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Drinking water resources investigation in Papaïchton Village (French Guiana)

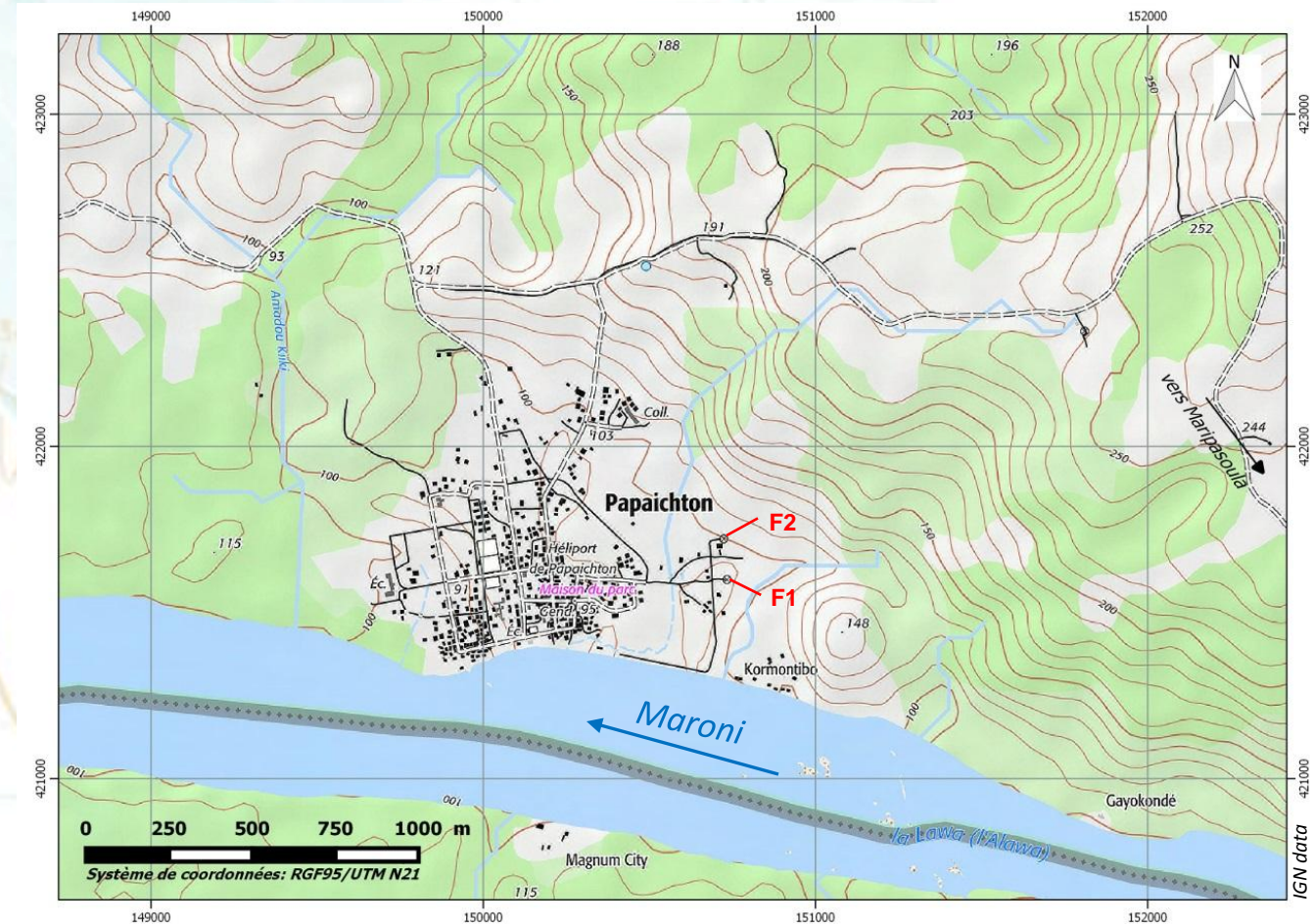
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27th September 2019



