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Seismic and well data interpretation for Fort Abbas area in Punjab Platform, Pakistan

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Abstract: This study is carried out to mark the structural trends of subsurface by using seismic reflection data. Present study involves seismic interpretation, preparation of Time and Depth contour maps, 3D time surfaces and Isopach map with help of reflection seismic data. This study suggests presence of Paleo-high of post Jurassic age. Paleocene and younger formations are unaffected by this tectonic event. Subsurface seismic and well data represents Basement, Salt Range, Jutana/Kussak, Tobra, Ranikot and Eocene rock units. A structural high is present in almost all seismic lines used. The general dip trend is due West and obvious on Time and Depth contour maps as well as on 3D surface. In northwest direction Cambrian sediments possess maximum thickness represented by Isopach maps. Triassic and Cretaceous formations are pinching towards southeast direction observed through well correlation.

Drilling of Fort Abbas Well-01 was carried out to test the hydrocarbon potential of these rock units. It was declared dry due to improper seal within the Cambrian reservoir. On the basis of seismic data, it would not be false to say that the Cambrian succession is highly fractured and complex to interpret.

Keywords: Seismic, well data interpretation, Frot Abbas.

1. INTRODUCTION

Studied area Fort Abbas lies at $29^{o}11'35''$N to 32^{o}N latitudes and 68^{o}E to $72^{o}51'13''$E longitudes in Punjab Platform. The Indus Basin is divided into Upper, Middle and Lower, demarcated by Sargodha and Khairpur highs respectively (Qadri, 1995). Middle Indus Basin is divided into Punjab Platform, Suleiman Fore-deep and Suleiman Fold Belt from East to West. The Punjab Platform is bounded in South by Sukkur Rift Zone and in North by Precambrian Sargodha High and extends to Bikaner Basin of India further in the East **(Fig.1).** It is leading edge of passive continental margin and dipping westward. Evidence from wells and outcrops along northwestern leading edge, of the platform shows Paleozoic, Mesozoic and Cenozoic in moderate thickness are present over basement (Platform), which continues as a platform area into India where petroliferous basins are locally formed (Raza *et al*, 1989). Punjab Platform is an eastern part of Middle Indus Basin in Pakistan with Sulaiman depression and fold belt in West, Sargodha High in North and Pokhran High in South (Aadil *et al*, 2011). Fort Abbas concession is part of Punjab platform which is a gentle eastward monoclonal rise in Central Indus Basin.

2. MATERIAL AND METHODS

Subsurface and paleo-highs exposures at Sargodha, Jacobabad indicate that Precambrian craton is comprised of granites, granidioritic, metavolcanics and metasedimentary rocks. The oldest rocks encountered in

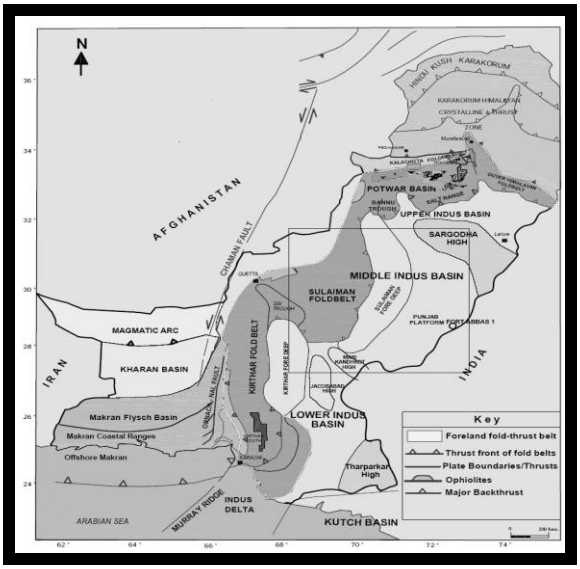


Fig.1 : Map showing the research area in Punjab Platform

Punjab Platform through drilling are of Infra-Cambrian Salt Range Formation. Pre-Himalayan orogenic movements have resulted in prolonged uplifts/sea regression causing unconformities. As a result, several salt cored anticline structures are expected in the southern portion of this monocline (Qadri, 1995) & (Humayun *et al*, 1991). Only scattered outcrops of Precambrian shield rocks are present in Sargodha, Kirana, Shahkot and Sangla Hill area. The generalized stratigraphic sequence in the area which is inferred from logs of exploratory wells is summarized in **(Fig.2).**

