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## Drinking water resources investigation in Papaïchton Village (French Guiana)

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# Drinking water resources investigation in Papaïchton Village (French Guiana)

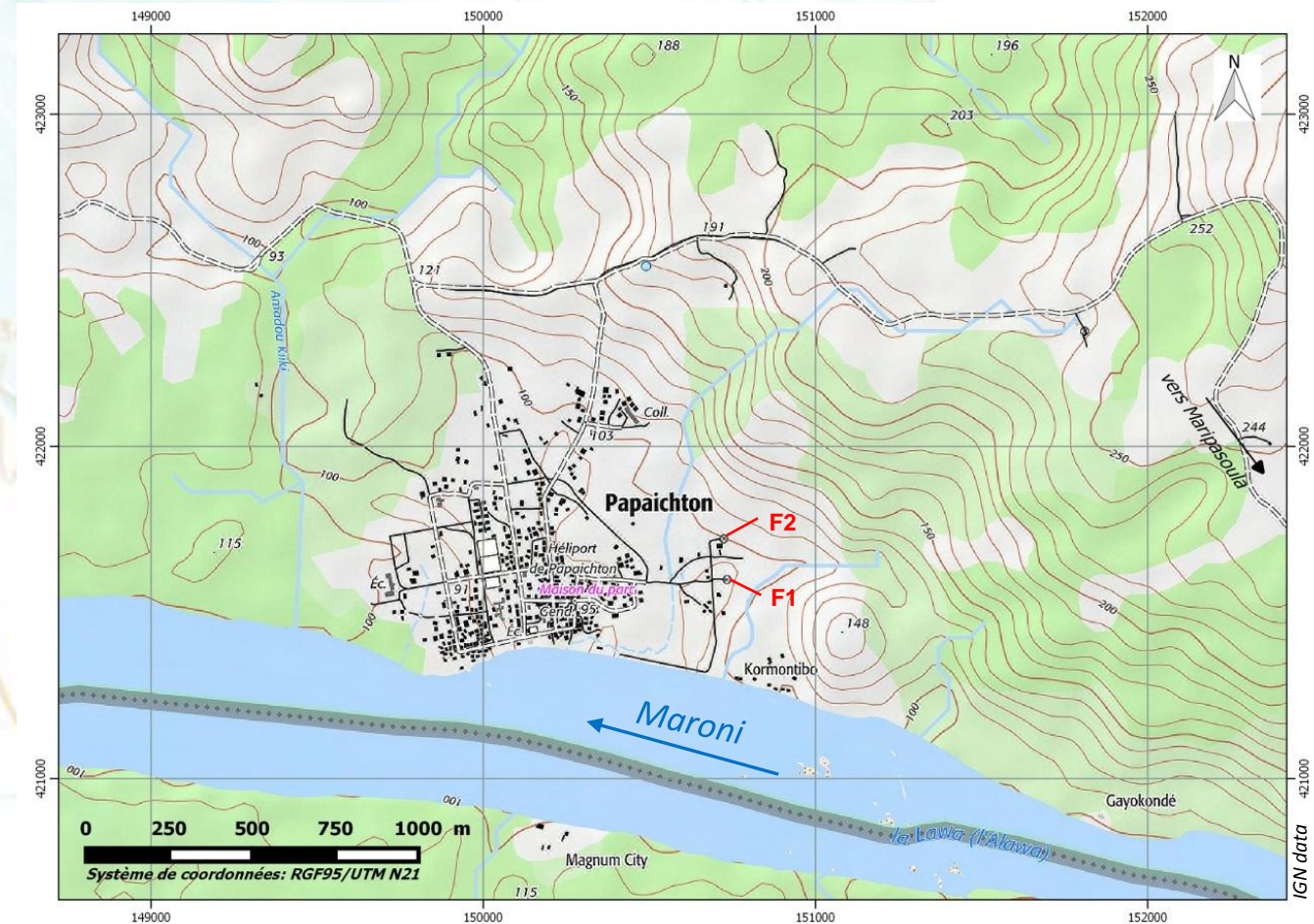
N. Brisset, F. Mathieu, J.M. Gandolfi, B. Dewandel, P. Bourbon, G. Aertgeerts, B. Joseph

*27<sup>th</sup> September 2019*



# LOCATION

- Village center located on the bank of the Maroni River in French Guiana
- Border with Suriname
- No connexion roads with the main cities of the coastal strip



