

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

**Sudan University Of Sciences And Technology**  
**College Of Petroleum Engineering & Technology**  
**Exploration Engineering Department**

## **Seismic Stratigraphy Sequences Study in Sufyan Sub-basin**

دراسة التتابع الطبقي لحقل سفيان

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- 4- Mohamed Elfateh**

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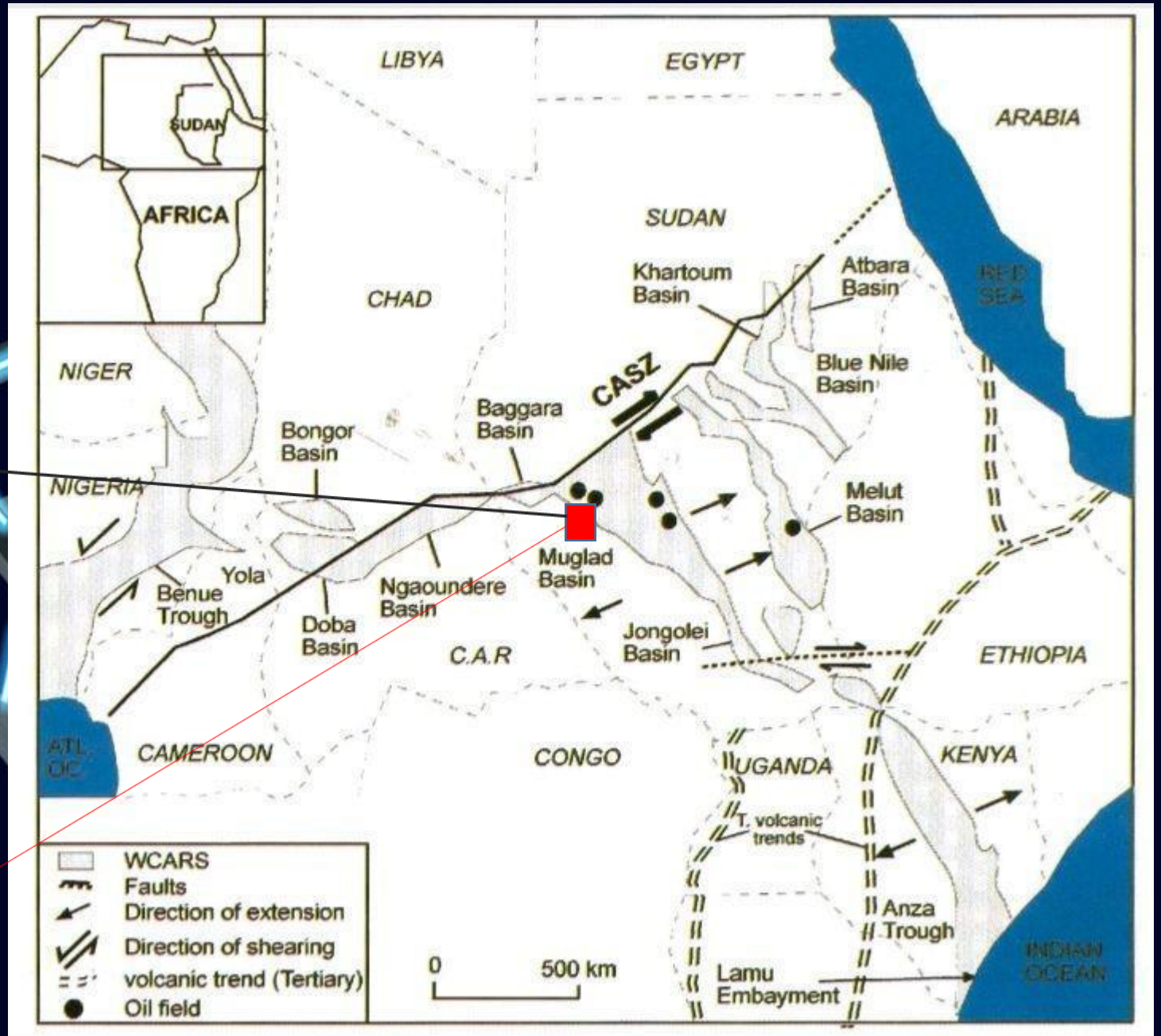
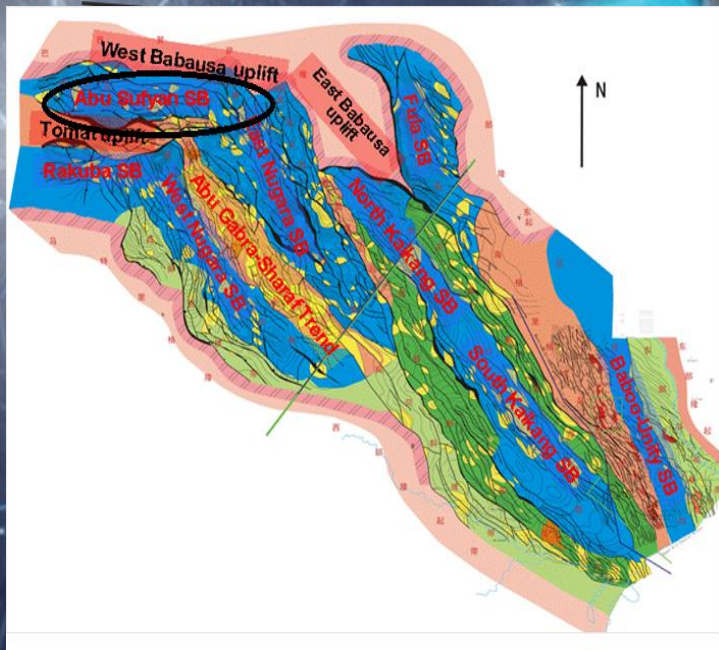


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# ➤ Introduction



# Problem Statement

- From previous studies, Abu Gabra formations in the area are up to 5000m thick of the whole sedimentary section of the basin, in which it has been found rich hydrocarbon source rock.
- Abu Gabra and Bentiu formations Darfur and Kordofan groups contain reservoir rocks and structurally controlled by complex fault network, therefore, there are complications in assessment the potential traps that have capability of retaining the generated hydrocarbon.
- Proper assessment of trap potential is required as it will be conducted in this study by accurate interpretation of seismic stratigraphy data integrated with borehole information.



# Study Objectives

The study aims mainly to make use the seismic stratigraphy data integrated with well data of the area to provide stratigraphic interpretation of seismic reflectors which help in predictive:

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- 
- **Detected Termination Pattern at the Upper Sequence Boundary.**



