Many previous studies on lacustrine basins in the East African Rift System have directed their attention to climatic controls on contemporary sedimentation or climate change as part of palaeoenvironmental reconstruction. In contrast, this research focuses on the impact of tectonism and volcanism on rift deposition and develops models that help to explain their roles and relative importance. The study focuses on the spatial and temporal variability in bulk sediment geochemistry from a diverse range of modern and ancient rift sediments through an analysis of 519 samples and 50 major and trace elements. The basins examined variously include, or have contained, wetlands and/or shallow to deep, fresh to hypersaline lakes. Substantial spatial variability is documented for Holocene to modern deposits in Lakes Turkana, Baringo, Bogoria, Magadi and Malawi. Mio-Pleistocene sediments in the central Kenya Rift and Quaternary deposits of the southern Kenya Rift illustrate temporal variability. Tectonic and volcanic controls on geochemical variability are explained in terms of: 1) primary controlling factors (faulting, subsidence, uplift, volcanism, magma evolution and antecedent lithologies and landscapes), 2) secondary controls (bedrock types, rift shoulder and axis elevations, accommodation space, meteoric and hydrothermal fluids and mantle CO2), and 3) response factors (catchment area size, orographic rains, rain shadows, vegetation densities, erosion and weathering rates and spring/runoff ratios). The models developed have, in turn, important implications for palaeoenvironmental interpretation in other depositional basins.

Prof. Bernie Owen has carried research on sedimentology, geochemistry and microfossils in Tertiary to recent lacustrine and marine sedimentary basins in Africa, Asia and Canada, with an emphasis on geolimnology and spring sediments. He has extensive experience in the rift valleys of Africa, especially in the Kenya and Malawi Rift Systems. In the last five years he has focussed his efforts on the Quaternary palaeoenvironmental history of the Magadi, Koora and Olorgesailie Basins in southern Kenya, where his work has involved geochemistry, pollen and diatoms from lacustrine, wetland and spring deposits. Owen, in collaboration with the others, has also carried out research into the sedimentology, facies, microfossils and geochemistry of modern siliceous spring deposits in Iceland, New Zealand and fossil spring tufas in Kenya. He has worked with a large number of researchers from universities in Europe, North America and Africa and is a currently a principal investigator in the international Hominin Sites and Paleolakes Drilling Project, which is examining several long cores (200–300 m) from five locations in Ethiopia and Kenya. This project is attempting to explore the major environmental and climate controls on hominin physical and cultural evolution. Recently, he has initiated collaborative research with colleagues from Germany, Kenya and Canada into sediments in the remote and arid north of Kenya (Suguta Valley) where he aims to explore the geochemical variability of Tertiary sediments and to reconstruct past environmental change.