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## Beyond Expectations: Unusual Water and Salt Chemistry in the Okavango Delta (Botswana)

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Wetlands developing in semi-arid regions are increasingly affected by salinisation and trace element enrichment; processes that should increase in time with climate changes and anthropic activities. The Okavango Delta (Botswana) provides a rare example of a pristine wetland that nevertheless shows evidence of trace element contamination. This alluvial fan located in the SW termination of the East African Rift System is in the heart of an endoreic drainage network taking its source in Angola and having its outlet in the Makgadikgadi pans. Annual floods enter the Delta, creating permanent and seasonal swamps that isolate thousands of islands of various sizes and shapes. Subsurface (2 to 3 m deep) groundwaters in the Delta are known to be largely alkaline with pH values up to 9, dissolved inorganic carbon values up to 4400 ppm and elevated concentrations of dissolved metals and metalloids, some of which are toxic (arsenic up to 6 ppm, uranium up to 12 ppm, vanadium up to 4 ppm, etc.). A first model explained the formation of the saline groundwater through evapotranspiration of the fresh water brought by the annual flood followed by infiltration through the tree belts surrounding the many islands emerging from the wetlands. However, our recent trace-element geochemical studies of groundwater and sediment in the central part of the Delta, showed that groundwater composition could not result from a simple evapotranspiration of surface water, leading to the proposition of a two-aquifer model. In this model, the two aquifers are hydrologically and chemically separated by a clay-rich layer. The surface aquifer contains circumneutral pH fresh water while the subsurface aquifer is seal-capped by the clay layer and contains alkaline water. Following this initial result, the present study addresses the nature, composition and origin of salt deposits that have been described on several of these islands of the Delta, especially in its eastern, more humid region. For the first time, we provide a complete major and trace elements geochemical description of these salts and compare them to evaporites from the Makgadikgadi pans. We demonstrate that the composition of the Delta salts (essentially trona) is very different from that of the Makgadikgadi evaporites (mostly halite) but, in some points, similar to that of the alkaline groundwater previously described. Our main hypothesis is that surface water could represent a source for the salt deposits through a coupling of mechanisms involving evaporation and biotic/abiotic (bio)geochemical processes. Here alkaline groundwater could represent a testimony of past similar processes trapped under a clay-rich layer. The concentrations of trace elements in the Delta salts (As: up to 110 ppm, U: up to 12 ppm, V: up to 14 ppm) and potential toxicity to the environment and local populations will be discussed.

### Speaker information

PhD 2nd year

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