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Processing of 2D Seismic Data from Western Sirte Basin Libya: A Case Study

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Summary

The importance of seismic data in hydrocarbon exploration is realised by the extent to which the subsurface information can be derived during the data interpretation. To achieve this objective seismic data processing should aim at improving the S/N ratio so that a good siesmic section can be produced for a meanigful interpretation of the subsurface geological features such as structural highs and lows, faults, pinchouts etc. which are of paramount importance in hydrocarbon exploration. In this paper, the results of Kirchoff Prestack Time Migration process together with prestack FK filtering in shot and receiver domain and prestack random noise atteunation which are carried over 2D data from an area in the Western Srite Basin, Libya is presented

Introduction

The study area (Fig 1) is situated in the Western region of Sirte basin, where the major structural elements are Uddan Uplift, Zella Trough the Dahra Platform, Hon Graben and Abator high.The western part of the Sirte basin contains upto 3 kms of Cretaceous-Miocene sediments. The principal petroleum system is the Cretaceous Sirte Shale-Paleocene –Eocene system. 80 fold 2D Vibroseis seismic data (Acquisition parameters are given in Table-I) data has been acquired in this area during 2007.

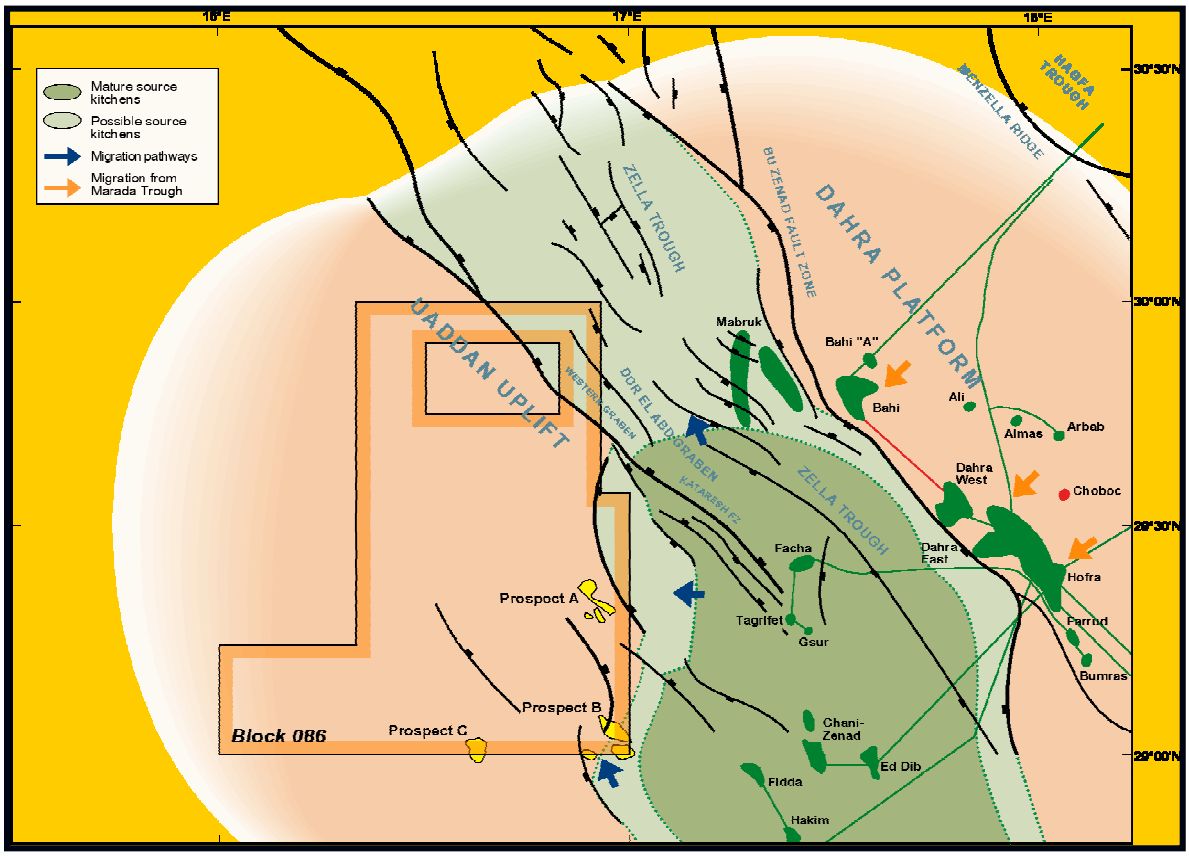

Fig: 1 Map Showing Area of Study (Western Sirte Basin, Libya)

