



PUBLICATIONS 2011

1. Ibrahim, E. , Kassem, O. and Al Bassam, A. (2011). Aeromagnetic data interpretation to locate buried faults in Riyadh Region, Saudi Arabia. Scientific Research and Essays, Vol. 7(22), p. 2022-2030.

Abstract

The evaluation of the faulting system is a prerequisite for any future assessment of the geo-hazard that could affect the study area and its surroundings. Therefore, the high resolution aeromagnetic data and various filtered maps are used in the present study to elucidate and locate buried faults in Riyadh region, Saudi Arabia. Filtering techniques such as Butterworth filter, horizontal gradient (HG), source edge detection (SED) and Euler deconvolution (ED) were used to map the structural lineaments in the study area. In this respect, the interpretation of these processed maps indicates that the area is dissected by a number of deep-seated faults that aligned mainly along NNW, NNE. The NW, NE, WNW and EW trending faults are present as second order. These faults divided the study area into three main zones of variable depth, width and pattern. To the northwest, there is an elongated high magnetic anomaly that indicates possible basement uplift, where a wide low magnetic anomaly dominates the western side of the area, with three local and circular low magnetic anomalies. This anomaly pattern is interpreted as a large and regional basinal area with three local depocenters separated by structural uplifts. The southwestern corner of the area is characterized by a general shallow basement structure with local low magnetic anomalies that form the Awsat and Nisah grabens. The edges of the interpreted structural zones are delineated clearly using SED techniques and the average depth to the magnetic sources ranged from ~5300 m to ~1300 m.

2. Fnais M.S., (2011): Ground-motion simulation for the eastern province of Saudi Arabia using a stochastic model. Proceedings of earthquake resistant engineering structures VIII.

The eastern Arabian Peninsula lies close to Zagros fold-thrust fault belt that has been considered as one of the most active seismotectonic regions in the Middle East, where the occurrences of large earthquakes ($M_w \geq 5.0$) are in abundance. The southern Kuwait seismic zone is the nearest source to the study area. Hence, a wide spread damage can be expected in this region due to the presence of thick section of soft sediments. Here earthquake catalogue is compiled, reviewed precisely and compared with the international seismological data. The affected seismotectonic zones are modeled and their seismicity parameters and maximum moment magnitude are estimated. Peak Ground Acceleration values for earthquakes with magnitudes $4.0 \leq M_w \leq 7.5$ have been simulated at distances up to 300 km from the source using a stochastic model. The predicted attenuation for Peak Ground Acceleration (PGA) at bedrock is estimated as: $\log(\text{PGA}) = -0.94 + 0.249 M_w - \log r - 0.00233r + 0.19 P$. With the help of this equation, the potential seismic hazard for the eastern part of the Arabian Peninsula can be assessed.

3. Hashim Almalki & Abdel-Khalek El-Werr & Kamal Abdel-Rahman (2011): Estimation of near-surface geotechnical parameters using seismic measurements at the proposed KACST expansion site, Riyadh, KSA. Arab J

Abstract

Eight shallow seismic refraction profiles were conducted at the proposed KACST expansion site, northwest of Riyadh, to estimate the near-surface geotechnical parameters for construction purposes. Both compressional (P) and shear (S) waves were acquired, processed, and interpreted using “time-term” technique which is a combination of linear least squares and delay time analysis to invert the first arrivals for a velocity section. The most important geotechnical near-surface parameters such as stress ratio, Poisson’s ratio, material index, concentration index, N value, and foundation material-bearing capacity are calculated. The results of these seismic measurements were compared with the results of borehole report in the project area in terms of number of layers, the lithological content, thicknesses, and N values of rock quality designation. A good matching between the results was observed Particularly at the sites of boreholes.

4. Deif A.; Azza Abed; Kamal Abdel-Rahman and Enayat Abdel Moneim (2011): Strong ground motion attenuation in Aswan area, Egypt. *Arabian Journal of Geosciences*, Vol. 4 No., 5-6, August 2011.

