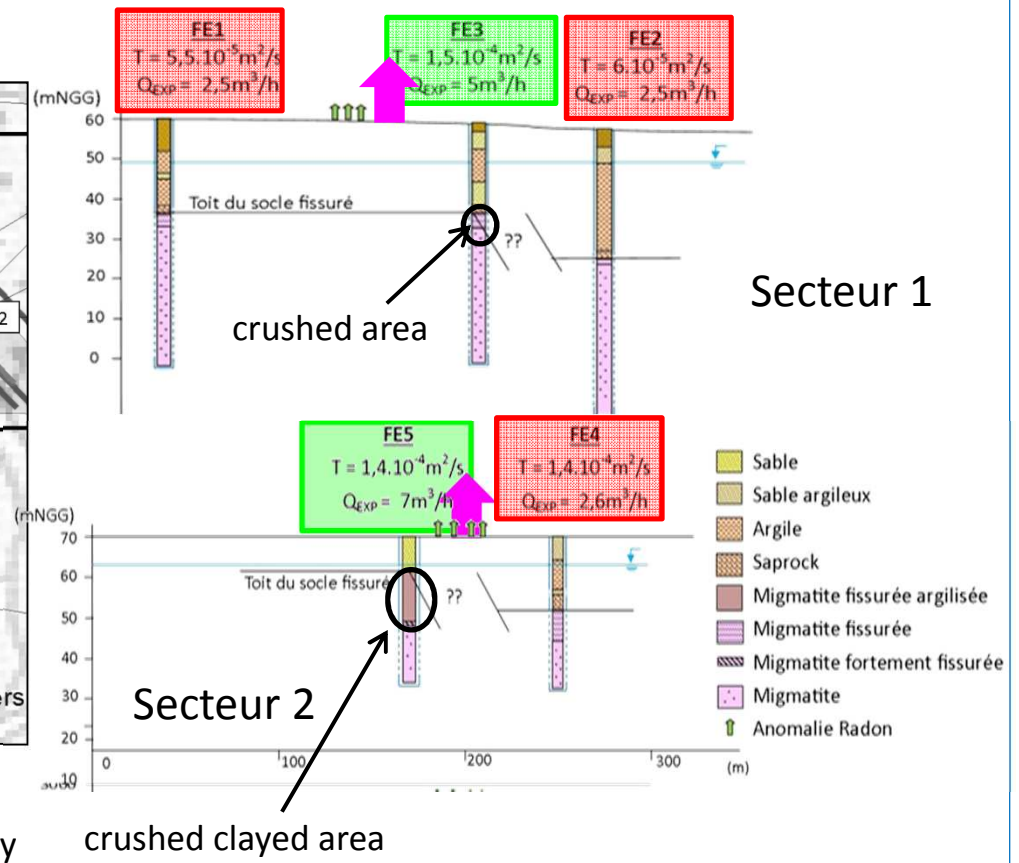
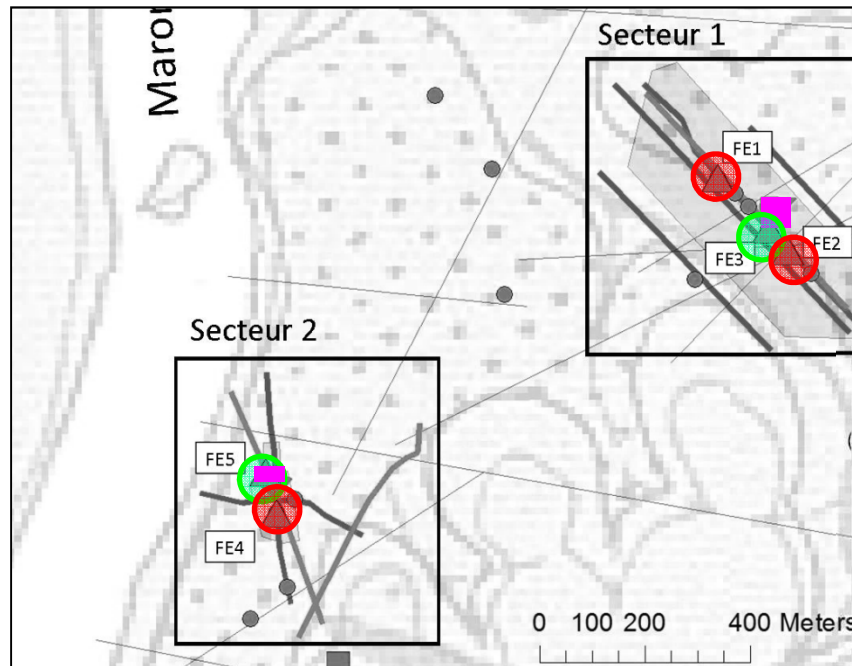
# Pumping tests main results



Productive borehole	F1	F2	FE3	FE5
T (m2/s)	$5.5 \cdot 10^{-4}$	$1.8 \cdot 10^{-4}$	$1.5 \cdot 10^{-4}$	$1.4 \cdot 10^{-4}$
Qexp (m3/h)	6	8	5	7

Low production borehole	FE1	FE2	FE4
T (m2/s)	$5.5 \cdot 10^{-5}$	$6 \cdot 10^{-5}$	$1.4 \cdot 10^{-4}$
Qexp (m3/h)	2.5	2.5	2.6

# Influence of structural discontinuity proximity on borehole productivity

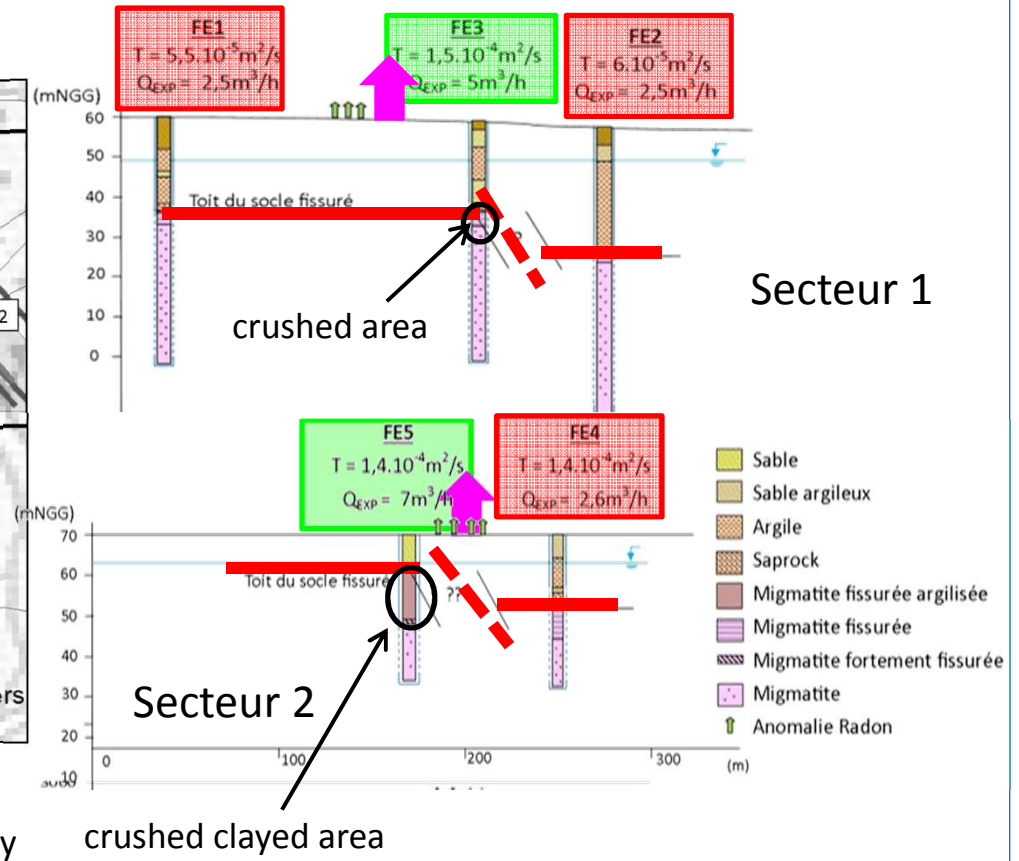
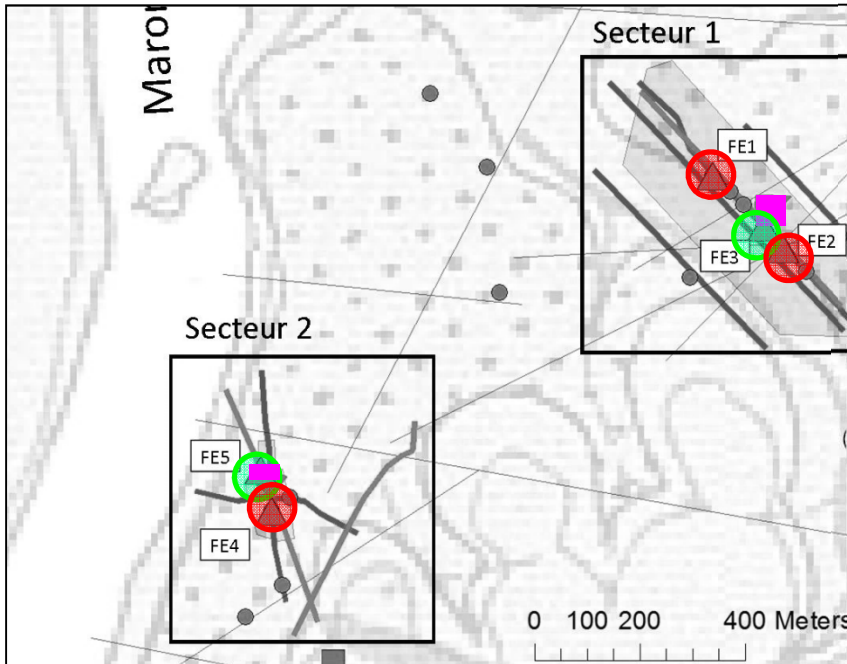