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



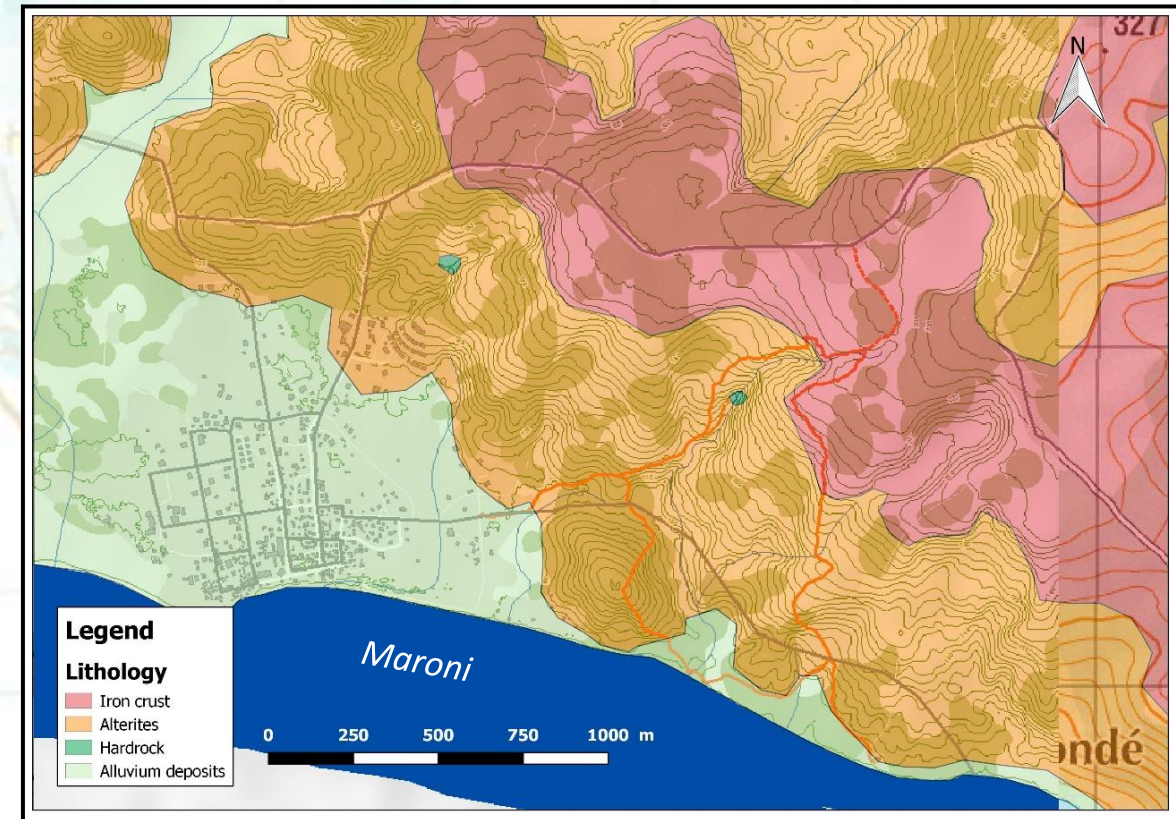
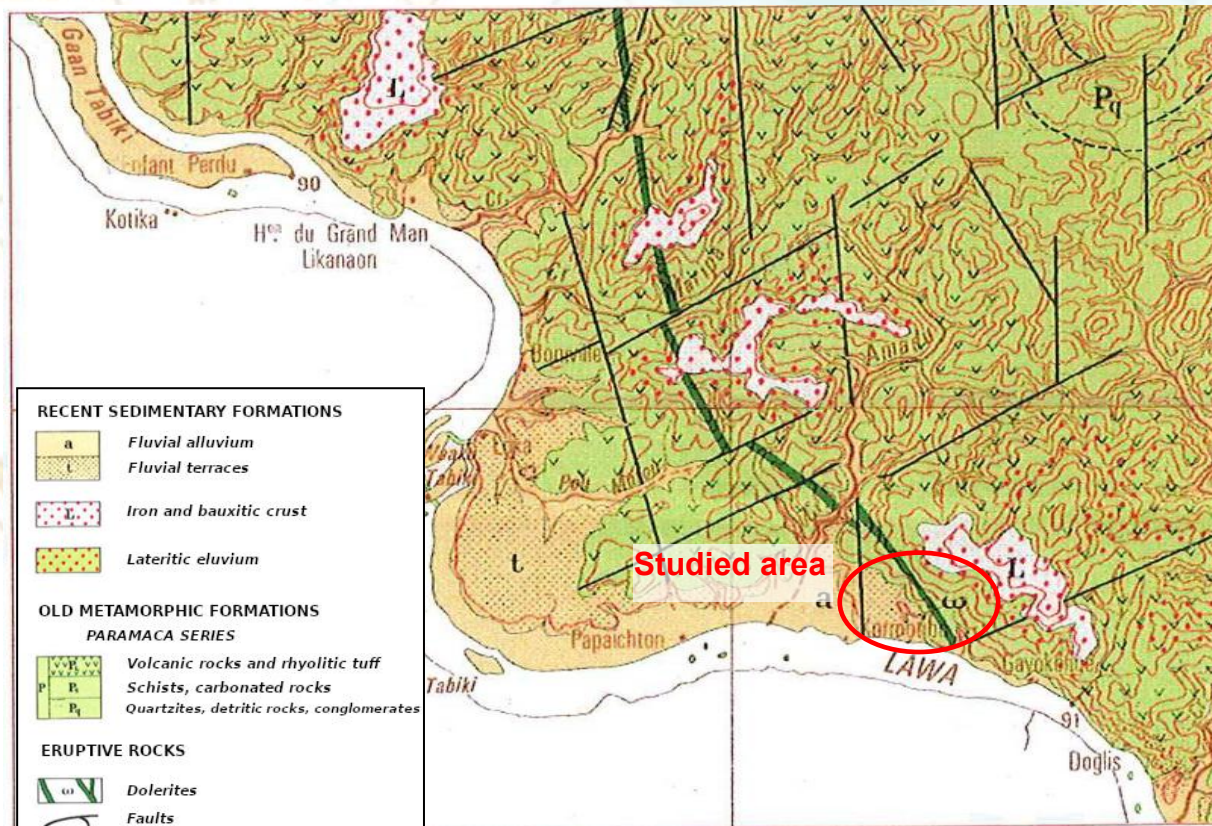
SOCIO-ECONOMIC CONTEXT

- Population around 3500 inhabitants with **demographic growth > 6 % per year**
- Local hospital, 2 primary schools and 1 secondary school
- Drinking water demand > 200 m³/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 m³/day**



