

Employing electron microscopy integrated with X-ray spectroscopy for Kuntawa Landslide assessment

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This work centres on Kuntawa landslide assessment owing to the enigmatic nature of a 2003 landslide which buried 4 people and a truck in Kuntawa village, of Nigeria.

A Phenom ProX Scanning Electron Microscope (SEM) integrated with Energy dispersive X-ray Spectroscopy (EDS) and Particlemetric software was employed to generate morphology, particle size data, elemental identification data and topography (at 3500x) of earth samples scooped from the landslide site. For a core sample 1 at depth, $d=3.75\text{m}$, average circle equivalent diameter, area and volume by area of $11.5\ \mu\text{m}$, $249\ \mu\text{m}^2$ and $3680\ \mu\text{m}^3$ were generated respectively; at $d=3.785\text{m}$, , and of $6.19\ \mu\text{m}$, $30.1\ \mu\text{m}^2$ and $124\ \mu\text{m}^3$ were generated respectively; at $d=3.82\text{m}$, , and of $11.5\ \mu\text{m}$, $130\ \mu\text{m}^2$ and $1380\ \mu\text{m}^3$ were generated respectively. For a core sample 2, at $d=3.75\text{m}$, and of $5.54\ \mu\text{m}$, $26\ \mu\text{m}^2$ and $108\ \mu\text{m}^3$ were generated respectively; at $d=3.82\text{m}$, , and of $19.4\ \mu\text{m}$, $338\ \mu\text{m}^2$ and $5240\ \mu\text{m}^3$ were generated respectively; 243 particles were scanned.

One of the results from specific surface for samples 1 and 2, reveals that it would take twice and four times the amount of water needed to wet an entire surface both at $d=3.82\text{m}$ than at $d=3.785\text{m}$ and $d=3.75\text{m}$ respectively.

Additional laboratory facilities reveal that soil water content, volumetric water content, porosity, soil water-filled pore space bulk density, decreased with increasing—this situation may have contributed to this earth surface event.

Elemental composition at the landslide site were generated from the EDS: oxygen (O), Silicon (Si), Bromine (Br), iron (Fe), Carbon (C) and Aluminium (Al). O and C had the highest and lowest concentration of elemental compositions of 68.5% at 3.75m depth and 1% at 3.82m depth for samples 1 and 2, respectively. The significant amount of oxygen unravelled from the result, is suggestive of algae presence at the landslide site—intense soil microbial activity may have contributed to landslide occurrence.

Micro-faults from granular topography and morphology are probably tips of bigger faults down below—inferring that past earth tremor events may have occurred leading to landslide.

Keywords: EDS, Particlemetric, SEM, Micro-fault, topography