Abstract

Recent and paleoseismicity indicate that moderate seismic activity is relatively large for Aswan area. This is a warning on the possibility of occurrence of earthquakes in the future too. No strong motion records are available in Aswan area for engineers to rely upon. Consequently, the seismological modeling is an alternative approach till sufficient instrumental records around Aswan become available. In the present study, we have developed new ground motion attenuation relationship for events spanning $4.0 \leq M_w \leq 7.0$ and distance to the surface projection of the fault up to 100 km for Aswan based on a statistically simulated seismological model. We generated suites of ground motion time histories using stochastic technique. The ground motion attenuation relation describes the dependence of the strength of the ground motions on the earthquake magnitude and distance from the earthquake. The proposed equation for peak ground acceleration (PGA) for the bed rock is in the form of: $\log(\text{PGA}/\text{gal}) = 1.24 + 0.358 M_w - \log(R) - 0.008R + 0.22P$. Where PGA is the peak ground acceleration in gal (cm/s^2); M_w , its moment magnitude; R is the closest distance between the rupture projection and the site of interest; and the factor P is a dummy variable. It is observed that attenuation of strong motion in Aswan is correlated with those used before in Egypt.

5. Ibrahim, E., Mohamed, S., Atwan, A. (2011). Combining fuzzy analytic hierarchy process and GIS to select the best location for a wastewater lift station in Elmahala El-Kobra, North Egypt. *International Journal of Engineering & Technology IJET-IJENS*, vol. 11(5), 44 – 50.

Abstract

Abstract: Determining the best location is a complex process that faces the Decision makers. In El-Mahalla El-Ku bra, Egypt this problem exists in selecting the best location for wastewater lift station of an under-construction industrial sewage system. The site selection problem comes with criteria that determine the best

location. Dealing with real life situation and experts' judgments involves uncertainty. To solve this problem, we designed a model containing Multi-Criteria Decision Making (MCDM) technique that is Analytical Hierarchy Process (AHP) with fuzzy theory to handle the uncertainty situations and Geographical Information System (GIS) to determine the best location. An application adopting the FAHP idea was developed to calculate weights of the criteria of the site. The GIS was used to overlay and generate criteria maps and suitability map. The study ends with an assessment of proposed sites to the generated suitability map.

6. Hussain, A., Ibrahim, E., Asem, A. (2011). Mobile geographic Information systems: A case study on Mansoura University. *International Journal of Computer Science & Information Technology, IJET-IJENS*, vol. 3(6), 173 – 181.

Abstract

With the rapid development of GIS, embedded technology and wireless communication technology, mobile GIS becomes an active research area in the field of GIS. Information collection is one of the most promising application directions of mobile GIS. The purpose of this paper is to study the field of geographical information systems to propose a contribution in solving one of the bottlenecks that stumbles researchers from getting benefit of this field. This research used WAP technology to facilitate the communication and data transfer between the end user and the GIS server. This enables the authors to solve the small storage area problem of mobile devices. The basic idea of the suggested solution is based on saving the layers and the database on the GIS server and executing queries on the Server instead of using the mobile storage that's so small comparing with PCS, so we saved the storage area immobile. The small storage area of mobiles is a great problem facing this research area. Two prototypes were built on Mansoura University as a case study. The first one is an execution of location-based systems (LBS) and the second one is an execution of field-based systems (FBS). Applying the first prototype has proved to achieve its aims in helping the University's management in making surveys on all the distributed computers in the university while they are in their offices without the need to go to the site. Applying the second one has proved that the new comers found it's useful in helping them get the information they needed as well as telling them how to get there from here without any trouble.

7. Mohamed, A., Ibrahim, E and Sabry, A. (2011). Petrophysical characteristics of Wakar Formation, Port Fouad marine field, north Nile Delta, Egypt. *Arab J Geosci*, accepted for publication.

Abstract

Petrophysical characteristics of the late Miocene Wakar Formation of Port Fouad Marine Field have been evaluated through the analysis of well-logging records of nine exploratory and development wells, distributed in the north-14 eastern offshore area of the Nile Delta. These records have been analyzed through utilizing the ELAN Plus petrophysics software in order to identify the lithological constituents and fluid saturation parameters. The gas potentialities of the studied formation have been evaluated through number of iso-parameteric maps. The litho-saturation analysis indicates that the Wakar Formation in the studied wells is mainly gas-21 bearing with some water-bearing sand levels. The analytical formation evaluation reveals that the lithological facies consists mainly of sandstone, shale, and siltstone. The disseminated shale is mainly of dispersed type and some of laminated habitat. It also points to the dominance of the intergranular porosity. The isoparametric maps of the petro-27 physical parameters show that the level S1 of Wakar Formation is the main reservoir.