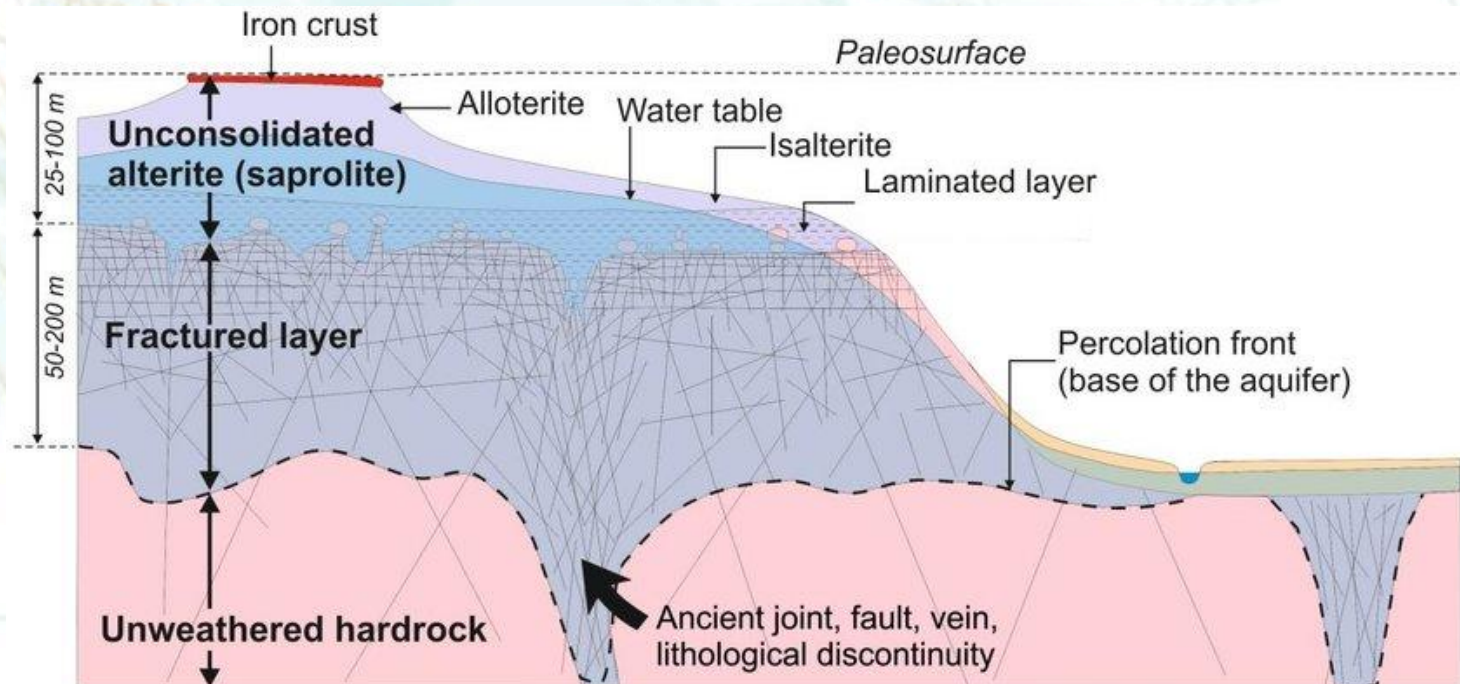
GEOLOGICAL CONTEXT

- Area mainly composed of old metavolcanic rocks and rhyolitic tuff (≈ 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 Papaïchtou area.
Production from 1 to 2 m³/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 m³/h in French Guiana
 - Alterite: in the sandier parts. Production from 0,8 to 2 m³/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



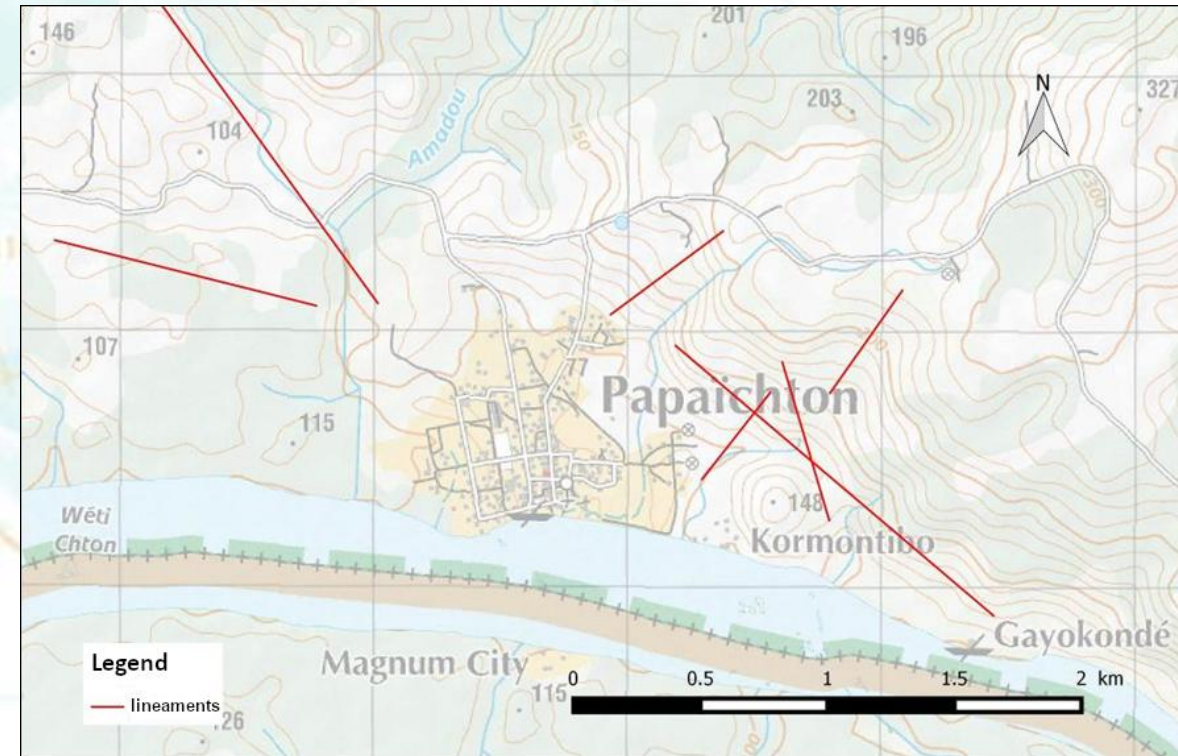
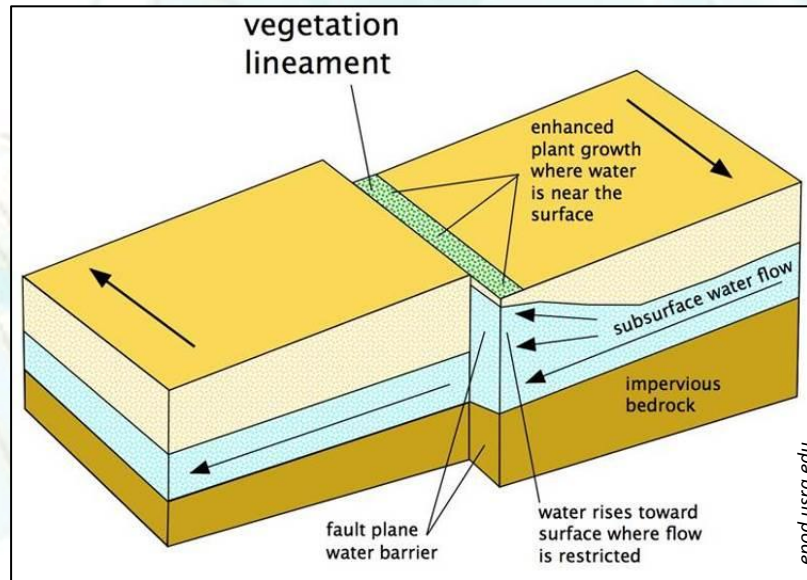
Sandy-clay alterites



