# PLATINUM-GROUP ELEMENT CONCENTRATIONS IN TROPICAL LAKE SEDIMENTS IN THE EXPLORATION FOR NICKEL LATERITE DEPOSITS

Gabriela Y. Ramirez, Marek Locmelis, Jonathan Obrist-Farner

Department of Geosciences and Geological and Petroleum Engineering, Missouri University of Science and Technology, Rolla, Missouri, 65409

## Introduction

- The development of reliable geochemical indicators to guide mineral exploration is the long standing goal of ore deposits research. This particularly applies to tropical regions that are heavily vegetated and weathered, which hampers boots-on-the ground exploration.
- Here we present the results of an ongoing study that investigates usefulness of platinum-group element (PGE: Pt, Pl, Os, Ir, Ru, Rh) chemistry in tropical lake sediments from Lake Izabal, Guatemala.

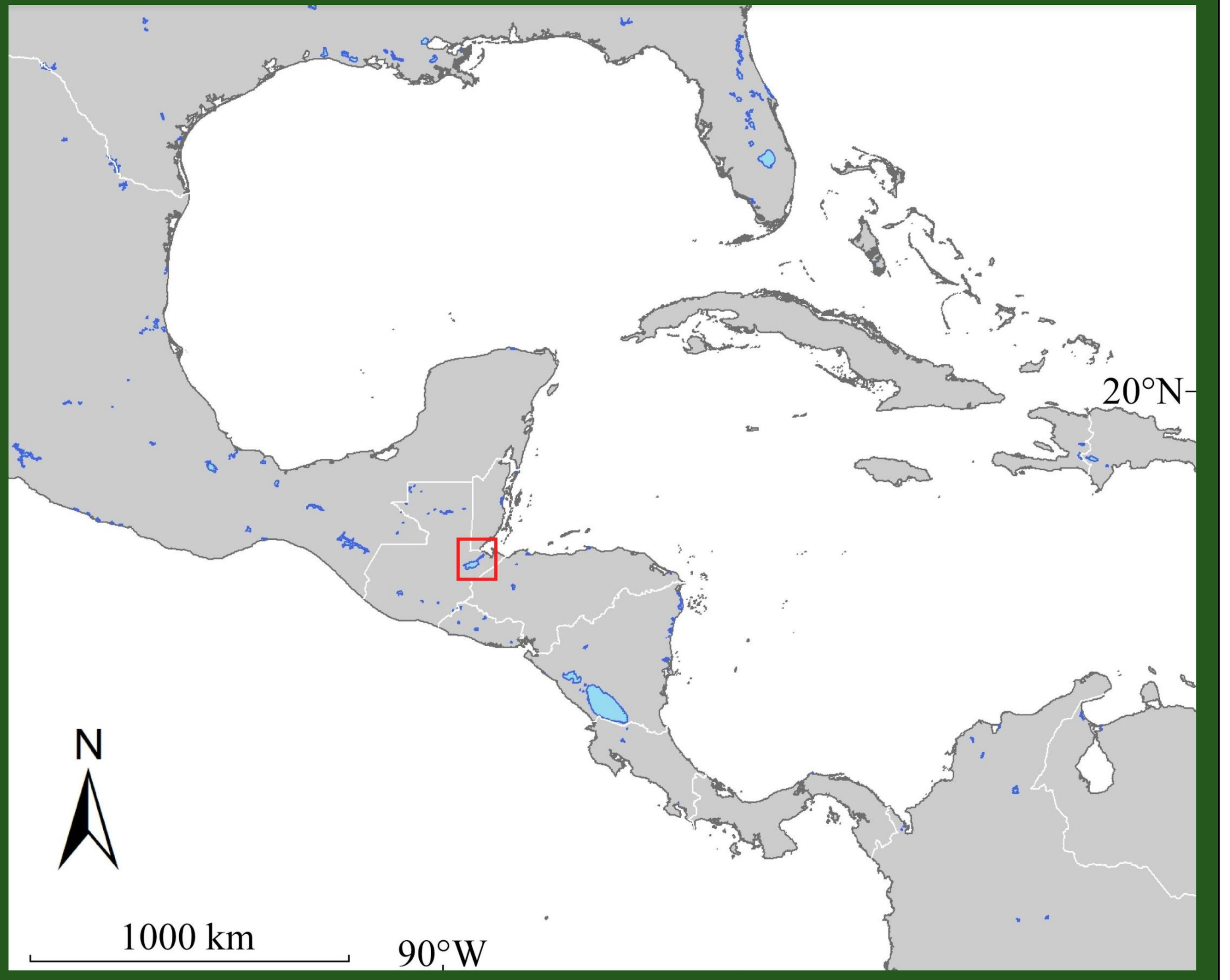


Figure 1. Map of Central America showing the location of the Lake Izabal Basin (red box) in eastern Guatemala.