8. Mogren, S., Batayneh, A., Elawadi, E., Al-Bassam, A., Ibrahim, E., and Qaisy, S. (2011). Aquifer boundaries explored by geoelectrical measurements in the Red Sea coastal plain of Jazan area, Southwest Saudi Arabia. *Int. J. Phys. Sci.*, 6(15), 3768-3776.

Abstract

Geoelectrical measurements using the vertical electrical sounding (VES) method were conducted on the Eastern Red Sea coast in Jazan area, Southwest Saudi Arabia. The objectives of the study were (1) to map the Quaternary sediments in areas where little is known about the subsurface geology and to infer shallow geological structure, and (2) to identify formations that may present fresh aquifer waters, and subsequently to estimate the relationship between groundwater resources and geological structures. Data collected at 9 locations were interpreted first with curve-matching techniques, using theoretically calculated master curves. The initial earth models were double checked and reinterpreted using a one-dimensional inversion program in order to obtain final earth models. Resistivity measurements show four zones with different resistivity values, corresponding to four different bearing formations: (1) A resistive surface layer at the top; (2) A basalt flow layer in the northern parts; (3) Strata saturated with fresh to brackish groundwater; and (4) A water-bearing formation containing Red Sea saltwater.

9. Benoit Dewandel, Patrick Lachassagne, Faisal Kamal Zaidi, Subash Chandra (2011). Conceptual hydrodynamic model of a geological discontinuity in hard rock aquifers: example of quartz reef in granitic terrain in South India. *Journal of Hydrology*, 405, 474-487.

Abstract

The structure and hydrodynamic properties of geological discontinuities and of a deeply weathered granite aquifer near these structures are described on the basis of geological, geophysical and hydrodynamic investigations in two sites of South India located along a 20–40-m-wide quartz reef intruding a weathered Archean biotite granite. One of the two sites also comprises a metre-wide dolerite dyke. Weathering processes appear to be at the origin of fissures development and of a related enhanced local hydraulic conductivity, both in the quartz reef and in the surrounding granite. The weathering profile in the granite (saprolite and fissured layer) is characterized by an abrupt deepening of the weathered layers in the granite near the contact and in the quartz reef itself. Therefore, the weathering profile shows a ‘U’-shape geometry with, among others, the verticalization of the granite’s fissured layer. The hydraulic conductivity of this verticalized layer is on average 5×10^{-6} m/s and storativity about 10^{-3} (–). The hydraulic conductivity of the fissured quartz is $4-6 \times 10^{-6}$ m/s and its storativity about $3-5 \times 10^{-4}$ (–). Both media are also characterized by a matrix hydraulic conductivity (10^{-7} – 10^{-9} m/s) and by a significant heterogeneity in hydrodynamic properties that generates preferential flow paths along the sub-vertical fissures parallel to the reef axis. A special attention has been paid for characterizing this heterogeneity. The weathering of the dolerite dyke, however, results in a local low hydraulic conductivity, which consequently does not enhance either the thickness of weathered granite layers or its hydraulic conductivity. The obtained results complete the conceptual hydrogeological model developed for weathered granite aquifers in characterizing the relationships between weathering processes and hydrodynamic properties near geological discontinuities.

10. Faisal Kamal Zaidi, (2011). Use of Drainage Basin Morphometry for identifying zones for Artificial Recharge: A case study from the Gagans River Basin, Uttarakhand, India. *Journal of the Geological Society of India*, Vol.77, No.02,

February 2011, pp. 160-166.

Abstract

Drainage basin morphometry is a quantitative way of describing the characteristics of the surface form of a drainage basin and provides important information about the region's topography and underlying geological structures. It plays an important role in hydrogeological investigations for delineating zones of adequate groundwater potential and selecting sites for construction of artificial recharge structures. In the present study an attempt was made to discover the stream properties in the Gagas River Basin of Almora district in the state of Uttarakhand using the various stream attributes. Based on the study the potential zones for the construction of artificial recharge structures in the basin were identified.

11. D. Ravat, Ahmed Salem, A.M.S. Abdelaziz, E. Elawadi, P. Morgan (2011): Probing magnetic bottom and crustal temperature variations along the Red Sea margin of Egypt. *Tectonophysics*, 150, 337-344.