Metavolcanic rocks with two different lithologies

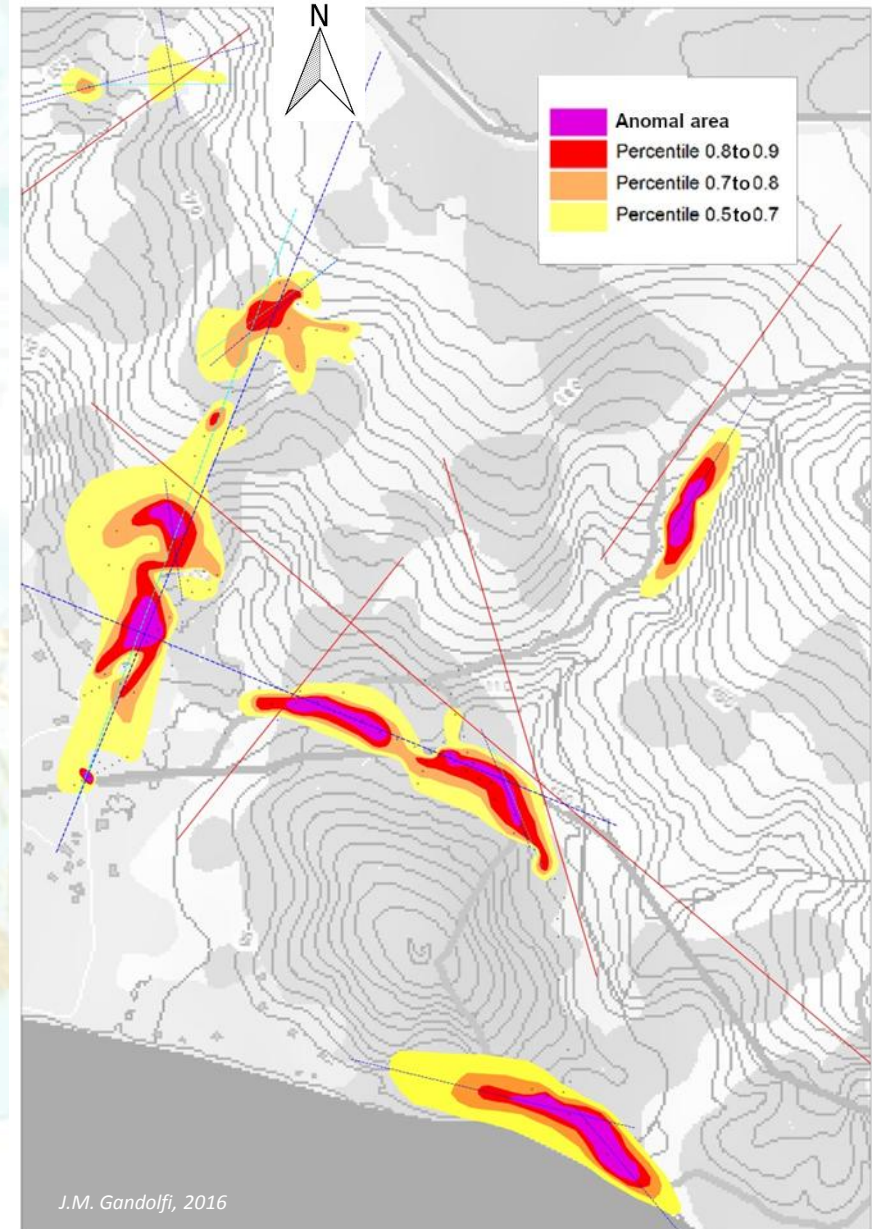
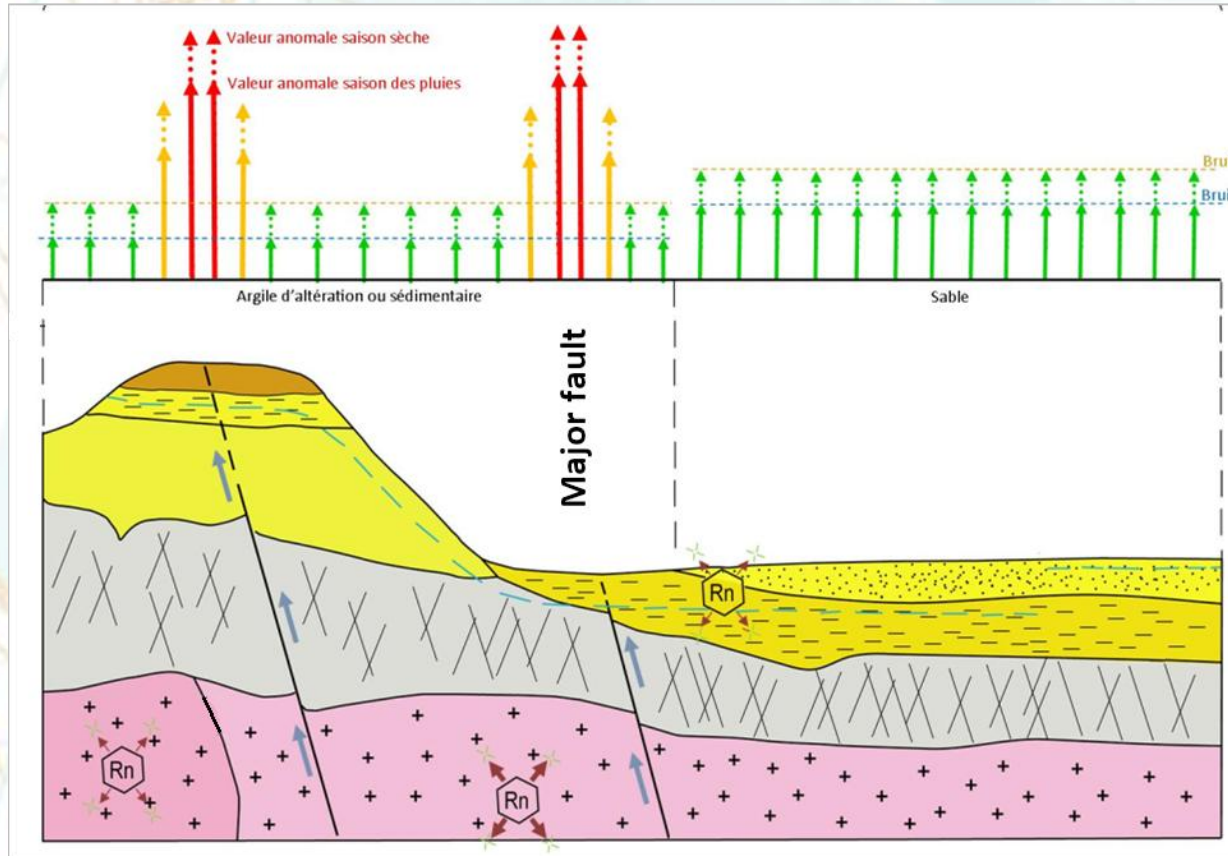
LINEAMENTS RESEARCH