Radon anomaly

Tectonics clues were found in FE5 and FE3 borehole



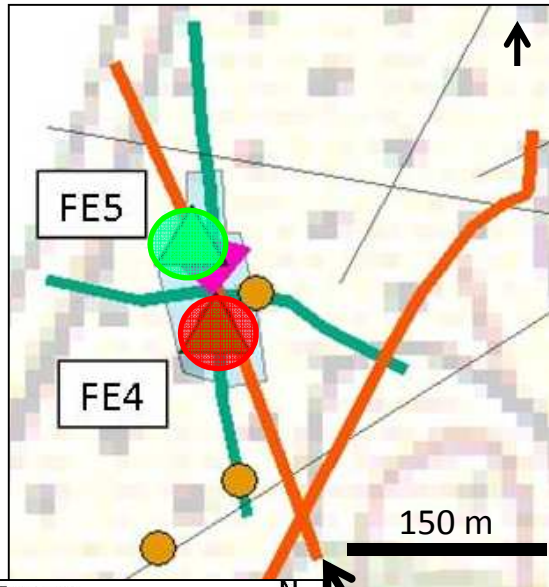
# Influence of structural discontinuity proximity on borehole productivity



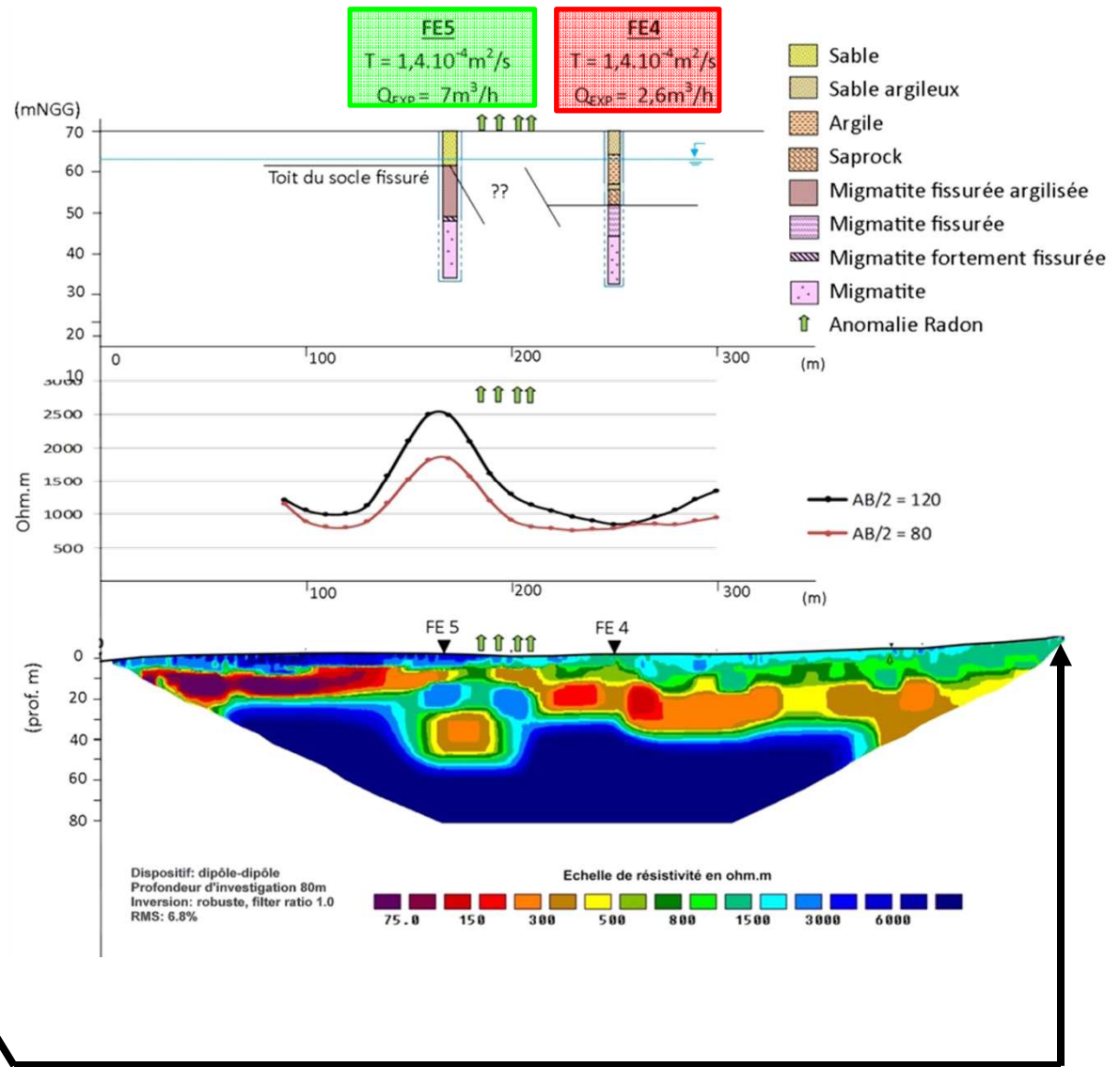
Radon anomaly

Two potentials tectonics accidents

# « Sector 2 »

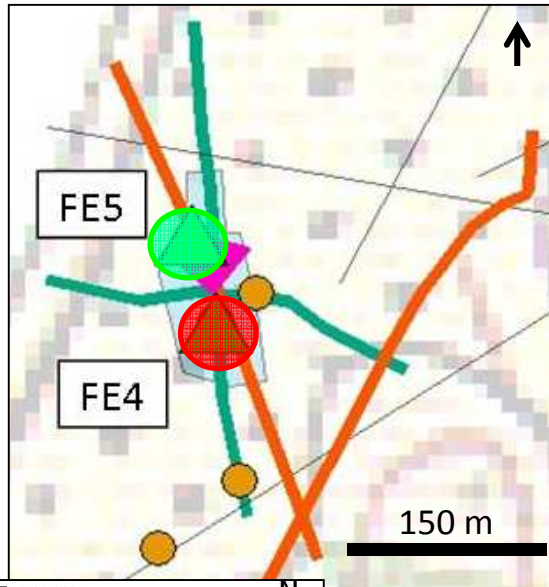


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- Traîné électrique
- Sondage électrique
- prospection émanométrique
- Anomalie Radon
- Linéament
- Château d'eau