Abstract

Over 50 magnetic bottom depths derived from spectra of magnetic anomalies in Eastern Egypt along the Red Sea margin show variable magnetic bottoms ranging from 10 to 34 km. The deep magnetic bottoms correspond more closely to the Moho depth in the region, and not the depth of 580 °C, which lies significantly deeper on the steady state geotherms. These results support the idea of Wasilewski and coworkers that the Moho is a magnetic boundary in continental regions. Reduced-to-pole magnetic highs correspond to areas of Younger Granites that were emplaced toward the end of the Precambrian. Other crystalline Precambrian units formed earlier during the closure of ocean basins are not strongly magnetic. In the north, magnetic bottoms are shallow (10–15 km) in regions with a high proportion of these Younger Granites. In the south, the shoaling of the magnetic bottom associated with the Younger Granites appears to be restricted to the Aswan and Ras Banas regions. Complexity in the variation of magnetic bottom depths may arise due to a combination of factors: i) regions of Younger (Precambrian) Granites with high magnetite content in the upper crust, leaving behind low Curie temperature titanomagnetite components in the middle and lower crust, ii) rise in the depth of 580 °C isotherm where the crust may have been heated due to initiation of intense magmatism at the time of the Red Sea rifting (~ 20 Ma), and iii) the contrast of the above two factors with respect to the neighboring regions where the Moho and/or Curie temperature truncates lithospheric ferromagnetism. Estimates of fractal and centroid magnetic bottoms in the oceanic regions of the Red Sea are significantly below the Moho in places suggesting that oceanic uppermost mantle may be serpentinized to the depth of 15–30 km in those regions.

12. Ayman I. Taha, G. El-Qady, Mohamed A. Metwaly, Usama Massoud (2011): Geophysical Investigation at Tell El-Dabaa "AVARIS" Archaeological site, Mediterranean Archaeology and Archaeometry, Proceedings of the 10th SEGJ International Symposium, 298-301.

Abstract

Tell El –Dabaa is one of the important archaeological sites in the Eastern part of the Nile Delta. It is located at about 7 km north of Faqus city, Sharqiya governorate,

Egypt. The ancient name of El-Dabaa area was Avaris, which had been considered as the main capital of Hyksos (Dynasty XV) from 1650 to 1542 B.C. The whole area was covered by the deltaic deposits during the successive flood events along Nile Delta. Geomagnetic and geoelectric surveys have been carried out in order to outline the subsurface archaeological remains in this area. The target area, which is about 10000 m², was surveyed in grid pattern each of 20x 10 m for magnetic survey and 20 × 20 m for geoelectrical resistance survey. Integrated results of the magnetic and geoelectric data analysis have succeeded in delineating a clear subsurface picture of archaeological remains. The results show many linear anomalies, which may represent buried walls, as well as some small archaeological remains detached from the main walls. Also, we could notice some rectangular features with different sizes, which might be described as remains of different archaeological buildings. Besides, some circular structures with small size obtained and could be interpreted as columns foundations

13. Ghrefat, HA ; Jamarh, A ; Al-Futaisi, A ; Al-Abri, B (2011): Water quality mapping and assessment, and weathering processes of selected aflaj in Oman, ENVIRONMENTAL MONITORING AND ASSESSMENT Vol. 181 (1-4), 509-524.

Abstract

: There are more than 4,000 falaj (singular of a peculiar dug channel) distributed in different regions in Oman. The chemical characteristics of the water in 42 falaj were studied to evaluate the major ion chemistry; geochemical processes controlling water composition; and suitability of water for drinking, domestic, and irrigation uses. GIS-based maps indicate that the spatial distribution of chemical properties and concentrations vary within the same region and the different regions as well. The molar ratios of (Ca + Mg)/Total cations, (Na + K)/Total cations, (Ca + Mg)/(Na + K), (Ca + Mg)/(HCO₃ + SO₄), and Na/Cl reveal that the water chemistry of the majority of aflaj are dominated by carbonate weathering and evaporite dissolution, with minor contribution of silicate weathering. The concentrations of most of the elements were less than the permissible limits of Omani standards and WHO guidelines for drinking water and domestic use and do not generally pose any health and environmental problems. Some aflaj in ASH Sharqiyah and Muscat regions can be used for irrigation with slight to severe restriction because of the high levels of electrical conductivity, total dissolved solids, chloride, and sodium absorption ratio.

14. Ghrefat, HA ; Goodell, PC (2011): Land cover mapping at Alkali Flat and Lake Lucero, White Sands, New Mexico, USA using multi-temporal and multi-spectral remote sensing data, INTERNATIONAL JOURNAL OF APPLIED EARTH OBSERVATION AND GEOINFORMATION Volume: 13 Issue: 4 Pages: 616-625.

