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High-resolution records of grain-size and depositional environment correlated to the Homo erectus Nariokotome Boy site, West Turkana, Kenya

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The Turkana Basin in northern Kenya contains a robust record of hominin fossils, including Nariokotome Boy (discovered from the NK3 site), the most complete H. erectus specimen found to date. Understanding the paleoenvironmental context in which hominins such as H. erectus evolved has been an objective of decades of research in eastern Africa. Here, we present a study using grain size analyses to infer the paleoenvironmental conditions responsible for the deposition of the sedimentary sequences directly associated with NK3. We resampled a ~14 m interval at from the West Turkana Kaitio (WTK13) core, collected as part of the Hominin Sites and Paleolakes Drilling Project. This interval ties directly to the outcrop where Nariokotome Boy was recovered. By sampling continuously at 0.5 cm intervals (~7 yrs/sample), we document the paleoenvironment in ultra high-resolution (i.e. a scale relevant to a hominin life) that directly correlates to the NK3 site. Over 350 sediment samples were pre-treated to remove carbonate, biogenic silica, and other organic material from detrital material. Grain size distributions were measured on a Malvern Mastersizer 3000 using wet suspension. Based on these analyses, the interval was dominated by silt, which was further investigated using end-member modeling. A four end-member solution explained on average 99% of the population variability. The bottom of the interval was more coarse-grained, with an abrupt fining transition at 38.83 meter below surface (mbsf), which corresponds with the transition out of a tuffaceous interval (Natoo tuff) and into a pedogenically modified interval. This correlation is significant as the top of this tuff is the surface upon which Nariokotome Boy was recovered. Previous facies and grain size analyses revealed and quantified Turkana's dynamic lake level history. However, our grain size analysis provides unprecedented resolution for the paleoenvironment during which Nariokotome Boy lived. Our 0.5 cm sampling resolution enables us to quantify depositional changes on a scale comparable with previous descriptive facies analyses and to refine transitions between paleosols, fluvial deposits, and lacustrine deposition at the interface of these three paleoenvironments enabling us to reconstruct a dynamic lakeshore environment during the lifetime of the Nariokotome Boy.