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Evidence of Groundwater Reservoirs Associated with Fault Structures and Magmatic Dyke Intrusions: Insights from Geophysics and Well Data Analysis in Central Cameroon

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Abstract : Central Cameroon is a mosaic complex of Proterozoïc litho-tectonic units, with structural deformations mainly inherited from Panafrican orogeny. It consists of a para-derived series with epicontinental affinity, structured as successive nappe thrusting southward on the Ntem complex, considered as the Congo Craton northern margin. A well-developed prograde metamorphic gradient is described from SE (Dja and Yokadouma meta-detritic series) to NW (gneiss and migmatites of the Yaounde series) with ages estimated at 600-620 Ma. Syn- to late phase of the Panafrican deformations crosscut the nappes structured with large mylonitic shear zones (Sanaga fault, Adamawa fault, Tcholiré-Banyo fault) coeval with intrusive granitoids. The scientific and industrial communities interested in exploring the groundwater resources of these litho-tectonic units using geophysics and geohydrology methods have grown steadily since the 1970s. In this paper, we present shallow and deep geophysical cross-sections that describe the most productive groundwater targets of the Central Cameroon litho-tectonic units. This study also discusses geological factors that control groundwater occurrences. The data analyzed were gathered from public and private groundwater surveys conducted in recent years and included 18 well-controlled resistivity sections and hydrogeological parameters of 150 drilling points. The depth of well records extends from 40 to 180m. Also, one of the challenges of geophysics investigations was to image groundwater reservoirs located above 120m depth. Therefore, the resistivity data were acquired using a 1200 m long digital streamer, with a 10 m electrode spacing in the selected sites. The modelled sections derived from these data show that the most productive groundwater targets of the study area include lithological contacts and dyke fault-zones. The average width of dyke fault-zones ranges between 40 and 380 m. These structures display a significant lateral extent, and their spatial distribution is often in correlation with mountain terranes and regional fault zones trending from SW-NE to NNW-SSE. Following these observations, transboundary aquifers associated with fractured magmatic rocks can be found in the study area.

Keywords : Proterozoic, resistivity sections, dyke fault-zones, groundwater target
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