



Stratified tephra records from lake sediment archives: Holocene eruptions of the Virunga Volcanic Province, East African Rift

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Lake sediments preserve rare stratified records of explosive volcanism, often with accompanying chronological controls or climatostratigraphic detail. In proximal areas where outcrop stratigraphies are complex, exposures isolated and sediments frequently eroded, the lacustrine archive provides a means to check the order of events and identify additional eruptions not preserved on land. The visible volcanic ash (tephra) record within lake sediments may be limited by eruption volume, distance from source and high sedimentation rates. A more complete eruption history can be detected through the study of non-visible tephra layers. Such “cryptotephra” records may be revealed through non-destructive core-scanning methods, such as XRF-scanning or magnetic susceptibility measurements, or by more thorough laboratory processes and microscopic analysis. Compositional analysis of tephra glass shards using WDS-EPMA and LA-ICP-MS provide a means to provenance eruptions, to cross-correlate between multiple sediment cores, and to establish connections between the lacustrine record and proximal outcrops. Here we present the results of such a “tephrostratigraphic” approach applied to the Holocene volcanic record of the Virunga Volcanic Province (VVP). More than 10 explosive volcanic eruptions, attributed to multiple volcanic centres, are evidenced over the last 12,000 years. This unique insight into the frequency of explosive eruptions from the VVP, demonstrates the potential of visible and cryptotephra investigations in lacustrine sediment archives as a means of studying past, present and future volcanic hazards.