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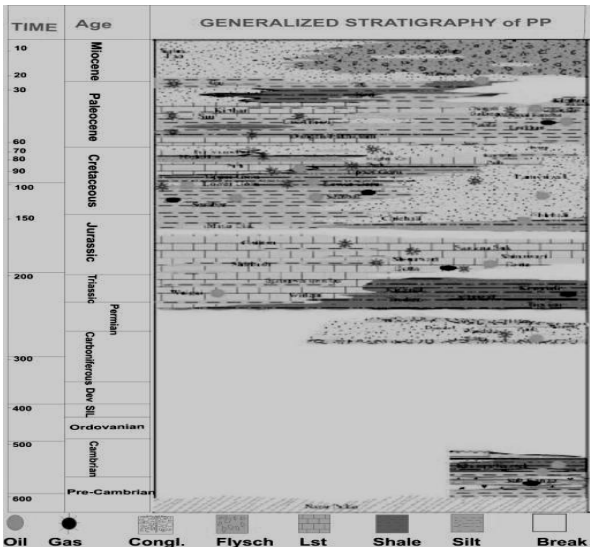


Fig.2: Generalized Stratigraphy of Punjab Platform.

Seismic lines & Well data

Seismic lines which are used for data interpretation in SEG Y digital format are 931-FABS-33, 931-FABS-34, 931-FABS-35, 931-FABS-36, 931-FABS-37,931-FABS-16-A, 921-FABS-03, 931-FABS-24, 931-FABS-23 and 921-FABS-04 are provided to endorse interpretation from wells data which are Fort Abbas-01, Bahawalpur East-01 and Marot-01 **(Fig. 3).** The horizons interpreted are Eocene, Paleocene, Jurassic, Permian, Cambrian, Pre-Cambrian and Basement with the help of SMT Kingdom 8.6 software.

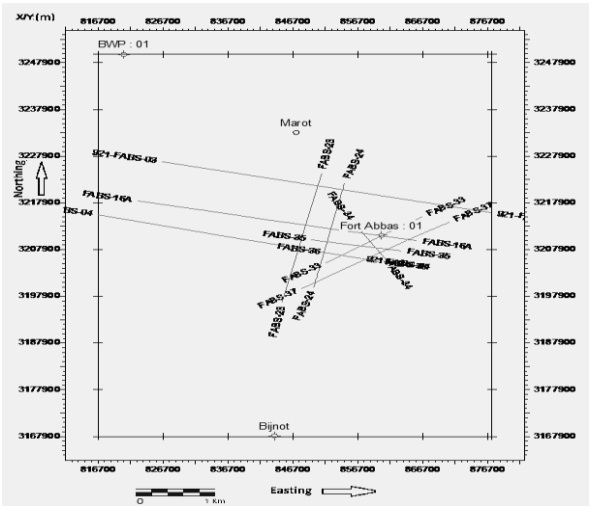


Fig.3: Basemap showing different seismic lines of Fort Abbas area and wells locations.

Well Correlation

Well Fort Abbas-01 was drilled in Bhawalnagar, Punjab Province, in Fort Abbas Exploration License area. Fort Abbas Well-01 is located in desert area at about 28.5 Kms from Fort Abbas town and 31 Kms SE of Marot Well No.01. Well Fort Abbas-01 is marked on the tie line of seismic lines 931-FABS-33 & 931-FABS-16A. The well is located at 28 ^{o} 58′ 31″N latitude and 72 ^{o} 41′ 54″E longitude. The purpose of well correlation is to study source of sediments and depositional centers during different geological time periods. The well drilled on the paleo-lows have not encountered older rocks and basement. The wells drilled on the paleo-high have penetrated in basement like Bahawalpur East-01 and Marot-01. In Fort Abbas area, thickness of Pre Cambrian strata is increasing from Southeast to Northwest. The thickness variation of Cambrian strata is decreasing towards Bahawalpur East-01 from Fort Abbas-01. The height of the paleo-high increase towards Fort Abbas from Marot-01 well. It is clear from well correlation that thickness is increasing from Southeast to Northwest.