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



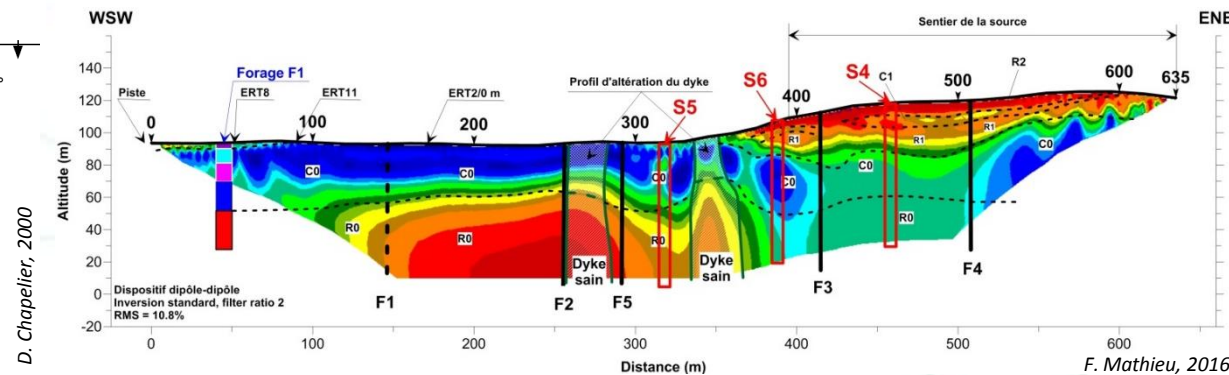
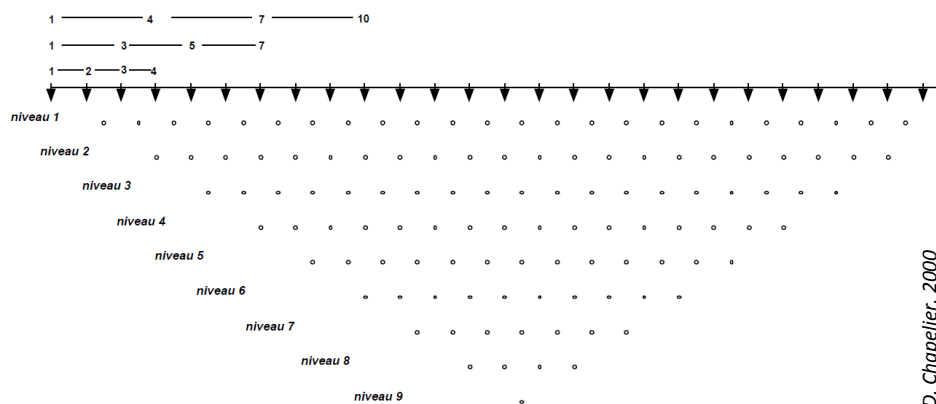
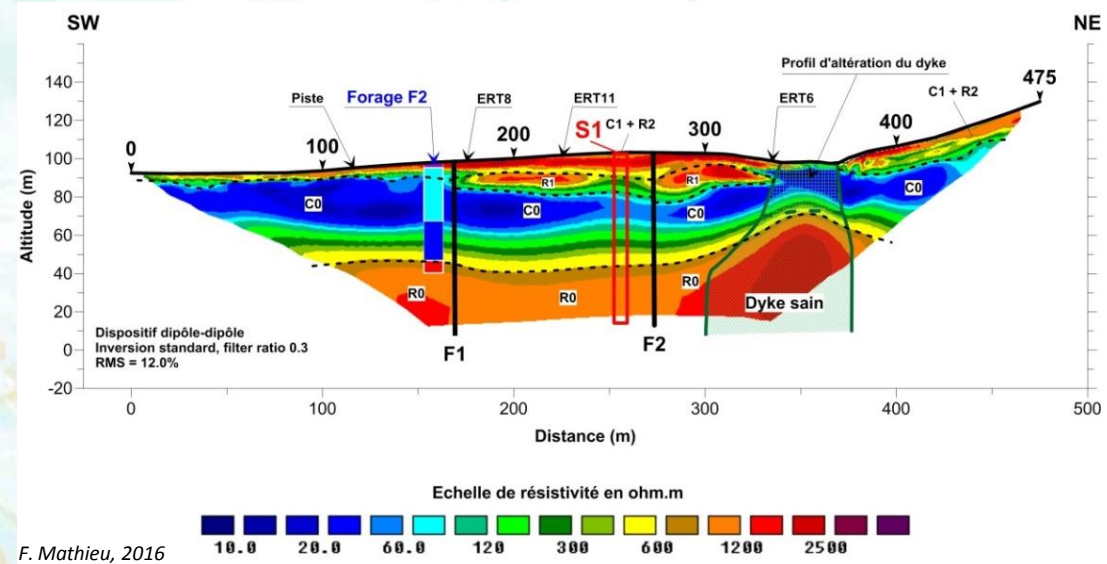
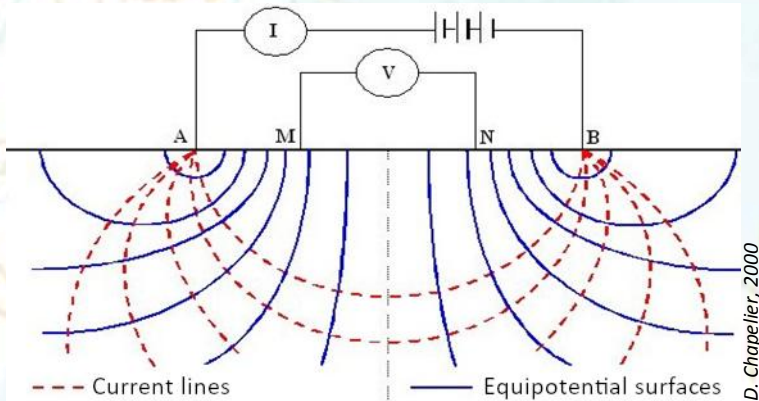
