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# Re-processing for Improved Imaging – A Case Study

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## Summary

*Reprocessing of seismic data with latest processing tools and new geological insight has often produced better subsurface imaging for enhanced confidence of the interpreter / satisfaction of the client. A case study showcasing the improvements brought out by reprocessing is presented in this paper. The reprocessing of one 3D data set of Cauvery Basin, on land Southern India, was carried out at RCC, Chennai to overcome the ambiguities encountered in earlier interpretations.*

## Introduction

There is a tremendous difference the way seismic data used to be processed about ten years back and how it is done now. With the advent of super parallel computing capabilities, many processing techniques, which earlier were available only to rich research groups, are now available in the market through various major software vendors at affordable cost. Advanced static correction solutions, water bottom multiple attenuation, amplitude-preserved noise attenuation techniques, pre-stack imaging, automatic velocity analysis, and interactive parameter testing, high resolution 3D graphics are some of the tools available in a modern processor's kit. The two dimensional explosion in seismic data processing i.e.,

(1) cluster computing for speed and
(2) enhanced and interactive tools for quality

have made oil companies to reprocess their vintage seismic data in a big way.

Major issues reprocessing tries to address are:

1. Resolving ambiguities in earlier interpretation.
2. Search for new prospects- deeper and/or shallower- with new geological insight.
3. Confirmation of earlier interpretation.
4. Towards DHI- AVO and Inversion
5. Prestack merging of contiguous investigations

Reprocessing can be understood in a larger perspective in terms of data and its information content Data is what is collected and is readily available; information is what is anticipated from data as out come of processing. It is this information which is subjected to interpretation for exploration and exploitation of Hydrocarbons. Data processing attempts to extract or derive the anticipated information from the data. How much information a given data set contains? The answer could be 'as much as you can extract'- and it depends not only on the effort put in by the processor but also on the latest tools, especially the interactive ones available in industry and how judiciously these are being used by the man behind the machine. A well informed processor with better interaction with the interpreter can deliver the best intended results and can help the interpreter in overcoming the ambiguities in interpretation by giving the best possible sub-surface imaging.

## Geology of the area

The Study area falls in Tranquebar sub-basin, of Cauvery basin, forming part of the North Western flank of Karaikal ridge. Kamalapuram formation is an established Hydrocarbon play in the Kamalapuram-Adiyakamangalam corridor with in the East –West trending Paleocene sub marine canyon. The hydrocarbon bearing sands are canyon fill sediments and occur above two unconformities viz., Kamalapuram top and Paleocene / Eocene top. Thickness of this formation ranges from 700 m to 1000 m . So far 22 oput of 38 wells drilled are hydrocarbon bearing in kamalapuram – Adiyakamangalam corridor from this formation . Reservoirs with in lower Kamalapuram formation Formation are spatially localized . lenticular turbidite channel lobes having poor lateral and vertical communication. These strati – structural features are subtle and localized in nature. For proper imaging of

subsurface and delination of such features a 3D seismic survey has been carried out. The present study is aiming to bring out improvement in such features.

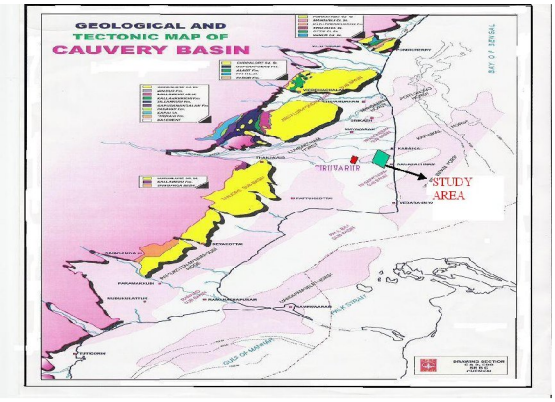


**Fig1: Location map showing the study area.**

## Description of data

In this paper the reprocessing of on land 3D seismic data set pertaining to Vazhakudi area of Cauvery Basin, South India (Fig.1) is presented. The data comprises of two 3D seismic volumes acquired with identical bin dimensions ,orientations and Recording parameters. The nominal fold for one investigation is 45 and for the other it is 54 (Fig2). The offset ranges 160 to 2500 and 160 to 3000 respectively.

