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Diatom based reconstruction of wet and dry conditions in the Ecuadorian Andes

Introduction

The neo-tropical Andes are highly sensitive to global climate change (1,2). Alpine lakes in Cajas National Park in Ecuador provide c. 60% of the drinking water to the city of Cuenca. Besides this major ecosystem service, Andean lakes support regional biodiversity (3). Climate conditions, especially wet and dry events, affect water properties and limnological processes (4). The occurrence of wet/dry phases are linked to the activity of the El Niño Southern Oscillation (ENSO) dynamics, acting on precipitation intensity in the region. The effects of wet and dry conditions on water properties and limnological processes in two Andean lakes are here explored using diatoms.

Study aim

The presented study focuses on two lakes in Cajas National Park: Pallcacocha (fed by a river delta) and Ocho. This study aims to provide an insight into past environmental conditions in the lakes and their catchment properties, focussing on: 1) reconstructing past changes in water level and in nutrient availability, 2) understanding lake dynamics and processes, and 3) revealing the (cyclic) occurrence of wet and dry conditions.

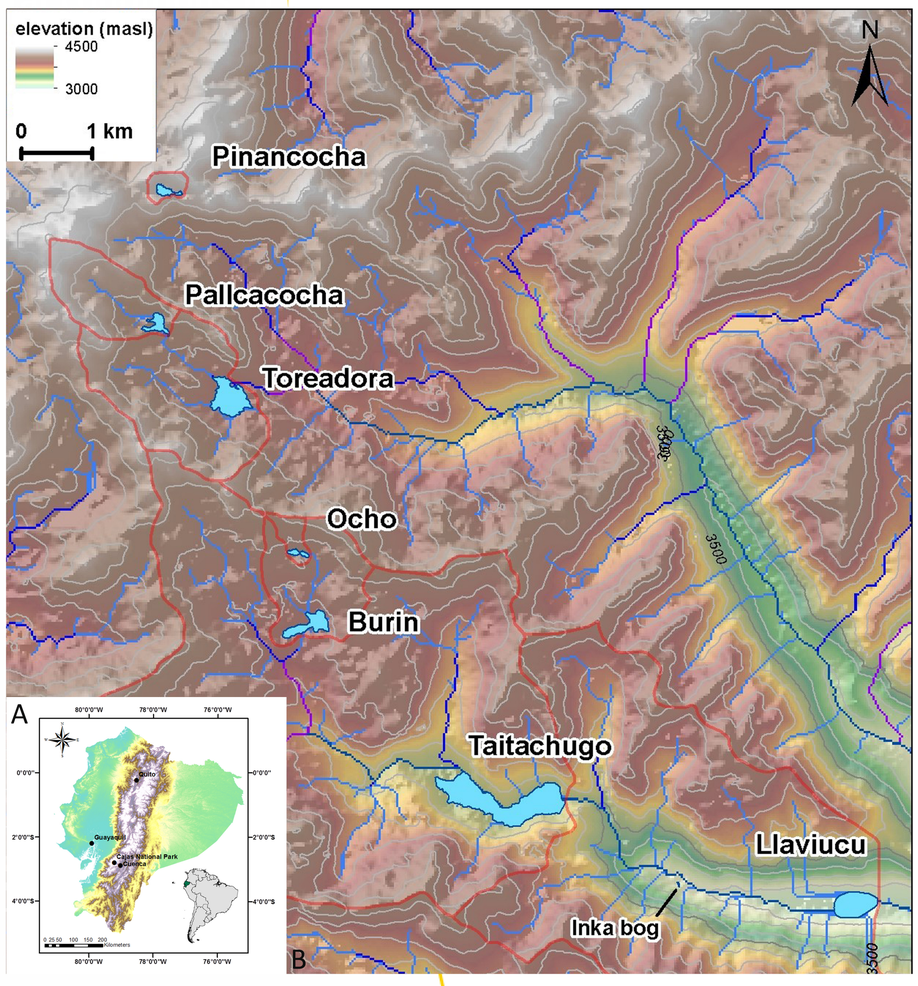

Fig. 1. (A) Map of South America and Ecuador (K. Hagemans) and (B) elevation map showing part of the Cajas National Park including the studied lakes (C.A.M. Nooren).