Abstract

: The goal of this research is to map land cover patterns and to detect changes that occurred at Alkali Flat and lake Lucero, White Sands using multispectral Landsat 7 Enhanced Thematic Mapper Plus (ETM+), Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), Advanced Land Imager (ALI), and hyperspectral Hyperion and Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) data. The other objectives of this study were: (1) to evaluate the information dimensionality limits of Landsat 7 ETM+, ASTER, ALI, Hyperion, and AVIRIS data with respect to signal-to-noise and spectral resolution, (2) to determine the spatial distribution and fractional abundances of land cover endmembers, and (3) to check ground correspondence with satellite data. A better understanding of the

spatial and spectral resolution of these sensors, optimum spectral bands and their information contents, appropriate image processing methods, spectral signatures of land cover classes, and atmospheric effects are needed to our ability to detect and map minerals from space. Image spectra were validated using samples collected from various localities across Alkali Flat and Lake Lucero. These samples were measured in the laboratory using VNIR-SWIR (0.4-2.5 μ m) spectra and X-ray Diffraction (XRD) method. Dry gypsum deposits, wet gypsum deposits, standing water, green vegetation, and clastic alluvial sediments dominated by mixtures of ferric iron (ferricrete) and calcite were identified in the study area using Minimum Noise Fraction (MNF), Pixel Purity Index (PPI), and n-D Visualization. The results of MNF confirm that AVIRIS and Hyperion data have higher information dimensionality thresholds exceeding the number of available bands of Landsat 7 ETM+, ASTER, and ALI data. ASTER and ALI data can be a reasonable alternative to AVIRIS and Hyperion data for the purpose of monitoring land cover, hydrology and sedimentation in the basin. The spectral unmixing analysis and dimensionality eigen analysis between the various datasets helped to uncover the most optimum spatial-spectral-temporal and radiometric-resolution sensor characteristics for remote sensing based on monitoring of seasonal land cover, surface water, groundwater, and alluvial sediment input changes within the basin. The results demonstrated good agreement between ground truth data and XRD analysis of samples, and the results of Matched Filtering (MF) mapping method. (C) 2011 Elsevier B.V. All rights reserved.

15. Ghrefat, HA ; Abu-Rukah, Y ; Rosen, MA (2011): Application of geoaccumulation index and enrichment factor for assessing metal contamination in the sediments of Kafraïn Dam, Jordan, ENVIRONMENTAL MONITORING AND ASSESSMENT Volume: 178 Issue: 1-4 Pages: 95-109.

Abstract

: An investigation is reported of the degree of metal pollution in the sediments of Kafraïn Dam and the origin of these metals. Fourteen sampling sites located at Kafraïn Dam were chosen for collecting the surface, cutbank, and dam bank sediment samples. The sediment samples have been subjected to a total digestion technique and analyzed by atomic absorption spectrometer for metals including Pb, Zn, Cd, Ni, Co, Cr, Cu, Mn, and Fe. XRD analyses indicate that the sediments of Kafraïn Dam are mainly composed of calcite, dolomite, quartz, orthoclase, microcline, kaolinite, and illite reflecting the geology of the study area. The enrichment factor (EF) and geoaccumulation index (I (geo)) have been calculated and the relative contamination levels assessed in the study area. The calculations of I (geo) are found to be more reliable than of those of EF. The enrichment of metals in the study area has been observed to be relatively high. I (geo) results reveal that the study area is not contaminated with respect to Ni, Co, Cr, Cu, and Mn; moderately to strongly contaminated with Pb; and strongly to extremely contaminated with Cd and Zn. The high contents of Pb, Cd, and Zn in the study area result from anthropogenic activities in the catchment area of the dam site. These sources mainly include the agricultural activities, sewage discharging from various sources within the study area (effluent of wastewater treatment plants, treated and untreated wastewaters, and irrigation return water), and the several industries located in the area. Degrees of correlations among the various metals in the study area are suggested by the results and the intermetallic relationship.

