7th International Conference & Exposition
on Petroleum Geophysics

"HYDERABAD 2008"

P - 193

Improvement in Subsurface Imaging Through Objective Based Designing of Acquisition Geometry in Tripura Area - A Step Towards Future Exploration Success

Mehra, M.P. *, *QCG, A &AA Basin, ONGC, Jorhat, Assam, India email: maheshprasadmehra@yahoo.com*
Lakshmi Shanker , *QCG, A &AA Basin, ONGC, Jorhat, Assam, India email:lsupadhyaya@yahoo.com*
Apte, M.G., *Block-III, Western Onshore Basin, ONGC, Vadodara, India email: milindapte@gmail.com*

Summary

The area under study falls in Tripura, which in turn, is a part of the Assam-Arakan Fold Belt and geographically situated in the northeastern part of India. Area is traversed by long narrow anticlines and broad synclines in an almost N-S trend that swings north-eastward towards the northern margin. Seismic exploration in geologically complex areas and in rugged terrain has been a challenging task before explorationists. The 2D and 3D seismic data acquired till date with coarser spatial sampling is inadequate to map the meaningful reflections on top of anticlines in fold belt area.. This paper deals with a seismic campaign in Gojalia area in Tripura, which is part of a tectonically very complex Fold Belt system of Assam. A 2-D line with fine spatial sampling was shot across the Gojalia anticline on experimental basis along with regular 3D acquisition work The initial results from processing of the data (2D data of experimental line) acquired in the field have brought out the subsurface picture with greater clarity in comparison to the old data in the southern part of the study area.

The objective of acquiring 2D data with fine spatial sampling was to get meaningful reflection events over Gojalia anticline. Results indicate the success of the methodology adopted as the imaging of anticlines has improved considerably.

Introduction

Seismic exploration in geologically complex areas is prone to both physical as well as technical problems. Owing to steep dips, complex pattern of folding and faulting and rapid elevation variations coupled with lateral velocity variations, seismic wave propagation in such areas becomes too complex. The anticlinal feature was not convincingly deciphered in the earlier data due to coarse spatial sampling. An experimental 2-D line was planned and shot in Gojalia in west Tripura during field season 2006-07. The location map of the experimental line is shown in Figure 1 & 2.

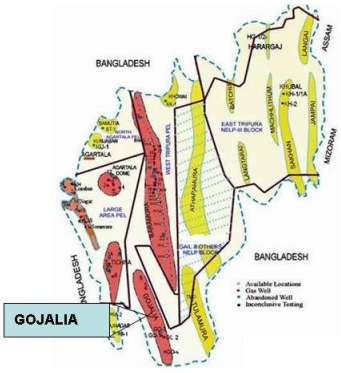

Figure 1. Location map of Gojalia Anticline.

The study area (Figure 2) is thickly forested, covered with numerous hillocks, valleys, tea gardens and practically devoid of approach roads.

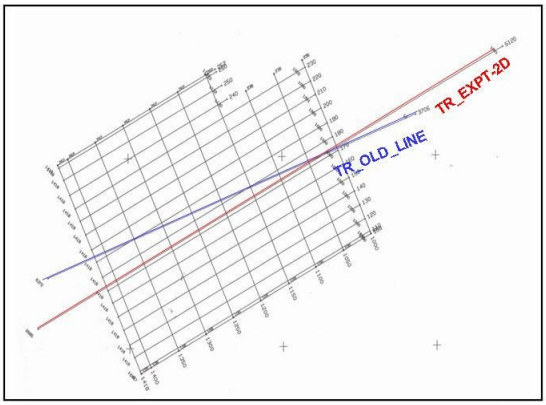

Figure 2. Scheme of Seismic coverage - 2D & 3D along with Experimental 2D line (in Red) in the study area.

Methodology

It was suggested to acquire single 2 D line on experimental basis with the following parameters.
Acquisition Parameters – Experimental

Location of line:	Across the central part of Gojalia anticline passing thro drilled well
Direction:	Dip direction
Line length:	12 km. (6 km on each side of Gojalia anticline)
Spread type:	Symmetric split spread
Group interval:	10 m
Number of channels:	300 + 300
Spread length:	3000 m + 3000 m
Shot interval:	30 m
Fold:	50+50
Up-holes interval:	500 m
Far offset:	3010 m

The survey was conducted by using the SN-388 unit keeping record length at 6 sec, sampling rate at 2 ms, preamp gain settings at 36 dB with Notch filter IN.

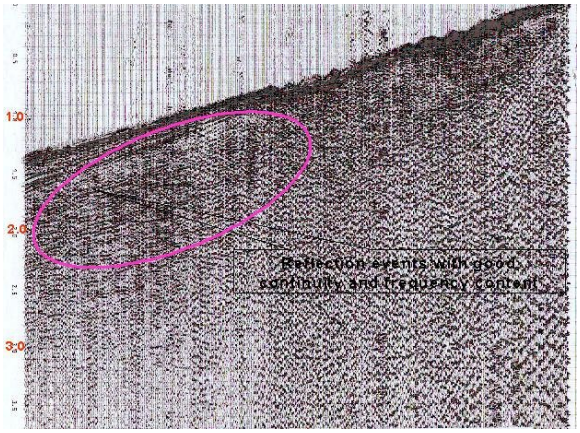

Figure 3. Field monitor record of experimental 2D line across Gojalia Anticline.

