Comparing the discriminating power of contrasted sediment tracing techniques to quantify the impact of nickel mining on river and lagoon siltation in New Caledonia

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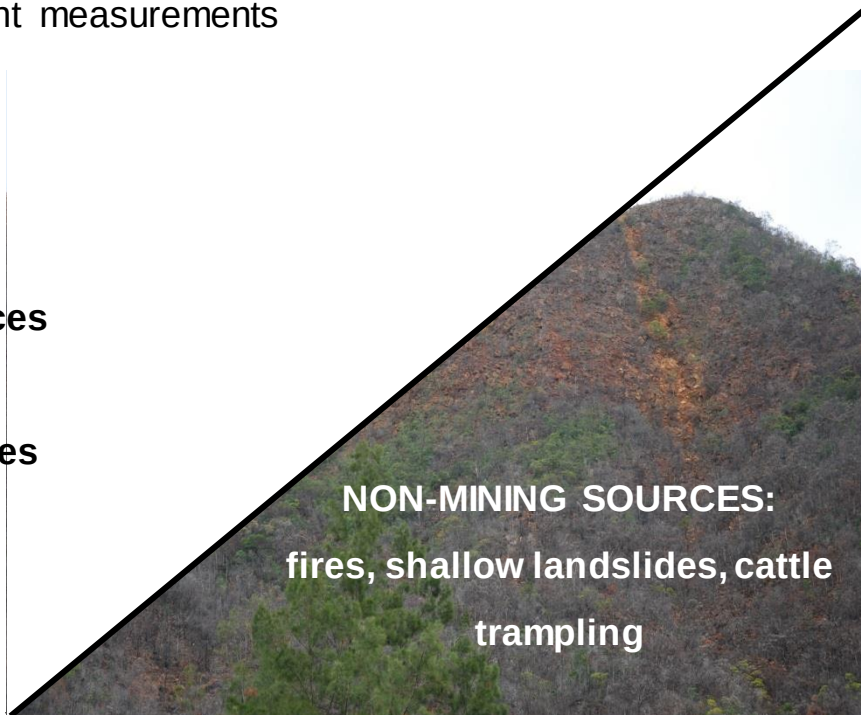
- Open-cast mining in operation since 1880s
- Strong increase in **soil erosion** and **sediment transfer** in river systems leading to **the island's ecosystem degradation** (*e.g.* flooding, water pollution)
- Two sediment sources : **Mining sources** & **Non-mining sources**
- Need to estimate the contributions of suspended sediment to guide the implementation of efficient management measurements

Objectives

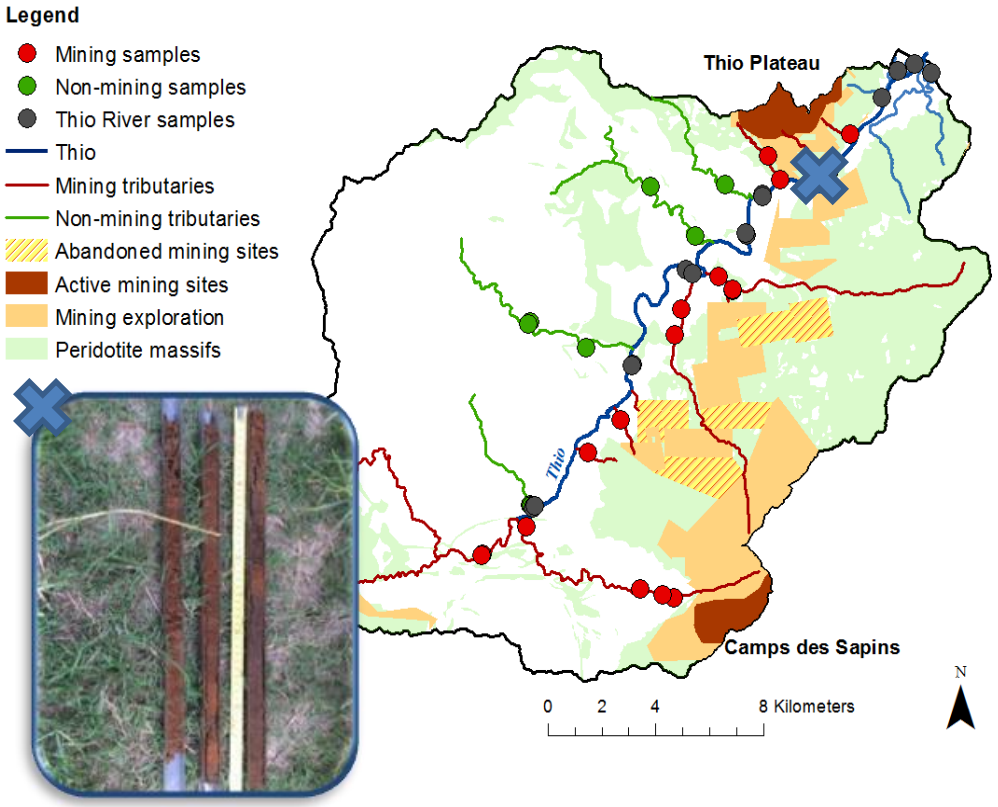
(1) Quantify the ongoing contributions of sediment sources

(2) Reconstruct the temporal changes of sediment sources



Thio River catchment (397 km²), one of the first areas exploited for nickel mining

(1) Lag deposits collected following the 'tributary tracing approach' (Laceby et al., 2017)



- 2015 : Overbank flood by a tropical depression
- 2017 : Overbank flood by Cyclone Cook
- Sediment core in 2016

(2) Select the optimal sediment fingerprinting method(s) among

5 conventional sediment fingerprinting methods :