Recorder	: SN 428XL
Source Interval:	40 meters
Sweep Length	: 16 seconds
No. of sweeps	: 12 (4 x3)
Sweep Frequency	: 8-80 Hz
Receiver interval	: 20 Meters

Table Showing Acquisition parameters.

Results and Discussion

The surface is mostly covered with scrub desert with an average elevation of 240 m. and the presence of Eocene anhydrite (Hon Evaporites) at places restricts the penetration of energy, thereby adversely affecting the S/N ratio and in turn the data quality. The line chosen for the present study cuts across such an area where few meters thick evaporties are present in the near surface. The line was processed at CGGVeritas processing centre at Tripoli, and it was observed that the normal sequence using a 2 pass velocity analysis with PSTM and two pass residual statics application did not yield much information over the area where the subsurface has got the evaporites where as away from the feature the data quality was found to be good. After careful examination of the velocity spectra and looking at the FK spectrum of the data it was decided to apply FK filtering in both shot and receiver domain and a third pass velocity analysis after PSTM along with FX random noise attenuation just before the PSTM stack. Also post stack Dip median filtering was applied with post stack FX decon on the PSTM stack. (Processing Sequence shown in Fig 2) The new approach has considerably improved the section and also gave some mappable meaningful reflections over the area where there were no reflections seen earlier