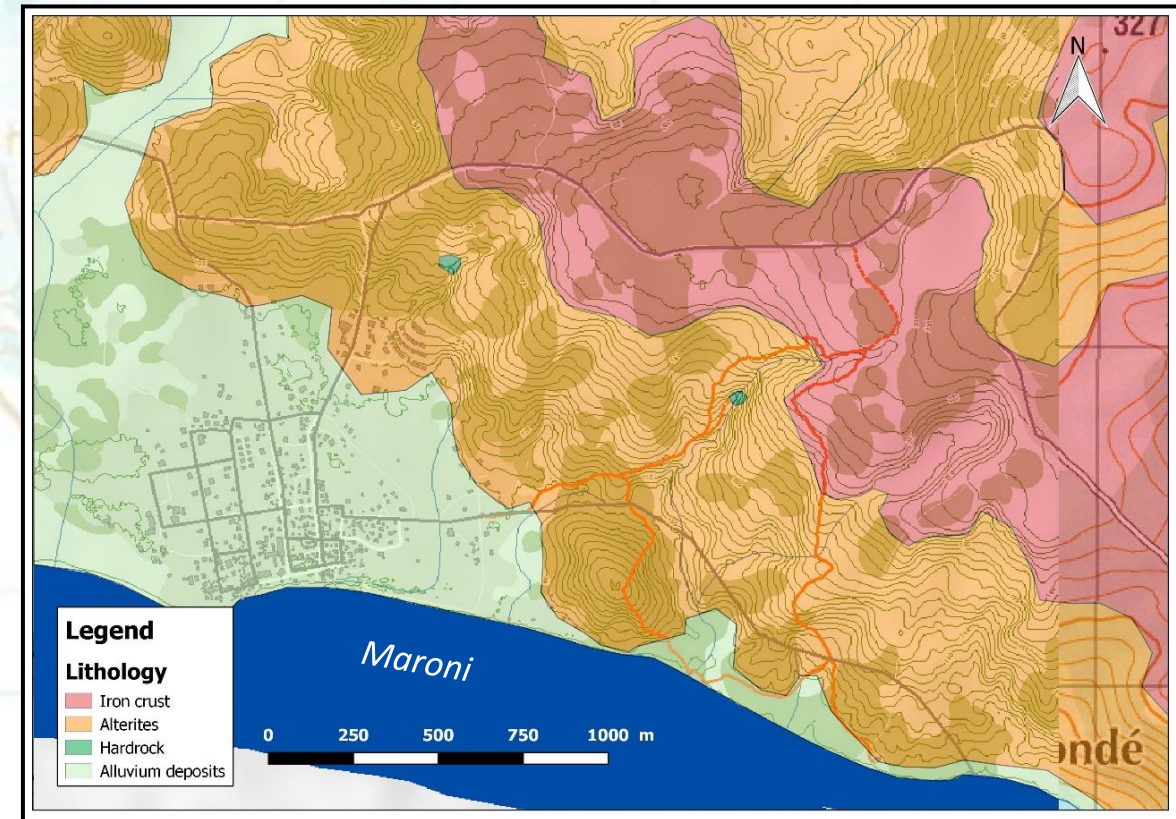
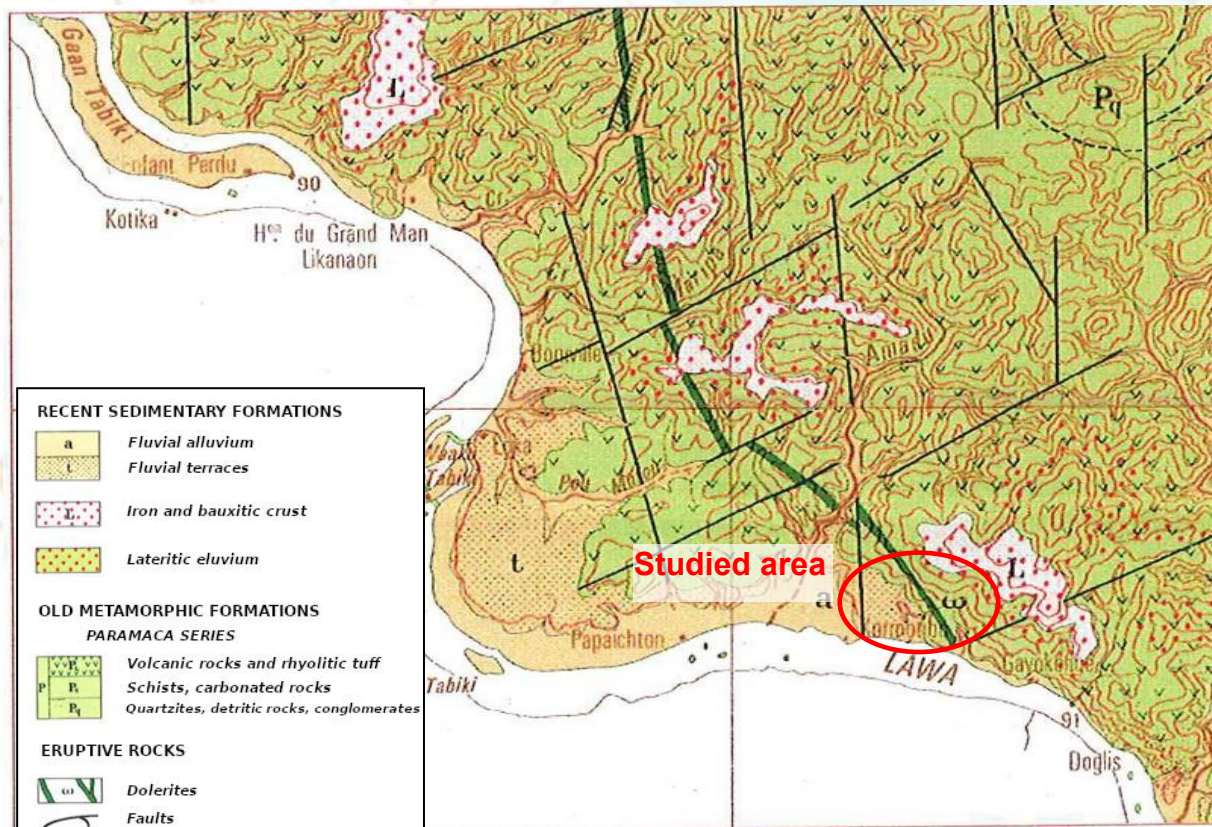
## SOCIO-ECONOMIC CONTEXT

- Population around 3500 inhabitants with **demographic growth > 6 % per year**
- Local hospital, 2 primary schools and 1 secondary school
- Drinking water demand > 200 m<sup>3</sup>/day (actual production !)
  - Water distribution cuts in the nights during the dry season...
- Potabilisation of the Maroni River requires heavy and energy-intensive treatment processes due to very high turbidity (natural clay particles + mining impact)
- **New underground water resources needed to obtain more than 400 m<sup>3</sup>/day**