Fig. 4. Lake Ocho

Fig. 5. Lake Pallcacocha

Lake Ocho

Samples from Lake Ocho were included in the study due to the absence of diatoms in the lower part of the Pallcacocha core. The pilot analysis showed good diatom preservation throughout the entire core (50 cm depth) recovered from Lake Ocho, which is unique to the area. The assemblages analysed so far show an interesting co-occurrence of alkaline (*Epithemia* spp.) and acidophilous (*Neidium* spp.) species, as well as some new forms, potentially new to science.

References: 1) Vuille, M. & Bradley, R. S. (2000). Geophysical Research Letters, 27(23), 3885–3888. 2) Vuille, M. Bradley, R., Werner, M., & Keimig, F. (2003). Climatic Change, 59, 75–99. 3) Michelutti, N. et al. (2015). PLoS ONE, 10(2), 1–10. 4) Michelutti, N. et al. (2016). Journal of Limnology, 75(2), 403–408. 5) Rimet, F. & Bouchez, A. (2012). Knowl. Manag. Aquat. Ecosyst., 406(1).

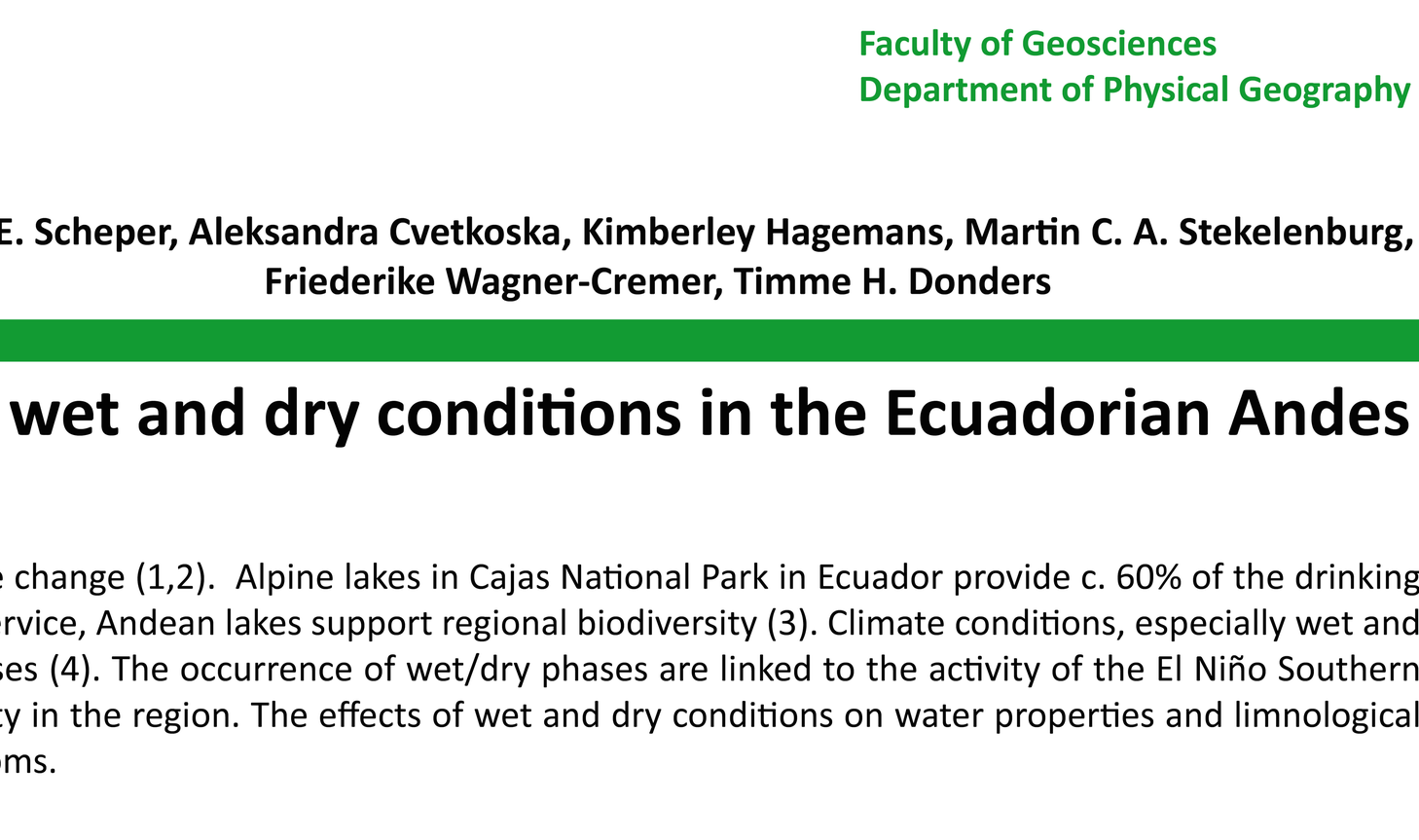

Fig. 2. Diatom diagram showing the relative abundance of the most dominant species and genera in Lake Pallcacocha; diatom zones delineated with CONISS clustering. Valves were only preserved in the top 10 cm of the core (350 valves counted per sample).

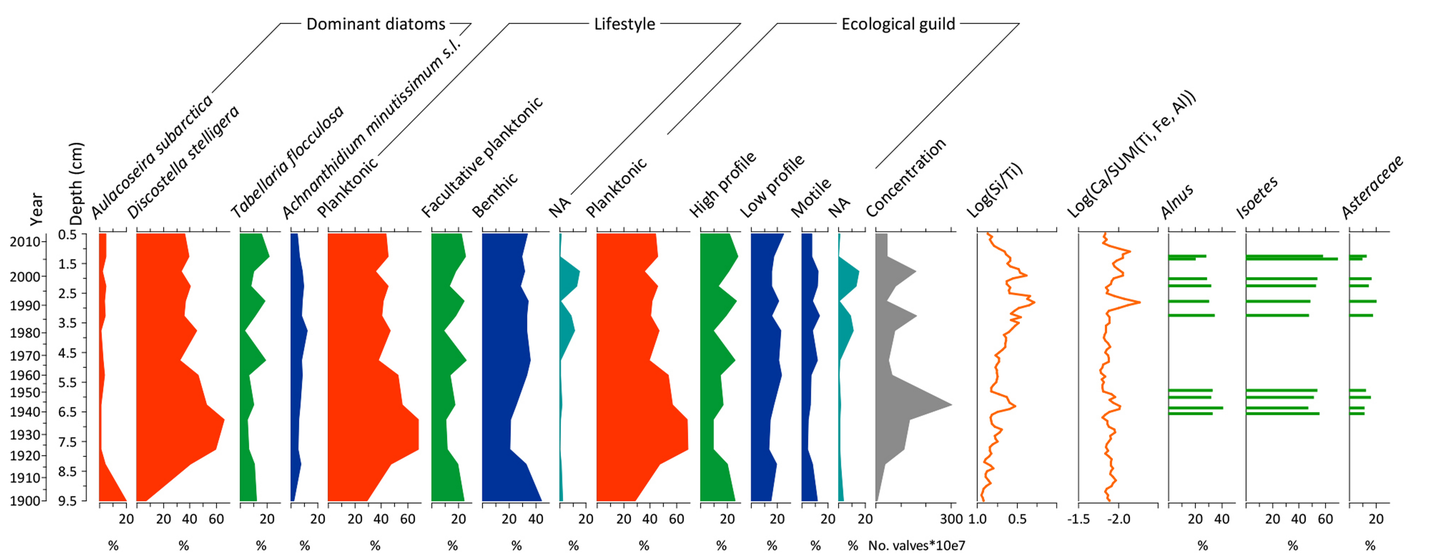

Fig. 3. Diatom diagram showing the relative abundance of selected dominant taxa, habitat preferences and ecological guilds of all species found in Lake Pallcacocha. Diatom concentrations, pollen abundances, log(Si/Ti) and log(Ca/SUM(Ti, Fe, Al) ratios as proxies for wet conditions are shown.