16. Lashin, A, Al-Arifi, N., and Abu Ashour, N., (2011): Evaluation of the ASL and Hawara formations using seismic- and log-derived properties, October Oil Field, Gulf of Suez, Egypt. Arabian Journal of Geosciences. Issue 3-4, pp: 365-383

Abstract

October Field is one of the most prolific offshore oil fields in the Gulf of Suez of Egypt. It consists of a number of marine platforms and produces oil from different reservoirs of different geological ages from the Lower Cretaceous to the Miocene. The aim of this study was to enhance a seismic-log evaluational procedure to evaluate the Miocene-aged Asl and Hawara Formations which encounter the main hydrocarbon and source rock potentials in the area North of October Oil Field. The well logging data, the borehole seismic data, and the velocity surveys are all used in this study. A number of synthetic seismograms are constructed and interpreted together with the deduced seismic impedance and reflection coefficient data for many wells in the study area. In addition, a comprehensive velocity analysis is performed using the seismic times and the computed average and interval velocities. These seismic-derived parameters are primarily used in recognizing and locating precisely the marl and sand sections of Asl Formation which show low to middle amplitudes. Furthermore, a quantitative well logging analysis is carried out over Asl and Hawara Formations to shed light over their hydrocarbon potentiality. Good oil saturation is exhibited by the Asl sand section which reaches to more than 90% in the southern parts of the study area. The petrophysical characters of this sand are very good in terms of good effective porosity (9% to 13%), low shale volume ($V_{sh} < 5\%$), and high oil saturation ($S_h > 85\%$). The sections of the Asl marl and the Hawara shale on the other hand are considered completely wet. An integrated model making use of the seismic- and log-derived properties is applied over the two studied formations for better understanding the reservoir of interest. Many relations are constructed between velocity, seismic impedance, and the rock pore spaces on one hand and between the velocity, lithology, and fluid content on the other hand. This study revealed that the sand section attains very good oil-bearing potentiality in the study area and proved that the application of an integrated model of the log- and seismic-derived properties led to an enhanced evaluation of the Asl and Hawara Formations, good discrimination between their lithological components besides precise differentiation from the overlying Middle to Late Miocene sections

17. A.K. Abdel-Fattah, K.Y. Kim, M.S. Fnais (2011): Slip distribution model of two small-sized inland earthquakes and its tectonic implication in north-eastern desert of Egypt. *Journal of African Earth Sciences*, Volume 61, Issue 4, November 2011, Pages 296–307

Abstract

Two slip distribution models of the 1999 and 2006 Beni-Suef earthquakes (M_w 4.5 and M_w 4.2, respectively) were revealed using waveform inversion with an empirical Green's function method. Waveform data used were recorded by the Egyptian Seismic Network's short-period stations. To identify the active fault plane associated with each event and to estimate the best fitting rupture velocity, a set of slip distribution models was recovered on both nodal planes of the focal mechanism with a range of fixed rupture velocities. The result for the 1999 event shows that the northwest trending plane consistently provided better fitting solutions than the southwest trending plane. This implies that the slip was left-lateral on a northwest trending plane dipping toward the southwest. The 2006 event caused a slip movement on a dip-slip fault dipping towards the north. The rupture velocities were founded to be 3.5 km/s and 3.0 km/s which gave a comparatively small residual for the 1999 and 2006 earthquakes, respectively. The corresponding slip distribution models for the 1999 and 2006 events provide their seismic moments of $7.6E + 15$ N m and $2.5E + 15$ N m and moment magnitudes of 4.5 and 4.2, respectively. From the viewpoint of tectonics in the region, the present results imply an extensional tectonic process along the pre-existing WNW–ESE/NW–SE faults

that may be transferred from the Gulf of Suez–Red Sea rift towards the northeastern desert in Egypt. This finding implies the diving of the northeastern of African plate beneath the Eurasian plate.

18. Chatterjee, R., Mukhopadhyay, M. and Paul, S., 2011. Overpressure zone under the Krishna-Godavary Offshore Basin: Geophysical implications for natural hazard in deeper-water drilling. *NATURAL HAZARDS* (Springer), Special issue on **Geomarine Hazards for the Bay of Bengal and Arabian Sea**, vol. 57(1), DOI [10.1007/s11069-010-9659-6](https://doi.org/10.1007/s11069-010-9659-6).