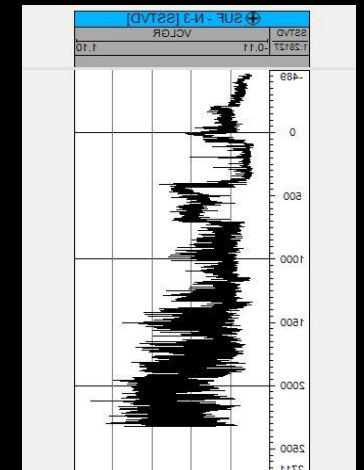
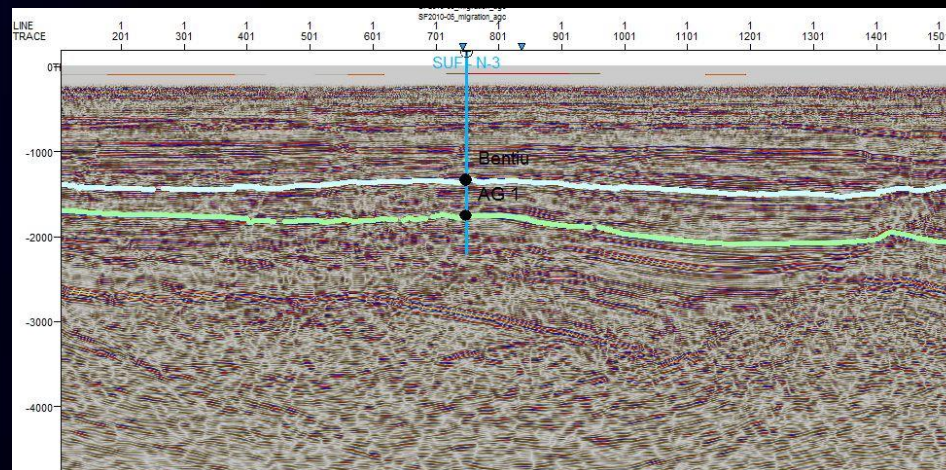
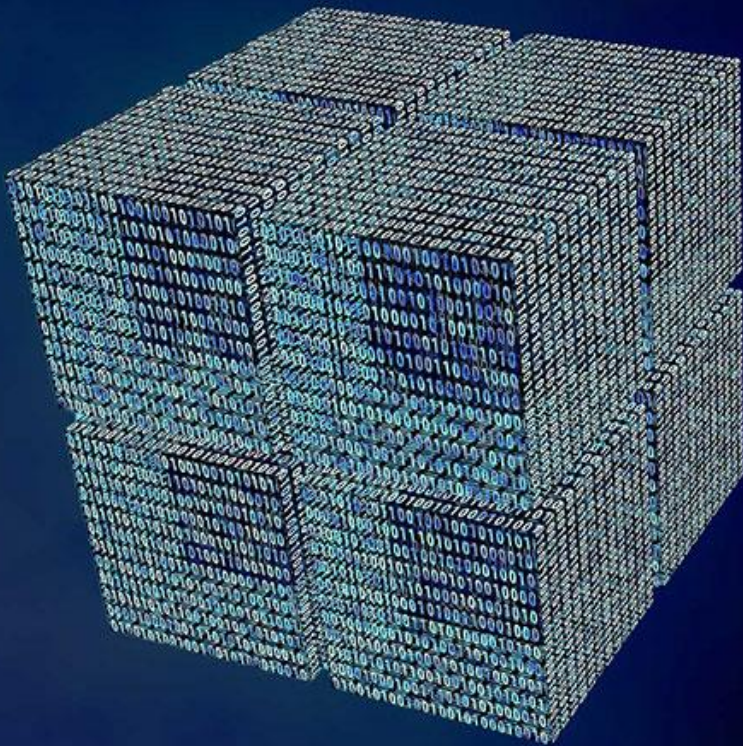
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- 
- **Detected Termination Pattern at the Lower Sequence Boundary.**



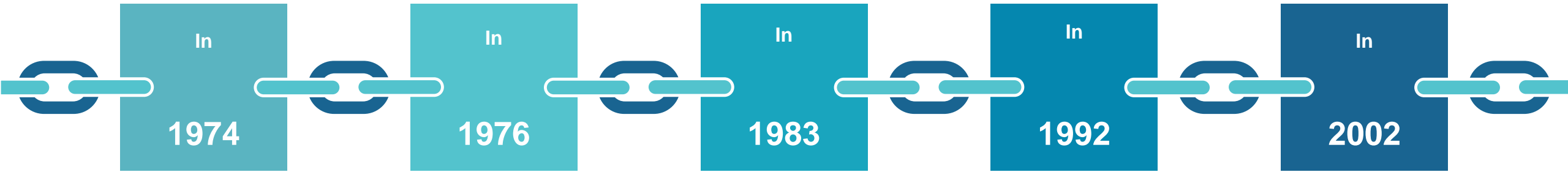
## ➤ Available data Set:

The available data that used in the study were the following:

- 19 2D seismic lines, and we using 4 lines (sf2010-05, sf2010-06, Sf2010-13, sf2010-14).
- Well information of(SUF – N3, Suf-1) which include:
  1. Horizon tops of (Bentiu and Abu-Gabra Formations).
  2. The logs.



# Previous Studies



the Government of the Sudan Republic and Chevron signed a Production Sharing Agreement (PSA), chevron directed their exploration efforts in Muglad basin through shooting seismic lines and drilling wells.

Baraka-1 well was drilled in the NW of the Muglad Basin, in the term between (1976-1980) chevron had made several oil discoveries such as in Unity-1, Unity-2, and Abu-Gabra wells.

Brown and Fairhead determined the Muglad basin geometry based on gravity, they realized that the Basin has depth of 4.5 KM and extension of crust approximated about 48KM.

Scull , Mann , and HC Hargue studied the stratigraphy and structure of Central African basins, and they found that the Basin contains as much as 13KM of sediment.

Mohamed Y.A et al conducted studies object to model the petroleum maturation and generation of NW of the Muglad basin by utilizing seismic profiles, well information, and gravity data



# ➤ Methodology:

## ➤ Reflection Seismic :

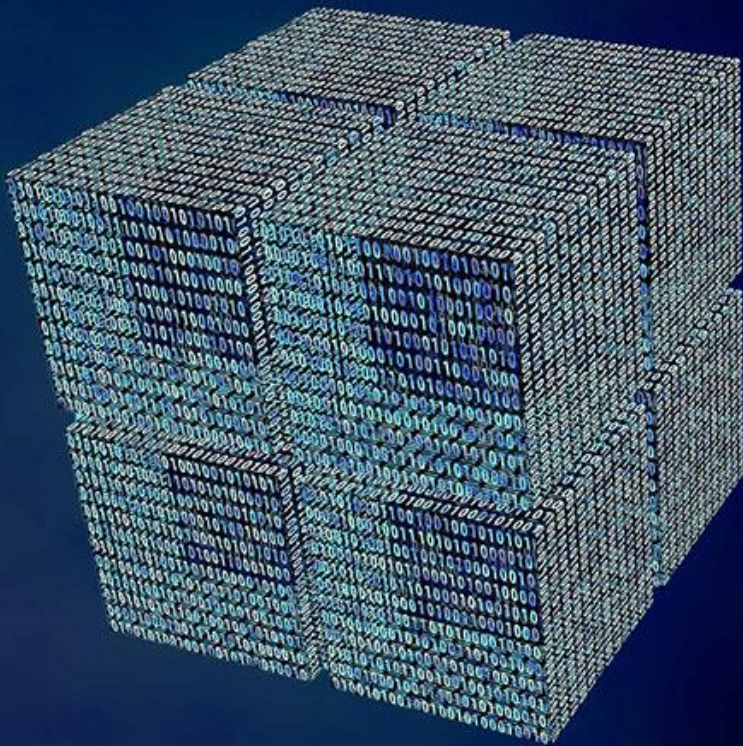
- The subsurface structure .
- The stratigraphy & the depositional environments.
- Reservoir characterization.

## ➤ Seismic Data Acquisition:

- Surveying/navigation system .
- Energy sources .
- Receivers .
- Cables .
- Recording system.

## ➤ Seismic Data Recording and Storing:

- The seismic recording applied to different types of correction and processing sequence to realize resultant seismic sections that give a true representation of geological structures.