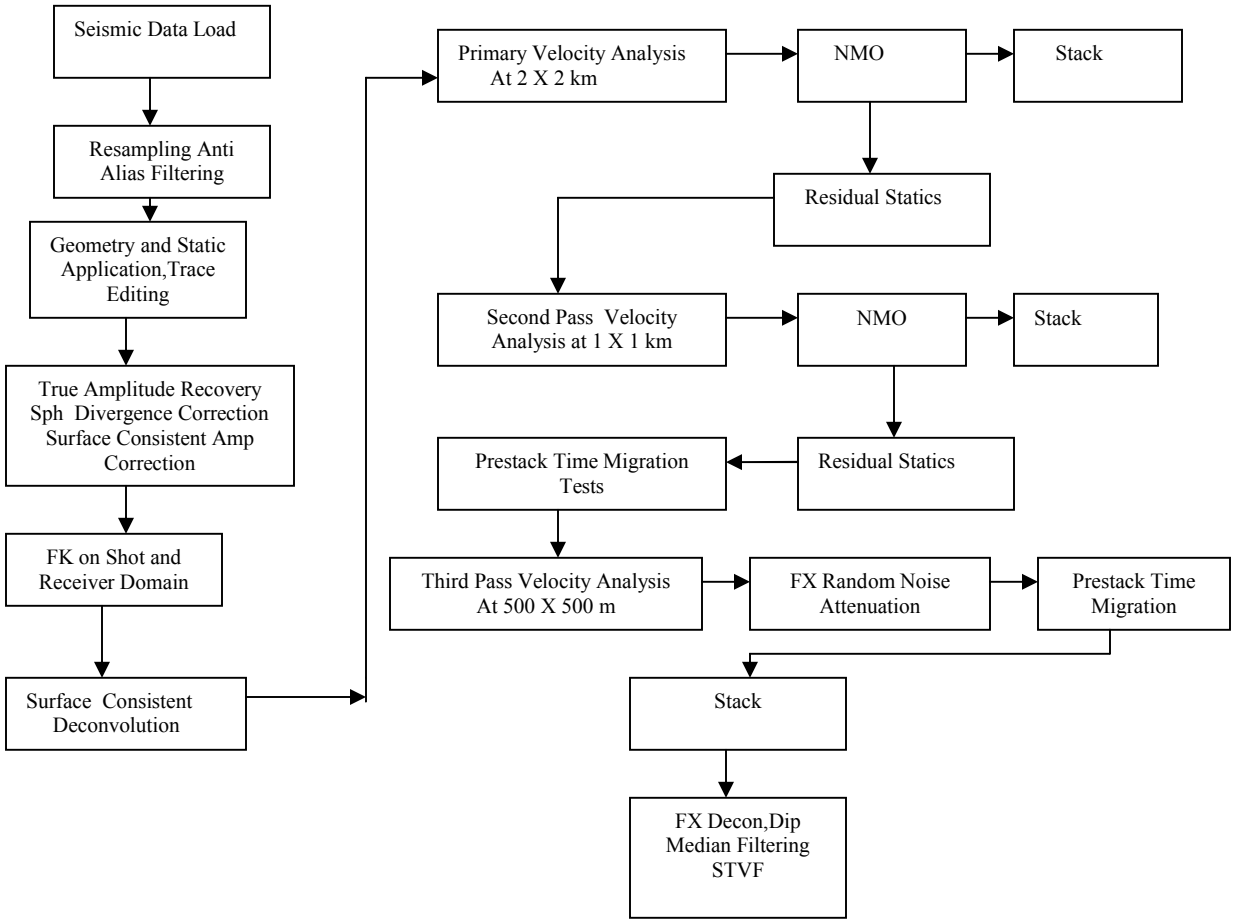

Fig2: Final processing Sequence used for the study.

The seismic section which was processed with PSTM but without the restack FK and FX decon is shown in Fig 3 where as the final processed sections with the sequence shown in Fig 2 is shown in Fig4.

