UNIVERSITE D'ANTANANARIVO

GQ 2019

10th International Groundwater Quality Conference

9-12 September 2019, Liege (Belgium)

http://aimontefiore.org/GQ2019

UNIVERSITE DE YAOUNDE I

ASSESSMENT OF WATER QUALITY IN SEMI-ARID ZONE: CASE OF VOHIBORY IN SOUTH WEST OF MADAGASCAR

Rakotondrabe Felaniaina[*1-2]; Ndam Ngoupayou Jules Remy[1]; Rasolomanana Eddy Harilala[2]; Mfonka Zakari[1-2] ;
Zafimakason François Smalah[3]; Ralaimaro Joseph[2]

[1]Department of Earth Sciences, Faculty of Science, University of Yaoundé 1,

[2]Department of Mines, Advanced School of Engineering of Antananarivo, University of Antananarivo

[3]Department of Earth Sciences, Faculty of Science, University of Toliara

* Corresponding author : E-mail : felaniaina_rak@yahoo.fr

INTRODUCTION

Madagascar has an abundant water resource, however its distribution varies considerably from one region to another and according to climatic and edaphic conditions.
The eastern and central parts are the most watered regions as opposed to the southern part which is rather arid (**Ohba et al., 2016**).The locality of Vohibory which serves as the study area is located in South-West of Madagascar. It is one of the areas most affected by the lack of water and is highly vulnerable to chronic drought. However, this locality has significant mining potential, like gold deposits, which are currently under intense artisanal exploitation (**Tucker et al., 2014**).
Therefore, this study has been designed to assess the water quality of Vohibory in relation to mining exploitation.