## Study Area

- Lake Izabal is the largest (672 km$^2$) lake in Guatemala and it is located in the eastern part of the country (Fig. 1). The lake is hydrologically open and is connected to downstream Amatique Bay via the Dulce River (Fig. 2). Lake Izabal is shallow (z = 15 m) and polymictic, with a temperature difference between surface and bottom waters of only ~2 °C (Brinson and Nordlie 1975; Machorro 1996). Mean annual precipitation in the region is ~2900 mm a$^{-1}$ (Pérez et al. 2011) and is characterized by a well-defined rainy season that extends from May through October, and a dry season from November to April (Magaña et al. 1999).
- Lake Izabal currently has active Ni-laterite mining operations in the northern mountain ranges and no history of mining in the south.Therefore, Lake Izabal is an idea natural laboratory that allows us to investigate PGE chemistry in the lake sediments and how they relate to mining operations, anthropogenic activities, and geological processes (e.g., erosion). The research goal is to identify PGE enrichment in sediments associated with erosion of Ni-rich host rocks thereby identifying areas that are most prospective for Ni-Laterite mineralization.

## Data and Methodology

- 9 sediment cores were collected and analyzed; four along the northern and five along the southern shores. Geochemical analyses were carried out in all collected cores at a shallow depth (typically 3-6 cm) and at a deeper depth (typically 27-30 cm). The two samples per core location allow to compare between sediment/metal input controlled by anthropogenic/modern processes (shallow sample) and erosion prior to anthropogenic activities (deeper sample). Samples were analyzed for their bulk rock content at Geoscience Laboratories, Canada.
- Because Ni is enriched in many rocks unrelated to Ni mineralization and easily mobilized, we focus on the usefulness of PGE chemistry as a corroborative proxy for the presence or absence of Ni-laterite deposits in the catchment area. This is in hope that local metal enrichment in lake sediments can be used to identify areas that are most likely to host undiscovered ore systems.