# ➤ Methodology :

## ➤ Seismic Data Processing :

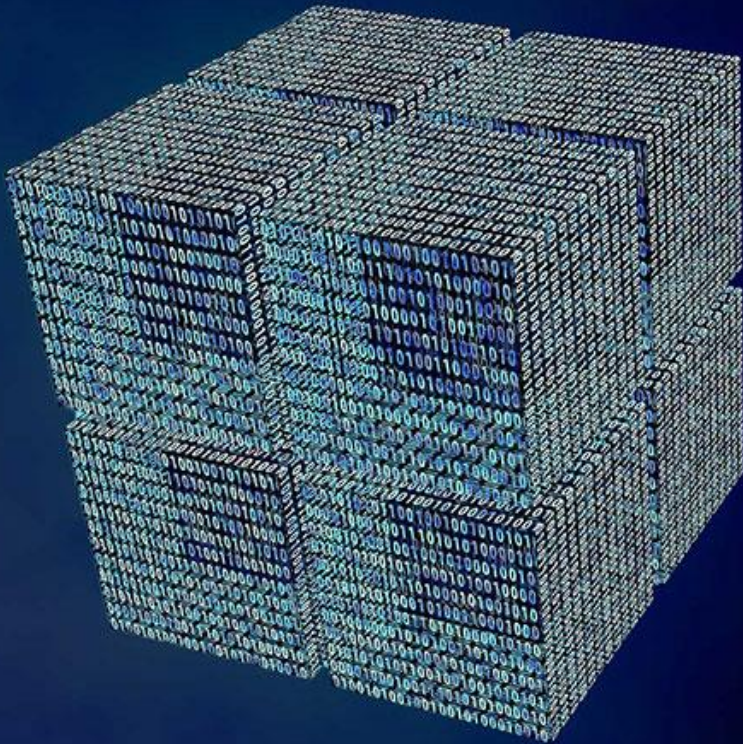
- Pre-processing.
- Pre-stacking.
- Post-stack.

## ➤ Seismic Interpretation :

- Structure Interpretation.
- Stratigraphy Interpretation.

## ➤ Stratigraphy interpretation:

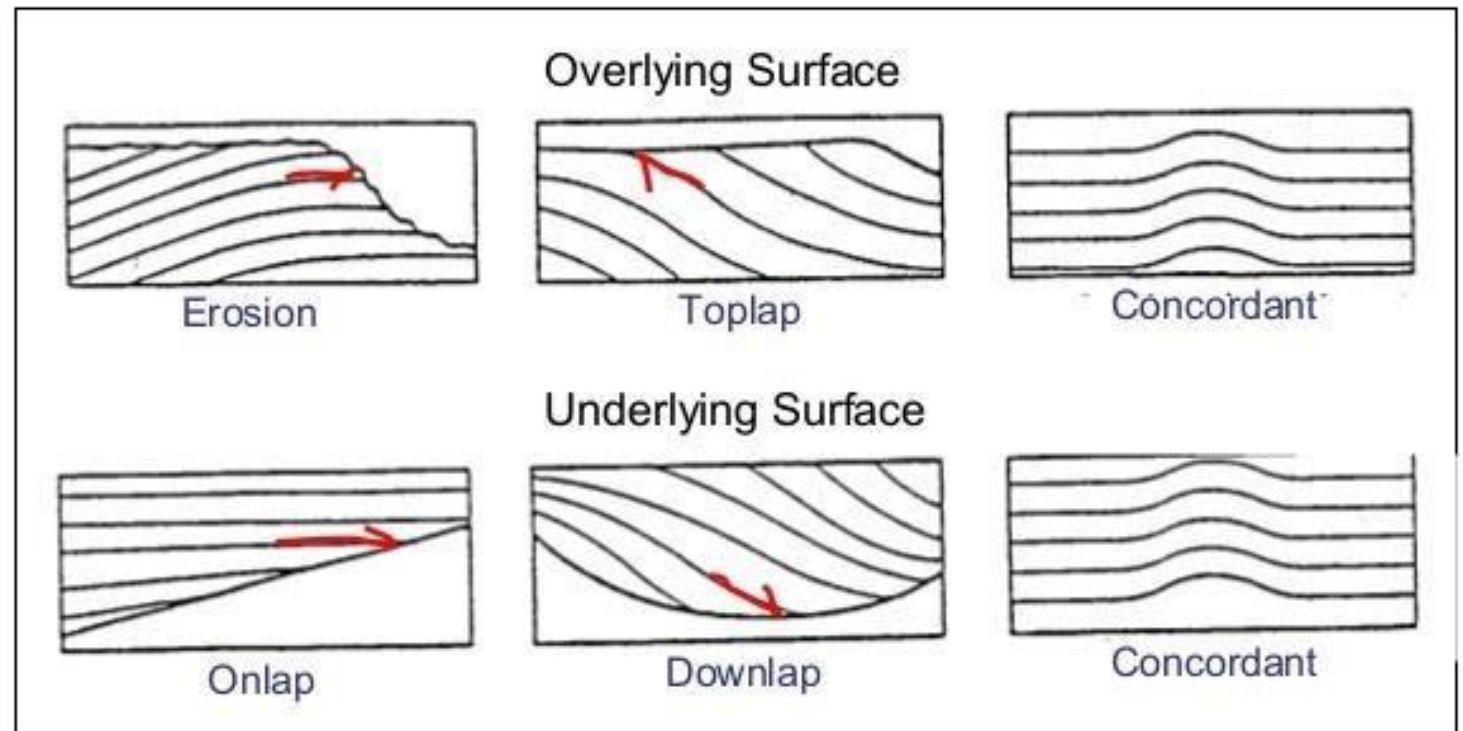
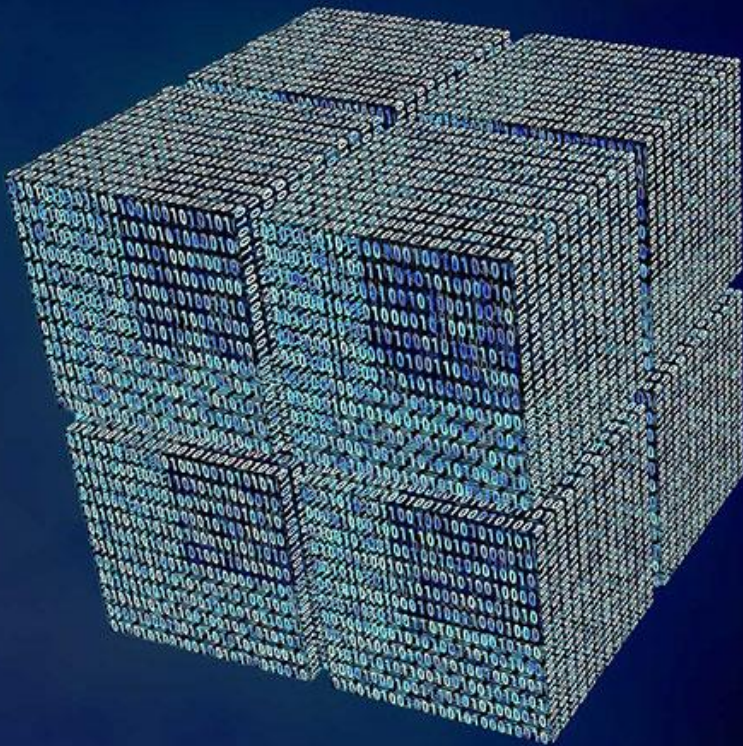
- Reflection continuity.
- Reflection amplitude.
- Reflection configuration.
- Reflection frequency.
- Interval velocity derived from seismic.