Abstract

Accurate knowledge of pore pressure is fundamental to any safe and economic well construction. Here, we present results that are indicative of over pressure zones (OPZ) for five wells drilled under the Krishna–Godavari offshore basin (KGOB) at the Eastern Continental Margin of India (ECMI). OPZ in areas of crustal flexuring can act as potential geohazard while drilling. These wells locate at water depths of 515–1,265 m, where their penetrated-vertical-depth reaches up to 3,960 m in clastic sediments. pore pressure gradient (PPG) and fracture pressure gradient (FPG) are estimated from acoustic log for all five wells, while the Normal Compaction Trend (NCT) and pore pressure are calculated from Miller’s sonic equation. Top of OPZ is indicated by values that are higher than the NCT; departure from NCT is observed at depth intervals of 1,320–2,180 m, 1,700–3,960 m, 1,600–1,880 m, 1,420–2,609 m and 2,080–2,200 m for the respective Wells 1 through 5. The pressure data from Modular Dynamic Tester (MDT) agree well with the pore pressure values obtained from the logs. The Overburden Gradient (OBG), PPG and FPG values increase rather slowly with total depth in deeper-water of KGOB when compared to the wells located in shallow water depth. Consequently, the operating safety margin between PPG and FPG decreases as the water depth increases, and this clearly leads to an increase in the number of casing strings to reach the target depth. Certain basic conclusions on the potentiality of natural hazard for drilling operations are drawn on the basis of these results, but evidently, further studies are warranted to present a more composite picture of OPZ under KGOB.

19. Mukhopadhyay, B., Dasgupta, S., Fnais, M. and Mukhopadhyay, M., 2011. Modeling the pore-fluid diffusion process in aftershock initiation for 2004 Sumatra earthquake – Implications for marine geohazard estimation in the Andaman region. *NATURAL HAZARDS* (Springer), Special issue on **Geomarine Hazards for the Bay of Bengal and Arabian Sea**, vol. 57(1), DOI [10.1007/s11069-011-9779-7](https://doi.org/10.1007/s11069-011-9779-7), published online: 16 March 2011.

Abstract

The role of fluid injection on the occurrence and migration path for the aftershocks of 2004 Sumatra earthquake (Mw 9.3) and January 2005 Andaman earthquake swarm within the aftershock sequence is investigated here from the viewpoint of pore fluid diffusion process. The Sumatra earthquake created a regionally extensive crustal rupture plane exceeding 1,200 km length below the Andaman Sea. The r - t plots (Shapiro et al. 1997) are constructed for these aftershocks in order to examine the role of poroelastic effects as rupturing progressed with time. Their main results are as follows: the r - t plot corresponding to first 3 h of aftershock activity (when only 44 events of mb C 4.5 originated) reveals that 95% of the data points occurred below the modelled parabola with relatively high D value of 20 m²/s, whereas a significantly low D value of 3.5 m²/s characterises the aftershock activity for the first 24 h (when 420 events of mb C 4.0 occurred). Here, the Coulomb stress was transferred from the main shock with a rapid imposition of normal stress, thus inducing the pore-pressure change that started diminishing almost immediately by

fluid diffusion, at a rate, defined by the diminishing D value. The modelling results for fault seismicity at far off distances from the main epicentre are interpreted here as potential indicators for large-scale sub-seabed rupturing—consequent to stress changes induced by bending of the Indian Ocean plate. Bathymetric slopes under the Andaman subduction zone are particularly amenable to sub-marine slides where crustal E–W hinge faults inferred seismically cut across the N–S trending regional thrust and strike-slip faults. Seabed rupturing appears to allow deep-slab hydration in these areas, producing pressure gradients along the normal faults. These features are important since they can herald marine geohazards in the Andaman region.

20. Mukhopadhyay, B., Mukhopadhyay, M. and Dasgupta, S., 2011. Seismic clusters and their characteristics at the Arabian Sea Triple Junction: Supportive evidences for plate margin deformation. **J. GEOL. SOC. INDIA** (Springer), 78: 131-146.

Abstract:

The plate margin features defining the Arabian Sea Triple Junction (ASTJ) are: the Aden Ridge (AR), Sheba Ridge (SR) with their intervening Alula-Fartak Transform (AFT), Carlsberg Ridge (CR) and Owen Fracture Zone (OFZ). Exact nature of ASTJ is presently debated: whether it is RRF (ridge-ridge-fault) or RRR (ridge-ridge-ridge) type. A revised seismicity map for ASTJ is given here using data for a period little more than a century. “Point density spatial statistical criterion” is applied to short-listed 742 earthquakes ($m_b \geq 4.3$), 10 numbers of spatio-temporal seismic clusters are identified for ASTJ and its arms. Relocated hypocentres help better constraining the cluster identification wherever such data exist. Seismic clusters actually diagnose the most intense zones of strain accumulation due to far field as well as the local stress operating at ASTJ. An earthquake swarm emanating from a prominent seismic cluster below SR provides an opportunity to investigate the pore pressure diffusion process (due to the active source) by means of “r-t plot”. Stress and faulting pattern in the active zones are deduced from 43 CMT solutions. While normal or lateral faulting is characteristic for these arms, an anomalous thrust earthquake occurs in the triangular ‘Wheatley Deep’ deformation zone proximal to ASTJ. The latter appears to have formed due to a shift of the deformational front from OFZ towards a transform that offsets SR. Though ASTJ is still in the process of evolution, available data favour that this RRF triple junction may eventually be converted to a more stable RRR type.