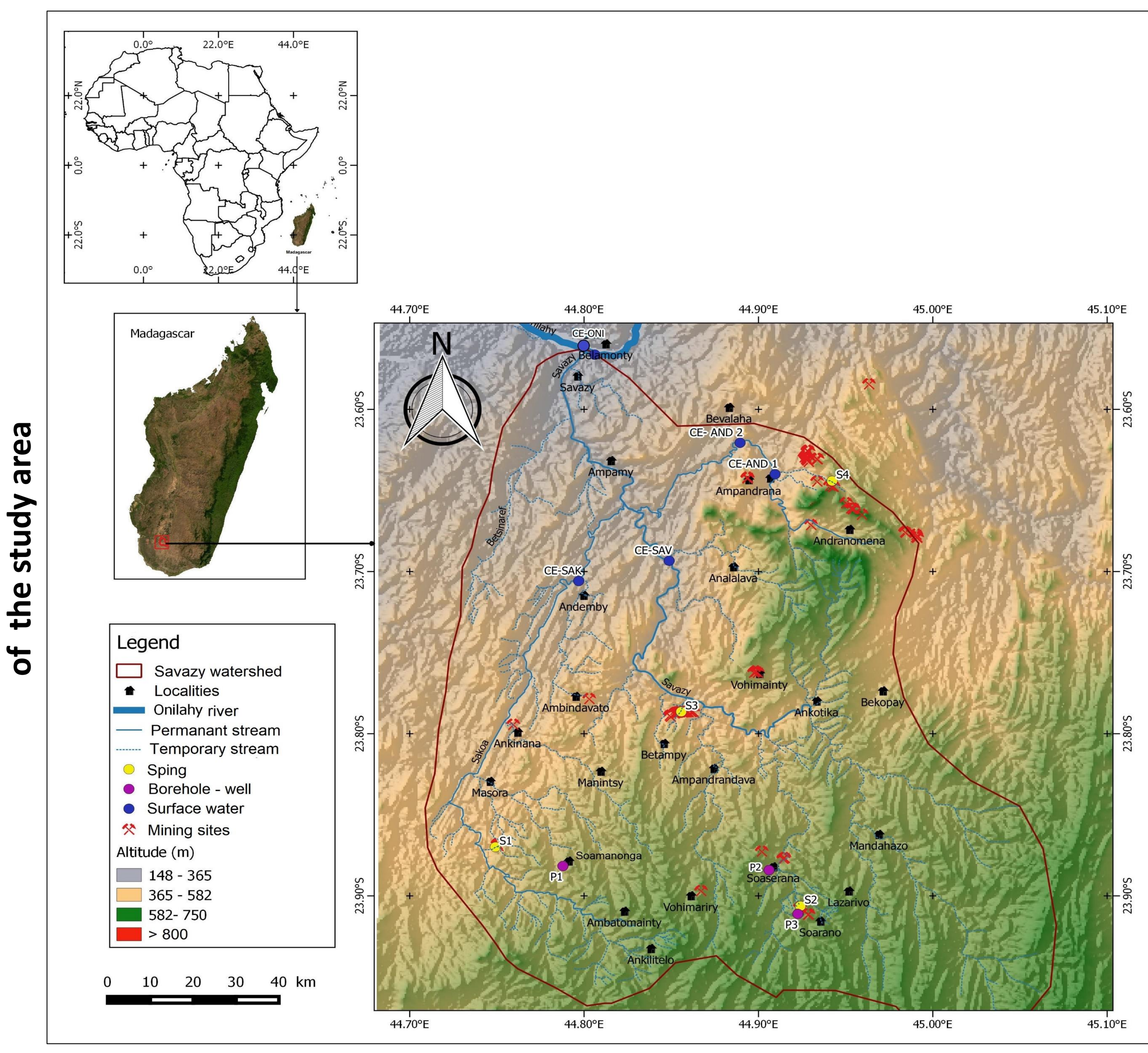

Fig. 1 The selected ground and surface water sampling points of the study area

MATERIALS AND METHODS

1. Field works

- Identification of mining sites and other human activities
- Socio-economic survey
- Water sampling (surface water, groundwater)
- Measurement of physical parameter in situ (pH, T, EC)

2. Laboratory works

- Measurement of physical parameter (pH, T, EC, TSS, Turbidity, Hardness)
- Major anion analysis (Na, Ca, Mg , K, NH4, HCO3, Cl, SO4, PO4, NO3) by visible Spectrometer
- Trace element analysis Pb, Cd, Cu, Mn, Zn, Fe by ICP-MS

3. Data management

- Standard method of hydrochemistry (Diagram software)
- Water Quality Index (WQI)
- Multivariate statistical analysis