# ➤ Methodology :

## ➤ Seismic Stratigraphy Sequence:

- Sequence Stratigraphy is the study of rock units within a chronostratigraphic framework bounded by erosional surfaces, nondeposition, or conformities .





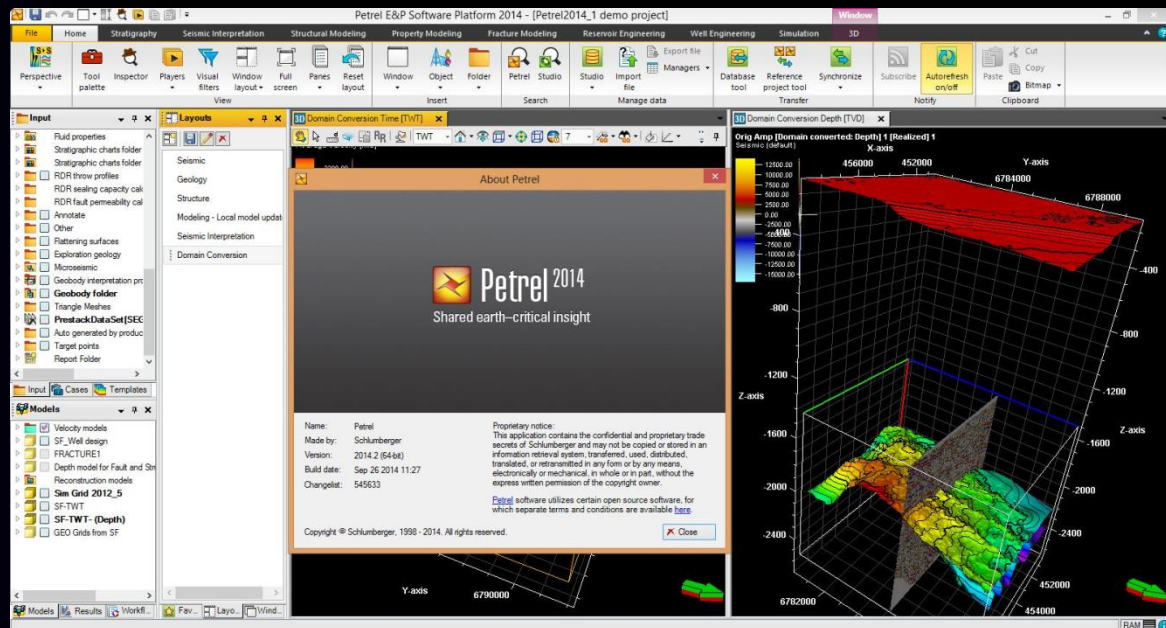
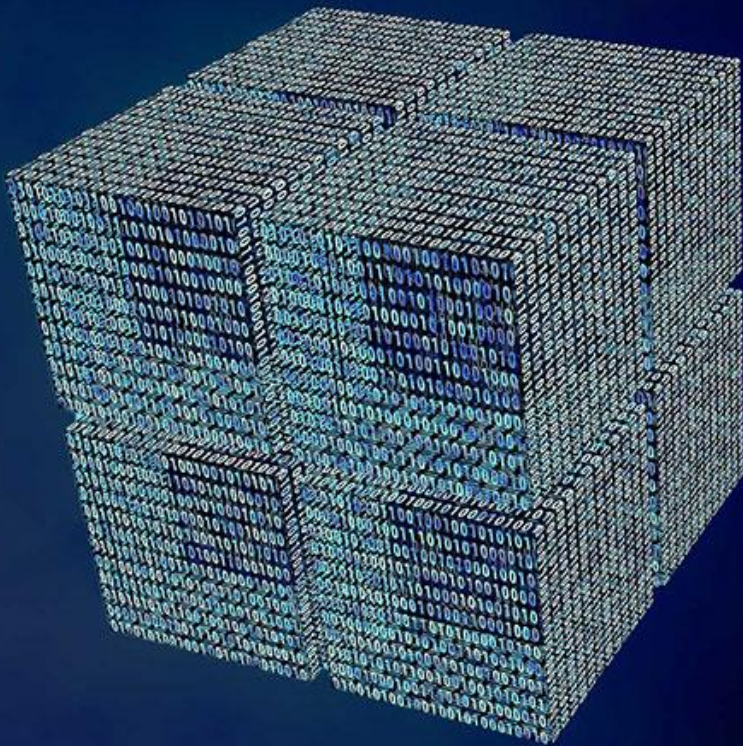
# ➤ Methodology :

## ➤ Well Logging :

- Sonic log
- Density log
- GR log

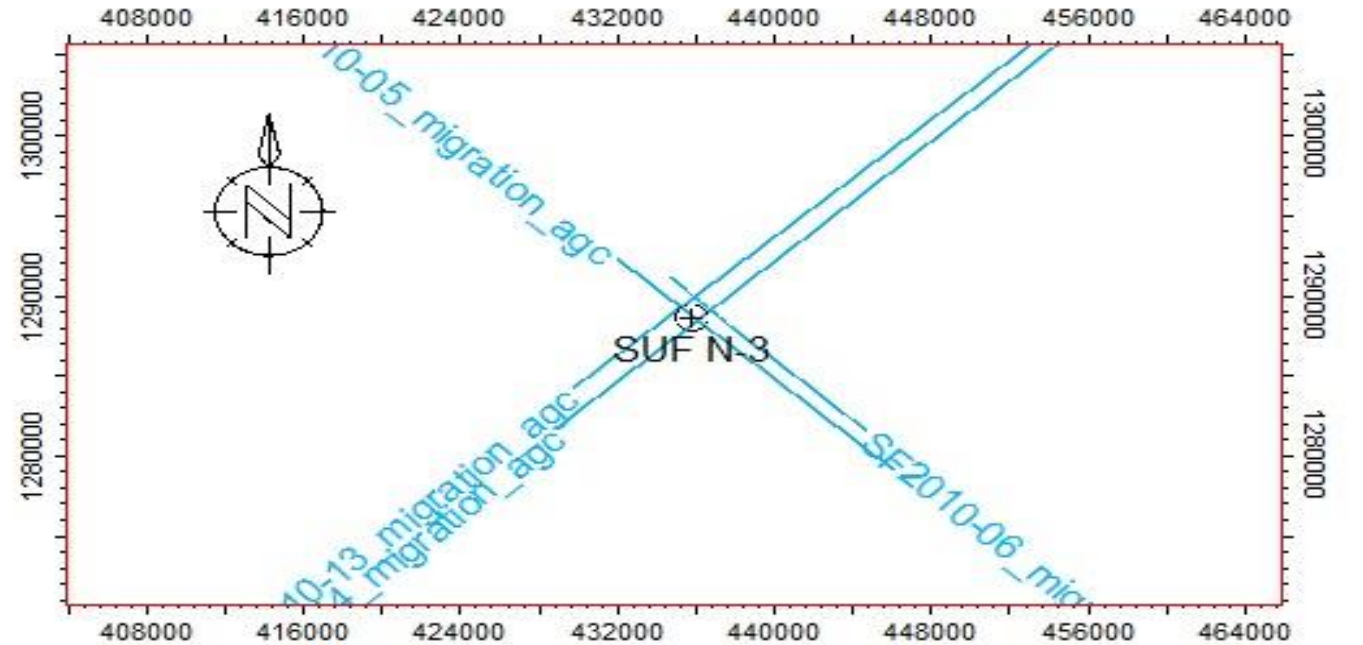
## ➤ Technical method :

- Petrel program.