RADON EMANOMETRY

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



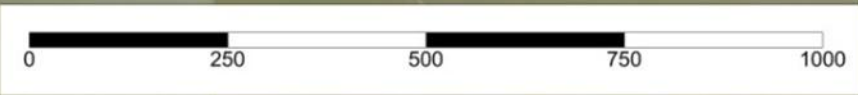
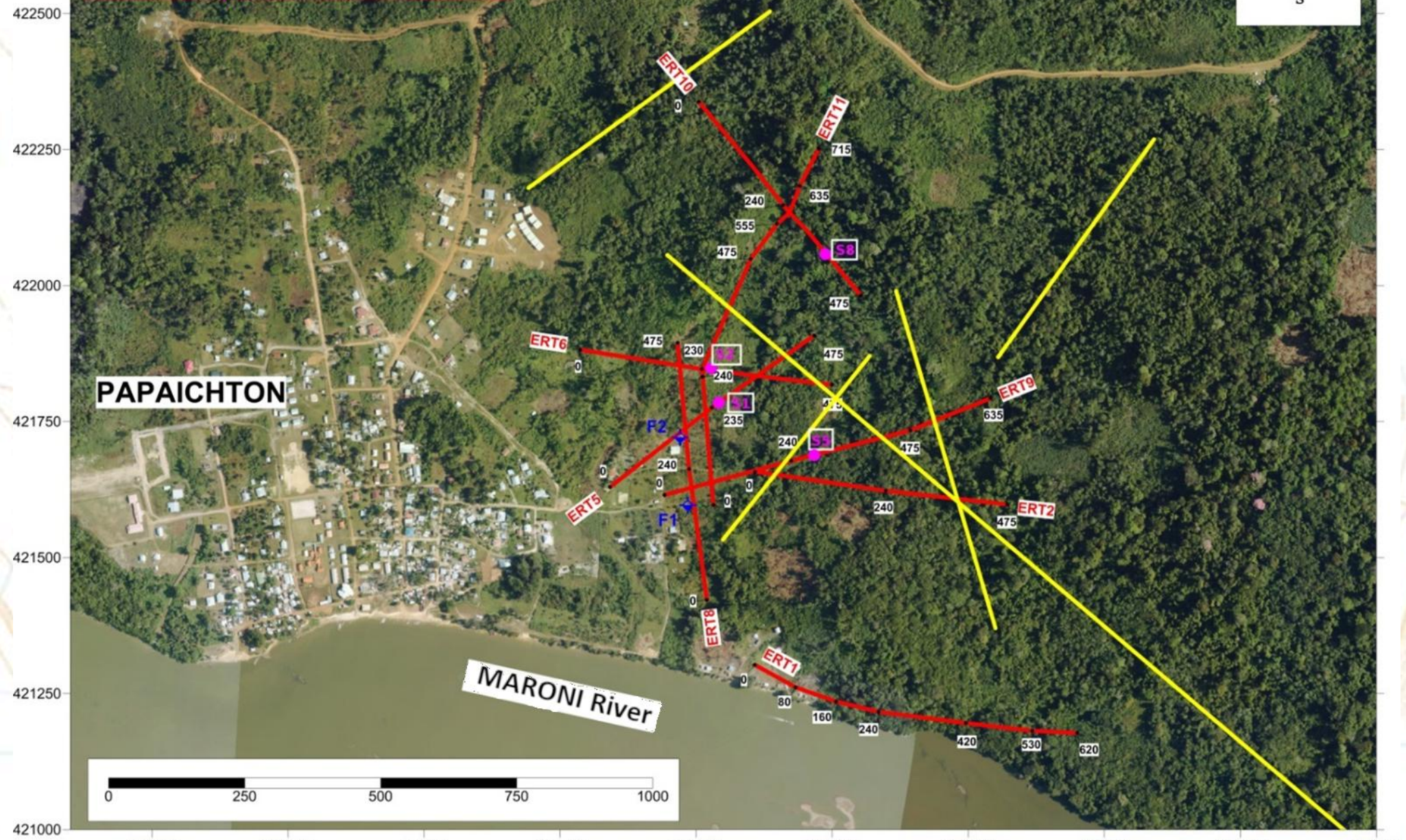
ELECTRICAL RESISTIVITY TOMOGRAPHY