Lake Pallcacocha

In Lake Pallcacocha, diatoms were present only in the top 10 cm. In the lowest part, valves were dissolved, except for *Aulacoseira* spp. The dominance of planktonic species, peaks in diatom concentration, and higher [Ti] are indicative of wet conditions.

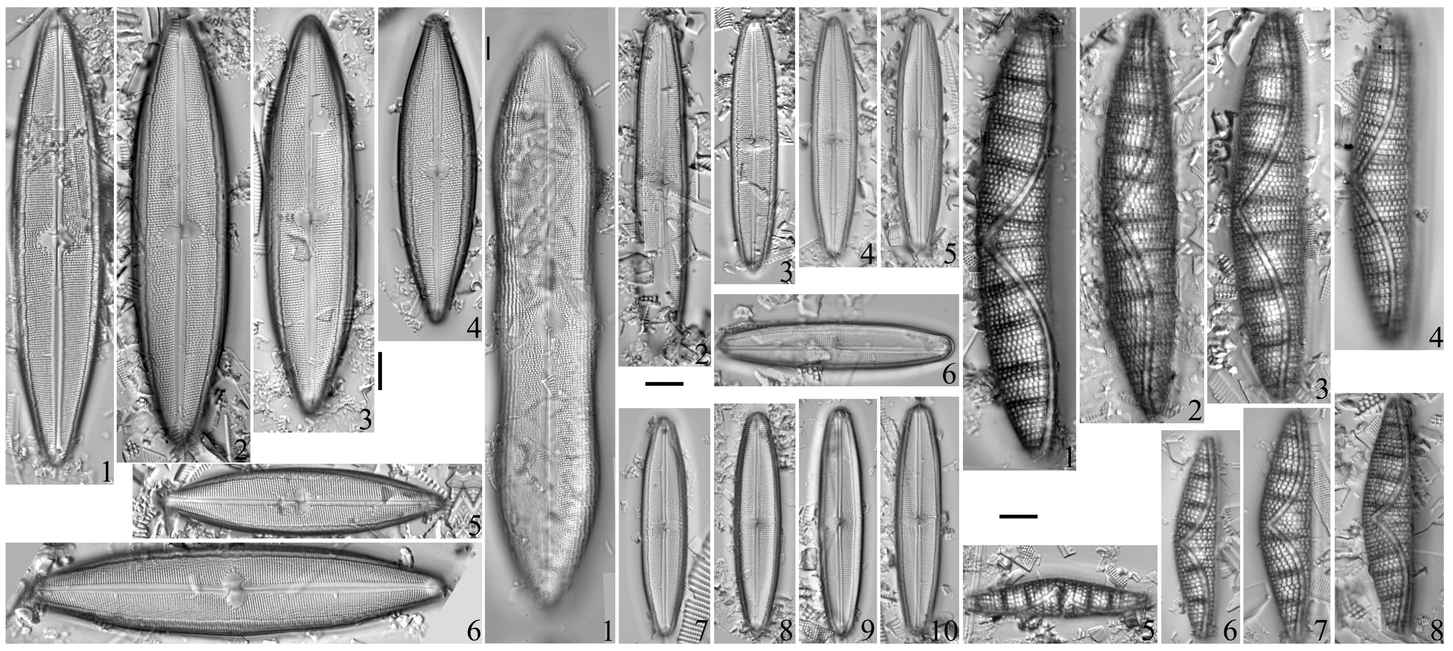

Plate 1: Figs 1–6. *Neidium* sp. 1. Scale bar: 10 µm.

Plate 2: Fig. 1. *Neidium magellanica*. Figs 2-10. Plate 3: Figs 1-8. *Epithemia* sp. Scale bar: 10 µm. *Neidium* sp. 2. Scale bar: 10 µm.