“Sequence Stratigraphy and Paleochannel Analysis of Dutch f3 Field”

OBJECTIVE, INTRODUCTION AND METHODOLOGY

Submitted by

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OBJECTIVE:

The objective of this project is to figure out a set of attributes that can be specifically applicable to enhance the **sequence stratigraphic features and paleochannel of Dutch f3 Field, Netherlands** in any 3D seismic cube of a region using PETREL software.

INTRODUCTION:

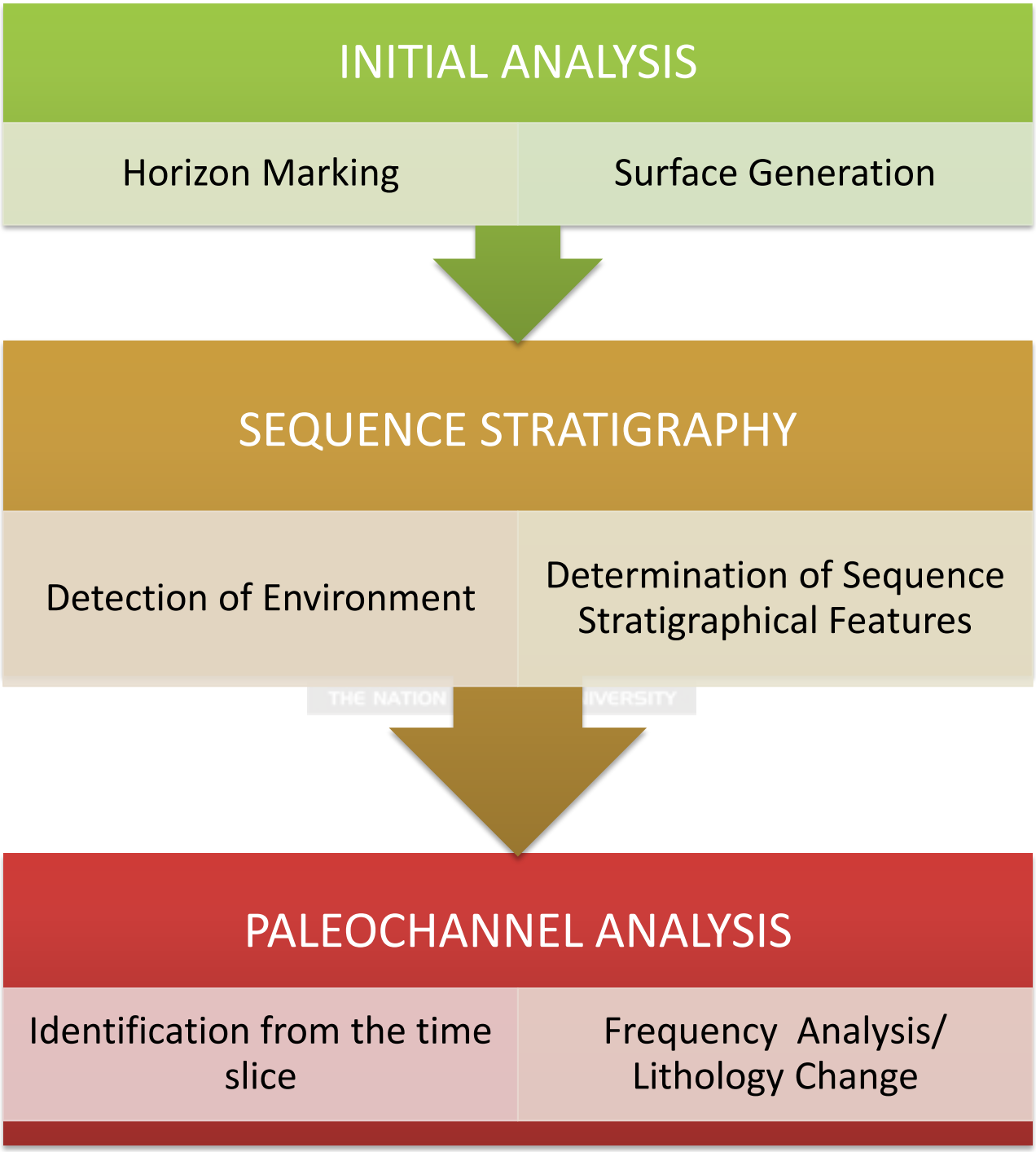
Seismic Attributes are a way to describe the seismic data thereby extracting measureable quantity of a characteristic content from the data. Amplitude, frequency and phase are the major properties of the seismic wavelet that are exploited to define the structural, startigraphic and textural features hidden in the seismic data. Attributes play a key role in responding to the uncertainty involved in the exploration and have the potential for hydrocarbon reservoir prediction, characterization and monitoring. The general classification of seismic attributes is into geometrical and physical. Geometrical attributes enhance geometrical characteristics of the input data such as: dip, azimuth and continuity. Physical attributes are related to physical properties of the subsurface which are inextricably connected to the lithology. These two categories can further be divided into prestack and poststack, depending on the data processing step from which they have been computed. However in Petrel 2009.1 this classification is not obeyed and the attributes are first divided into volume and surface attributes, depending on the input data, and then into libraries whereby each library groups attributes which will enhance similar features.