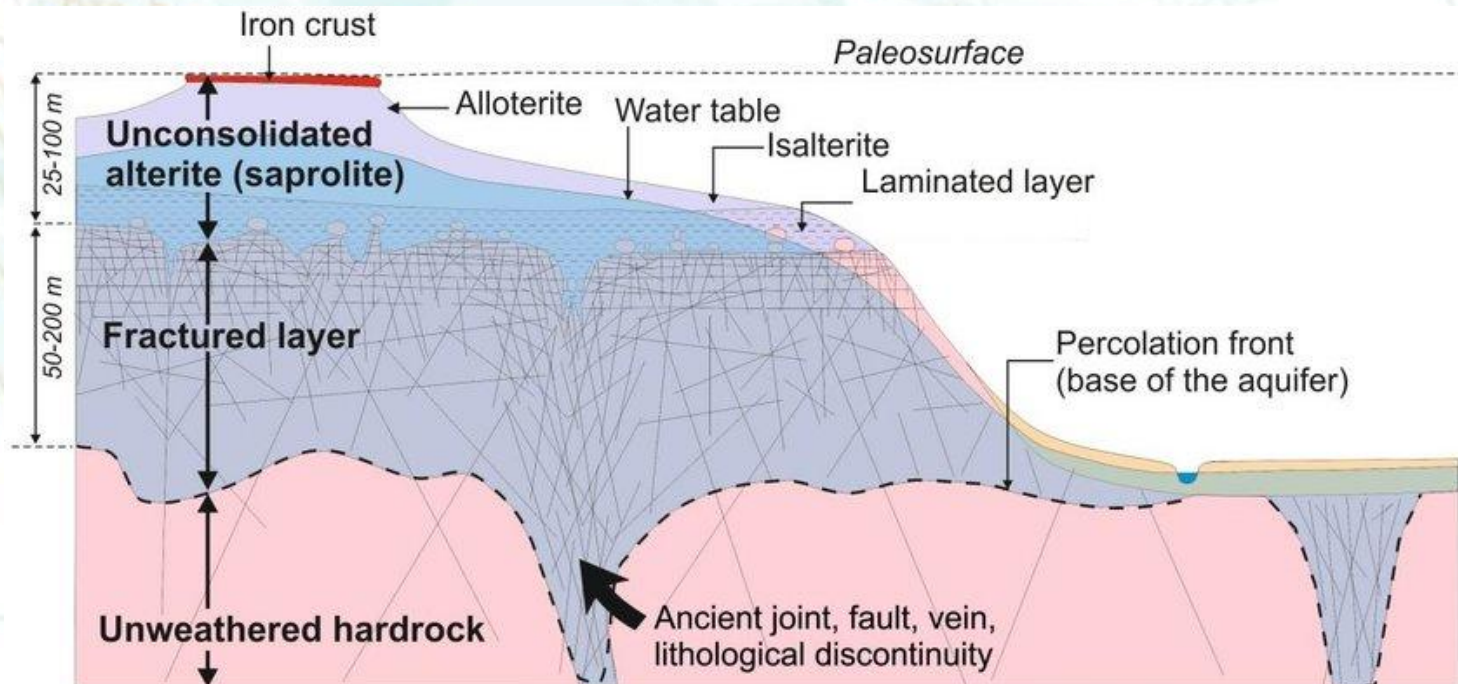
# GEOLOGICAL CONTEXT

- Area mainly composed of old metavolcanic rocks and rhyolitic tuff ( $\approx 2$  Gy) intruded by more recent dolerite dyke and quartz veins and affected by tectonic faults
- Very strong rock alteration giving sandy-clay alterites on several decameters with iron and bauxitic crust on the top
- Alluvial deposits (from 2 to 5 meters) on the Maroni banks



## HYDROGEOLOGICAL CONTEXT

- Alluvial aquifer on the Maroni banks : thin thickness and very vulnerable on Papaïchton area.  
Production from 1 to 2 m<sup>3</sup>/h
- Hardrock aquifer
  - **Fractured layer** : fracture network, with draining structure close to the faults and dykes, well protected by the lateritic clay. Production classically between 2 and 6 m<sup>3</sup>/h in French Guiana
  - Alterite: in the sandier parts. Production from 0,8 to 2 m<sup>3</sup>/h



## ON FIELD OBSERVATIONS

- Field investigations were conducted to clarify the geological map, to characterize the geomorphology of the site and to understand the springs dynamic



*Iron crust dismantled on the slopes*



*Old spring water catchment in Papaïchton forest*



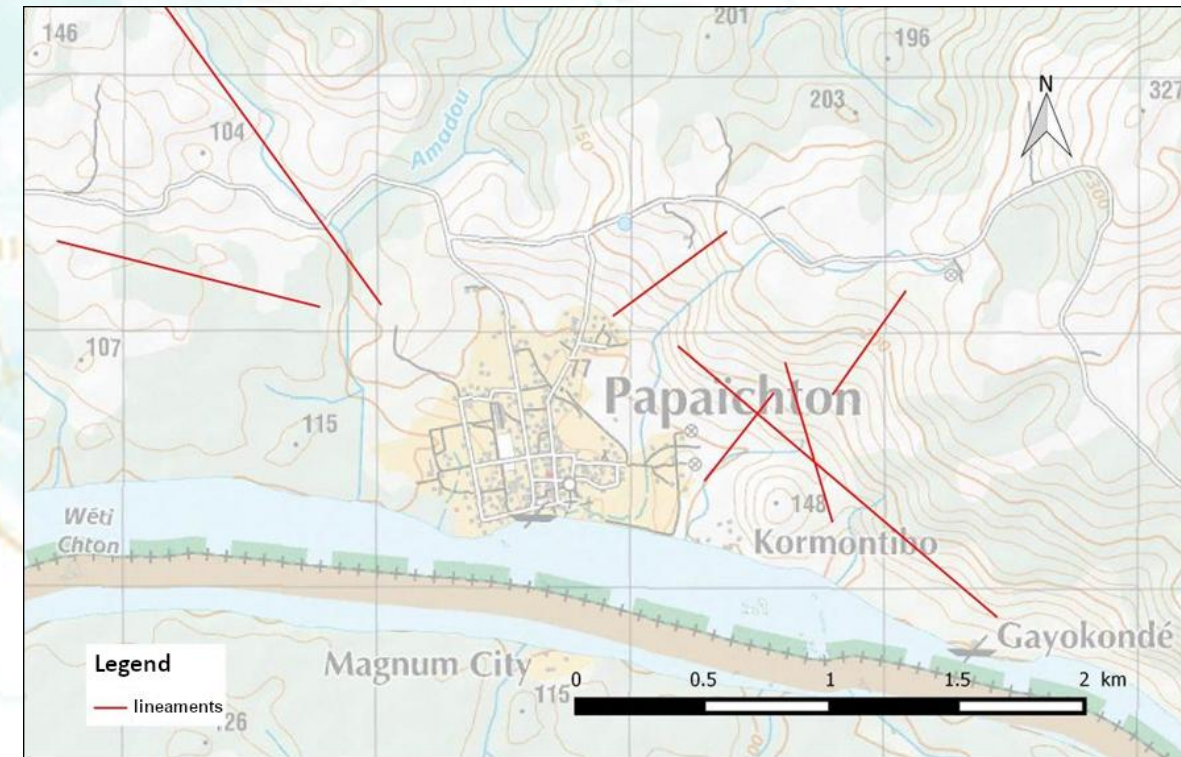
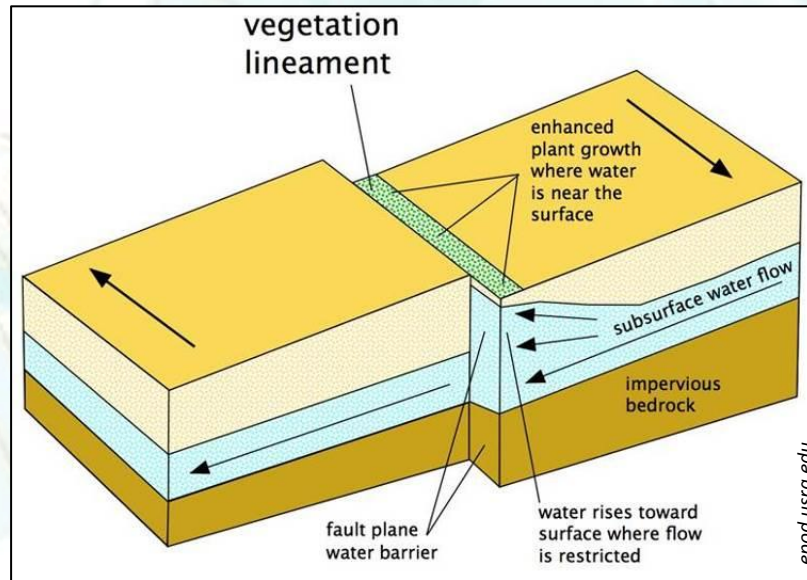
*Sandy-clay alterites*



