Application of Neural-network Technology in Analyzing Deep-water Depositional Elements

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The introduction of neural-network technology in 3D seismic interpretation proves to be a powerful tool in constructing depositional elements in basin plain environment. The most known software that uses neural network technology to classify the seismic facies by imitating the human's brains work is Stratimagic. Its 'magic' requires a reference surface, interval thickness (window) and number of iteration as data inputs to create a facies map. (Figure. 1)

The reference surface(s) is used as a reference to define the interval thickness. Interval thickness acts as a processing window that depends mostly on lithology complexity and the quality of the seismic data while the number of iteration defines how much trial-and-error processes are needed in search of a better correlation to the real traces. The result is a series of signal traces that represents the diversity of the signal shape over the seismic volume. In other word, Neural Network Technology trains itself actual trace shapes within a 3D seismic interval by constructing synthetic seismic traces. (Figure. 2a)

An interpretation by using Neural Network Technology was applied to a Pleistocene seismic interval in North Sumatera area. The area is located about 100 km from the present day shelf with greater than 4000 ft water depth. Based on preliminary seismic interpretation, the paleo-slope of the area is flat which indicated deep-water basin plain deposition environment.

Stratimagic is proven to be a very valuable tool in recognizing submarine channels in the area when a comparison was made between RMS amplitude extraction map and Stratimagic image within the same window (Figure. 2b & 2c). The process reveals complexity in channel body by identifying subtle channel features that was only seen as high amplitude areas in amplitude extraction map (Figure 2b, yellow arrow). It also reveals "hidden" facies around the main channel body that cannot be visualized by amplitude extraction map (Figure. 2b, purple arrow). This geometry is interpreted as flood plain deposit that deposited during high sediment influx.

The superiority of Neural Network Technology over RMS amplitude extraction is further demonstrated in another seismic interval of the area. The image is coming from a submarine braided channel deposits with high complexity pattern. Stratimagic recognize the internal complexity of the channel pattern (Figure. 3a, red arrow) better than Amplitude Extraction map. It can reveal some channels that are not displayed in the Amplitude Extraction map (Figure. 3b, light green arrow). Most likely, these channels are filled with the

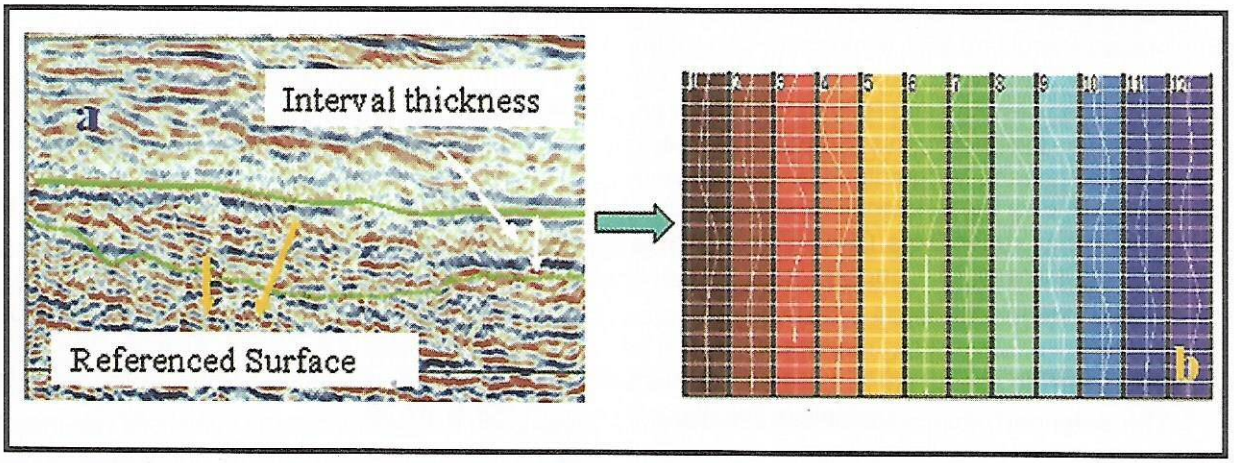


Figure. 1 A seismic cross section displays a referenced horizon and interval thickness (1a) which resulting synthetic seismic traces (1b)