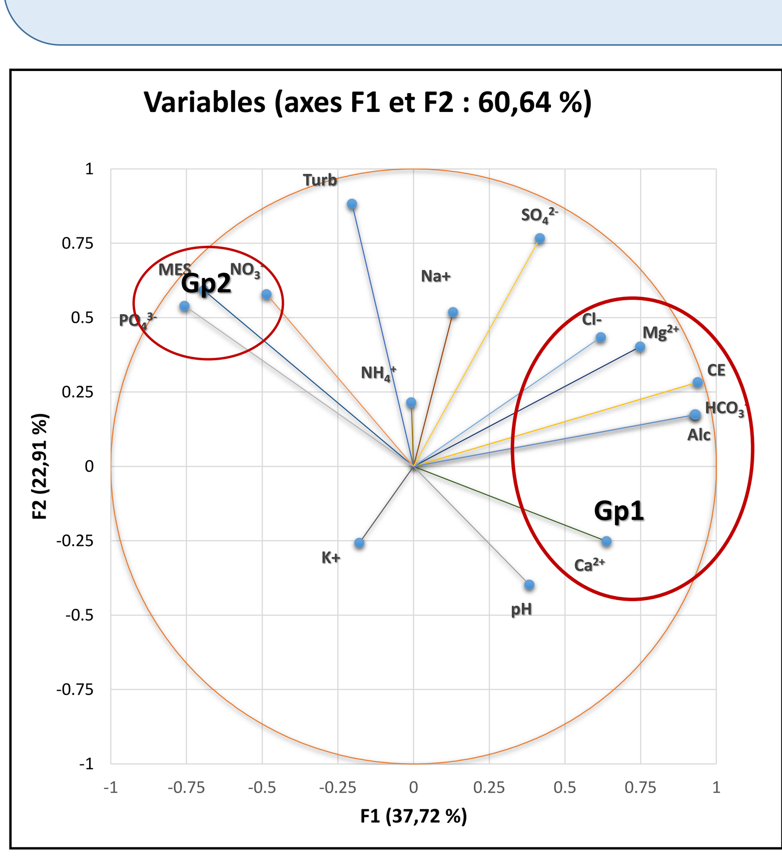

Fig.4. Principal Component Analysis (PCA) for major elements, physical parameters

- **Gp 1** indicated the global mineralization of water that is natural or geogenic origin.
- **Gp 2** mark by nitrate, phosphate and TSS. This group indicates a strong anthropogenic contribution. It reflects the importance of domestic, agricultural and mining inputs

Acknowledgements : This write up constitutes part of data generated during the Ph.D study of the corresponding author. The authors are very thanked to **UNESCO** Section on Groundwater Systems and Settlements Natural Sciences Sector to have financed this travel.

RESULTS AND DISCUSSIONS

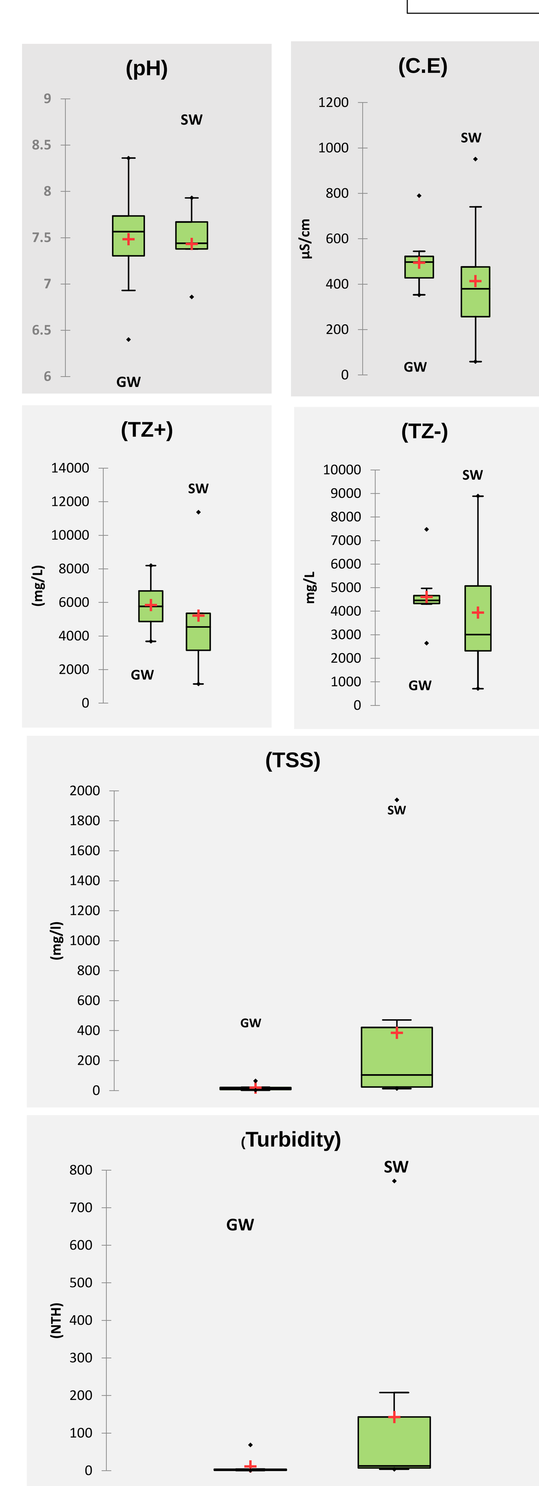

Fig. 2. Box plots of the main hydrochemical parameters of groundwater (GW) and surface water (SW)