*Metavolcanic rocks with two different lithologies*

# LINEAMENTS RESEARCH

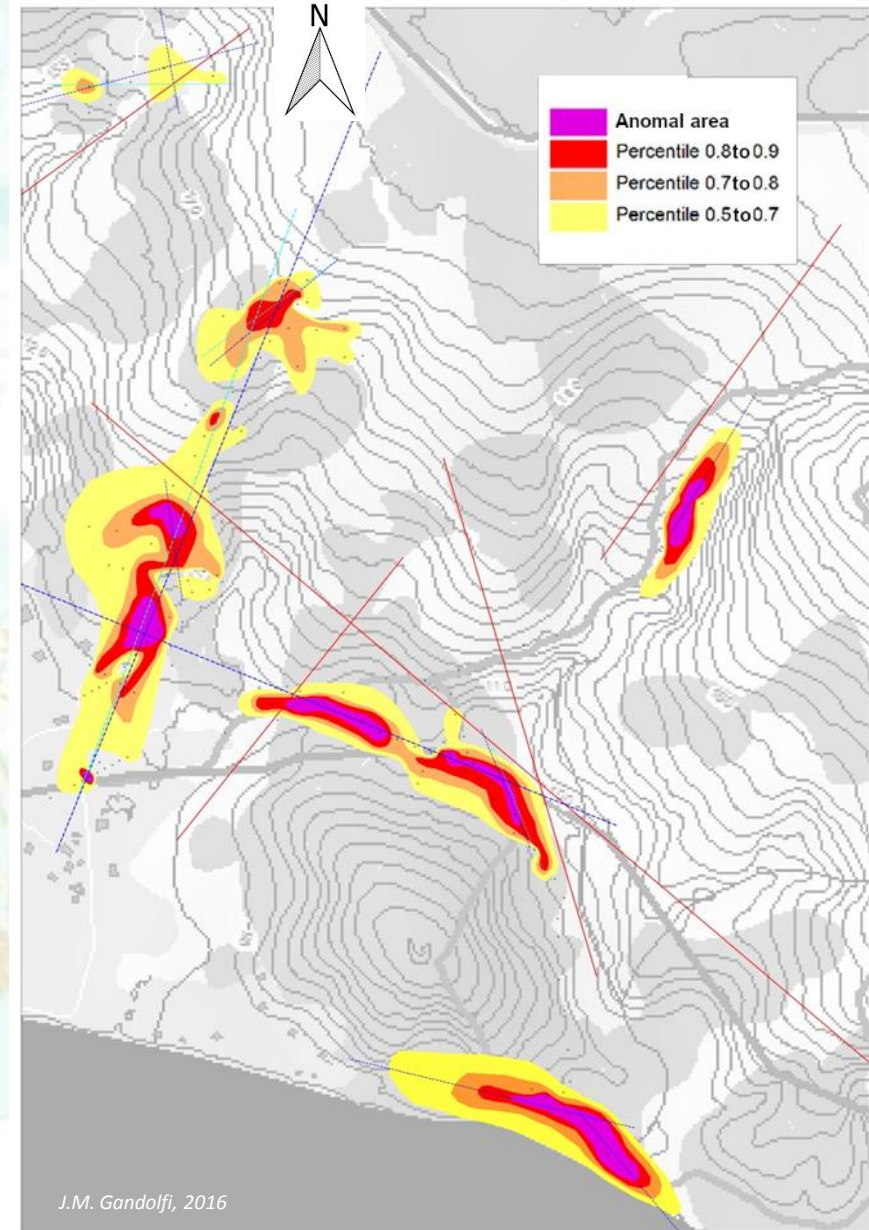
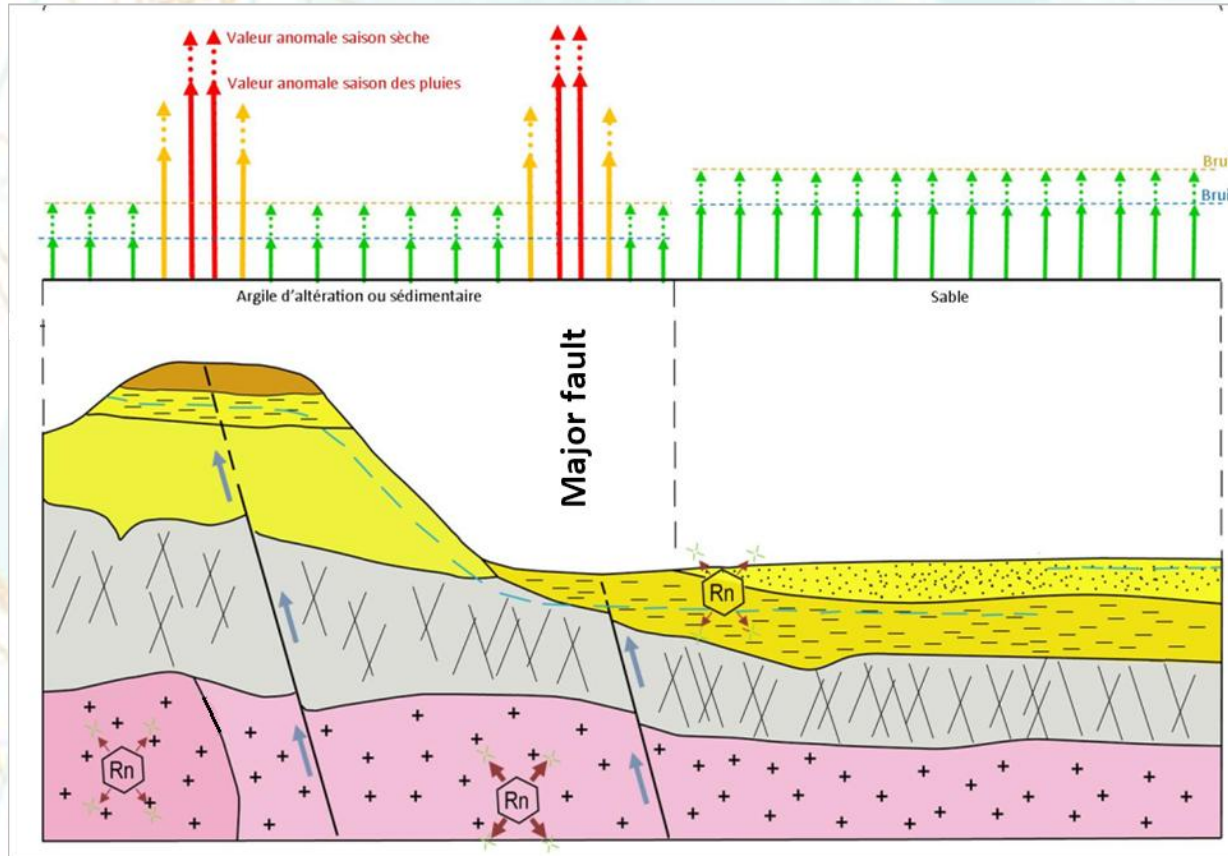
- Vegetation lineaments study by stereoscopy, based on old and recent aerial photographs
- The lines highlighted can reflect corridor faults