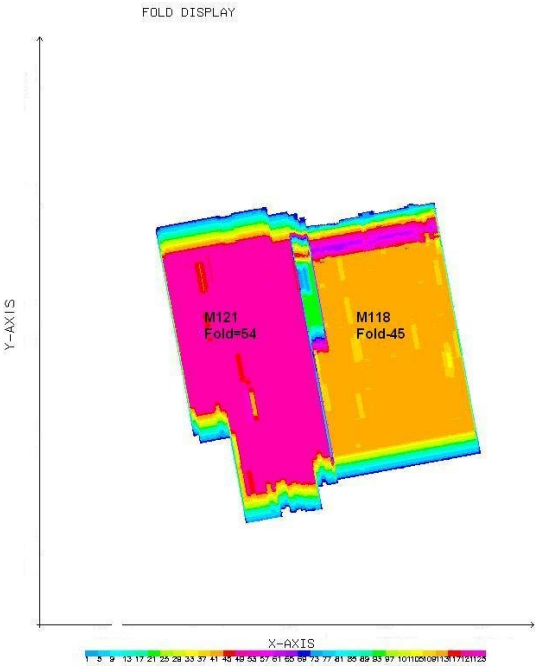


**Fig:2 Foldage diagram of M118-121**

## Earlier processing

The objective of earlier processing was to map the prospective formations with in a zone of interest from 600 to 1800 ms TWT. The final sections are produced through DMO Stack followed by Post Stack Migration. The processed data did not show good continuity at target levels. The data also did not facilitate unambiguous mapping of the structurally complex basement. Though it is not the authors' intention to dissect the earlier processing parameters and methods, the poor show of the sections could be attributed to inadequate statics, insufficient grid for velocity analysis, and inability of the algorithms, then available to map steep dips.

## Objective of reprocessing

As the earlier data was 'interpreted' the task of defining the objectives for reprocessing became cut out – to fix the ambiguity in interpretation of the earlier processed data. Further, with more and more geological inputs and the dynamic reservoir models, new exploration targets have also been identified. Mapping of basement has also become a crucial aspect of the exploration programme. .

## Processing parameters

The processing parameters were fixed keeping in view the desired improvement in the continuity and resolution at prospective levels and the basement. Care was taken at every stage of the processing, including noise attenuation to preserve the relative amplitudes of the data. Pre-stack time migration was run with adequate aperture to map the basement. The processing sequences followed is shown in Fig:3. At each stage, interaction with client has helped in improving the data quality particularly at target levels (that is from Kamalapuram formation to Basement) and minimizing the noise levels.

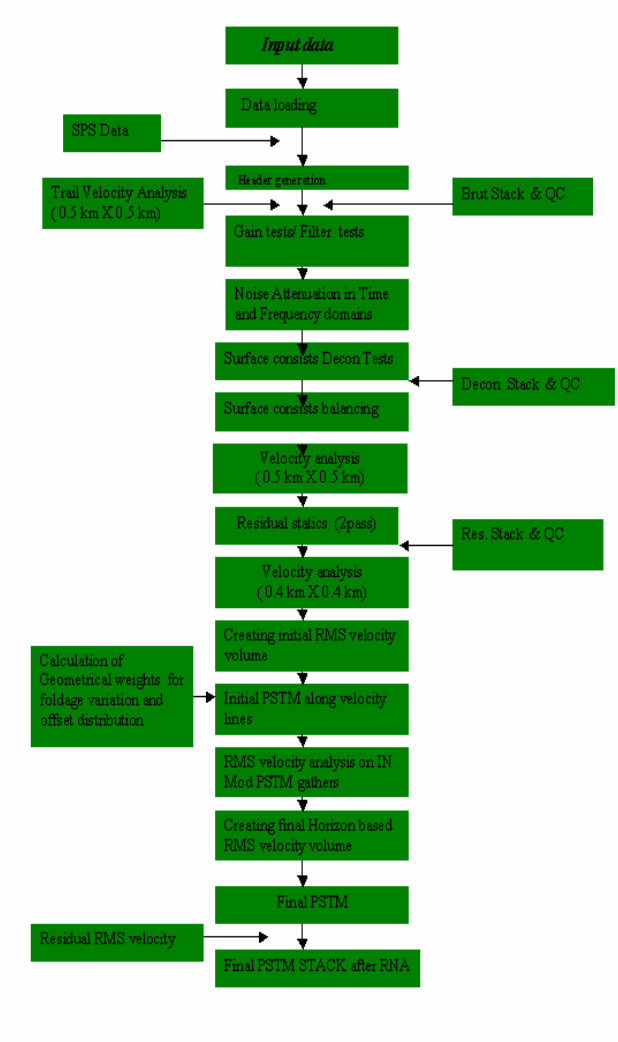


**Fig:3 Processing Flow**

## Quality of the output

A tremendous improvement in the quality of output is observed. The continuity at target levels has improved. Unambiguous configuration of structurally complex basement also has come up. Figures 4 to 7 provides a comparison between outputs earlier processed and reprocessed outputs.