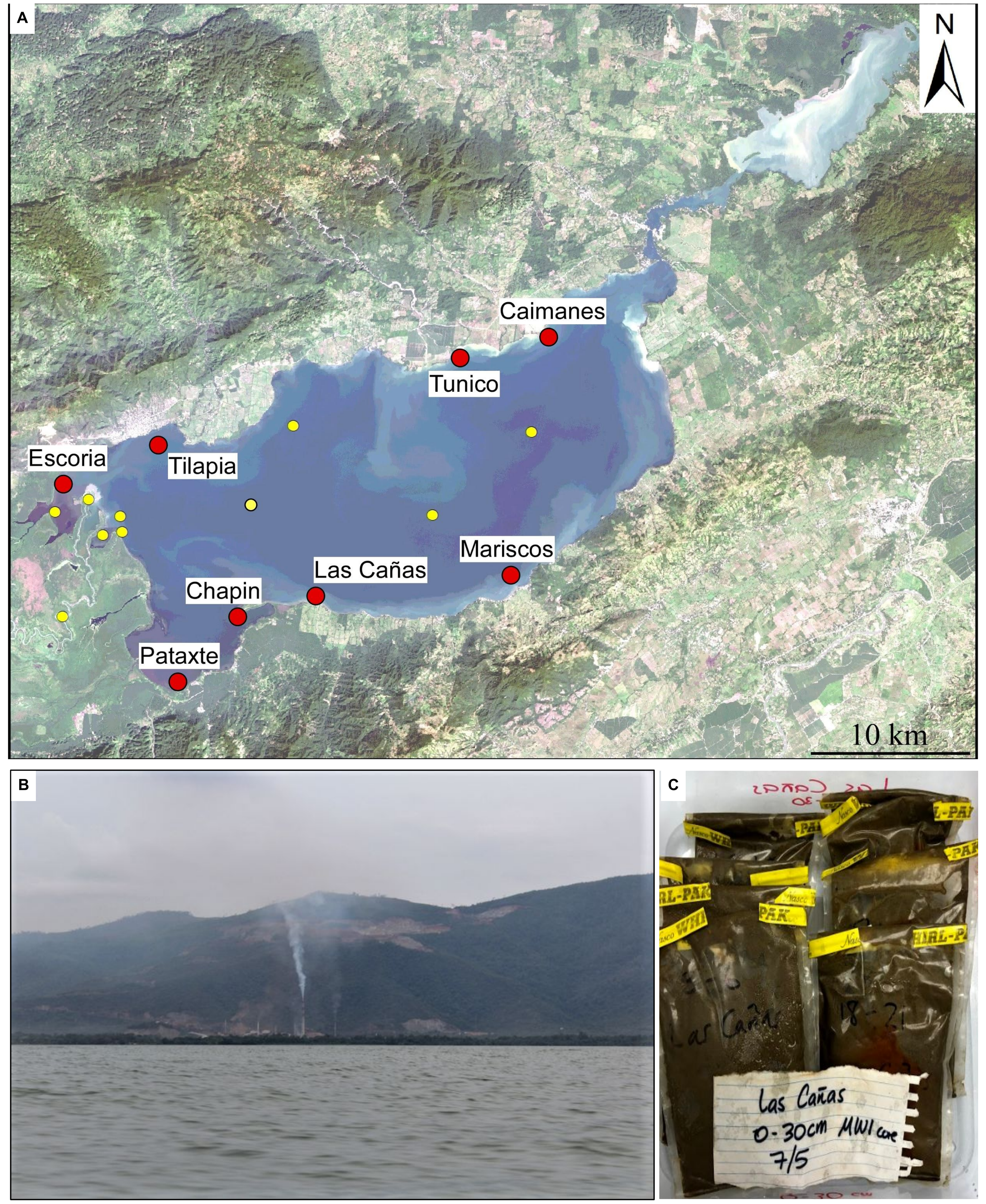


Figure 2. A) Map of Lake Izabal, eastern Guatemala, showing coring location (yellow circles) and the location of the cores used in this study (red circle). B) Field photo showing the location of the Ni-laterite mine and processing plant along the northern shore of Lake Izabal. C) Example of one of the lake sediment cores analyzed in this study. Samples were bagged and placed in a refrigerator after core collection.