- 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



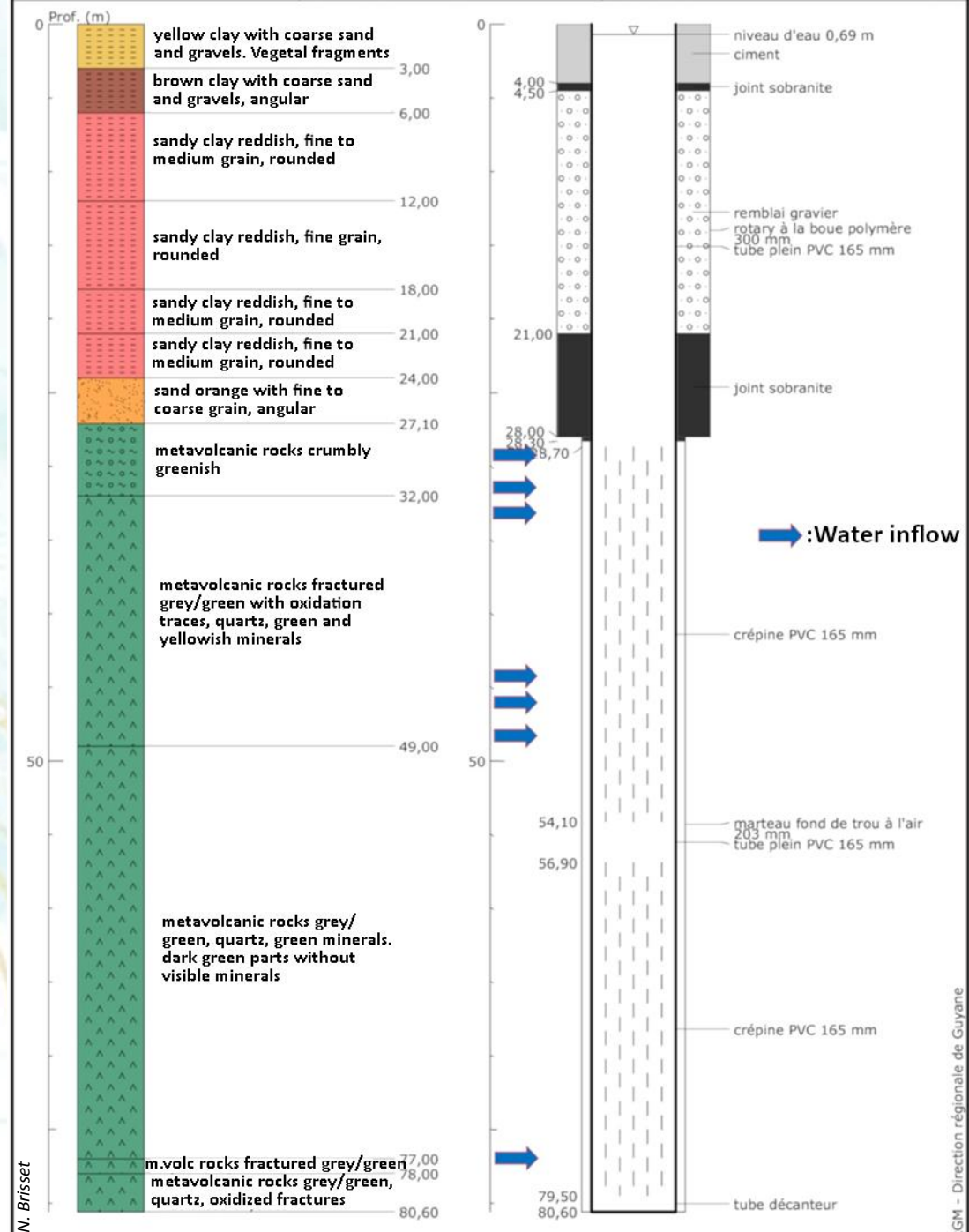


- F1 Existing well
- Photo lineament
- Electrical Resistivity Tomography
- Proposed borehole