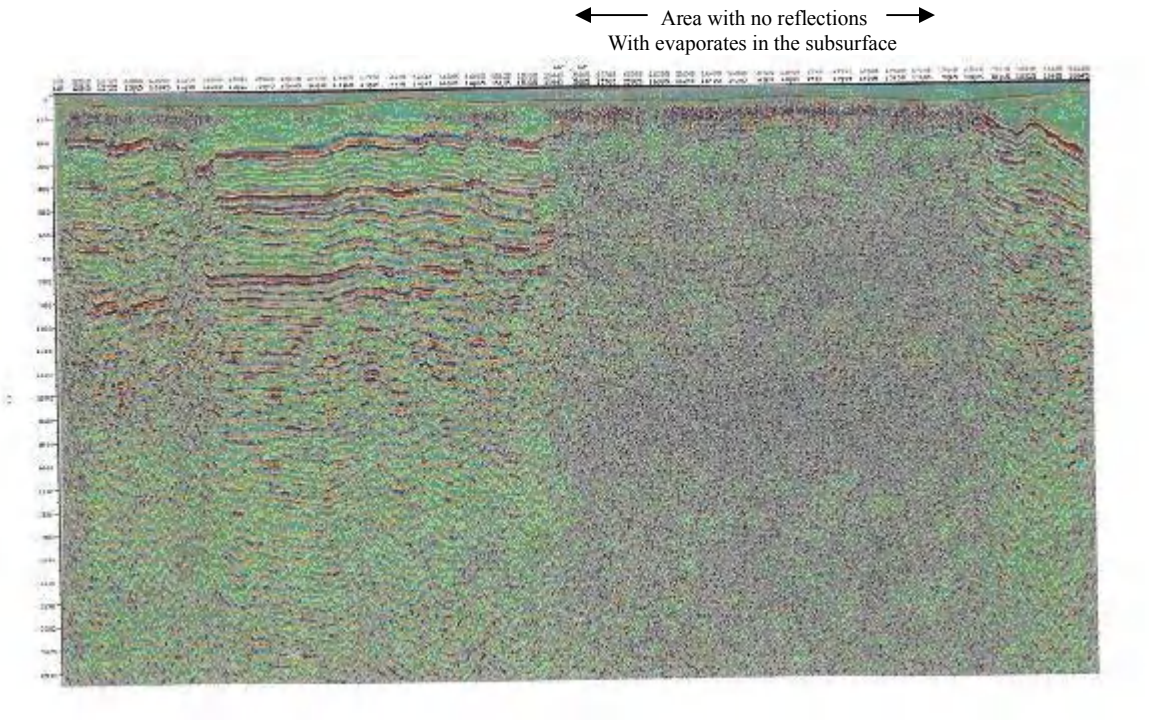

Fig3: Seismic section processed with PSTM

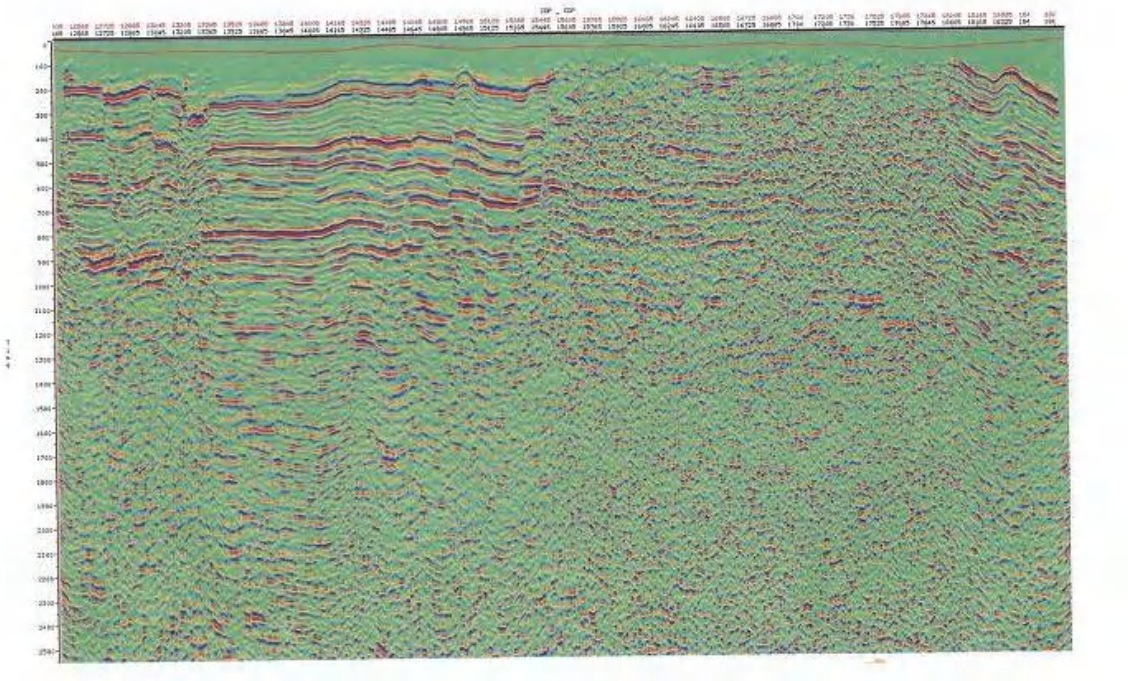

Fig 4: Seismic section processed with PSTM and Prestack FK and Prestack FX Decon.

Conclusions

As mentioned above it is clear that very good improvement can be seen in data quality both laterally and vertically from the section processed with prestack FK filtering and FX deconvolution applied on the nmo corrected gathers just before stacking .As it is evident from the above in addition to the mappable events which were observed over the area with no reflections earlier there is also considerable improvement in the reflector quality to the left of the area with poor reflections. The above may be due to the careful application of pre stack FK filtering on shots and receivers as the same is instrumental in removing coherent linear noise and side scattered energy which were obscuring the primary reflections in the recorded data. Also it should be noted here that FX decon applied on nmo corrected prestack data has also contributed to the significant reduction in noise and enhancement of the coherent signal in the section.

The above case study clearly brings out the fact that in difficult subsurface conditions in addition to careful designing of the survey, it is imperative that extensive testing of different processing routines need to be carried out before arriving at a proper sequence which will gives us meaningful subsurface information which can be correlated with the lithogy which in turn can help us in the interpretation of the subsurface.

References

1. Various published/unpublished reports on geology of Western Sirte Basin,Libya.