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Investigation of Subsurface Structures within Bosso Local Government for Groundwater Exploration Using Magnetic and Resistivity Data

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Abstract : The study area is part of Bosso local Government, enclosed within Longitude 6.25' to 6.31' and Latitude 9.35' to 9.45', an area of 16x8 km^2, within the basement region of central Nigeria. The region is a host to Nigerian Airforce base 12 (NAF 12quick response) and its staff quarters, the headquarters of Bosso local government, the Independent National Electoral Commission's two offices, four government secondary schools, six primary schools and Minna international airport. The area suffers an acute shortage of water from November when rains stop to June when rains commence within North Central Nigeria. A way of addressing this problem is a reconnaissance method to delineate possible fractures and fault lines that exists within the region by sampling the Aeromagnetic data and using an appropriate analytical algorithm to delineate these fractures. This is followed by an appropriate ground truthing method that will confirm if the fracture is connected to underground water movement. The first vertical derivative for structural analysis, reveals a set of lineaments labeled AA', BB', CC', DD', EE' and FF' all trending in the Northeast – Southwest directions. AA' is just below latitude 9.45' above Maikunkele village, cutting off the upper part of the field, it runs through Kangwo, Nini, Lawo and other communities. BB' is at Latitude 9.43' it truncated at about 2Km before Maikunkele and Kuyi. CC' is around 9.40' sitting below Maikunkele runs down through Nanaum. DD' is from Latitude 9.38'; interestingly no community within this region where the fault passes through. A result from the three sites where Vertical Electrical Sounding was carried out reveals three layers comprised of topsoil, intermediate Clay formation and weathered/fractured or fresh basement. The depth to basement map was also produced, depth to the basement from the ground surface with VES A_2, B5, D_2 and E_1 to be relatively deeper with depth values range between 25 to 35 m while the shallower region of the area has a depth range value between 10 to 20 m. Hence, VES A_2, A_5, B_4, B_5, C_2, C_4, D_4, D_5, E_1, E_3, and F_4 are high conductivity zone that are prolific for groundwater potential. The depth range of the aquifer potential zones is between 22.7 m to 50.4 m. The result from site C is quite unique though the 3 layers were detected in the majority of the VES points, the maximum depth to the basement in 90% of the VES points is below 8 km, only three VES points shows considerably viability, which are C_6, E_2 and F_2 with depths of 35.2 m and 38 m respectively but lack of connectivity will be a big challenge of chargeability.

Keywords : lithology, aeromagnetic, aquifer, geoelectric, iso-resistivity, basement, vertical electrical sounding(VES)
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