Combined seismic attributes to recognize the architecture and evolution of turbidities- Marlim Sul field, Campos Basin, Brazil

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Abstract

This method was employed on studies of reservoirs in Marlim Sul field located in Campos Basin, Brazil. It takes account two simple seismic attributes, minimum amplitude of one surface and acoustic impedance of one time interval between two surfaces. However, both attributes are combined to allow volumetric visualization of sand bodies and recognize the geometries e genetic relationships besides the evolution of reservoir system of turbidities.

Introduction

Seismic attributes are defined as information extracted or computed from seismic data. The use of combined seismic attributes become more and more important to the success of exploration and exploitation petroleum industry. However there are several different attributes and combinations among them. The appropriate use of attributes depends on human expertise and the objectives to find the correct way to employ these informations in order to extract the real geology inside the seismic, obviously considering the resolution and quality limitations of the data.

When the seismic data have high signal to noise ratio, the images obtained with this technology are very clear and allow make correlations with analogues outcrops. The sequence of images allows also the visualization of system evolution.

Method

To use these attributes in combination is necessary appropriate volumetric software to seismic interpretation with resources of sculpting, opacity and different data put into the same space. In this case was used voxelgeo of Paradigm.

The fig.1 shows the normal attribute amplitude with two different surfaces: top of reservoir and blue marked. The fig.2 shows the attribute impedance with the same surfaces. The fig.3 shows the combination between amplitude and impedance both with 50% of transparency in the same space.

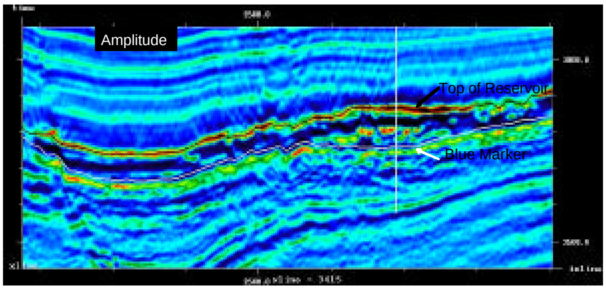

Fig.1: Amplitude section with appropriate color palette and compatible with impedance color palette of fig.2.

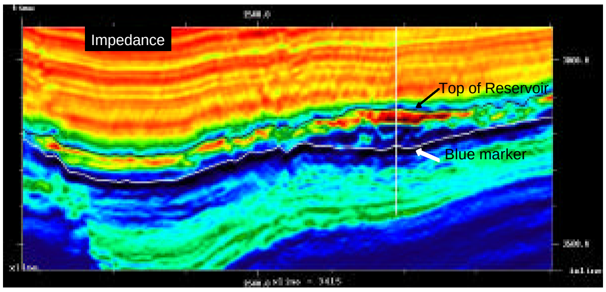

Fig.2: Impedance section.

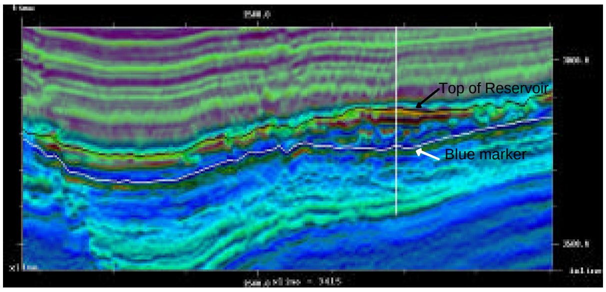

Fig.3: Impedance+Amplitude with 50% of transparency for both.

The fig.4 shows the sculpting between the two surfaces in impedance data.

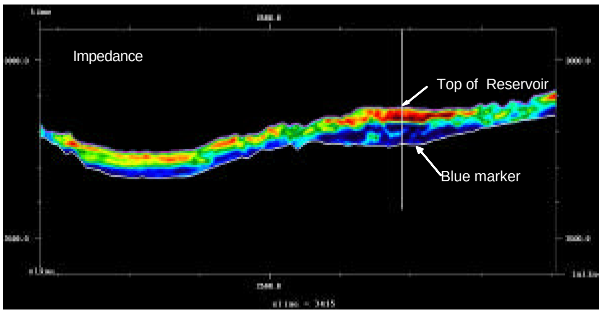

Fig.4: Sculpting between the two surfaces in impedance data.

The fig.5 shows the fig.4 with transparency of non reservoir rocks, so just the reservoirs are visible.