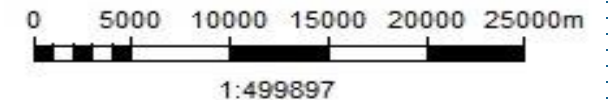


# Work on Data

❖ Seismic data interpretation of four selected 2D seismic lines was integrated with well data (Sufyan N-3) to delineate the dominant sequence stratigraphy of study area. These lines were loaded on the Petrel™ software.



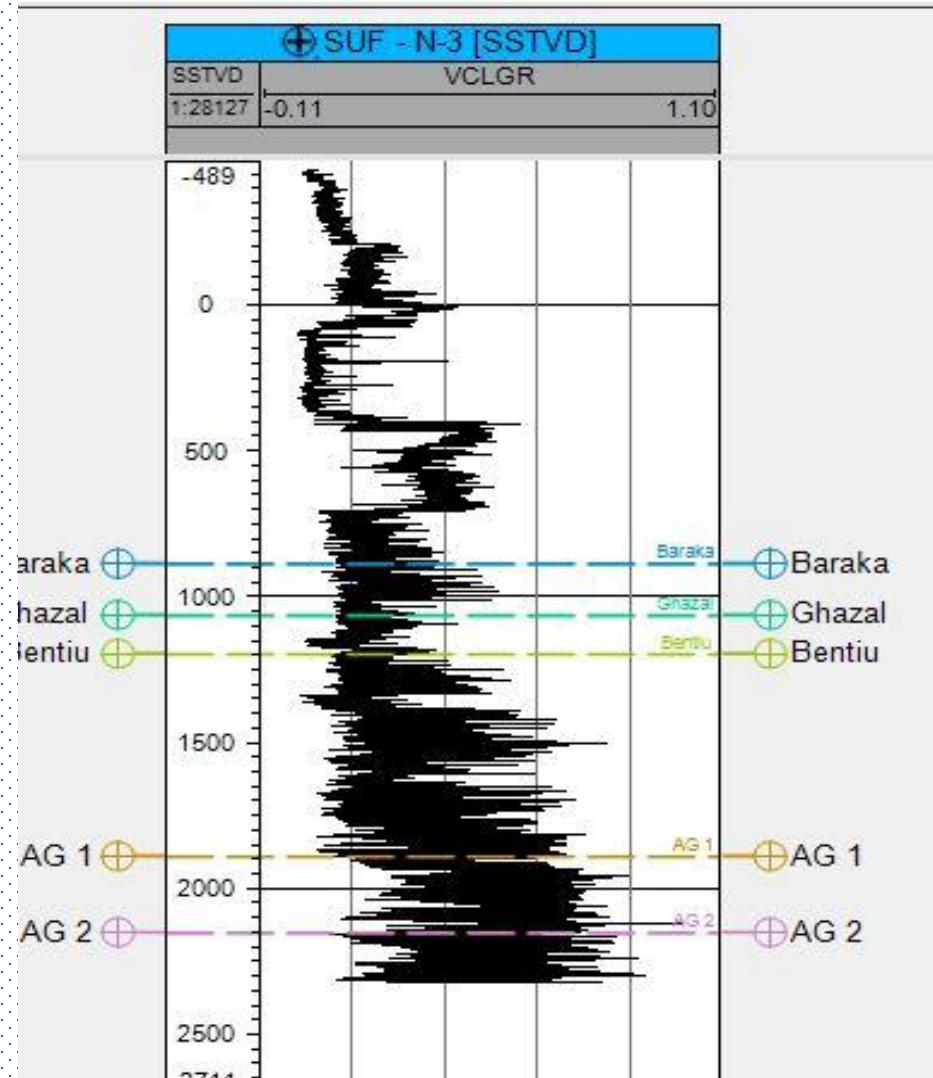
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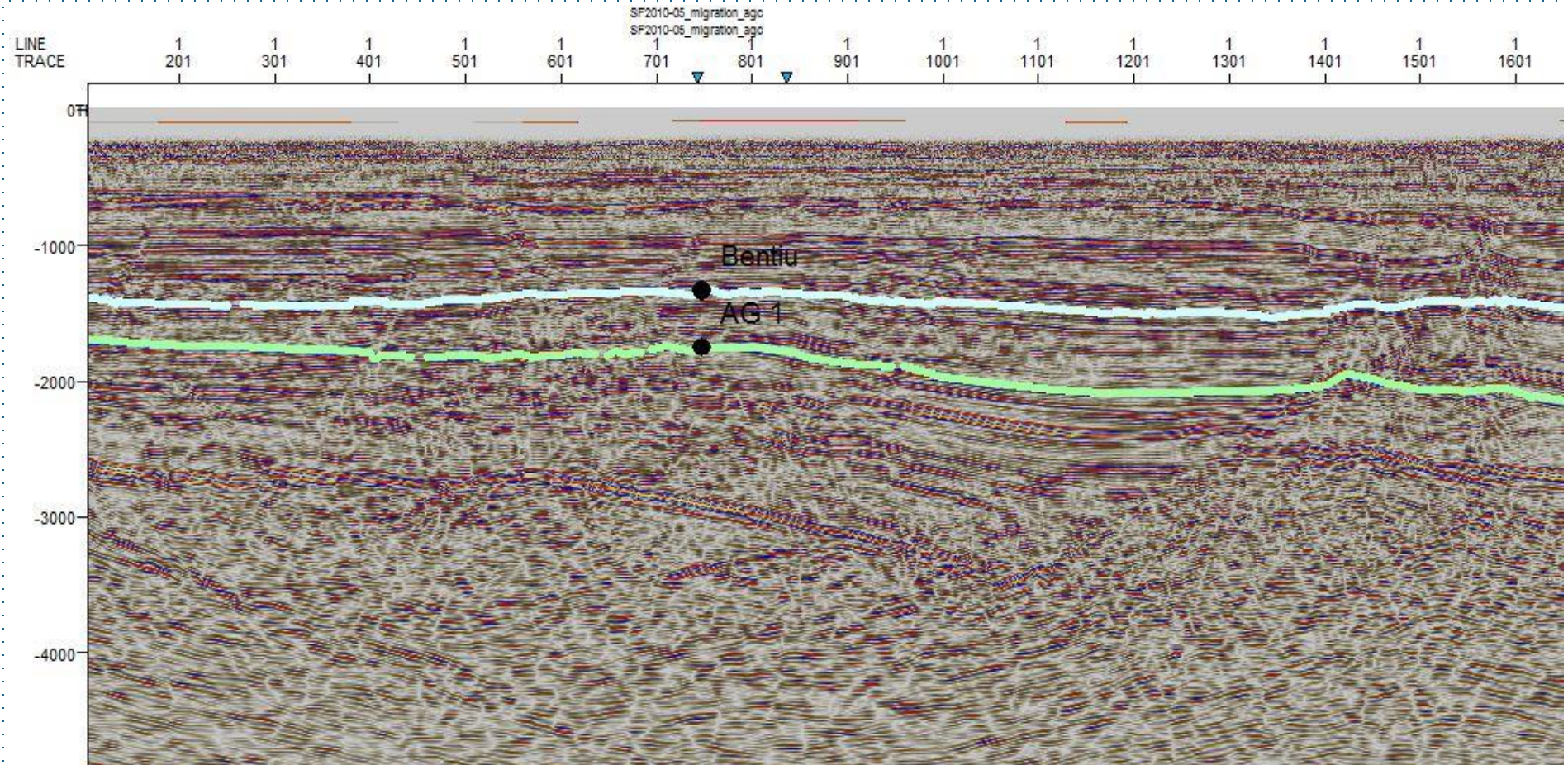
# Work on Data

❖ The data of well logging was been jointed with the seismic section to picking horizon which representing the surface of unconformity .