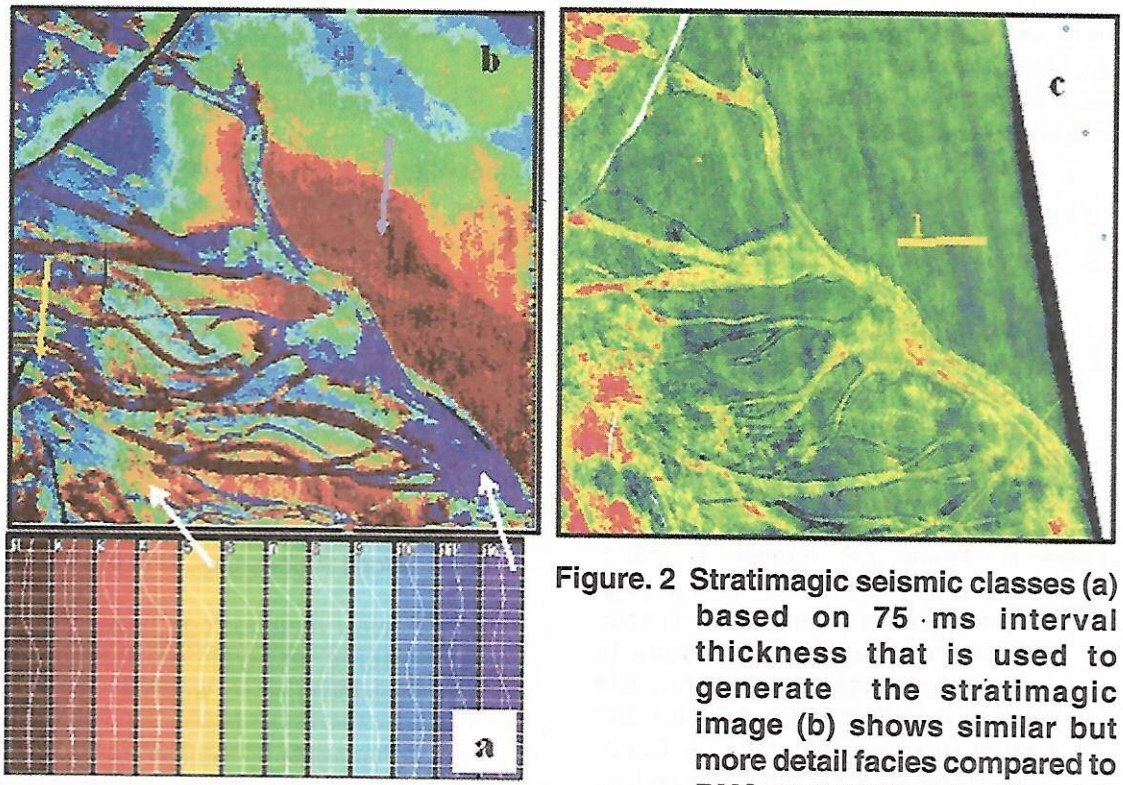


Figure. 2 Stratimagic seismic classes (a) based on 75 ms interval thickness that is used to generate the stratimagic image (b) shows similar but more detail facies compared to RMS amplitude extraction (c)

same material of the surrounding mud that creates no impedance contrast therefore do not appear in amplitude extraction map.

As the preceding technique, the RMS amplitude extraction map had done well in producing images of an interpretative geological deposit type. By the neural network technology, however, the more detailed features are pictured better. With further validate, it also could reveal the "hidden" features that can't be seen by conventional method. The information is a very important input for a more comprehensive sedimentological interpretation of a project area.

Acknowledgement

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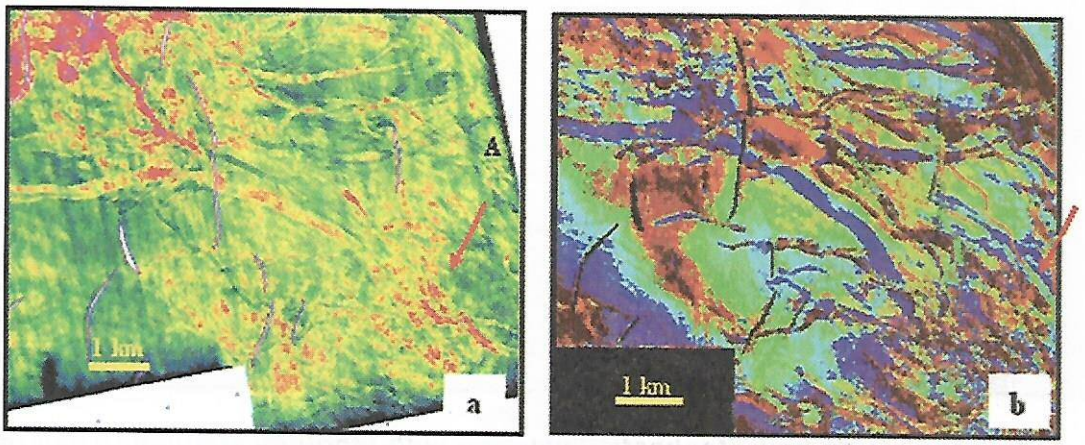


Figure. 3 Braided channel pattern shown by Amplitude Extraction map (a) and Stratimagic facies map from the same window (b) based on the 50 ms interval thickness. Note that Stratimagic can visualize the complexity of this low amplitude area better than RMS Amplitude Extraction (red arrow)