## Results

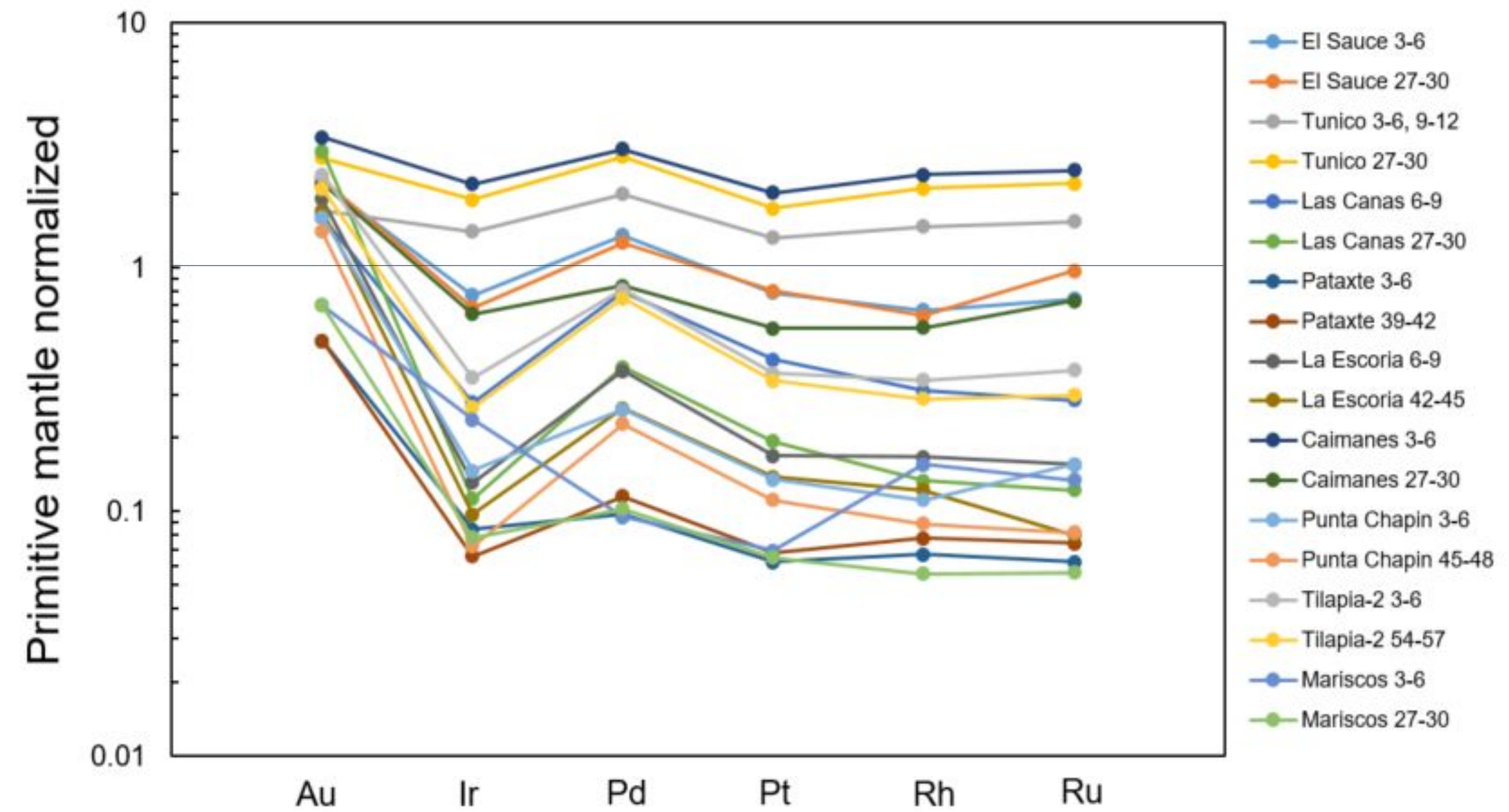


Figure 3. Primitive mantle-normalized concentrations of PGE (Reference for BSE values; McDonough and Sun, 1995).