3. RESULTS AND DISCUSSION

Exploration and Production companies started to carry out conversion from analogue to digital methods. These companies made extra advances in digital processing and technology (Lawyer *et al*, 2001). Reflection seismology is a remote imaging method used in petroleum exploration (Robinson *et al*, 2008). It is a very powerful tool to delineate subsurface features. The present study involves Seismic Interpretation, preparation of Time and Depth contour maps, 3D time surfaces and Isopach map with help of reflection seismic data. This study suggests the presence of Paleo-high of post Jurassic age. Paleocene and younger formations are unaffected by this tectonic event. This bulge did not allow the cretaceous rocks to deposit over and those rocks are lying at the flanks of the bulge.

Seismic Line 931-FABS- 33 is showing a bulge and a well is drilled on it. The overall inclination of the reflectors is towards northwest. Paleo-high occurs in Cambrian, Permian and Jurassic. There is no influence in the reflector of the Paleocene. It can be concluded that activity was seized at a time of Paleocene. This high can be related to the episode of uplifting of Sargodha High (northwest). On flanks of Datta Formation, there are leftovers of Cretaceous **(Figs. 4and 5).**

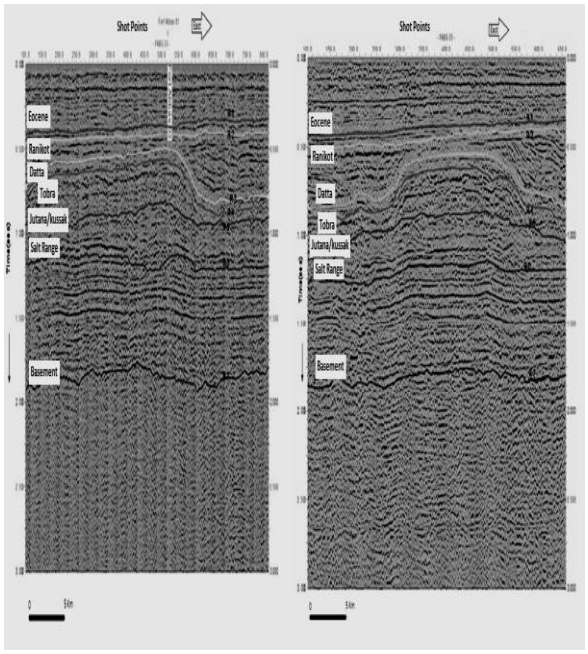


Fig.4:Interpreted seismic section of 931-FABS-33. Fig.5: Interpreted seismic section of 931-FABS-35.

Time and Depth contour maps give clear picture about structure and dip of formation (Fig.5). With help of these maps the direction of subsidence and shift of depocenter are studied. 3D surface show that shift of depocenter and sign of basin inversion are seen from Permian age (**Figs. 6and 7).**

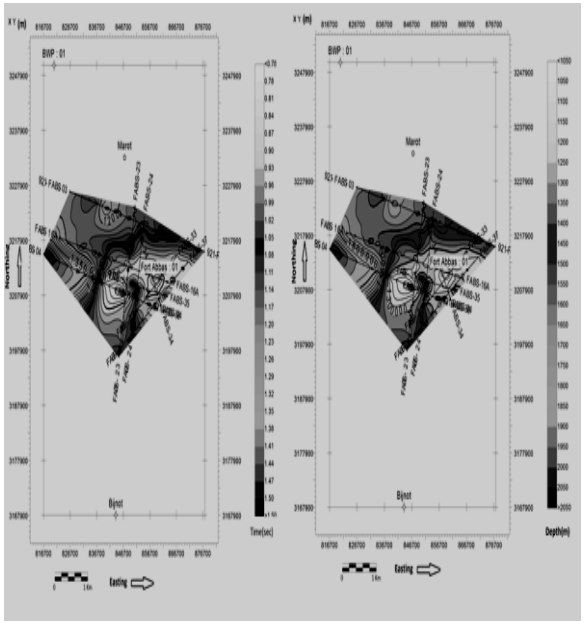


Fig.6: Time and Depth contour maps of top of Jutana-Kussak (Cambrian).