# Work on Data

- ❖ Moving well tops to seismic section to select seismic sequence which represented by upper horizon (Bentiu) and lower horizon (Abu Gabra)





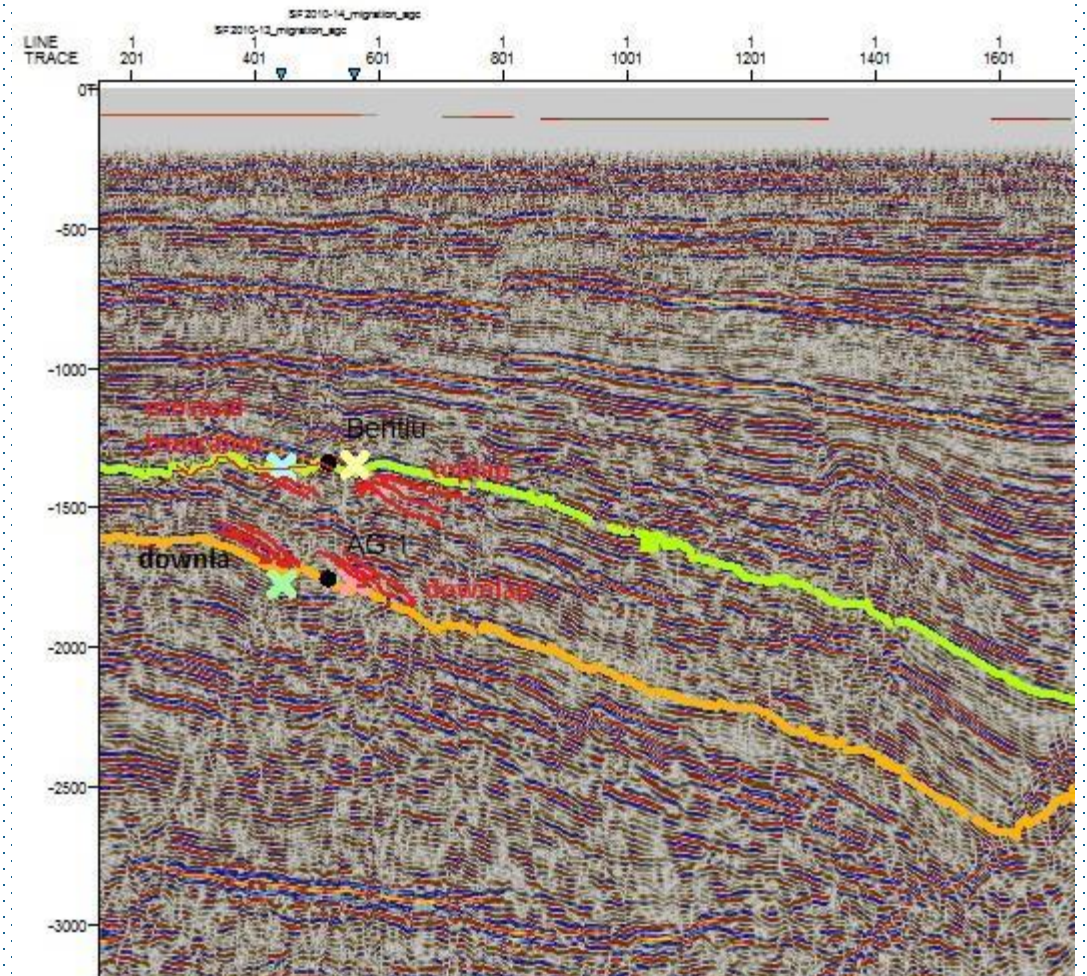
# Work on Data

❖ After we select sequence we start to detect Termination pattern of upper and lower boundary of intersect of each line to be representative of all area

## ➤ Interpreted sequence:

### Line 5

- In the upper boundary we found two upper termination :
  1. Erosional truncation in shot point 550.
  2. Top-lab in shot point 650.
- In lower boundary we found two lower termination :
  1. Down-lab in shot point 550.
  2. Down-lab in shot point 650



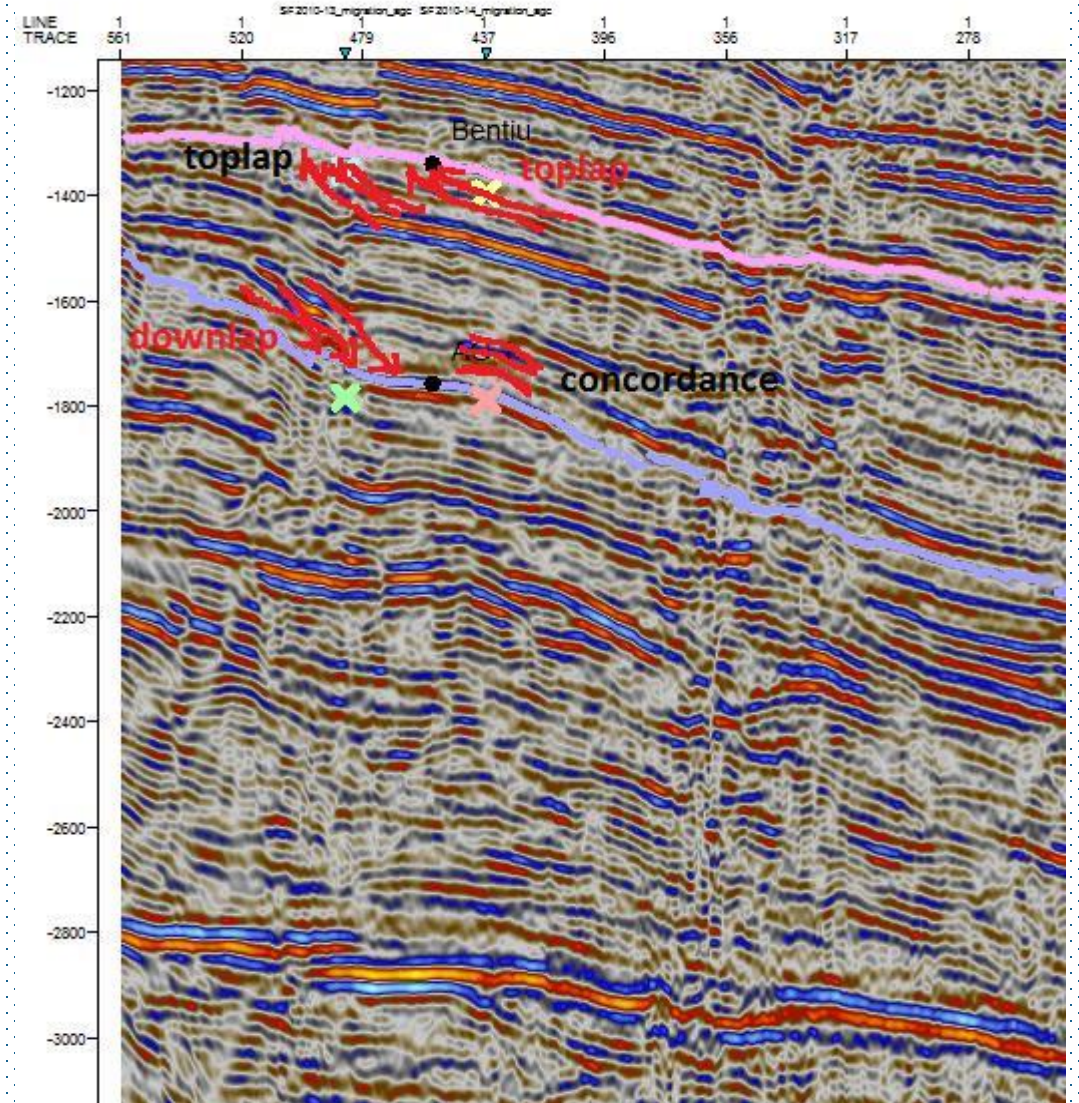


# Work on Data

## Interpreted sequence:

### Line 6

- In the upper boundary we found two upper terminations:
  1. Top-lab in shot-point 490.
  2. Top-lab in shot-point 450.
- In the lower boundary we found two lower terminations:
  1. Down-lab in shot-point 490.
  2. Concordance in shot-point 450