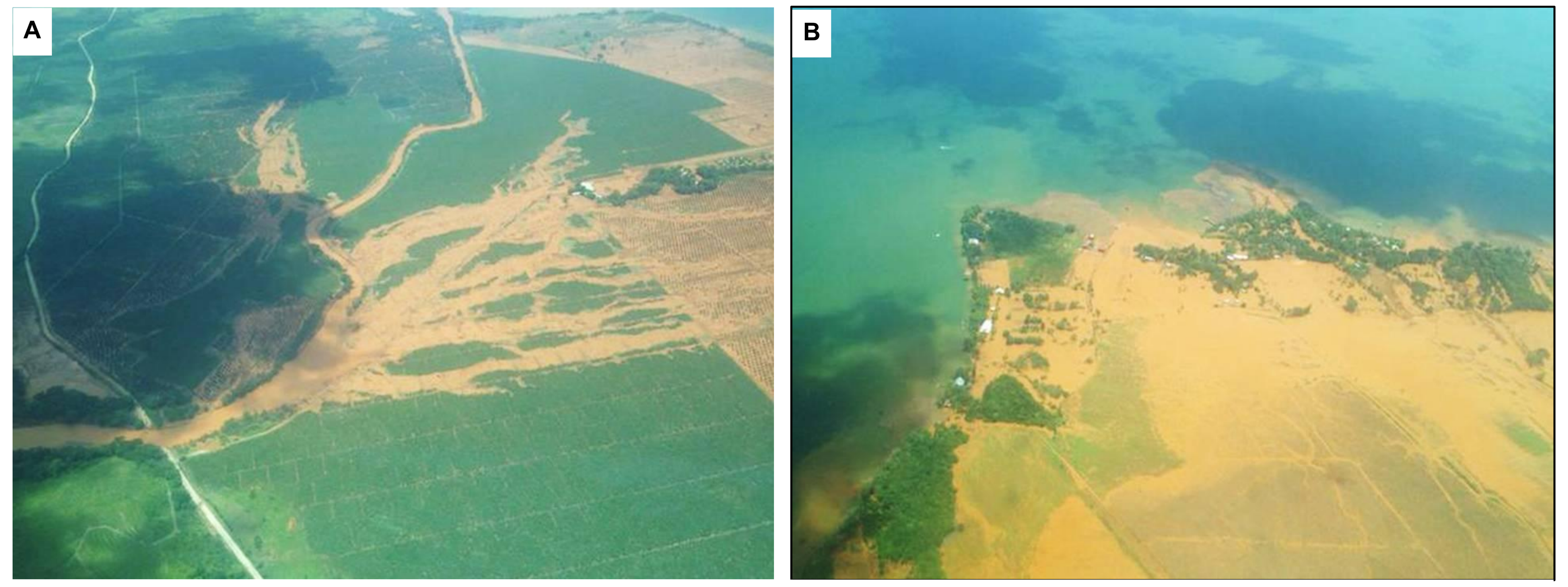


Figure 4. A) Aerial view of the Tunico River during a flooding event. Notice the brown color of the water which is typical for stream eroding the Ni-laterite deposits to the north of Lake Izabal. B) Aerial view of the Caimanes fan delta during the same flooding event.

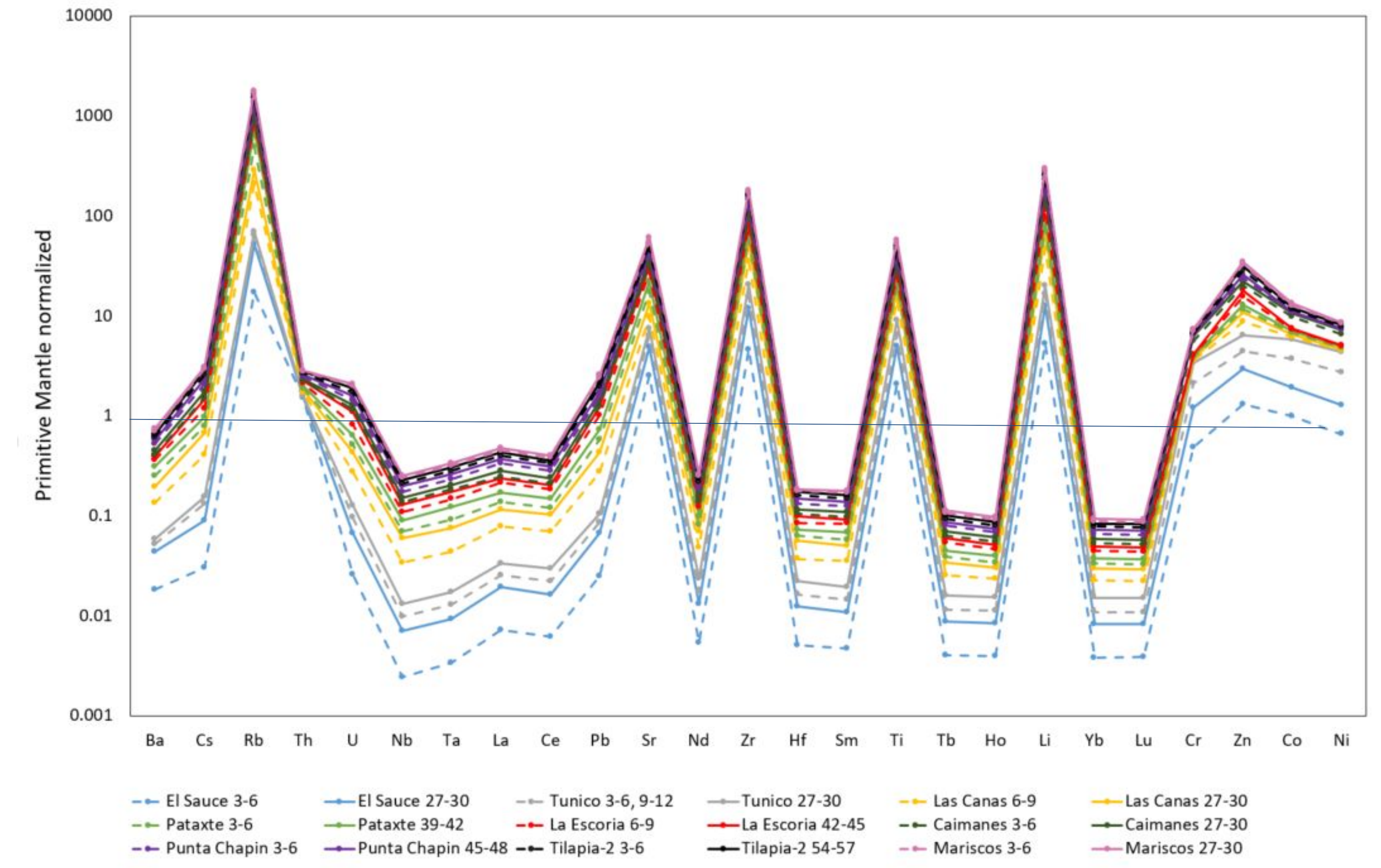


Figure 5. Primitive mantle-normalized concentrations of minor and trace elements (Reference for BSE values; McDonough and Sun, 1995).