21. Kassem, O. M. K. 2011: The Effect of Microstructural and vorticity analysis for the Metavolcano-sedimentary rocks. *Annals of Geological Survey of Egypt*, Vol. 31, pp. xx-xx (Accepted on 21/9/ 2010).

Abstract

The relationship between the orientation of rigid objects and their aspect ratio can be used in vorticity analyses in a variety of geological settings. The vorticity analysis of porphyroclasts was determined in high temperature mylonites. The kinematic vorticity number for the Metavolcano-sedimentary rock samples in Gabal El Mayet area range from 0.66 to 0.90, and together with the strain data suggest deviations from simple shear. It is concluded that nappe stacking occurred early during the underthrusting event probably by brittle imbrication and that ductile strain was superimposed on the nappe structure during thrusting. The accumulation of ductile strain during thrusting was not by simple shear and involved a component of vertical shortening, which caused the subhorizontal foliation in the Gabal Mayet shear zone and adjacent units.

22. Kassem, O. M. K. 2011: Determining Heterogeneous deformation for Granitic rocks in the Northern thrust in Wadi Mubark belt, Eastern Desert, Egypt.

Abstract

Finite-strain was studied in the mylonitic granitic rocks and metasedimentary rocks in the northern thrust in Wadi Mubarak belt to show a relationship to nappe contacts between the old granitic and metavolcano-sedimentary rocks and to shed light on the heterogeneous deformation for the northern thrust in Wadi Mubarak belt. We used the R_f/ϕ and Fry methods on feldspar porphyroclasts, quartz and mafic grains from 7 old granitic and 7 metasedimentary samples in the northern thrust in Wadi Mubarak belt. The finite-strain data shows that old granitic rocks were moderate to highly deformed and axial ratios in the XZ section range from 3.05 to 7.10 for granitic and metasedimentary rocks. The long axes (X) of the finite-strain ellipsoids trend W/WNW and E/ENE in the northern thrust in Wadi Mubarak belt. Furthermore, the short axes (Z) are subvertical associated with a subhorizontal foliation. The value of strain magnitudes mainly constants towards the tectonic contacts between the mylonitic granite and metavolcano-sedimentary rocks. The data indicate oblate strain symmetry (flattening strain) in the mylonitic granite rocks. It is suggested that the accumulation of finite strain was formed before or / and during nappe contacts. The penetrative subhorizontal foliation is subparallel to the tectonic contacts with the overlying nappes and foliation was formed during nappe thrusting.

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Gabtani H., Chully-Zennati B., Jallouli C., Mickus K., Bedir M. (2011). The crustal structure of the Sahel Basin (eastern Tunisia) determined from gravity and geothermal gradients: Implications for petroleum exploration. *Arab. J. Geosci.* 4(3-4):507-516.

Abstract

An analysis of Bouguer gravity anomaly data and geothermal gradient data obtained from bottom hole and drill stem tests temperature is used to determine the crustal structure of the Sahel Basin in eastern Tunisia and its role in the maturation and location of the large number of oil and gas fields in the region. The regional Bouguer gravity anomaly field is dominated by gradual increase in values from the northwest to southeast and is may be caused by crustal thinning as revealed by regional seismic studies. In addition, higher geothermal gradients in the same region as the Bouguer gravity anomaly maximum add an additional constraint for the existence of crustal thinning in the region. A detailed analysis of the Bouguer gravity anomaly data was performed by both upward continuation and horizontal gradients. These two techniques were combined to show that the study area consists of two structural regions: (1) the North–South Axis (NOSA)–Zeramedine region which is characterized by northwestdipping, northeast-striking faults, thicker crust (30–31 km) and low geothermal gradients, and (2) the Mahres–Kerkennah region which is characterized by vertical, northwest-striking faults, thinner crust (28–29 km) and higher geothermal.