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## Using borehole gamma-ray spectroscopy to detect tephra layers in lacustrine deposits: An example from Lake Chalco, central Mexico

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Lacustrine sediments are archives of past environmental conditions. In recent decades, multinational ICDP efforts have conducted lake drilling projects to encode the potential of paleoclimate signals. Gamma-ray spectroscopy is a particularly useful tool as it is non-destructive, fast, and affordable even in cased boreholes. Gamma radiation can be used to identify elemental isotopes in the geological record, which is used for stratigraphic correlation and paleoclimatic investigations.

However, some lake sediments contain tephra layers with specific gamma-ray signatures, presenting a challenge for extracting the primary signals caused by environmental and climatic agents. Here, we use the sediments of Lake Chalco in central Mexico to propose a protocol to identify tephra layers embedded in other sediments using high-resolution spectral gamma-ray spectroscopy. This facilitates dividing the overall sediment column into representative horizons of tephra and non-tephra.

Among the upper 300 m of the lake deposit, our index detected 363 tephra layers, while 388 total tephra layers ( $\geq 1$  mm in thickness) were reported from the core description of the same borehole, predicting 92% of tephra layers documented in the lake deposits from core descriptions. We suggest that not only the strength of the gamma-ray signal but also the composition of its constituent energy channels can be used to detect embedded tephra layers.