Acquisition Parameters

PARAMETERS	TRIPURA- (3D)	TRIPURA-(2D)EXPERIMENTAL	TRIPURA-OLD (2D)
INSTRUMENT	SN-388	SN-388	SN-388
REC FORMAT	SEGD	SEGD	SEGD
RECORD LENGTH	6 SEC	6 SEC	6 SEC
SI	2 MSEC	2 MSEC	2 MSEC
TYPE	ORTHOGONAL (END ON)	SYM. SPLIT SPREAD (600 CH#)	SYM. SPLIT SPREAD (240 CH#)
FOLDAGE	6X5	100	60
ENERGY SOURCE	EXPLOSIVE	EXPLOSIVE	EXPLOSIVE
SHOT INTERVAL	60 M	30 M	40 M
GROUP INTERVAL	40 M	10 M	20 M
CDP INTERVAL	20 M	5 M	10 M
NEAR OFFSET	20 M	10-30 M	80 M
FAR OFFSET	2820 M	3010 M	2460 M

Table 1. Comparison of acquisition parameters

Results and Discussion

The continuous and meaningful reflections are seen on top of Gojalia anticline A full Gojalia anticline is observed in the stacked section in the area with rugged terrain and thus the area is seismically imaged. Previous seismic investigations in this area were not able to delineate the structural features effectively. It might be attributed to the fact that data acquired with coarser spatial sampling and less foldage was not able to achieve the desired delineation in flanks and crestal part of the anticline.

Comparing the seismic section of the experimental line with that of earlier investigations, it is observed that the earlier data quality was not good enough to delineate/confirm the anticlinal feature in the area. It also shows the remarkable improvement in vertical and

horizontal resolution particularly in the zone of interest; Fig 4, 5 & 6. The outcome of the experimental study

will be extremely useful for designing suitable acquisition parameters in future, in the tectonically complex areas.

Higher foldage is a must where targets are both shallow and deep so that muting does not affect shallow target severely and also gives an improvement in S/N ratio.

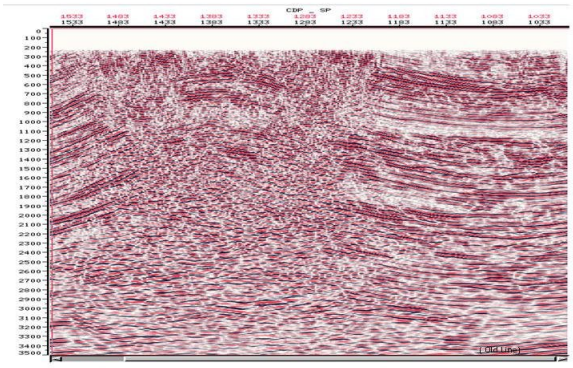

Figure 4. Old 2D section across the anticline.

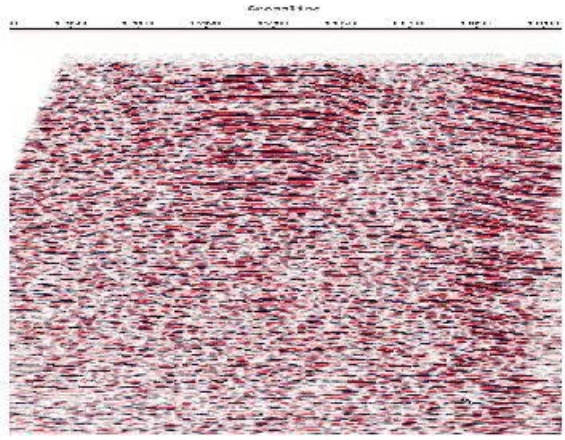

Figure 5. Old 3D section across the same anticline.

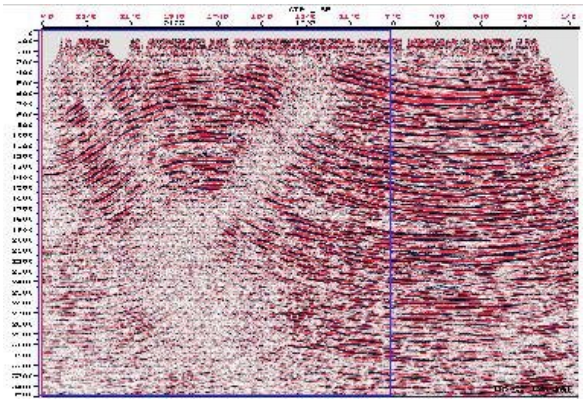

Figure 6. Improved delineation of the structure in the experimental line.

Conclusion

Better quality seismic data can be acquired in hostile environment in rugged terrain and improvement in sub-surface imaging at the crestal part of anticline can be accomplished by adopting objective based acquisition parameters and symmetric split spread shooting with fine group interval.

Acknowledgements

The authors are grateful to Oil and Natural Gas Corporation Limited for allowing use of the data for preparation of the paper. The authors are thankful to the then Basin Manager A&AA Basin Shri J S Sekhon, for his outright support for the execution of the project. The authors are grateful to the Basin Manager, A & AA Basin Shri .S.Choudhury for permission to publish the paper. They are very thankful to the Head, Geophysical Services, Shri B.K.Das and Block Manager Dr M C Khandpal for encouragement. The crucial help rendered by S/,Shri S..Panigrahi (Head RCC), C.M.Varadarajan, P.R.Balak & Members of Processing Group at Regional Computer Centre, Jorhat, Assam and Shri Prakash Khare and P.Mishra is highly appreciated and thankfully acknowledged.

Authors also place on record their appreciation of dedication, commitment, hard work & team spirit of the members of GP-17 at all levels during data acquisition.