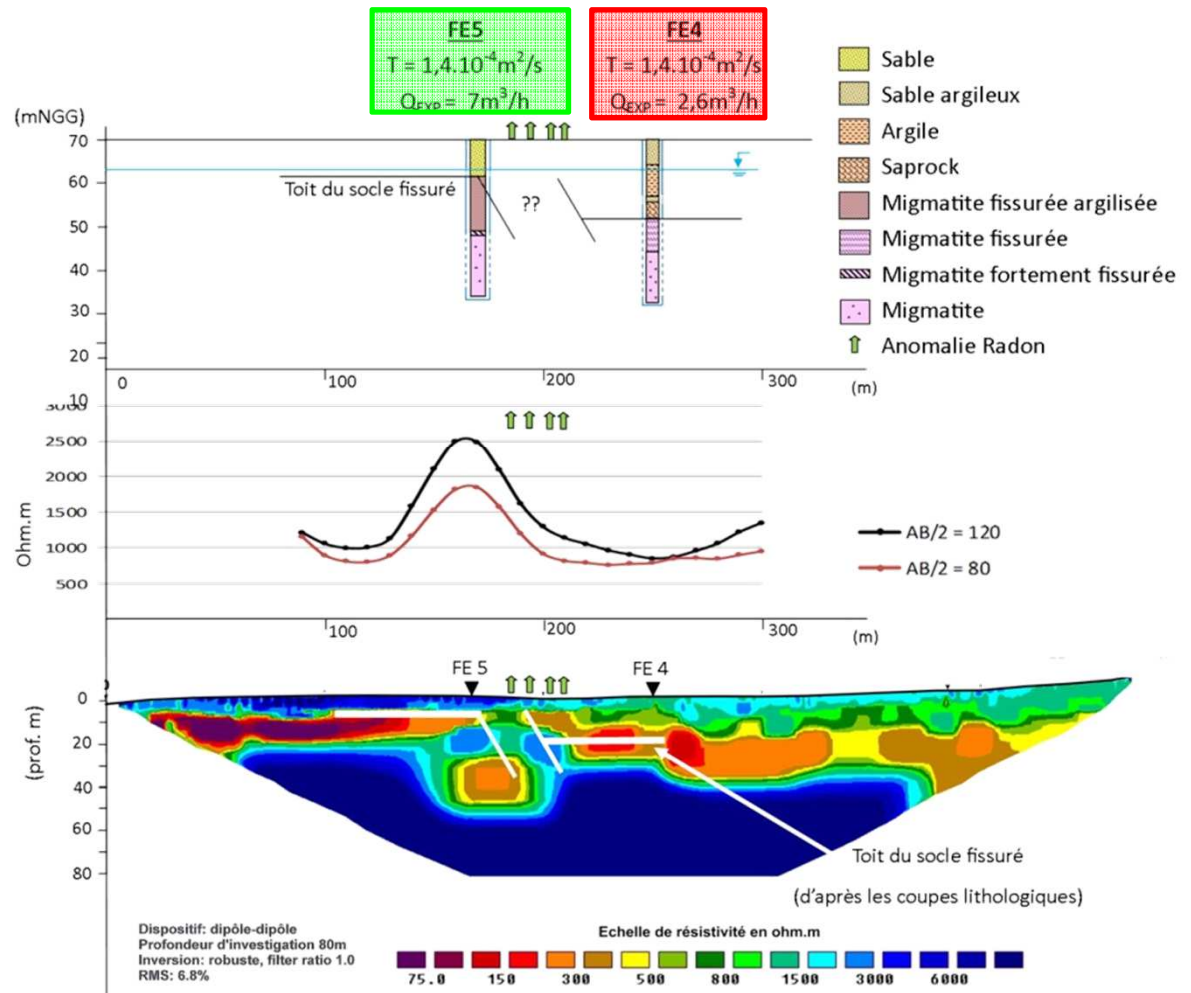




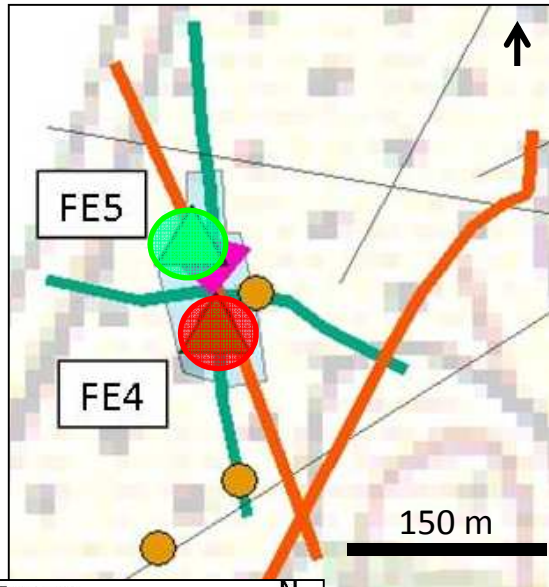
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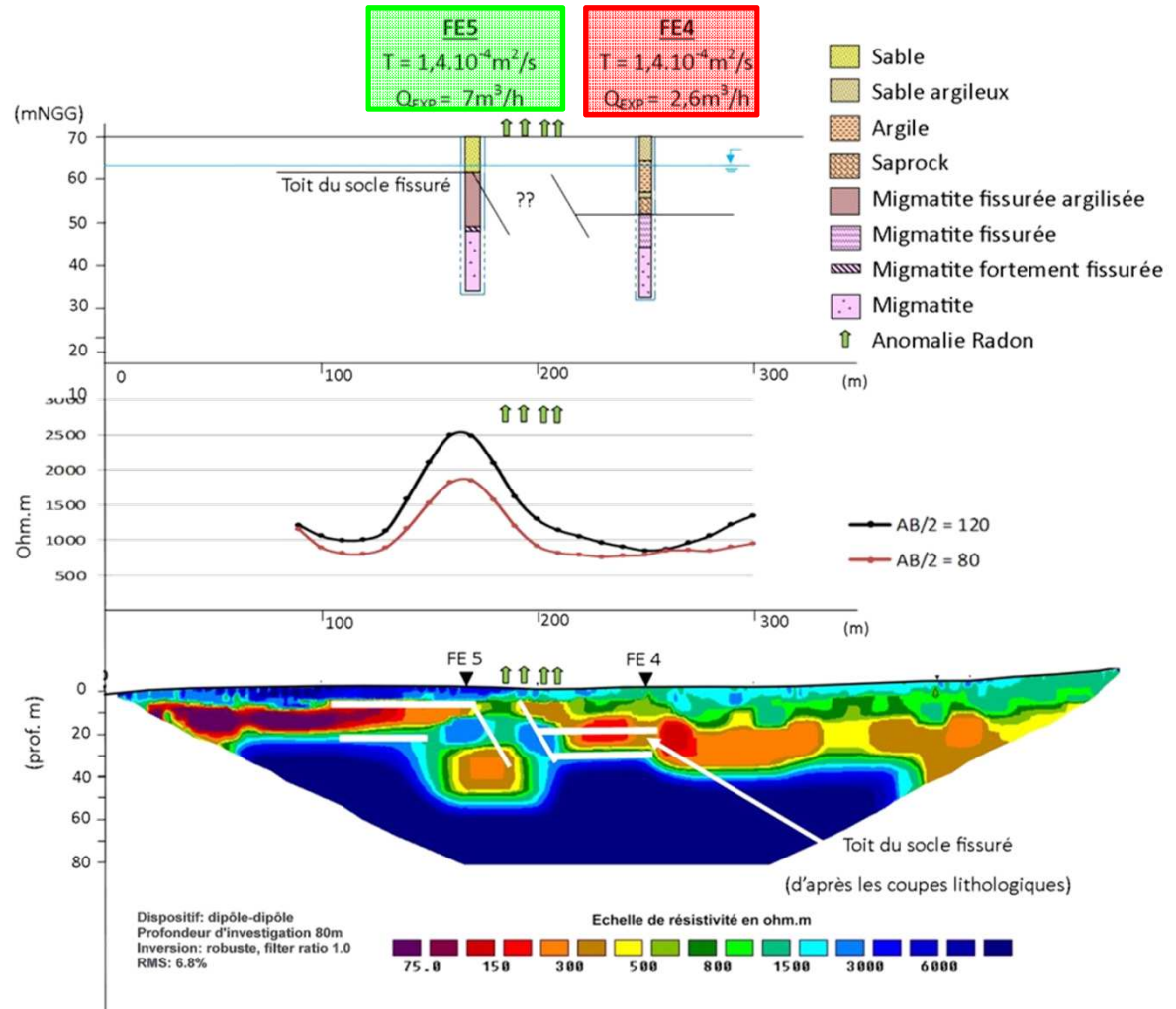
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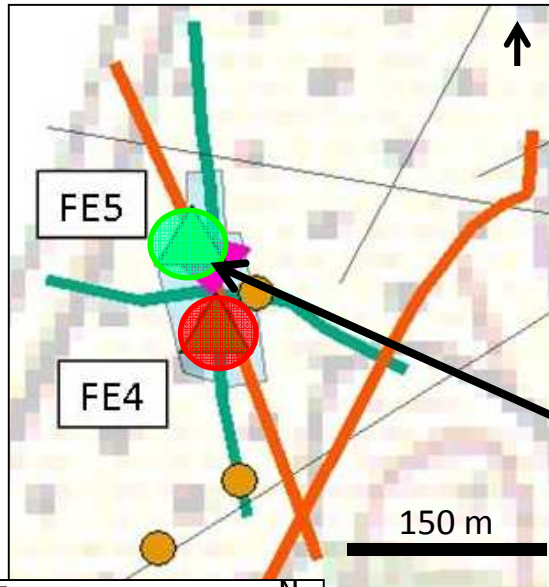