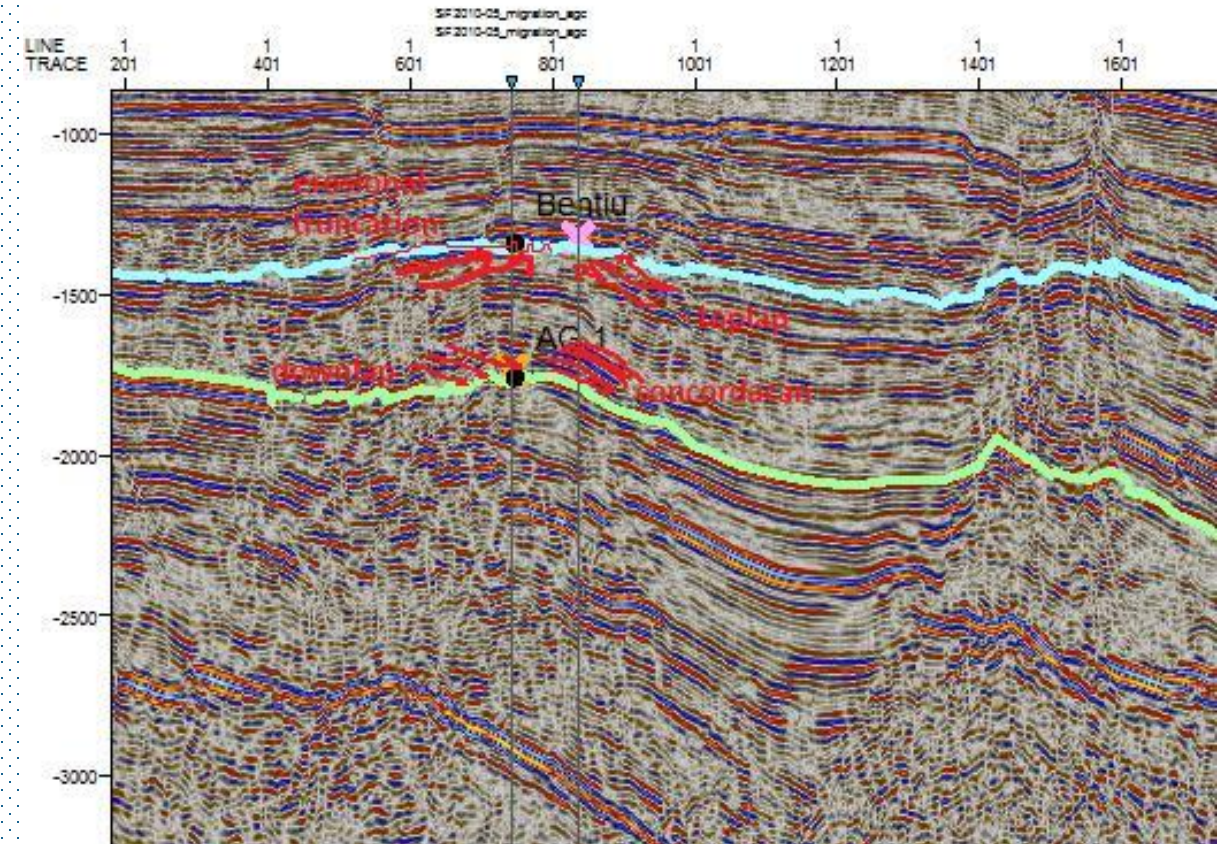


# Work on Data

## Interpreted sequence:

### Line 13

- In the upper boundary we found two upper terminations:
  1. Erosional truncation in shot-point 701.
  2. Top-lap in shot-point 850.
- In the lower boundary we found two lower terminations:
  1. Down-lap in shot-point 701.
  2. Concordance in shot-point 850.