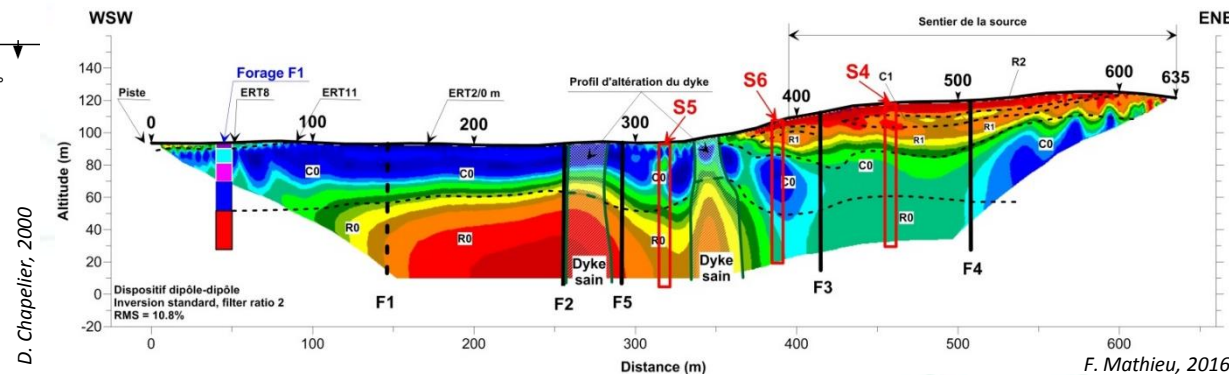
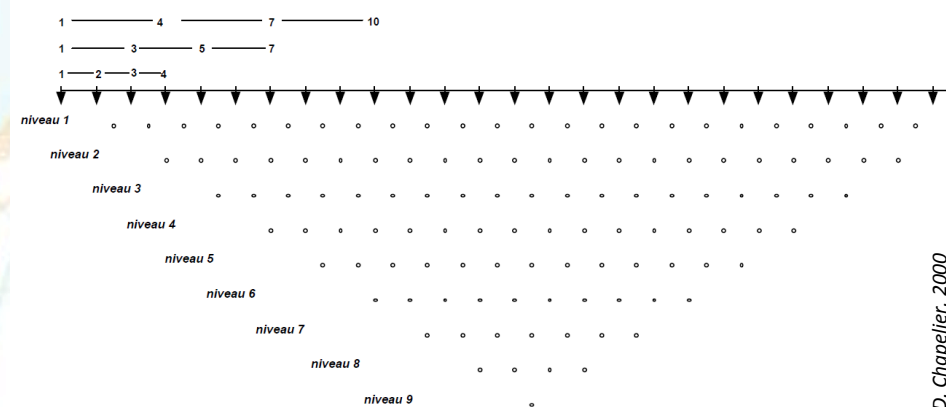
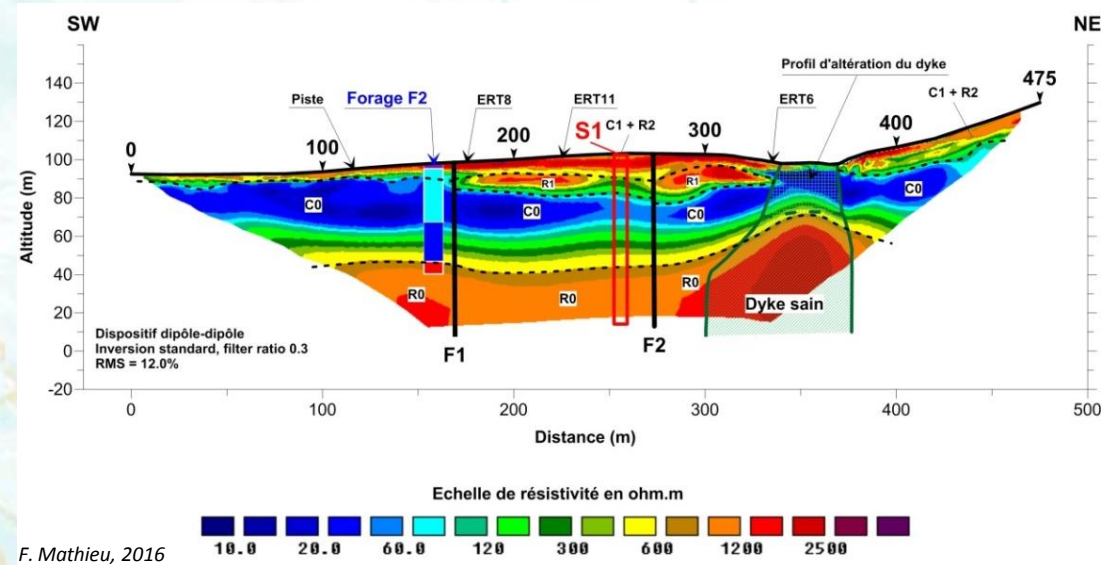
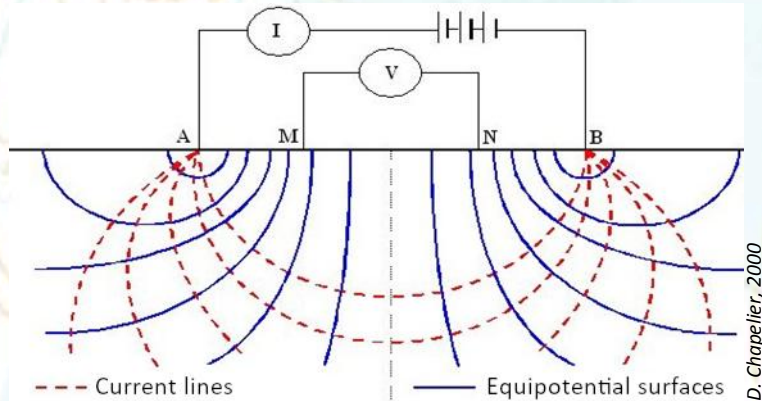
# RADON EMANOMETRY