Figures 4 & 5 are along inline where as Fig 6 & 7 are along Cross lines

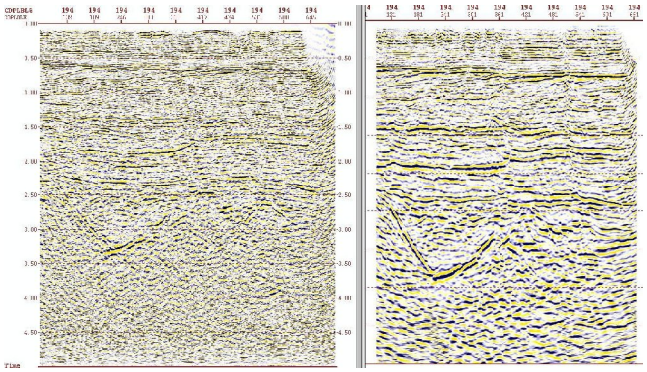

**Fig 4 Earlier processed section**

**Fig 5 Reprocessed section**

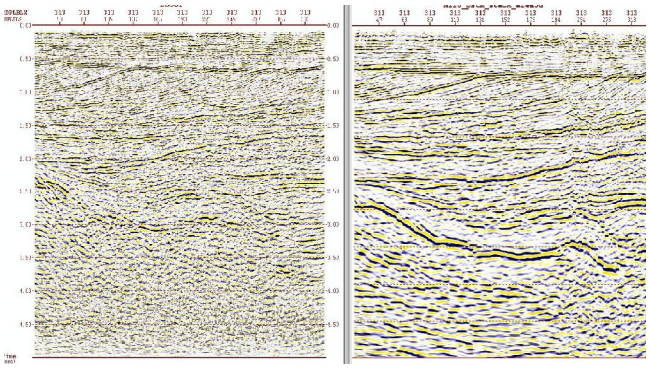

**Fig 6 Earlier processed section**

**Fig 7 Reprocessed section**

The enhanced data quality is attributed to:

1. Well defined and focused objectives for processing. The 'shortfalls' of the earlier interpretation and the new geological insight earned over the years have *educated* the processors on the expected output.

2. The processor is in a problem solving situation. He is challenged and the best in him has come out.

3. Extra efforts put by the processors - stringent QC of survey data, elevation and statics, extensive testing for process and parameter fixing, estimation and application of residual statics, repeated close grid velocity analysis followed by Pre Stack Time Migration.

4. Frequent and result oriented interactions with the interpreter.

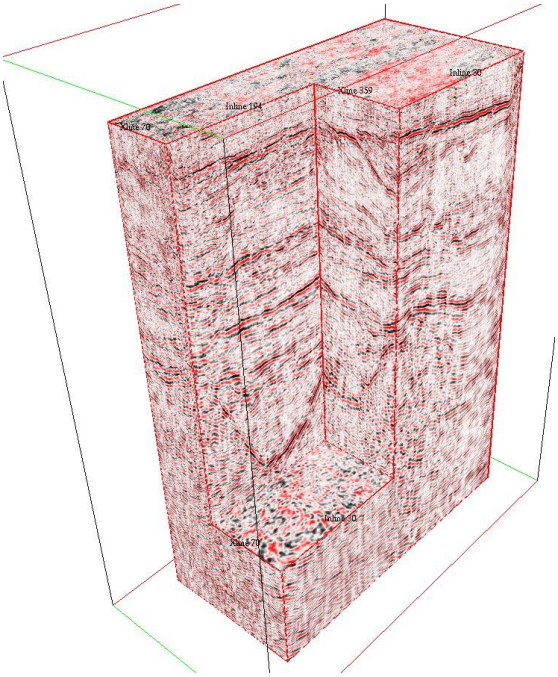


**Fig:8 Reprocessed Volume**

The reprocessed output (Fig 8) shows significant improvement in the output, paving the way for more meaningful and unambiguous interpretation. The authors believe that, as there are large reserves of untapped HC resources in Indian sedimentary Basins, there is a lot of information to be extracted from the seismic data available in our library. This can be achieved through skillfully and judiciously utilizing the tools available for processing the wealth of seismic data available.

## References

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