

Seismic Refraction and Resistivity Survey of Ini Local Government Area, South-South Nigeria: Assessing Structural Setting and Groundwater Potential

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Abstract : A seismic refraction and resistivity survey was conducted in Ini Local Government Area, South-South Nigeria, to evaluate the structural setting and groundwater potential. The study involved 20 Vertical Electrical Soundings (VES) using an ABEM Terrameter with a Schlumberger array and a 400-meter electrode spread, analyzed with WinResist software. Concurrently, 20 seismic refraction surveys were performed with a Geometric ES 3000 12-Channel seismograph, employing a 60-meter slant interval. The survey identified three distinct geological layers: top, middle, and lower. Seismic velocities (V_p) ranged from 209 to 500 m/s in the top layer, 221 to 1210 m/s in the middle layer, and 510 to 1700 m/s in the lower layer. Secondary seismic velocities (V_s) ranged from 170 to 410 m/s in the topsoil, 205 to 880 m/s in the middle layer, and 480 to 1120 m/s in the lower layer. Poisson's ratios varied from -0.029 to -7.709 for the top layer, -0.027 to -6.963 for the middle layer, and -0.144 to -6.324 for the lower layer. The depths of these layers were approximately 1.0 to 3.0 meters for the top layer, 4.0 to 12.0 meters for the middle layer, and 8.0 to 14.5 meters for the lower layer. The topsoil consists of a surficial layer overlaid by reddish/clayey laterite and fine to medium coarse-grained sandy material, identified as the auriferous zone. Resistivity values were 1300 to 3215 Ωm for the topsoil, 720 to 1600 Ωm for the laterite, and 100 to 1350 Ωm for the sandy zone. Aquifer thickness and depth varied, with shallow aquifers ranging from 4.5 to 15.2 meters, medium-depth aquifers from 15.5 to 70.0 meters, and deep aquifers from 4.0 to 70.0 meters. Locations 1, 15, and 13 exhibited favorable water potential with shallow formations, while locations 5, 11, 9, and 14 showed less potential due to the lack of fractured or weathered zones. The auriferous sandy zone indicated significant potential for industrial development. Future surveys should consider using a more robust energy source to enhance data acquisition and accuracy.

Keywords : hydrogeological, aquifer, seismic section geo-electric section, stratigraphy

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