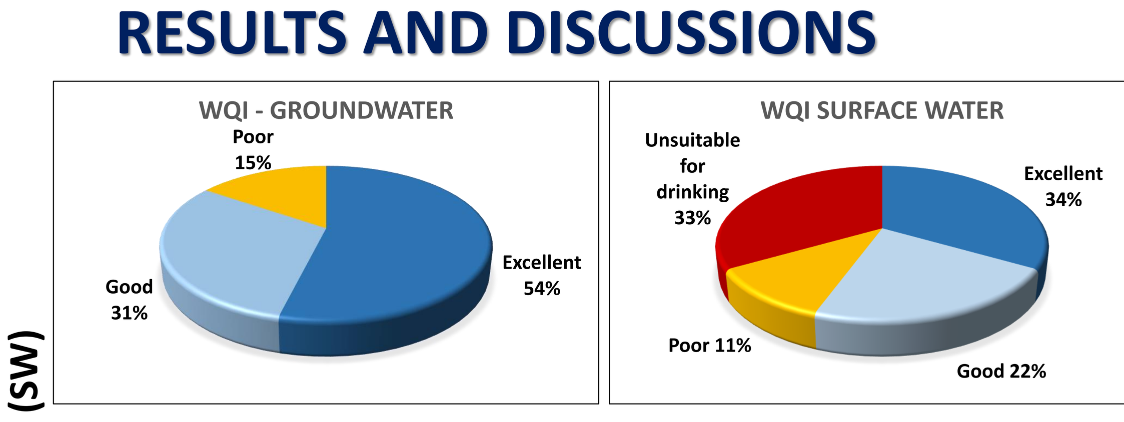

Fig.5. Graphical data representation of WQI in Vohibory

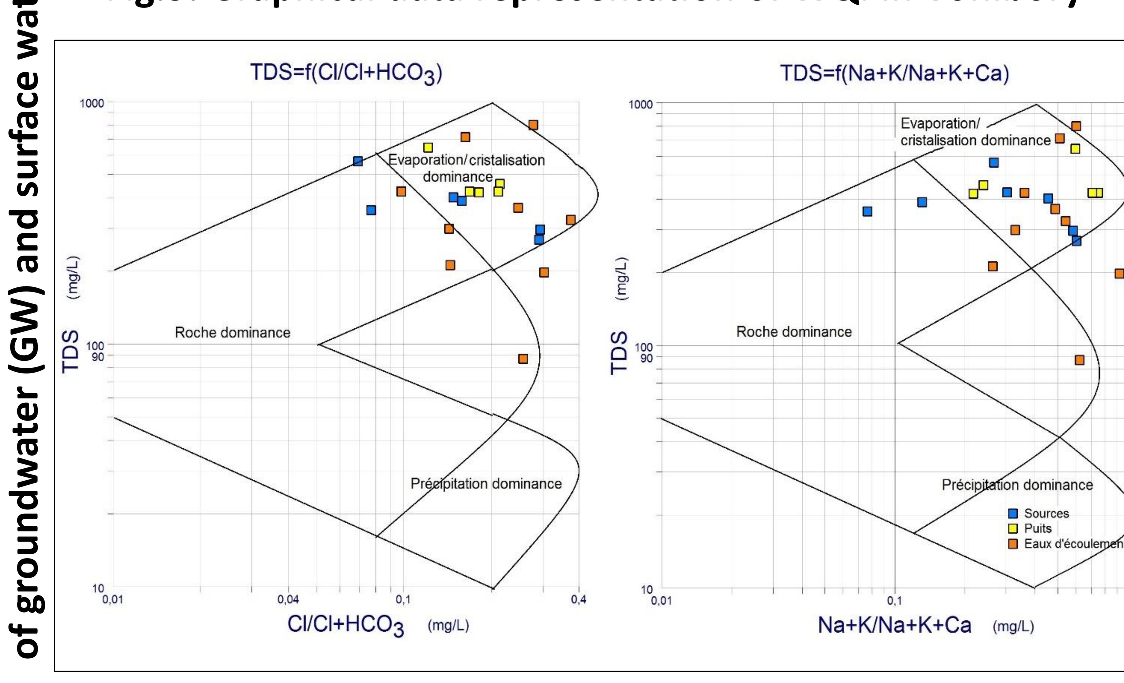

Fig.6. Major natural processes controlling water chemistry in Vohibory adapted from Gibbs (1970).

