

## Integrative Methods and Technologies in Geophysical Research and Management

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### Editorial

The current issue presents challenges and opportunities as well as advanced technologies in geophysical research and hydro-resources management. The presented articles contain a high applied aspect based on the detection of earth surface dynamics and the hydro-environment beneath and above the earth surface in various parts of the world (e.g. Africa, Asia). The effects of hydro confining pressure on the flow properties of sandstone and carbonate rocks have been investigated by Sudad Al-Obaidi & Falah [1]. They documented that there was a significant effect of the hydro confining pressure of the core holder on the flowing properties of rock formations. This effect was caused due to the mechanical elastic deformation of the core when laboratory studies of the waterproof and polymer compositions were carried out. The authors concluded that the deformation changed the permeability and voids storage capacity of the studied core samples. Therefore, it was argued to consider the changes of permeability and voids storage capacity of such cores when dealing with studies on core formations.

Dynamics in the hydro-environment by digital modelling of bar (char) incidence and braiding intensity of the Padma River in Bangladesh was studied by Rahman and Islam [2]. Their work prepared bar incidence map and assessed braided intensity of the river. GIS techniques have integrated spatial (satellite images) and attribute data to identify the char's location and determined the braiding intensity on the Padma riverbed. The results showed that young chars with ages below eight years contained 48%, the mid- to long-term chars between 8-20 years exhibited 43% of the active channel. But the very long duration chars appeared only for 9% along the studied river reach. Moreover, the braiding intensity changed in the late 1960s and early 1970s from 1.63 to 1.75. During 1976 to 1984, the braiding intensity dropped to a minimum (1.38 to 1.50), increased very rapidly further on from the early 1990s and reached its peak value of 2.13 in 1997. The authors concluded that both, bar dynamics and braiding intensity are closely related to the sediment supply and changes in the sediment regime of the studied catchment.

The third hydro-environmental study by Akpan [3] conducted a vulnerability assessment of groundwater to contamination using electrical resistivity methods at the open dumpsite in Gosa, Abuja, Nigeria. The study was implemented to determine the vulnerability of groundwater in the area as well as the surrounding environment to leachate contamination. Sixteen vertical electrical sounding points with the maximum current electrode of 100 m were investigated. The results of the geoelectrical survey showed sandy topsoil, clayey sand, weathered basement and fractured/fresh basement. Apparent resistivity values were obtained for four discrete layers ranging from 64.6  $\Omega$ m and 1719.9  $\Omega$ m, - with a high variability in resistivity for the different layers. Furthermore, the ranges of the thickness of the layers were found to be between 0.7 m and 21.6 m. Based on the results the authors examined that the parameters used in characterizing the aquifer protective capacity of the overburden units were layer thickness and their

corresponding resistivity values. Moreover, the low protective capacity of the area aided the conclusion that the water aquifer in the area was highly vulnerable to leachate contamination from the dumpsite.

Another research of the current issue [4] integrated geophysical analysis and rock physics to study the hydrocarbon reservoir of the Bitrisim Area in Pakistan. In their study the authors focused on horst and graben structure which are the symbolic depiction of extensional tectonics in Pakistan. Two seismic dip lines and one strike line were figured out based on the structural and stratigraphic interpretation. Moreover, subsurface mapping indicated that the major fault trend was NNW-SSE were marks of fault out-breakings, indicated the existence of various tectonic periods. The results showed that the dominant structural trend of the area provided the basic components of a petroleum system. In addition, porosity calculations were made to determine the water and hydrocarbon saturation. The study concluded that the main elements of a petroleum system are presented and also proven by a number of oil and gas findings, but there is still a need for advanced techniques to improve seismic resolution and the excellence of interpretation.

Moreover, Ndip [5] performed a seismic stratigraphic and petrophysical characterization of reservoirs of the Agbada Formation in the offshore Eastern Niger Delta Basin in Nigeria. Two-dimensional seismic and composite well logs in the eastern offshore Niger delta basin were used to carry out a seismic stratigraphic and petrophysical characterization of reservoirs of the Agbada Formation. Three seismic sequences have been delineated showing depositional environments. These deposits have prograded from the delta platform in the determined seismic sequence one down to the wave dominated prodelta /slope of seismic sequences three. In total five seismic facies have been mapped within the study area. In addition, twenty reservoir zones were identified as a central outcome with porosity ranging from 0.192 to 0.423 and permeability from 5.078 to 12,397.895 md, indicating very good porosity and permeability as a result of the low shale volume (0.031-0.148). The values for the bulk volume water were constant or nearly constant throughout the reservoirs and it was concluded that the reservoirs can produce water free hydrocarbon. For this reason they can be seen as very good hydrocarbon reservoirs.

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Finally, the study of Umar [6] presents the application of a fry strain analysis technique on metasediments around Danko Area in Northwestern Nigeria. The study area is part of the Zuru Schist Belt that comprises of Archean and Proterozoic rocks, bearing the imprints of the Liberian, Eburnean and Pan-African orogenic events. Here, three deformational events have been identified to have affected the rocks of the study area. The fry strain analysis was used to digitize the centre of the grains from which axial ratios and angles to reference lines of fifteen photomicrographs from low grade Meta sedimentary rocks (quartzite and muscovite schist) for understanding their deformation pattern and strain history. Quartzite recorded a more intense strain history while muscovite schist recorded a slightly constrictive strain. The study attributed the discrepancy in strain values to be the result of a ductile contrast between the rock types. The majority of the strain in these rocks appeared to come from a specific deformation due to the nearly vertical long axis of the strain and corresponding field evidence based on the heterogeneity in bulk strain [7].

In summary the presented issue of the Journal of Geology and Geophysics addresses important topics in earth's resources management including the presentation of state-of-the-art techniques in different countries. Nevertheless, the need for more research in the interdisciplinary field in geophysical sciences to improve the process

understanding and the follow-up advancements of management techniques has been highlighted.

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