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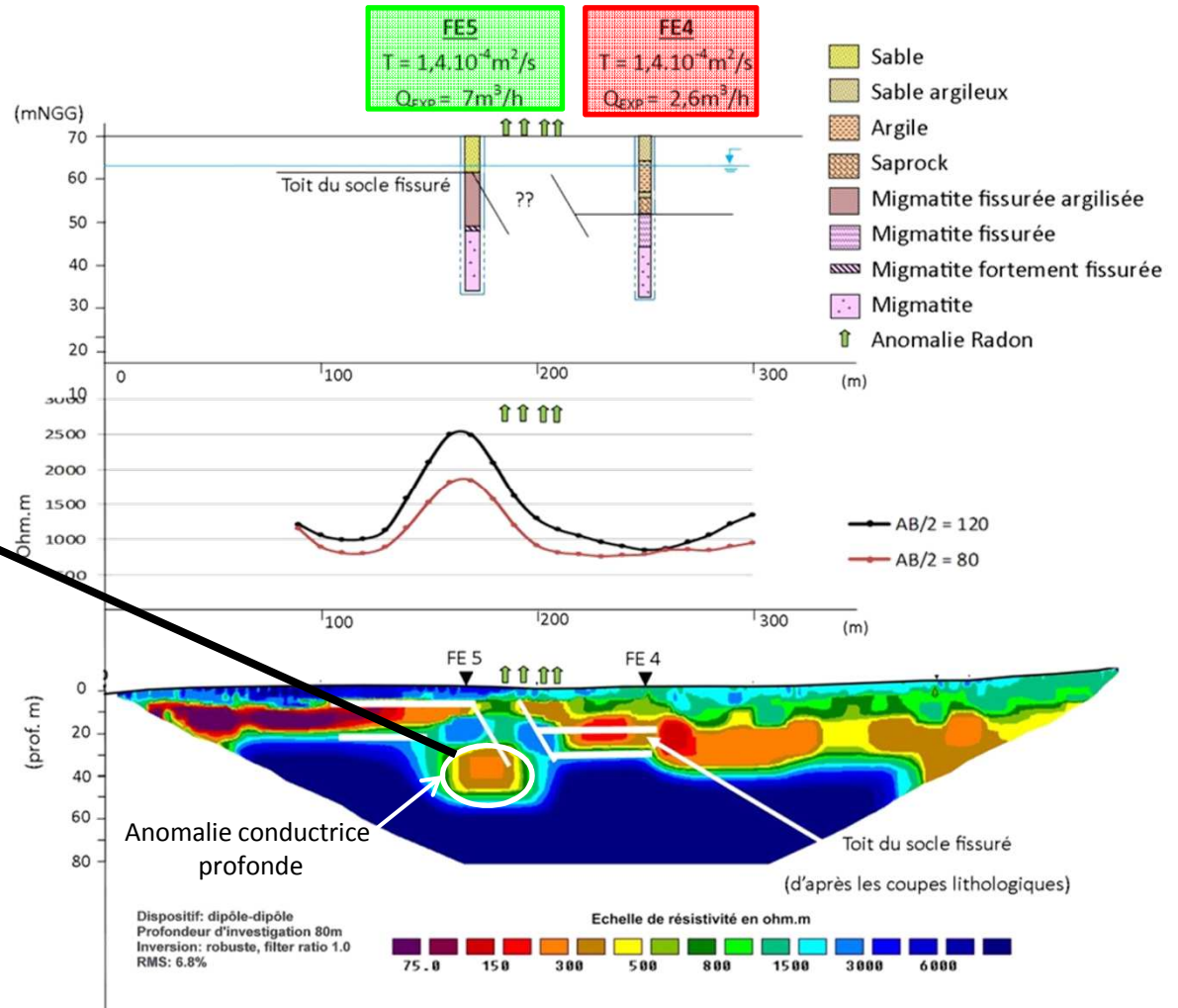




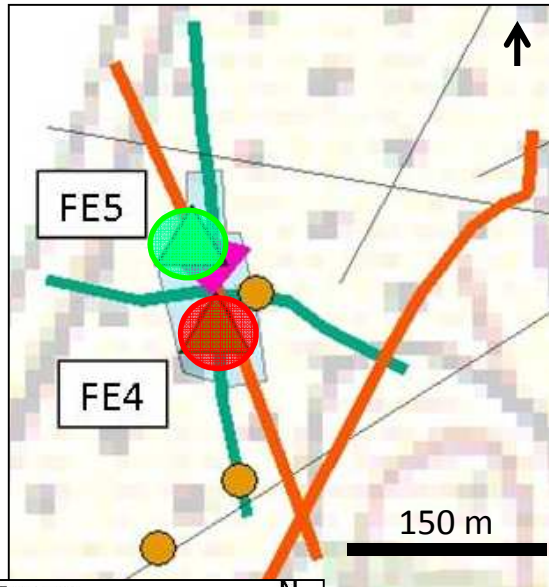
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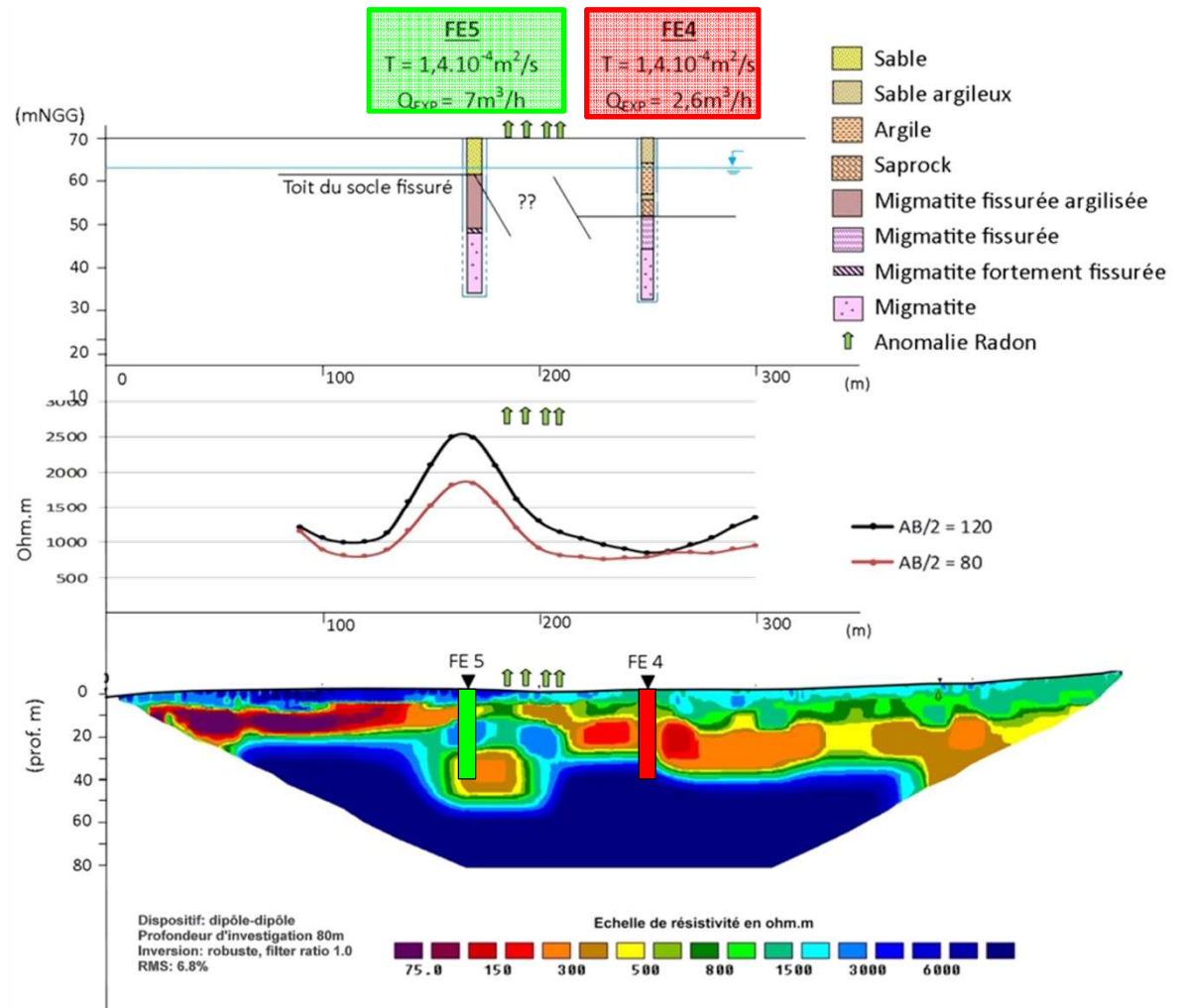
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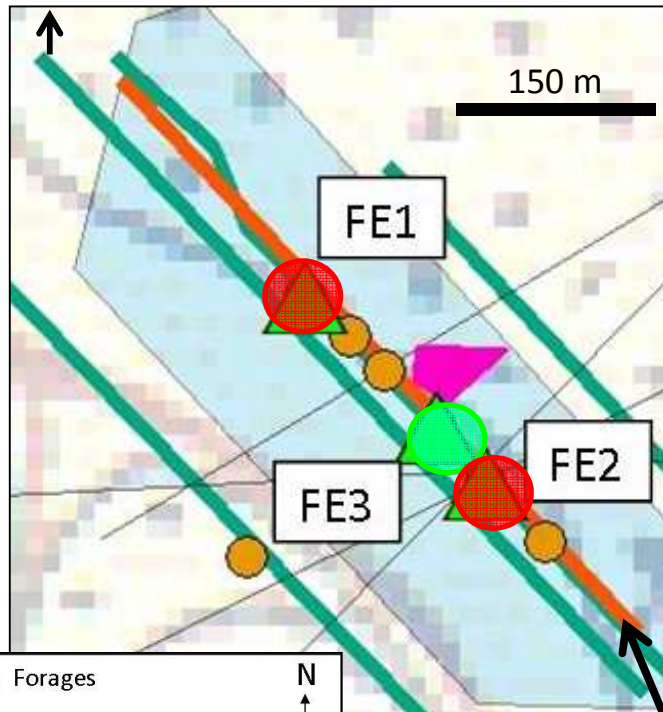