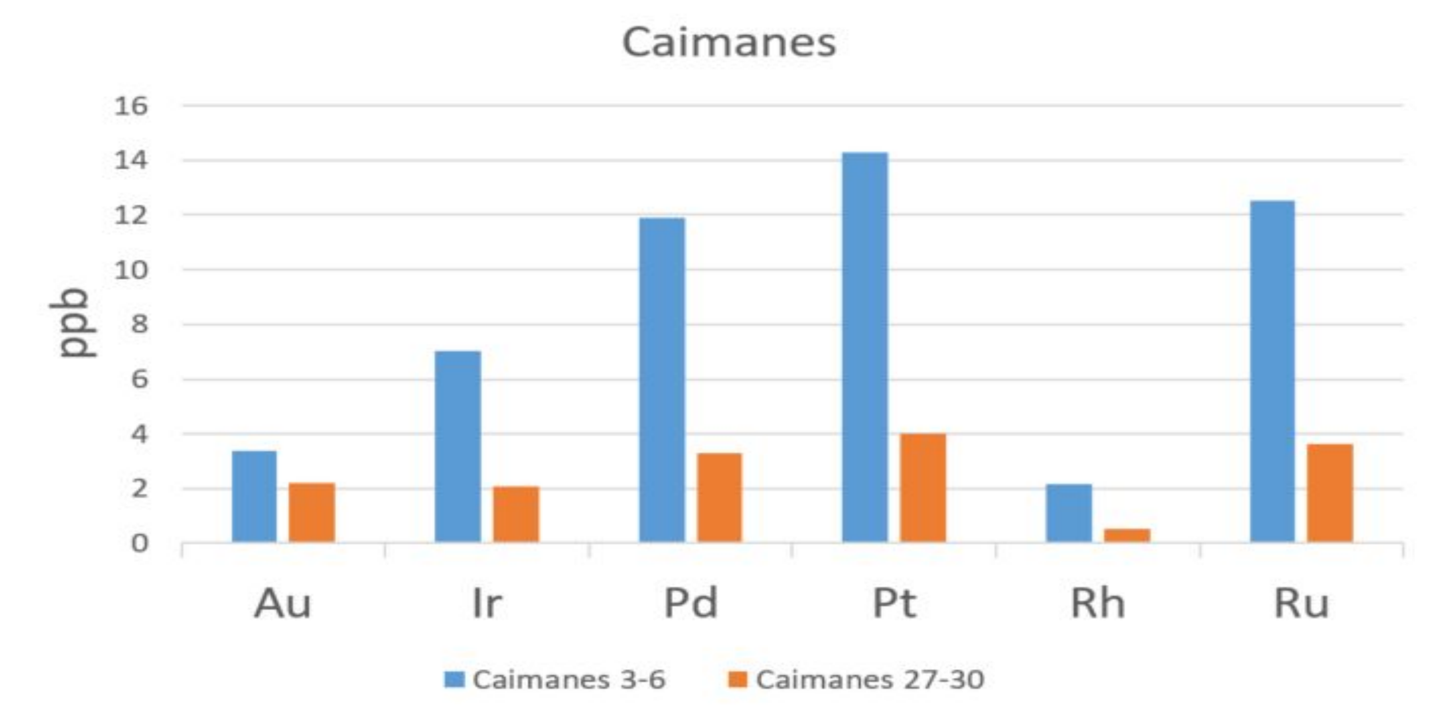


Figure 6. Comparison of PGE concentrations between the shallow (3-6 cm) and deep (27-30 cm) samples taken from Caimanes.