- Fallout radionuclides (^{137}Cs, $^{210}Pb_{xs}$)
- Geogenic radionuclides (Th, U, K)
- Elemental Geochemistry
- Colour parameters
- Elemental Geochemistry + colour parameters

Reliability of the models
=
Test on artificial mixture samples

One alternative sediment fingerprintingmethod

- Visilble spectrum (PLS regression model)

Results

Fallout radionuclides : **low activities** in mining and non-mining sources

Geogenic radionuclides

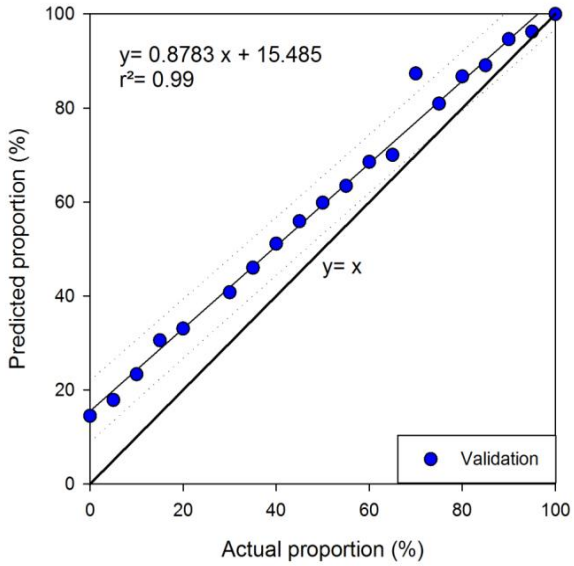
Elemental Geochemistry

Colour parameters : Not provide satisfactory source discrimination

Elemental geochemistry + colour parameters

Visible spectrum : Not provide satisfactory source discrimination

Elemental Geochemistry



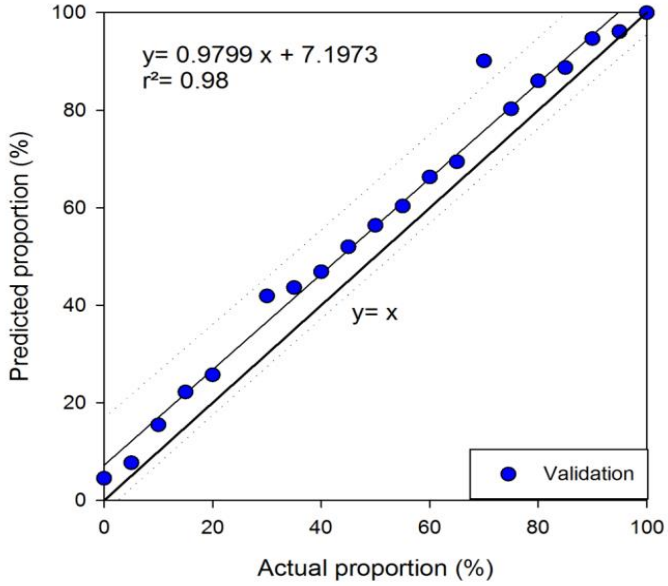
83% of variance explained

15% overestimation of mining sources

Elemental geochemistry + colour parameters

93% of variance explained

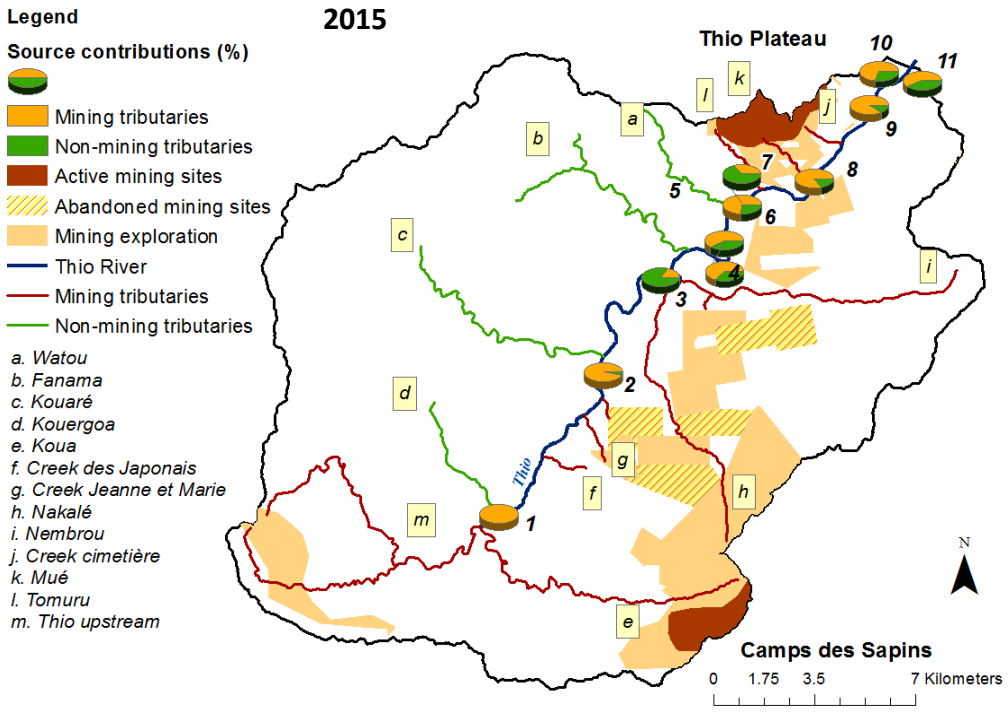
7% overestimation of mining sources



Results

Recent overbank floods 2015-2017

Elemental geochemistry + colour parameters



68 ± 25 % of the Thio River sediment originating from mining sources for the 2015 flood event

88 ± 8% for the 2017 flood event

74 ± 13% in the sediment core

Sediment core

Elemental Geochemistry

Colour parameters are not conservative