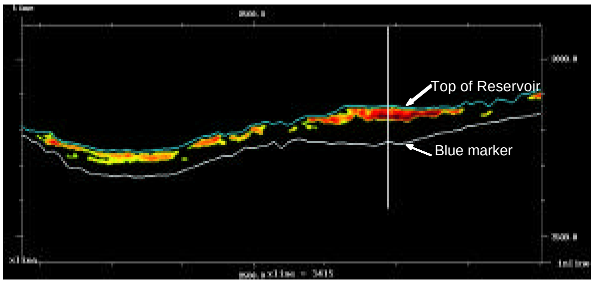

Fig.5: Fig.4 with total transparency for non reservoir rocks

The fig.6 shows the surface top of reservoir with color palette representing the minimum amplitude compatible with impedance color palette so the fig. 7 shows both attributes in a volumetric view.

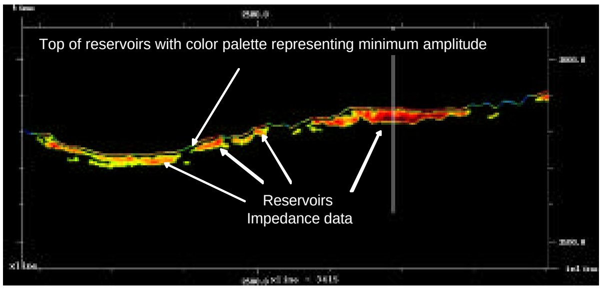

Fig.6: Compatible color palette between amplitude of top of reservoir surface and impedance reservoir interval.

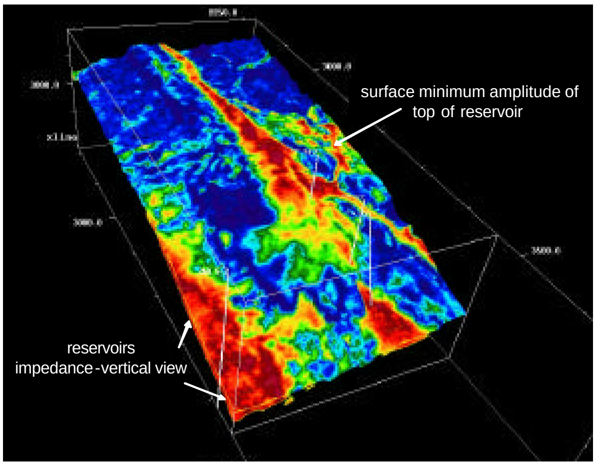

Fig.7: Volumetric view of both attributes: minimum amplitude of top reservoirs and impedance of interval between top of reservoir and blue marker surfaces.

These results are extremely useful to visualize the geometries of turbidities. When many transversal sections are generated the dynamic evolution of the system can be understood and the comparison with analogue outcrops becomes easier. The follow pictures show how to use this tool to recognize the geologic elements to build the architecture of turbidities. The sequence of the pictures shows the evolution and the genetic relations of two different reservoirs MRL100 and MRL200 in a small part of Marlim Sul field.

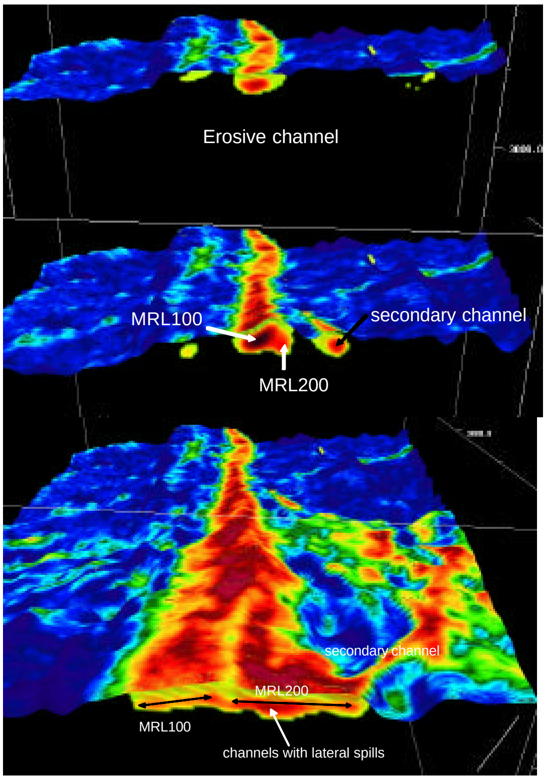

Fig.8: The pictures show the geometries, the geologic elements, the different reservoirs and the evolution of the system since the erosive channel until the depositional channels with spills associated.

Conclusion

This method allows best understanding of reservoirs. It allows visualize the geometries to know the architecture and identify the genetic geologic elements of the depositional system . Also, the method allows knowing the evolution of this system, the different events on time and theirs relationships . So, it allows minimize incertitude, make better the reservoir modeling and simulation flow to improve the financial project.