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Sedimentology and heavy mineral studies of Ologe Lagoon, South Western Nigeria

Ibitola M P[1] and Dublin Green C O[2]
[1]Nigerian Institute for Oceanography and Marine Research, Nigeria
[2]University of Lagos, Lagos State

Eighteen bottom sediment samples were analysed for textural characteristics, heavy minerals analysis and provenance study of the Ologe lagoon. The megascopic studies showed the dominant sediments as sand and sandy mud. Pattern of sediment distribution consists of mud in the swallow marginal areas of the river channel while the channel centers are predominantly fine grained sand. The granulometric analysis reveals a fine grained sand of an average graphic mean of 2.22 ϕ. Sediments were moderately well sorted with an average Inclusive standard deviation of 0.65 ϕ. Skewness varied from fine skewed to coarse skewed with majority of the sediment samples are near symmetrical. The kurtosis average value is 1.19 ϕ (leptokurtic). The heavy mineral assemblages within the lagoon show the presence of opaque and non opaque minerals such as Zircon, Tourmaline, Rutile Staurolite and Garnet. The percentage proportion of individual heavy minerals analysed are opaque mineral 45.61%, Rutile 19.78%, Zircon 18.29%, Garnet 8.53% and Staurolite 2.57% respectively. The calculated zircon tourmaline, rutile (ZTR) index in percentage varied between 76-92%, average garnet-zircon index (GZI), rutile-zircon index (RuZI) values in all the stations are 16%, 54%, 25%. The bathymetry reveals an average depth of 3.3 m. The marginal areas and channel centres has a depth of 2.8 m and 8.5 m respectively with high concentration and deposition of heavy minerals at the deep channels. The ZTR index average value of 85% was obtained indicating that the sediments within the lagoon are mineralogically matured. The low value of SZI indicates sediments with a long transportation history. The presence of zircon, rutile and tourmaline indicates an acid igneous rock source of the sediments. However, the presence of staurolite, rutile and garnet occurrence indicates reworked sediments of pre existing rocks (sedimentary and metamorphic rock source).

mayoribi@yahoo.co.uk

Occurrences and possible applications of geothermal energy in Jordan

Bassam Sunna
Jordanian Geologists Association, Jordan

Energy imports constitute a significant part of the drain on hard currency reserves in Jordan. Numerous initiatives are being proposed in order to help the country gain a certain level of energy independence and to mitigate the effect of energy costs on the economy. These include initiatives to extract energy from indigenous oil shale deposits, build nuclear power reactors, wind and solar energy and even hydroelectricity derived from the Red Sea with the Dead Sea proposed canal. Following the appreciable increase in energy prices in the mid-1970s the Natural Resources Authority (NRA) of Jordan started in 1975 a systematic program to explore the geothermal energy of Jordan. The project progressed over the last forty years through several stages with various decision points along the way and limited development by the private sector. From that date up till now most of the activities of the NRA were implemented either by NRA staff members or through the Ministry of Planning and in cooperation with the following foreign countries and organizations: UNDP, USGS/USA, Italy, Germany, Czechoslovakia, France, Britain and Iceland. The work done so far included geological, volcanological, geochemical, geophysical, hydrological, hydro-geological, hydro-chemical, pre-feasibility and feasibility studies with concentration on Zarqa Main and Zara areas in Central Jordan, where shallow and deep drilling programs were also implemented. The renewable energy is currently booming in Jordan, however, the focus is made merely on solar and wind, while the country is blessed with enormous, underused huge potential of geothermal energy resource. The current level of use is limited to therapeutic and touristic applications in Ma'in and the northern Jordan Valley. Thermal waters in Jordan can be broadly classified into two groups. These are the thermal springs (more than 150 springs) which emanates along the fringe of the Jordan Valley Rift; and thermal wells (more than 100 wells) all over Jordan, in particular the eastern plateau, especially south of Amman, the Azraq, Risha and Sirhan areas. Both are distributed in about 20 geothermal fields. The current situation of geothermal energy in Jordan and the already done or possible applications is summarized hereinafter and will be discussed in the paper. The paper summarizes the various activities of Jordan in the field of geothermal energy and the results of these activities, the obstacles facing utilization of this valuable resource and what is the expected role in the future energy - mix in Jordan. There is very good potential in Jordan for most of the applications of geothermal energy in Jordan.

bassamsunna@yahoo.com