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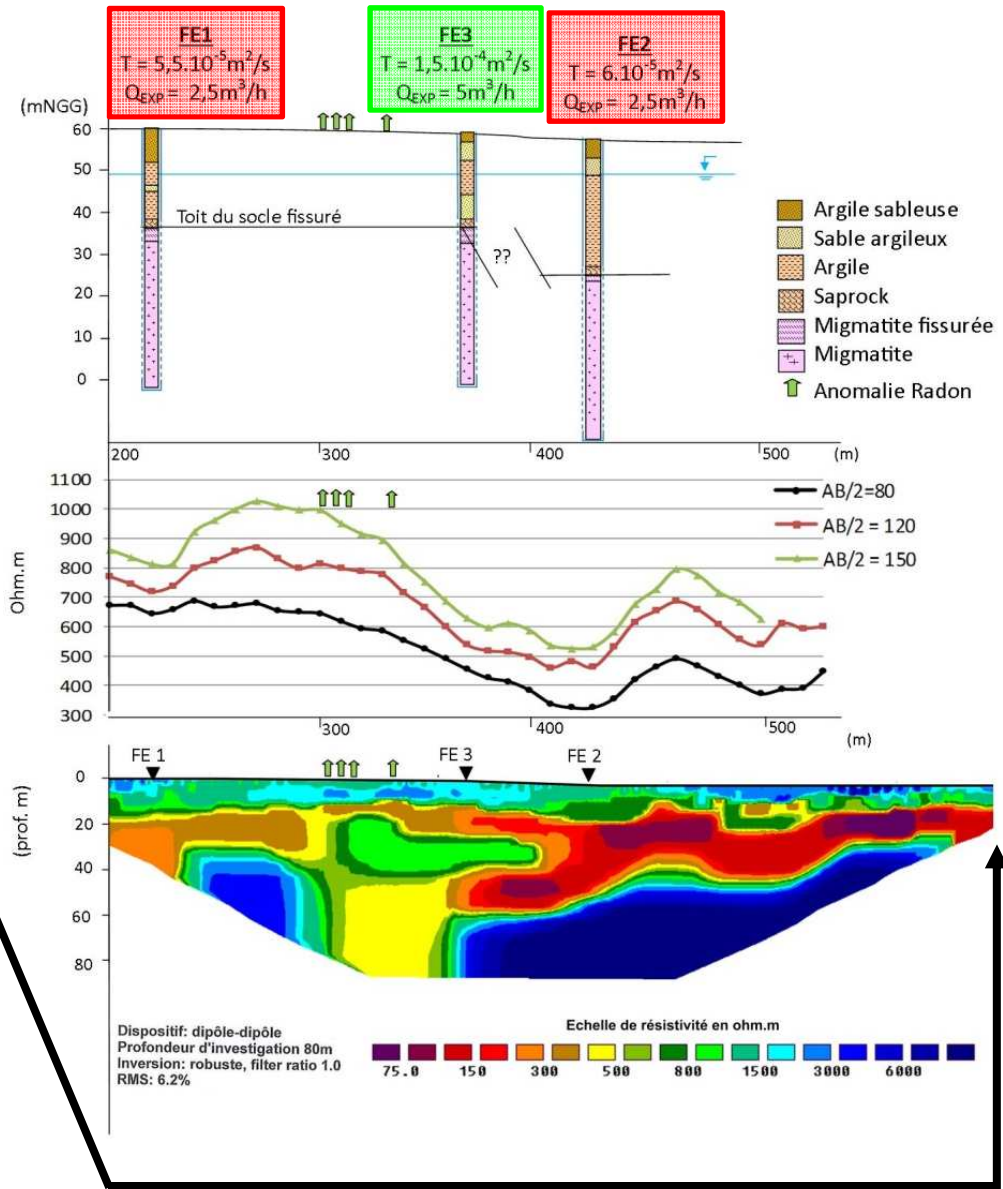


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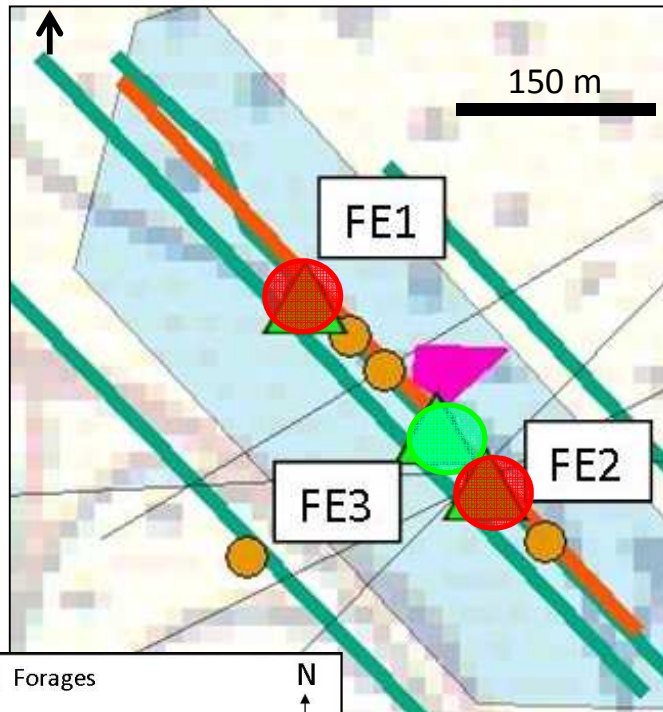