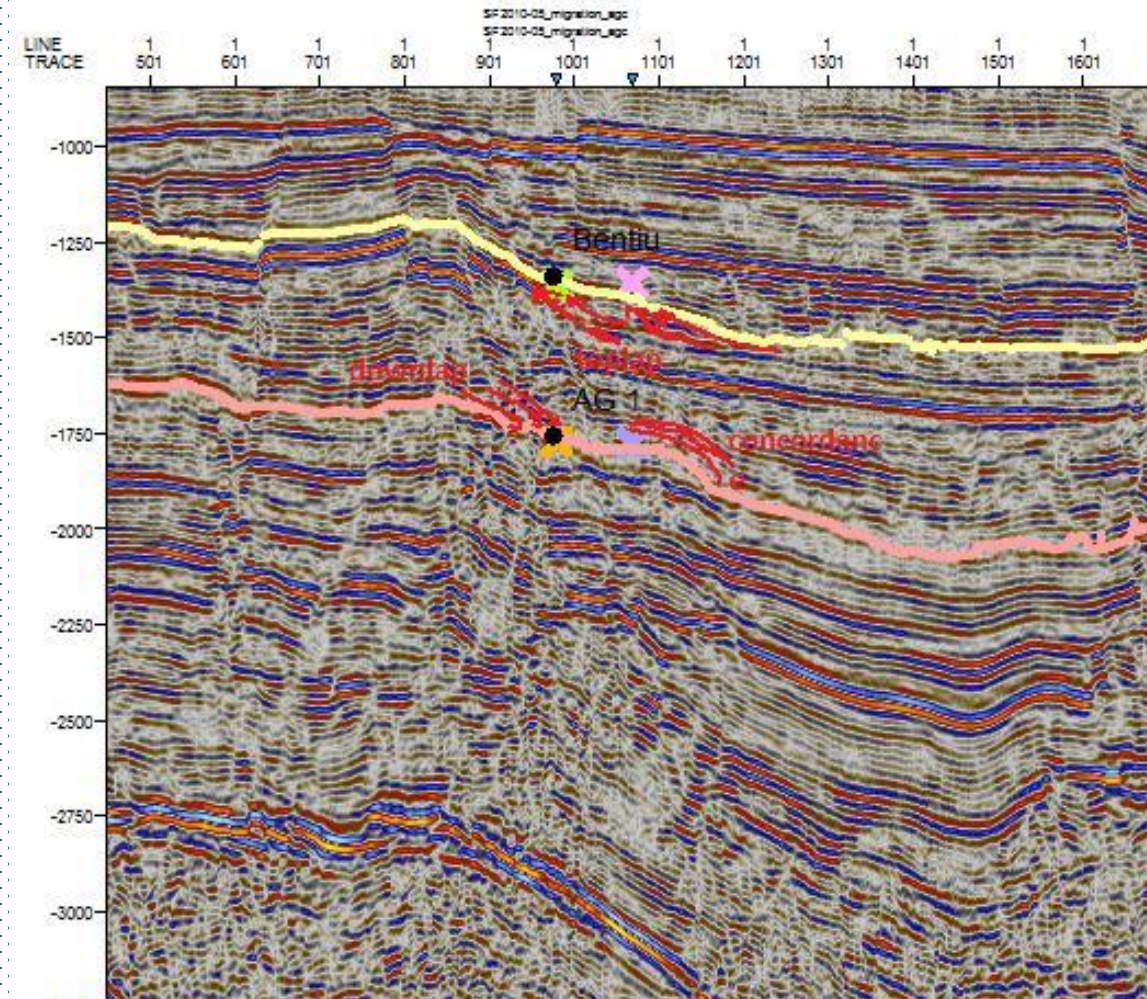


# Work on Data

## Interpreted sequence:

### Line 14

- In the upper boundary we found two upper terminations:
  1. top-lab in shot point 1001.
  2. top-lab in shot point 1101.
- In the lower boundary we found two lower terminations:
  1. Down-lab in shot-point 901.
  2. Concordance in shot-point 1101.



# Work on Data

## ➤ Map of ABC Code :

Key Stratigraphic Units Are Broken Out by using A B C method where:

$$\frac{A - B}{C}$$

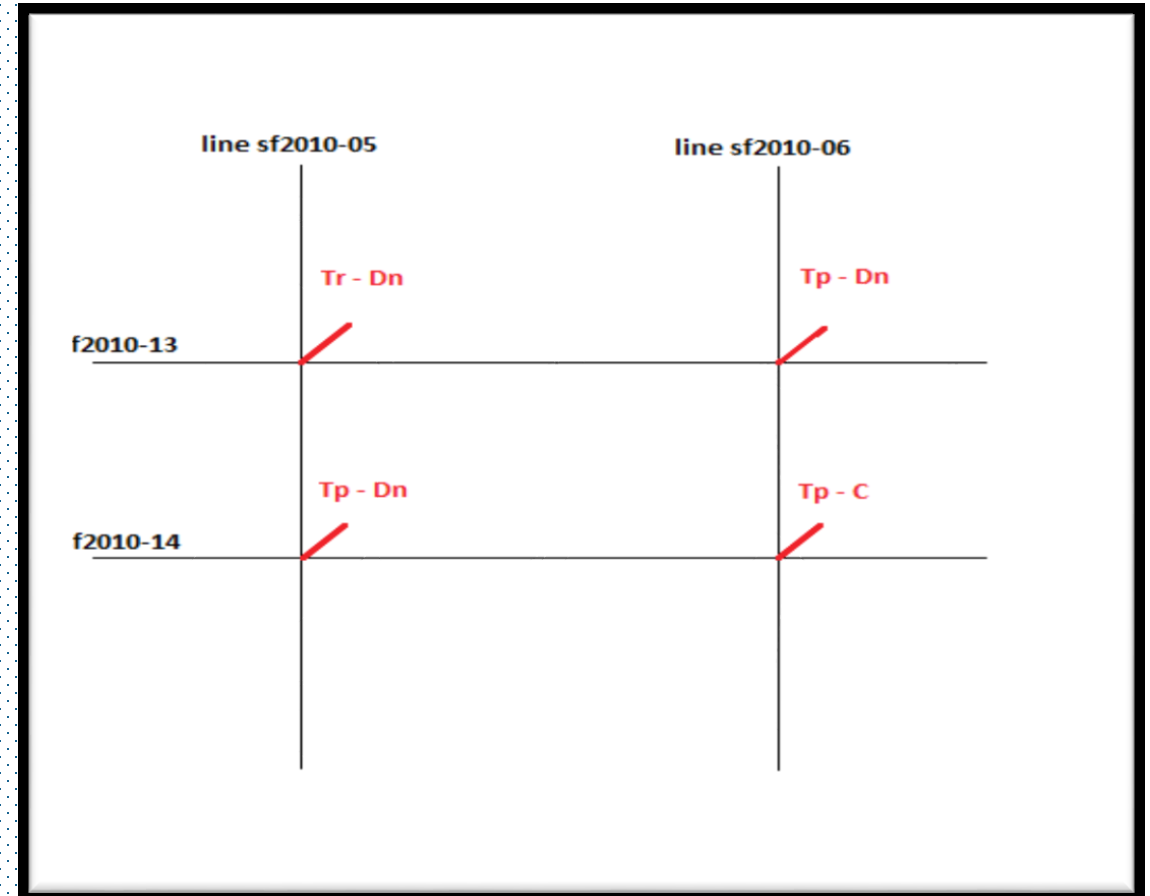
A = Termination Pattern at the Upper Sequence Boundary

Tr = Truncation Tp = Toplap C = Concordant

B = Termination Pattern at the Lower Sequence Boundary

On = Onlap Dn = Downlapn C = Concordant

C = Internal Reflection Pattern

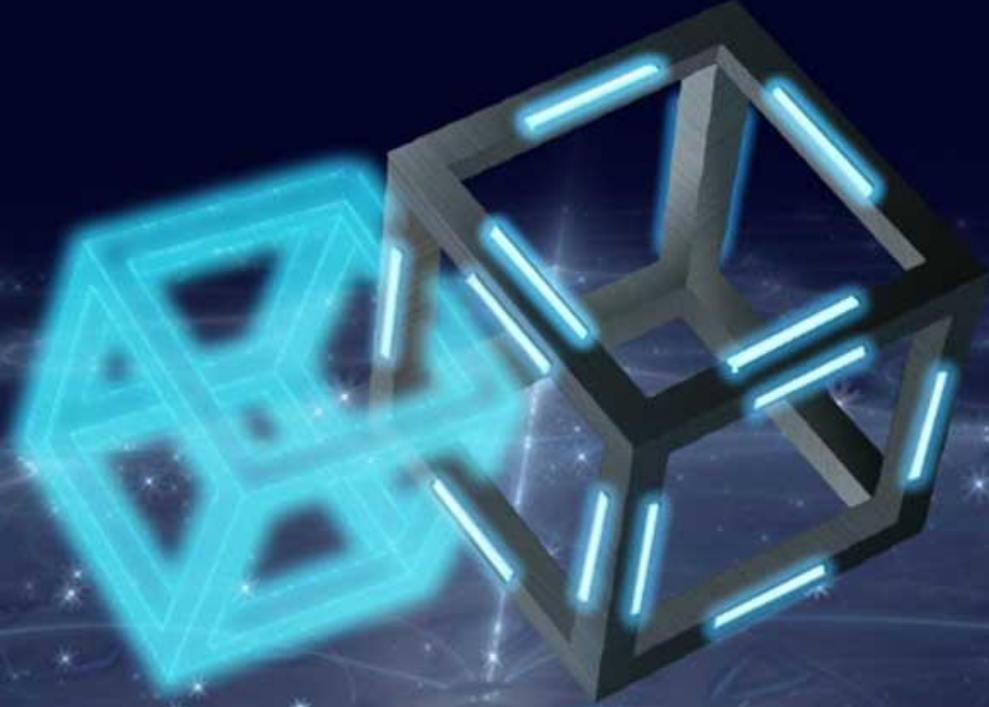


## ➤ *combined problems*

1. Poor quality of seismic data .
2. No suitable software program to analyze integrated stratigraphic studies.







**THANK YOU**