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Characterization of the Hydrogeological Conditions of Some Portions of the Neoproterozoic Voltaian Supergroup in Northern Ghana

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Author(s)

Sandow Mark Yidana, Aliou Abdul-Samed, Bruce Banoeng-Yakubo, Prosper M. Nude

ABSTRACT

Spatial variations in the essential aquifer parameters obtained through regular aquifer tests were evaluated for some aquifers of the Neoproterozoic sedimentary aquifers of the Voltaian Basin. Ordinary least squares regression models have also been developed to relate aquifer transmissivity and specific capacity, and well yield and transmissivity. These analyses suggest that in the northern parts of the Voltaian, aquifer transmissivity exists in a non-linear relationship with specific capacity and yield. This is in keeping with the findings of previous research in the southern part of the Voltaian, and deviates from the regular Dupuit-Thiem relationship between the two major aquifer parameters. Lithology specific models have been developed in this study. The exponent of the non-linear models appears to be related to the lithology, and tends to approach unity in the mudstone and siltstone aquifers, whilst manifesting obvious departures from nonlinearity amongst the sandstone aquifers. This study finds that the sandstone aquifers are the most prolific and offer themselves as the best lithologies for drilling successful wells in the area. Linear prediction maps suggest that the most prolific aquifers are located in the northern parts of the study area, where aquifer transmissivity, specific capacity, and well yield values are quite high due to enhanced secondary permeabilities. There has been no obvious relationship between the major aquifer parameters and static water levels, which are quite high in the middle and western sections of the study area. The hydrogeological properties of rocks within the Voltaian appear to be based on discrete structural entities which manifest high variability in the study area. Even within the same lithology, standard deviations are quite high in the data for all the aquifer parameters examined in this study.

KEYWORDS

Savelugu-Nanton, Regression, Specific Capacity, Transmissivity, Yield, Kriging

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