- 202 gas samples from ground subsurface
- Zones with Radon anomalies can indicate draining structures and precise the location of the interesting areas



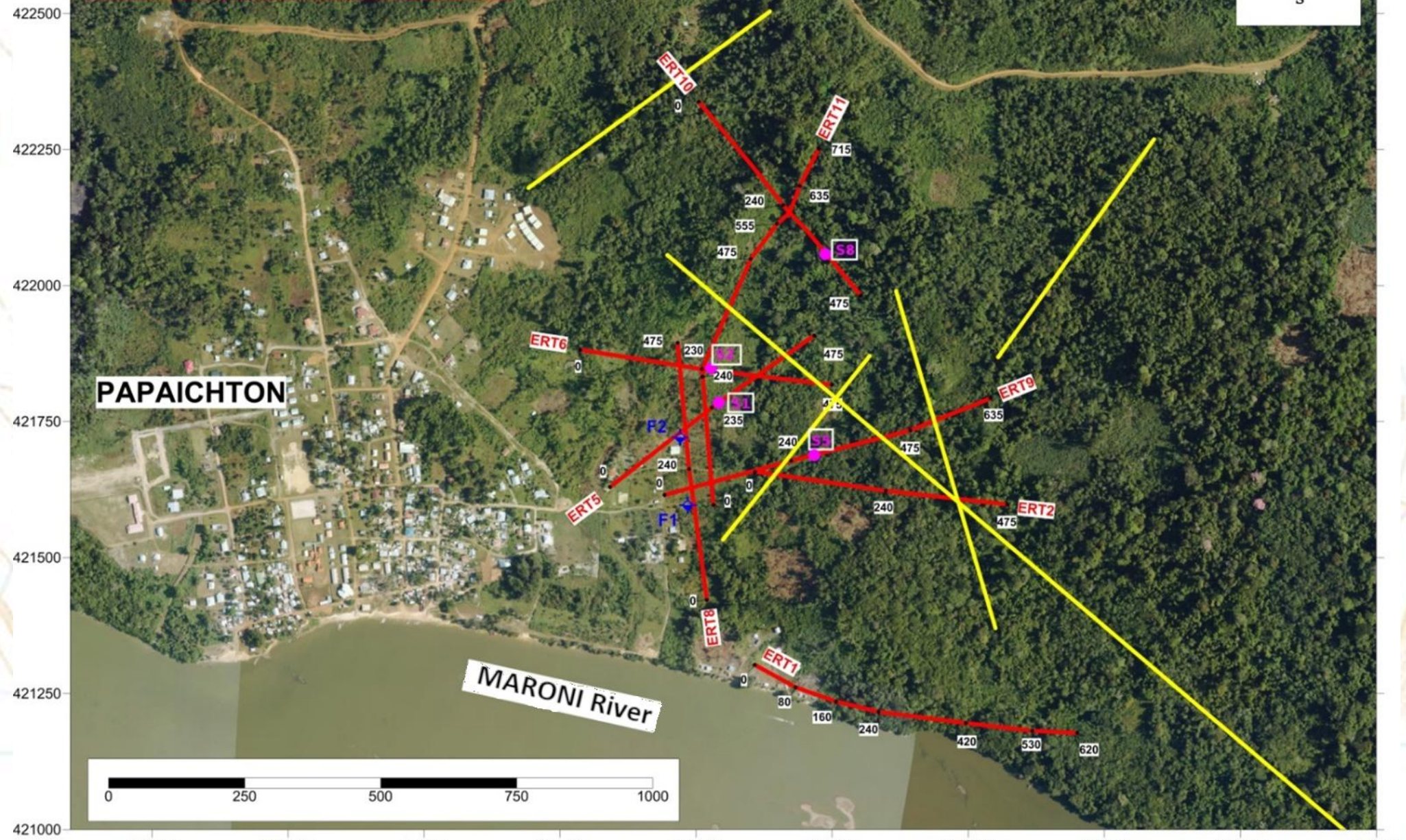
# ELECTRICAL RESISTIVITY TOMOGRAPHY

- 8 tomographies in 2D realized on 4345 linear meters
- Signal calibration on the existing wells
- Revelation of underground structures and hydrogeological targets → future drilling wells positioning



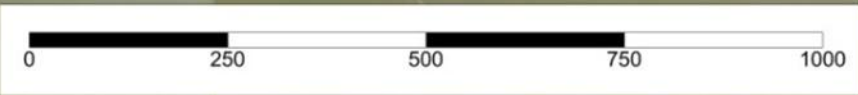


- F1 Existing well
- Photo lineament
- Electrical Resistivity Tomography
- Proposed borehole