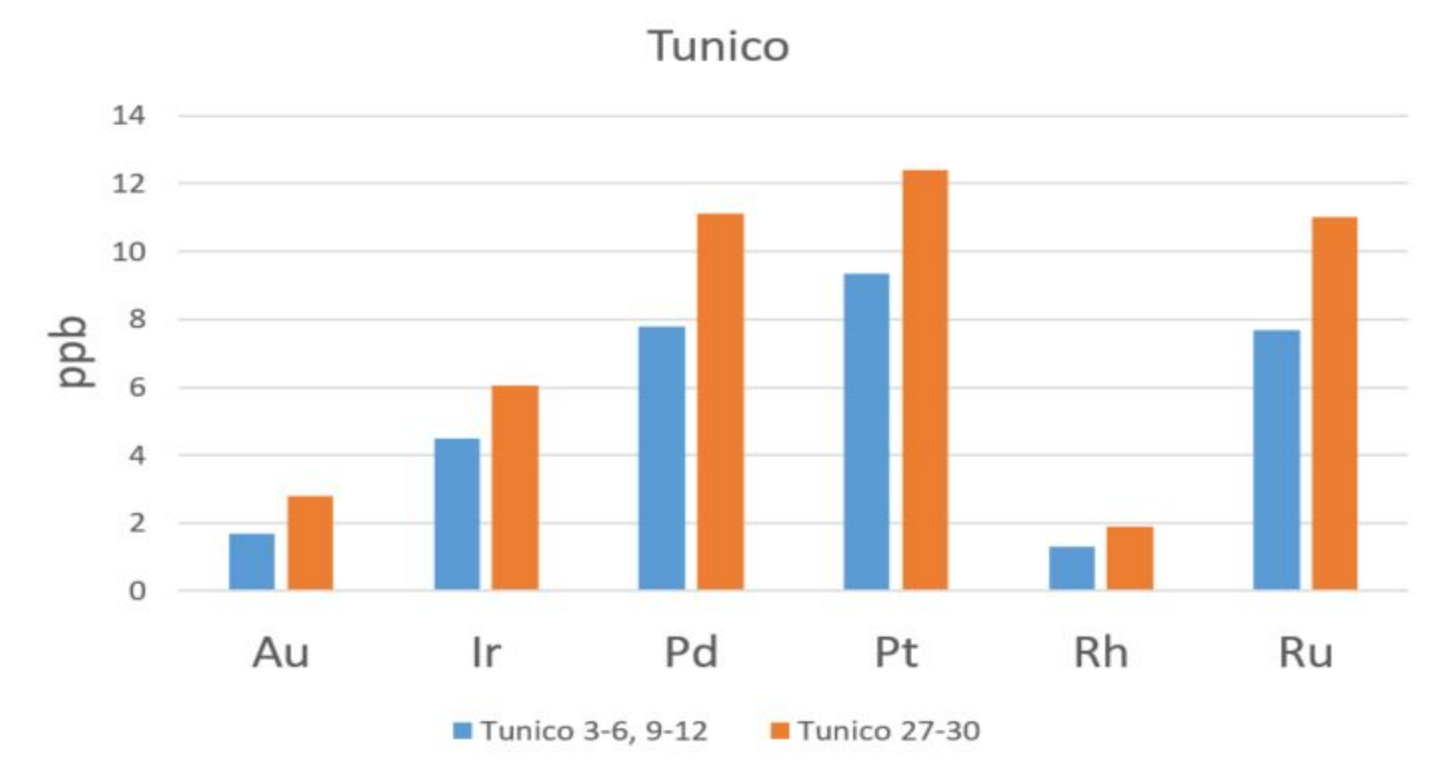


Figure 7. Comparison of PGE concentrations between the shallow (3-6, 9-12 cm) and deep (27-30 cm) samples taken from Tunico.

## Discussion

- The vast majority of samples are characterized by low PGE concentrations, implying the absence of mineralized rocks in the eroded areas (Figs. 3, 5).
- Two notable exceptions exist:
  1) Caimanes (Fig. 6) shows a noticeable change in PGE concentrations between the different sampling depths. Since there is a large increase in PGE concentrations in the shallow sample, this implies that the area the material mobilized during the flooding event (Fig. 4) is mineralized and can be further explored.
  2) Tunico (Fig. 7) also shows notable PGE enrichments. Similarly to Caimanes, this highlights the exploration potential of the northern mountain belt.
- Through our geochemical analysis, we were able to show that PGE concentrations can be used to find evidence of natural erosion of potential mineralized deposits.
- Consequently, our preliminary findings highlight the usefulness of sediment chemistry in the exploration for ore deposits in tropical regions.

## Acknowledgements & References

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