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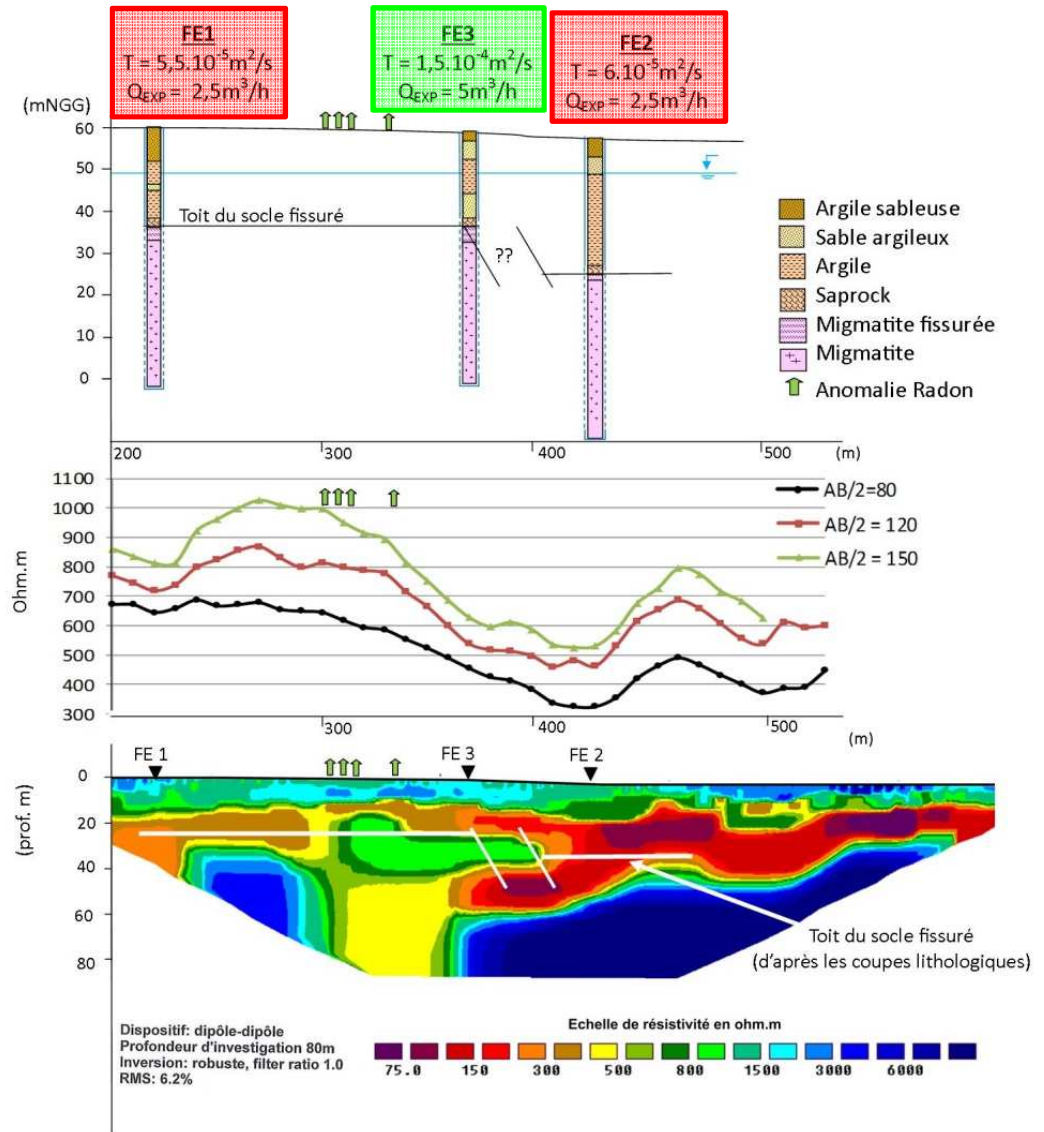
NB : ERT was performed a posteriori.



# « Sector 1 »

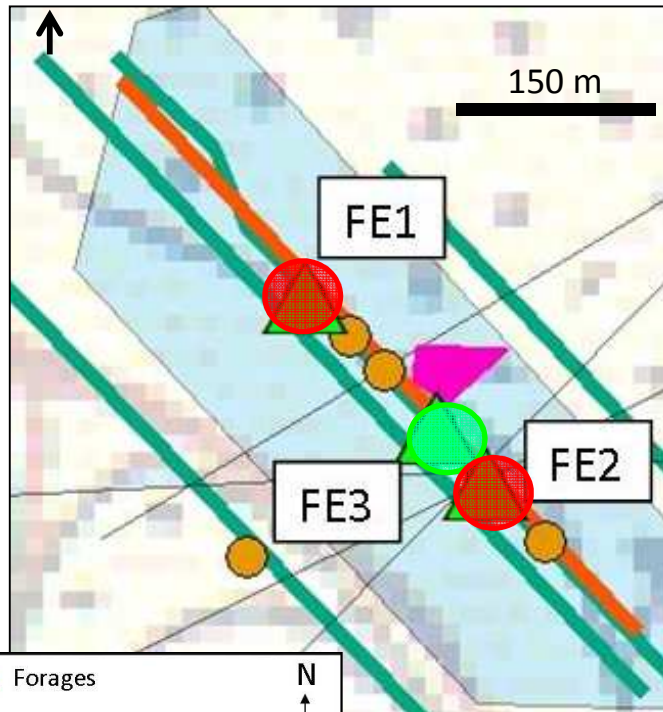


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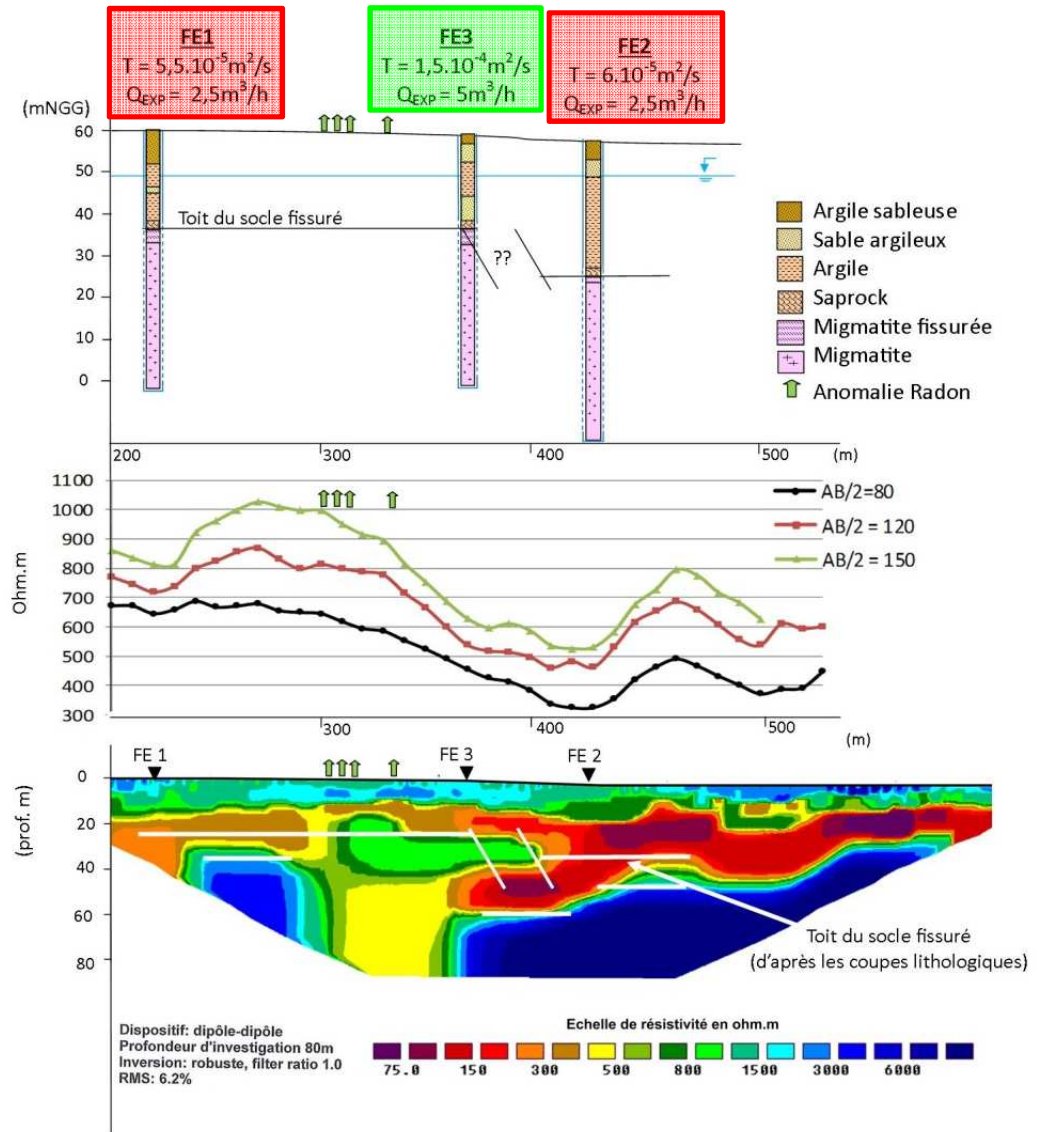