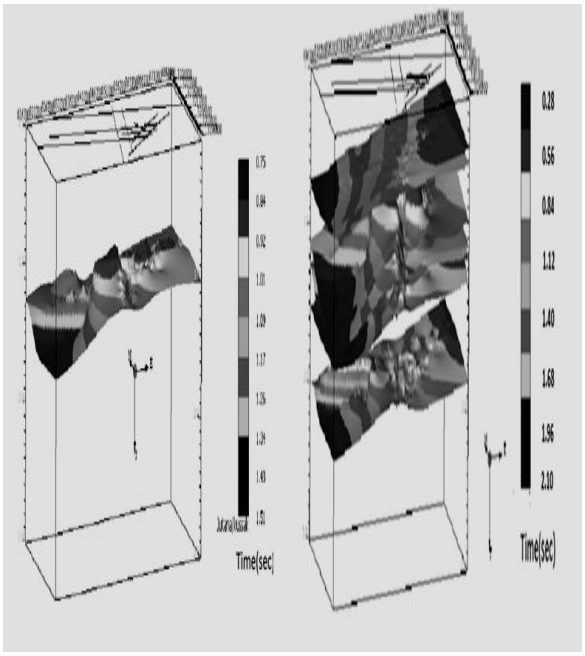


Fig.7: 3D Time surface view of Jutana-Kussak (Cambrian) with Paleo- high and all formations.

The Isopach map of Jutana/Kussak Formation indicates in Cambrian age, the depocentre is in northwestern part of the platform and direction of sediments flow is from SE-NW **(Fig. 8, 9).**

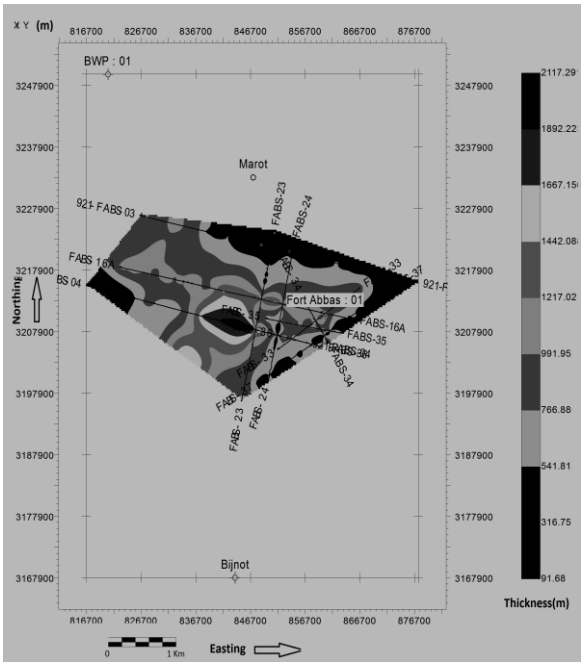


Fig.8: Isopach map of the Kussak/Jutana formations show increasing thickness in NW direction. Blue color is sho wing the expected minimum thickness.

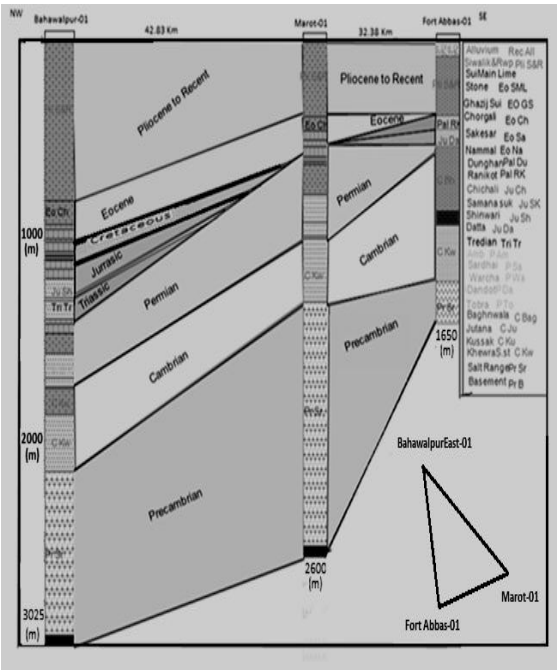


Fig.9: Well correlation by using well tops of Bahalpur-01, Marrot-01 and Fort Abbas-01.

4. CONCLUSIONS

Structural variations of Eocene, Ranikot, Datta, Tobra, Jutana/Kussak, Salt Range and Basement are studied in the area.

Formations from Permian to Jurassic show a Paleo-high.

Time & Depth contour maps and 3D viewer show the dip of strata is towards West.

Isopach map indicates sedimentation flow in Cambrian age is from Southeast-Northwest.

Well correlation shows formations are pinching out and the thickness is increasing from Southeast to Northwest.

5. ACKNOWLEDGEMENT

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