Table 1. Metal level in surface water and groundwater

	S2	P1	Oni	WHO (mg/L)
Pb	0,433	0,399	0,318	0,01
Cd	-	-	-	0,003
Cu	-	-	-	2
Zn	-	-	-	3
Mn	-	-	-	0,4
Fe	0,26	-	1,5	0, 3

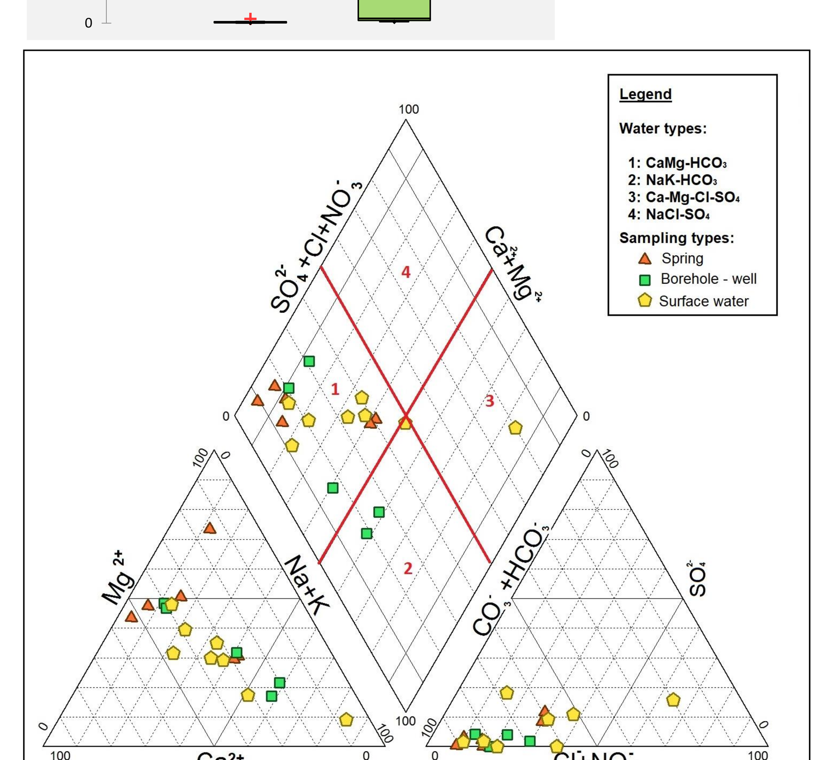

Fig.3. Piper diagramme (Piper, 1944)

Two main water types has been identified:

- CaMg-HCO3 (85%)
- Na-K-HCO3 (5%).

The predominance of CaMg-HCO3 is in agreement with studies several authors who have worked in the same geological environments in Africa and elsewhere in the world (crystalline basement). These water types come from dissolving minerals. The other type, representing 5% suggest contamination of the water by anthropogenic factors

CONCLUSION

- Vohibory waters are neutral to basic (6,86 ≥pH ≥8,36) with very low to hight mineralization;
- The major element are below the WHO drinking standard with exception for NO3 which show high concentrations in some wells and surface water;
- Some trace metals such as Fe and Pb are also identified in some surface and groundwater with levels above WHO standards for water intended for human consumption;
- The WQI shows that the surface water are more polluted than groundwater;
- Several environmental factors control the quality of water in Vohibory: the diversity of lithologeology (crystalline basement and sedimentary) , climate, vegetation and human activities