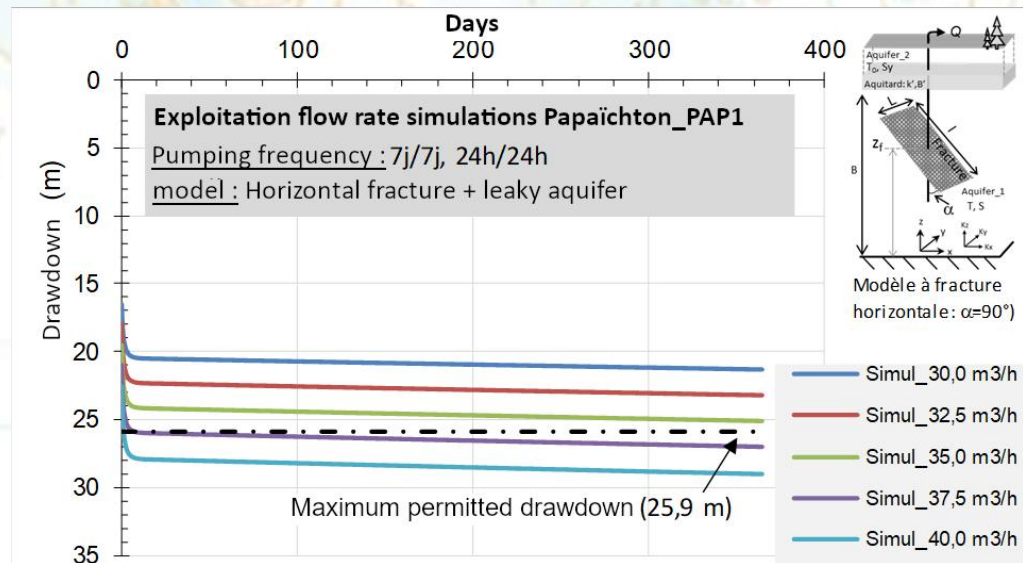
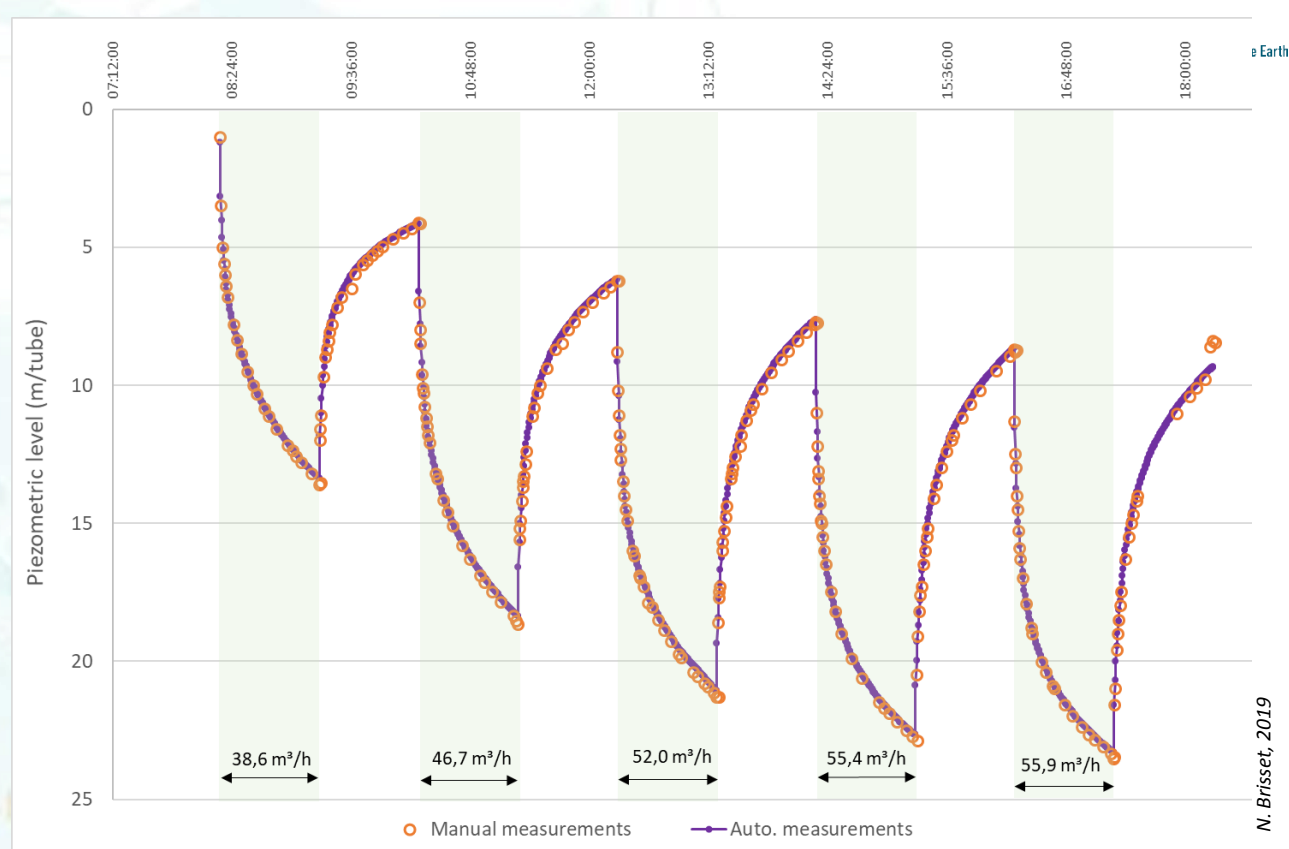
DRILLING OPERATIONS

- 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 m³/h (actual record in hardrock aquifers for French Guiana)** and 5 m³/h
- Objectives of 12 m³/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