This project aims to develop a specific set of attributes (multiattributes) to enhance the sequence stratigraphic features, analysis of paleo channel features found in the data and the choice of attributes is justified by the characteristic property of the seismic wavelet that best augments the reflector terminations and unconformity.

METHODOLOGY:

A cluster of attributes are available under the Geophysics option in the processes pane in 2009.1 version of Petrel for enhancing the structural as well as the stratigraphic features present in the 3D seismic data. There are two processes to compute seismic attributes under the Processes pane inside the Geophysics family where seismic attributes are further divided into volume and surface attributes. Each process has the available attributes organized by several libraries which attempt to group attributes with similar outputs. Volume attributes are those computed from an entire 3D seismic cube resulting in a new seismic cube containing the attribute information. Surface attributes are the value of the computed attribute from a seismic cube in one surface, created from seismic interpretation, or in between two surfaces, or between a surface and a constant time window. Volume attributes are divided into five libraries and within each library several attributes can be chosen in a total of 29 whereas surface attributes have an extensive list of 50 attributes which are categorized into four libraries. For the purpose of this project volume attributes are used that are classified under the seismic signal library and the complex trace attribute library, thus resulting in a seismic cube with more amplified features that goes hidden in the original seismic cube. Some of the attributes have a scope to modify their scope by entering the user defined parameters to achieve the data with the best quality nonetheless, the default values are provided by Petrel. In this project we have displayed how subtle features are visible in the seismic data by varying the user defined parameters.

POJECT OVERVIEW:



1. **INITIAL ANALYSIS**: It involves all the initial steps that are required for the project. Basically it comprises of getting acquainted with the data so as to determine the probable features and properties which are required for the project. It has several steps:

   1.1. **HORIZON MAKING**: Picking the horizon is one of the most important parts of any seismic attribute analysis project. As strong reflectors are the basis of any seismic feature present. Strong reflectors are being picked up and marked manually so as to get a reflecting surface.
   These reflectors are also being corrected by using seeded auto tracking feature which helped in automatic generation of horizon.

   1.2. **SURFACE GENERATION**: After marking the strong reflectors (horizons) the surface has to be made. To analyze prominent features that are present on the field a proper surface has to be made so as to deduce the conclusions about any kind of structural, stratigraphical or lithological feature. A generated surface can give the evidence of following.

   - Highs and Lows in elevation
   - Prominent depositional trend
   - Faults (if present)
   - Geological features

2. **SEQUENCE STRATIGRAPHY:** The first step in the stratigraphic interpretation is to determine the vertical and horizontal scale of the section. To find out on the header or the seismic data if the section has been migrated, and weather it is marine or land data. The next step is to divide the seismic data into the discrete natural stratigraphic packages that make up the section and then identify and mark reflection terminations.

   2.1. **DETECTION OF DEPOSITIONAL ENVIRONMENT:** The depositional environment of the particular filed needs to be determined so as to determine the type of features present in the field. A depositional sequence has chronostratigraphic significance because all the rocks of the sequence were deposited during the interval of geological time defined by the ages of the sequence boundaries where transcend. Seismic sequence analysis involves identification of major reflection “packages” that can be delineated by recognizing surfaces of discontinuity.

   2.2. **DETERMINATION OF SEQUENCE STRATIGRAPHICAL FEATURES**: A stratigraphic unit composed of a relatively conformable succession of genetically related strata and bounded at its top and base by unconformities or their correlative conformities in known as a seismic sequence. Different sequence stratigraphical features are to be identified. Some of them are :

   - Onlap

- Toplap
- Downlap
- Erosional truncation and unconformities
- Offlap

3. **PALEOCHANNEL ANALYSIS:** A palaeochannel is distinct from the overbank deposits of currently active river channels, including ephemeral water courses which do not regularly flow. A palaeochannel is distinct from such watercourses because the river bed is filled with sedimentary deposits which are unrelated to the normal bed load of the current drainage pattern. Paleochannel analysis deals with the identification of major lithology change and the frequency analysis so as to bring out major channels and features.

   3.1 **IDENTIFICATION FROM TIME SLICE**: The time slice is being looked for major sites of deposition. The probable sites of deposition of sediments are being marked and separated so as to study for different distinguished properties of channel like change in lithology, frequency variation, and amplitude change. Palaeochannels can be most easily identified from the time slice itself as broad erosional channels into a basement which underlies a system of depositional sequences which may contain several episodes of deposition. Change in depositional trends also shows an important property.

   3.2 **LITHOLOGY CHANGE/ FREQUENCY ANALYSIS:** Different seismic attributes are being applied on the probable sites of channels or deposition which are being picked from time slice. Lithology change is one of the most important properties which confirm the presence of channel. Thus several seismic attributes are being applied on the seismic cube which are:

   - RMS Apmlitude
   - Variance
   - Graphic Equalizer
   - Structural Smoothening