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Basement Mapping and Structural Analysis Of the Jifarah Plain and Adjacent Area,NW Libya

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Basement Mapping and Structural Analysis Of the Jifarah Plain and Adjacent Area,NW Libya By Ahmed S. Saheel1 Mohamed A. Saleem2 ;;&Omar S.Hammuda3

1- Libyan Petroleum Institute, (ahm_saheel@lpilibya.org) 2- Libyan Petroleum Institute, (m_sal533@yahoo.com) 3. Geol.Dept. Al Fateh Uniersity,Tripoli,Libya. Abstract This study of the Jifarah Plain and adjacent area in Northwest Libya covers a block about 500 by 250 kilometers including onshore and offshore parts. The Pleistocene and Holocene rock units predominate the upper part of the geological succession, while Mesozoic rock units form the lower part in the north side of the area; however, in the south side the lower part includes Mesozoic as well as Paleozoic sediments. The area is characterized by many fault zones belonging to different fault systems. This paper is part of a study entitled: “Evaluation of Jifarah Plain Hydrocarbon Potential”, which was carried out recently by the Libyan Petroleum Institute. The paper was undertaken to construct a detailed investigation focusing on the subsurface structures and basement morphology of the area. 27000 real gravity data and 202000 gridded magnetic data, as well as a logging data of 15 oil wells were used. The residual gravity map which was obtained by applying the second order trend removal demonstrates that the Jifarah Plain has a sediment thickness less than the surrounding basins (the north part of Ghadames Basin and both Sabratha and Misrata basins in the offshore). The gravity maps as well as the magnetic maps show that the thickness of sediments decreases northward to the present coast line. Then the thickness increases again toward the north in the offshore. This arching structure along the coast line has been named the Permian Hinge Line in older literature. The derivative of the data in x, y direction and the total horizontal derivative delineate the edges of the trends from

which a series of fault systems are defined such as the coast line fault system, Al Aziziyah fault system, Gharian fault system, and Wadi Ghan fault system. All of these fault systems can be grouped in two main trends: Northwest to southeast trend and East northeast to West southwest trend. By defining all these trends, a new structural map has been produced for the area. The examination of the spatial power spectrum of the magnetic grid identifies five source ensembles at average spectral slope depths of 1.8km, 2.25km, 3.4km, 7.3km and the regional source (deep crust) 20km 3D Euler deconvolution has been applied, to the gridded magnetic data to estimate the location and depth of magnetic features and basement configuration, a new basement depth map has been produced which shows that the maximum depth of basement in the area of study is about 8250 m. Using 2¡D modeling, two gravity profiles have been constructed from residual gravity anomaly: one is 320 km long in a NE-SW direction, and the other is 240 km long in a NW-SE direction. Both profiles support the fact that the basement depth is very shallow near the coast line, increasing south ward. The first profile also shows some of the fault systems that dominate the area. By applying the upward and downward continuation filters to several levels, we found that almost all of the fault systems are starting near the surface and extending to higher depths.