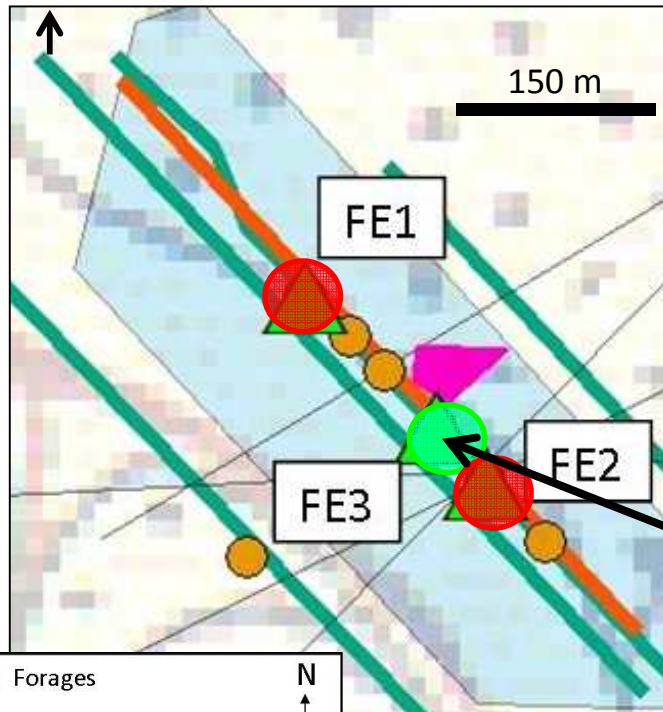
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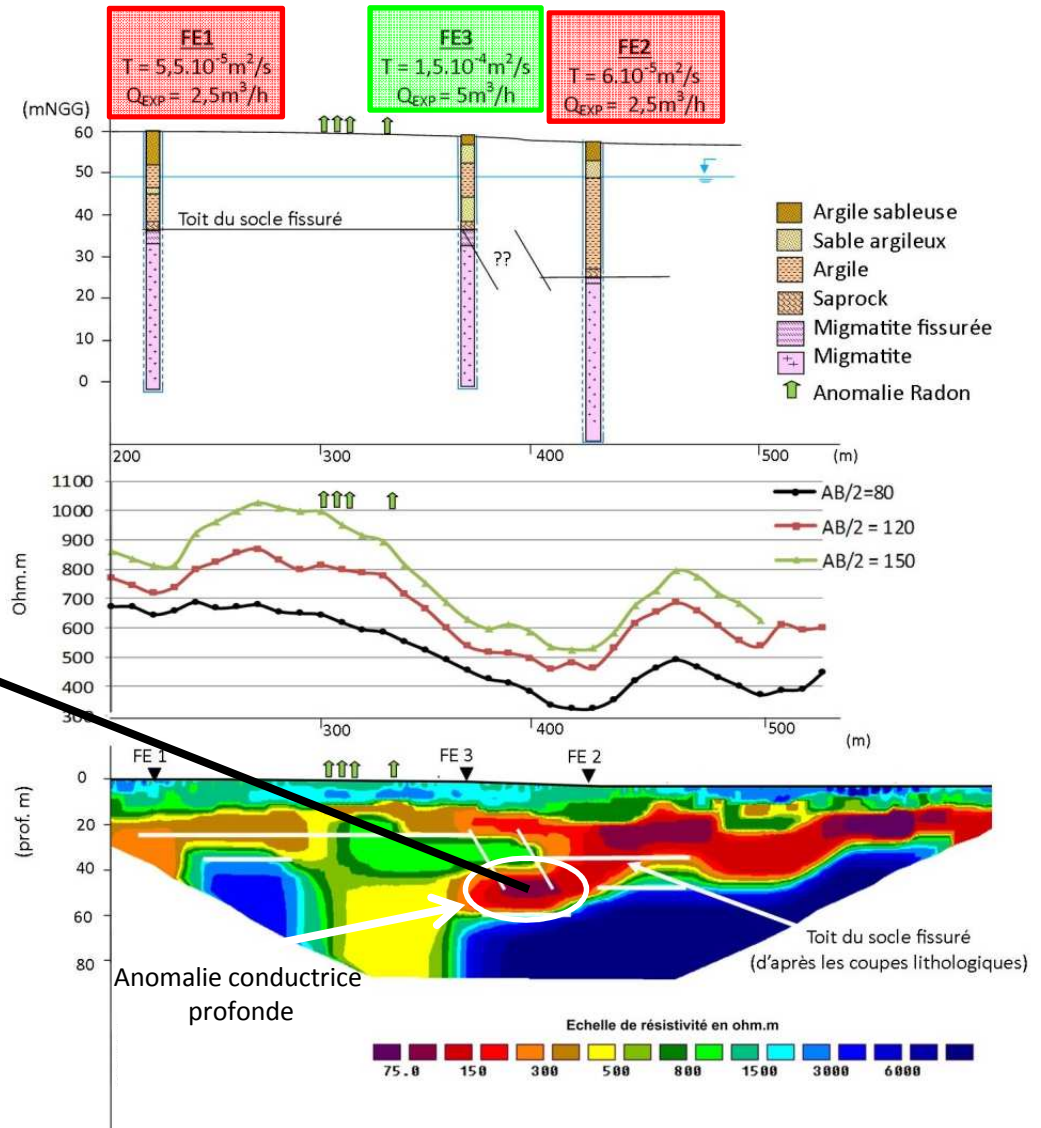
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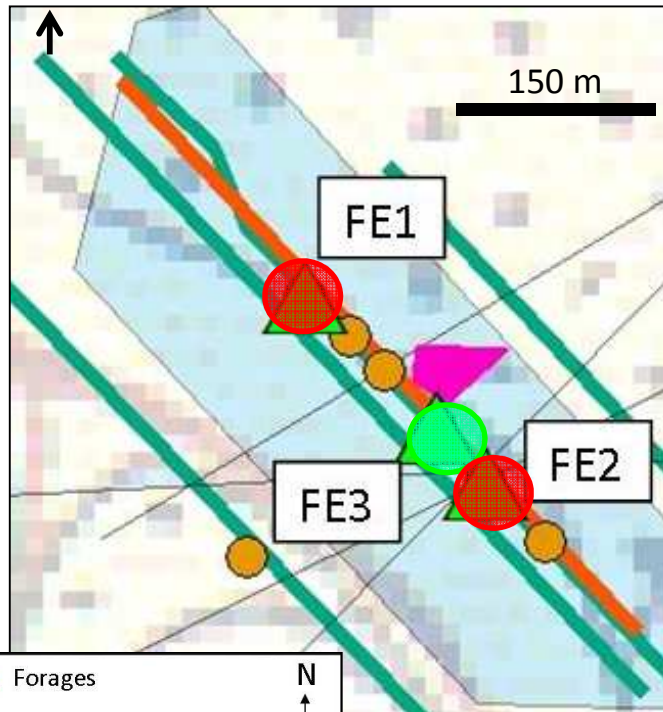
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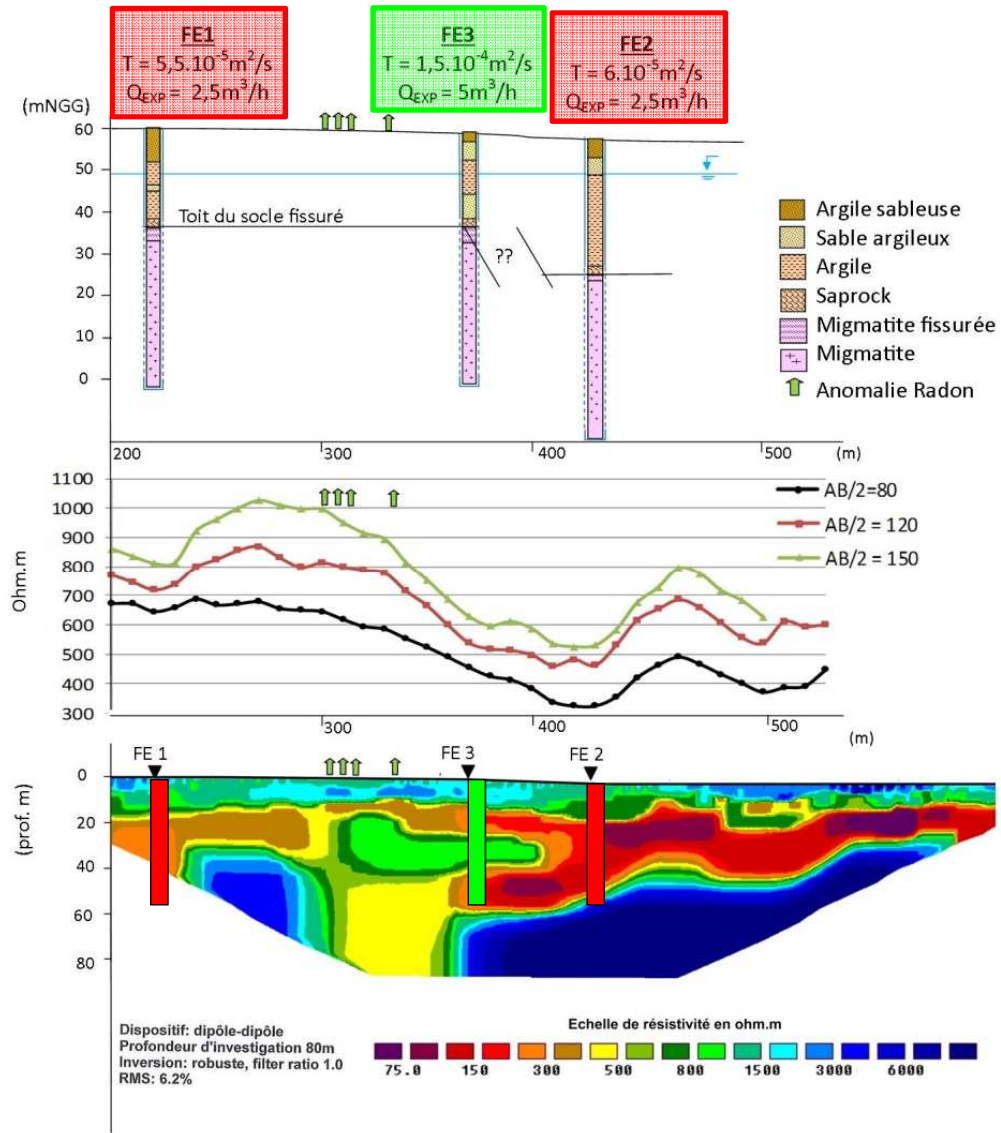
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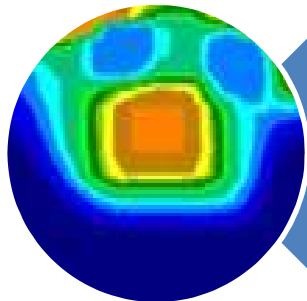
# Conclusion