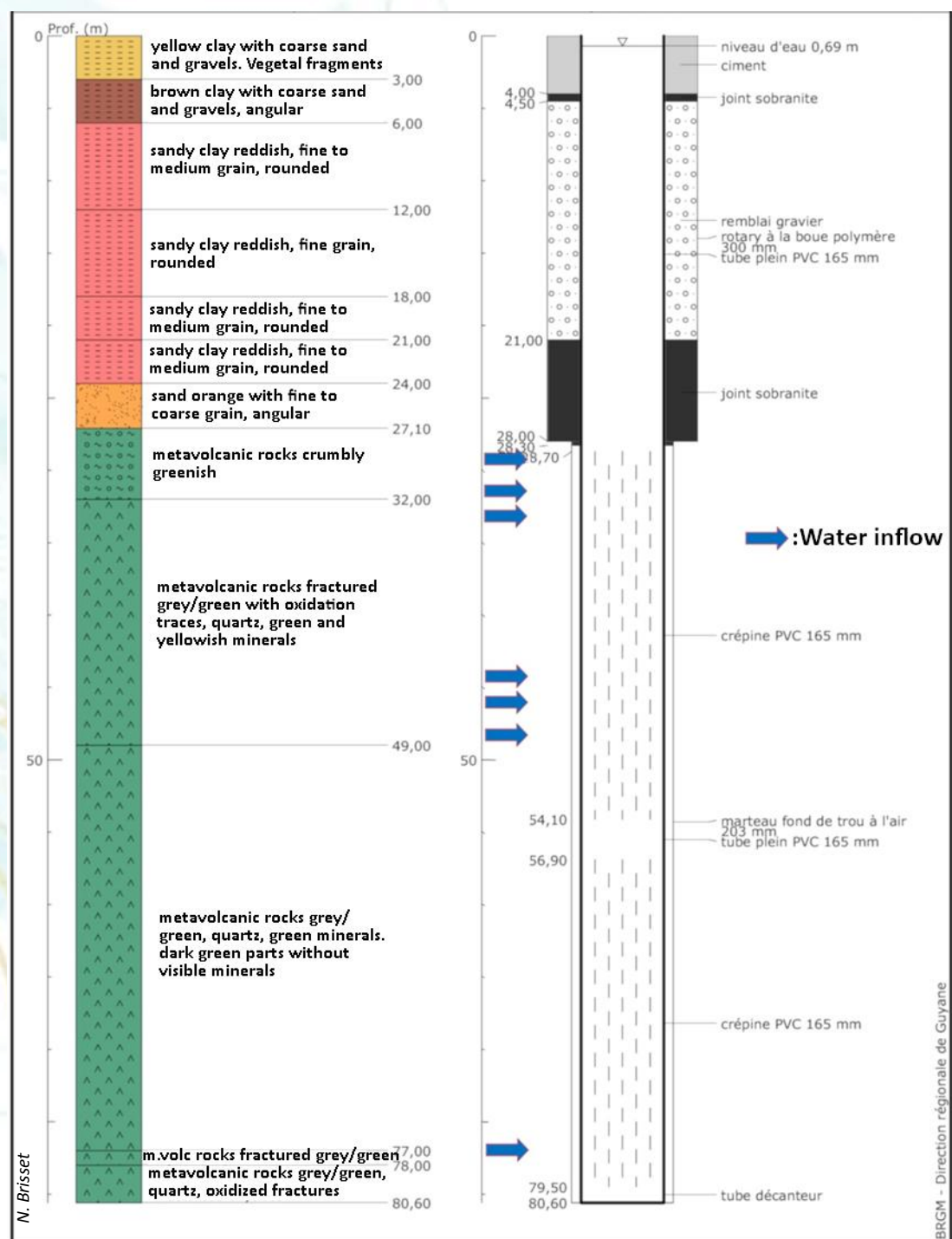
**PAPAÏCHTON**

**MARONI River**



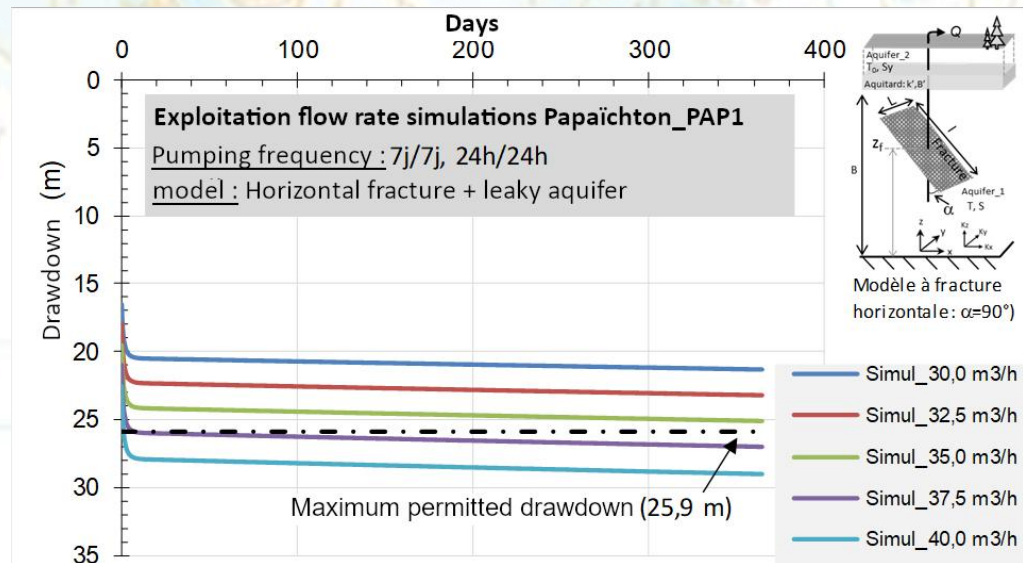
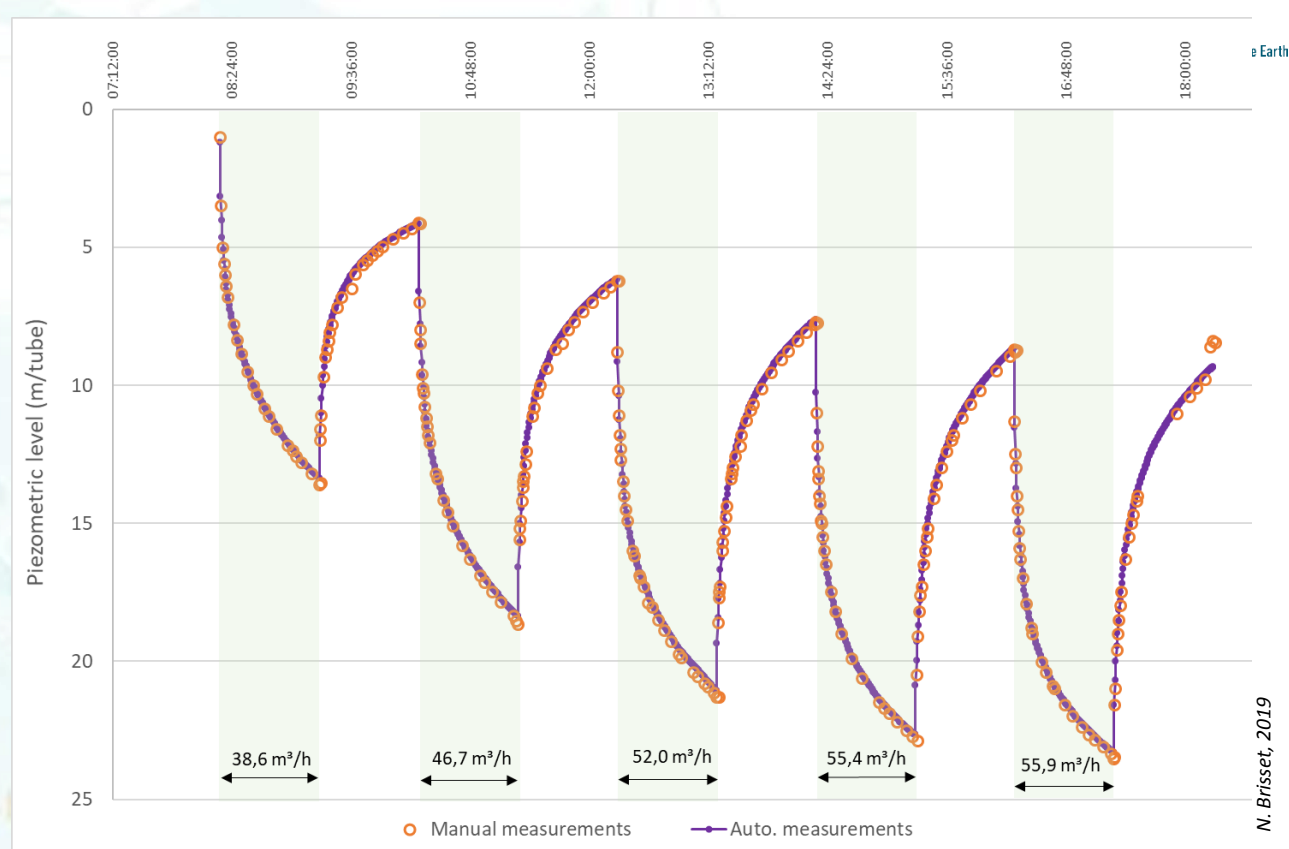
# DRILLING OPERATIONS

- Drilling equipment transport by pirogue on the Maroni river during the rain season
- 4 small-diameter exploration drill holes realized on the best hydrogeological targets to evaluate the potential at lower cost
- **2 water wells designed for the exploitation drilled near the two most productive boreholes**
- Pumping tests during the dry season



# AIR LIFT AND PUMPING TESTS

- **Double-column air lift** to avoid iron precipitations in the capturing chamber due to the oxygenation
- **Step-tests** to determine the critical flow rate and pressure losses
- Long-term pumping test (72 h), **interpretation with derived method**, and simulation with different flow rates to define the exploitation one



## CONCLUSION

- With security margin, the two operational boreholes can produce respectively **30 m<sup>3</sup>/h (actual record in hardrock aquifers for French Guiana)** and 5 m<sup>3</sup>/h
- Objectives of 12 m<sup>3</sup>/h largely exceeded
- Demonstration of the importance of groundwater resources in the **drinking water supply of isolated sites** in French Guiana in order **to meet the demographic and development challenges** of the territory
- This work shows how a **combination of prospection methods** enables to find interesting hydrogeological targets and productive wells in hard rock aquifers in Amazonian context

# Thank you for your attention !



*Artesianism on the PAP1 water well*