Well productivity is directly linked to the proximity of a structural discontinuity (fault)

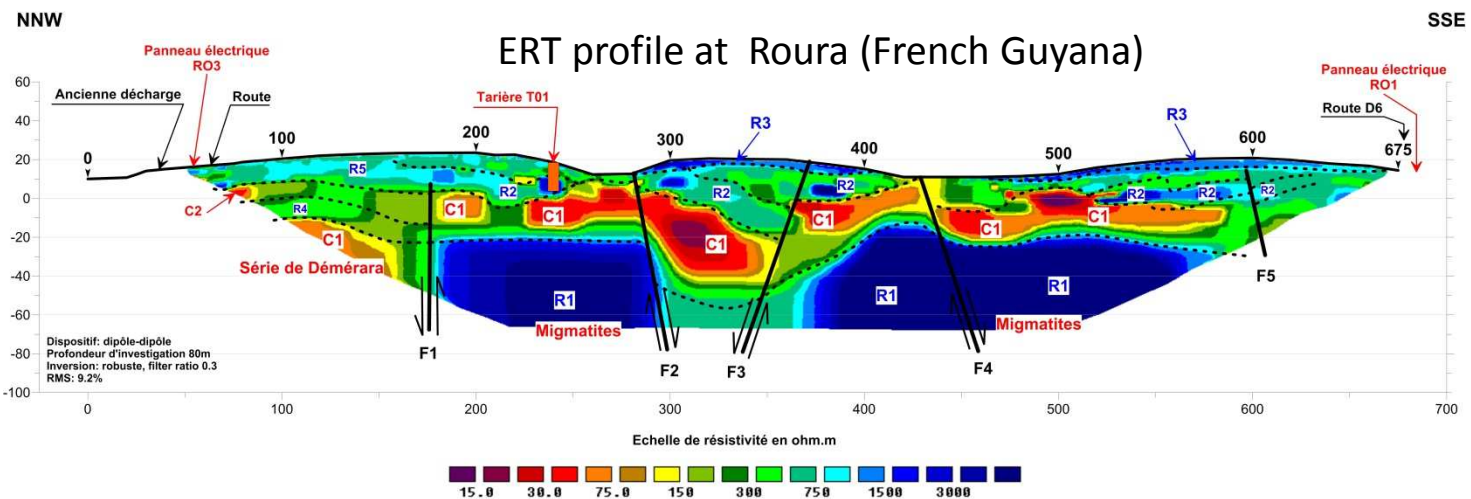
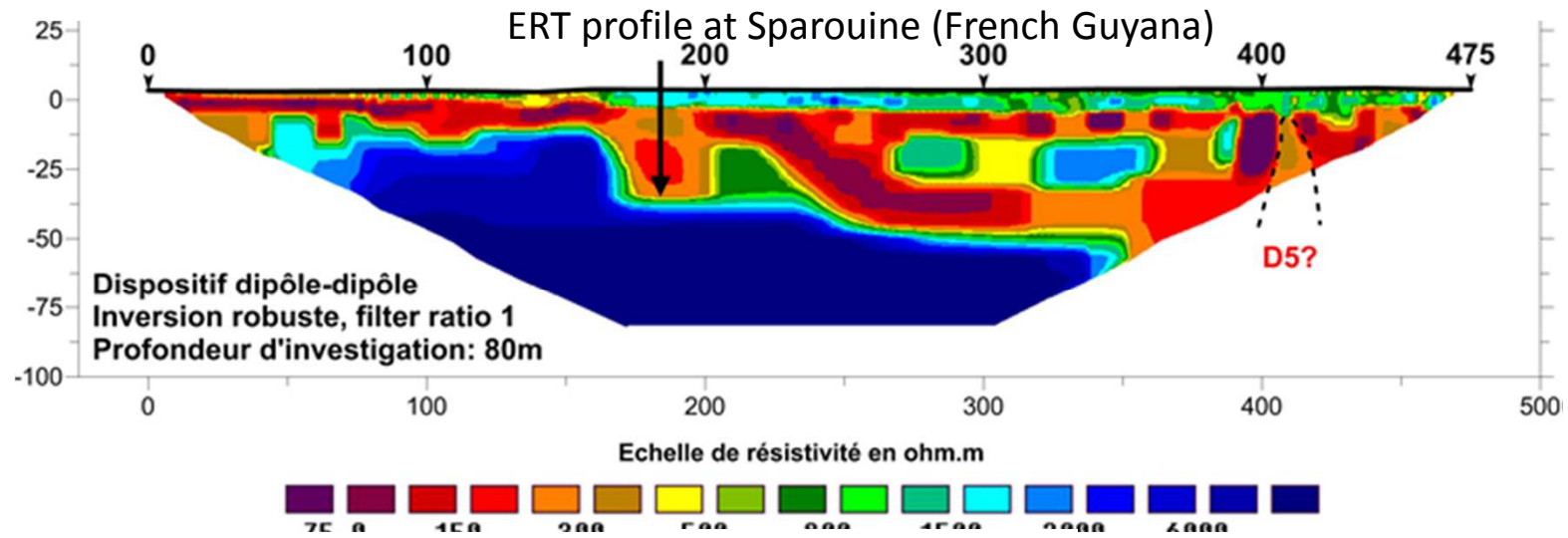


Structural discontinuities can be revealed thanks to Radon and geoelectrical survey interpretation

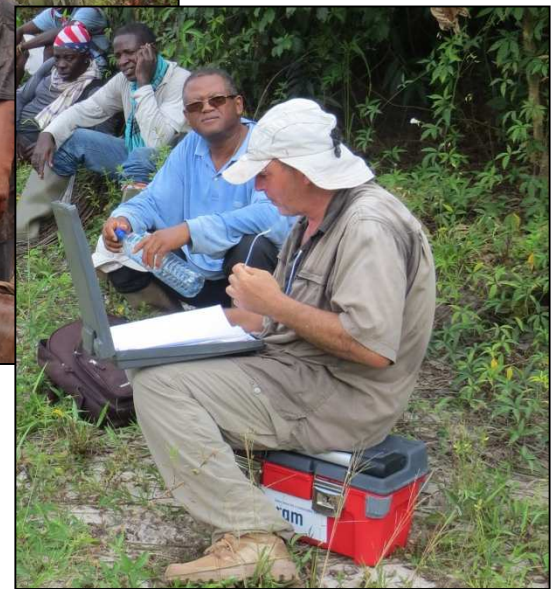


ERT profiles improve considerably the localisation of faults.

# Similar deep conductive anomalies found in other places in French Guyana







**Thank you**