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3D- Seismic in Defining Subtle Petroleum Traps[1)]

with 2 figures

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3D seismic has already proven its value in defining complex structural traps for hydrocarbon accumulations. In the 80's and early 90's 3D seismic technology was mainly deployed to correctly image the subsurface structures. The impact of 3D seismic in defining structures such as salt or compressional tectonism has been documented quite well in the past 20 years. A comparison of 2D seismic section and a corresponding line from the 3D data is shown in Figure 1. The clarity of faults and the imaging on the 3D data is striking.

With the continuous improvement in processing and interpretation technology 3D seismic is now increasingly used to study the depositional environment and subtle petroleum traps. This technology is proving an effective tool for facies imaging and studying ancient depositional systems. In such areas we need to understand the drilling results so that we can make accurate exploration and development decisions to maximise returns and minimise the likelihood of an uneconomic development.

So much information is locked inside the 3D data, we have only to free it with the right tools. Fortunately, while the sophistication of the geophysical analysis and computer power have grown, so has the conceptual understanding of the subsurface geology. By utilising sequence interpretation, attribute analysis, and multiple displays of the same 3D data the interpreter can readily achieve project goals such as accurate well predictions, reserve calculation and building reservoir models even in purely stratigraphic traps. The objective here is to define the depositional environment and delineate perspective stratigraphic facies within a given unit. The industry is working extensively on the other aspects of 3D seismic technology. This includes the development of 3D pre-stack depth migration, 3D AVO, 3D inversion and attribute analysis, 3D coherency and 3D imersive visualisation technology.

The 3D technology is perhaps the technology offering the greatest possibility for improvement in our exploration and development performance. The future will be one of reduced exploration and development drilling risk coupled with more efficient recognition and recovering of reserves, both in new and mature fields. We will

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[1)] Paper presented at the Annual Convention of VSP in Disentis

[2)] OMV Aktiengesellschaft Vienna, Austria

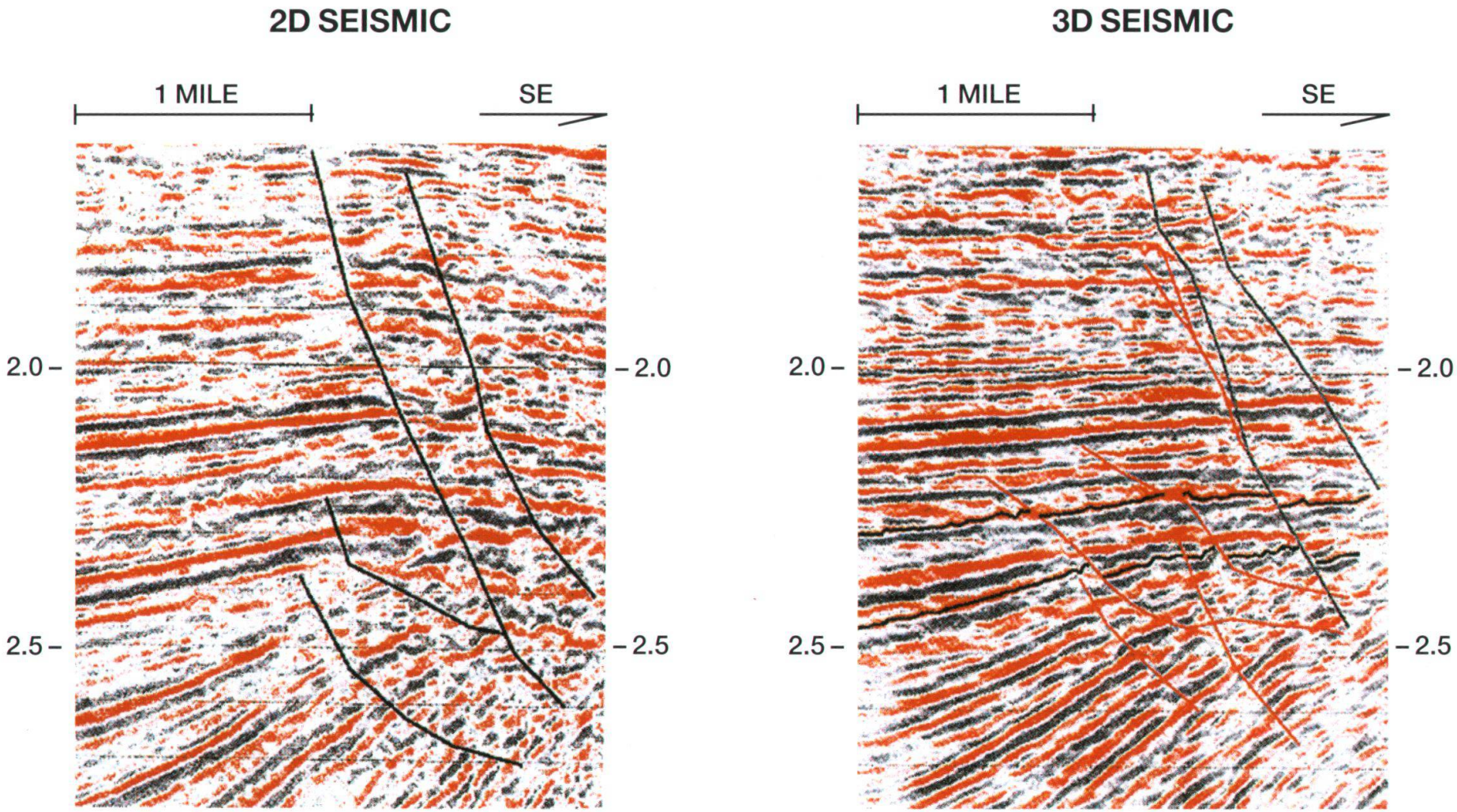

Fig. 1: Comparison of 2D seismic section and a corresponding line from the 3D data. The clarity of faults and the imaging on the 3D data is striking.

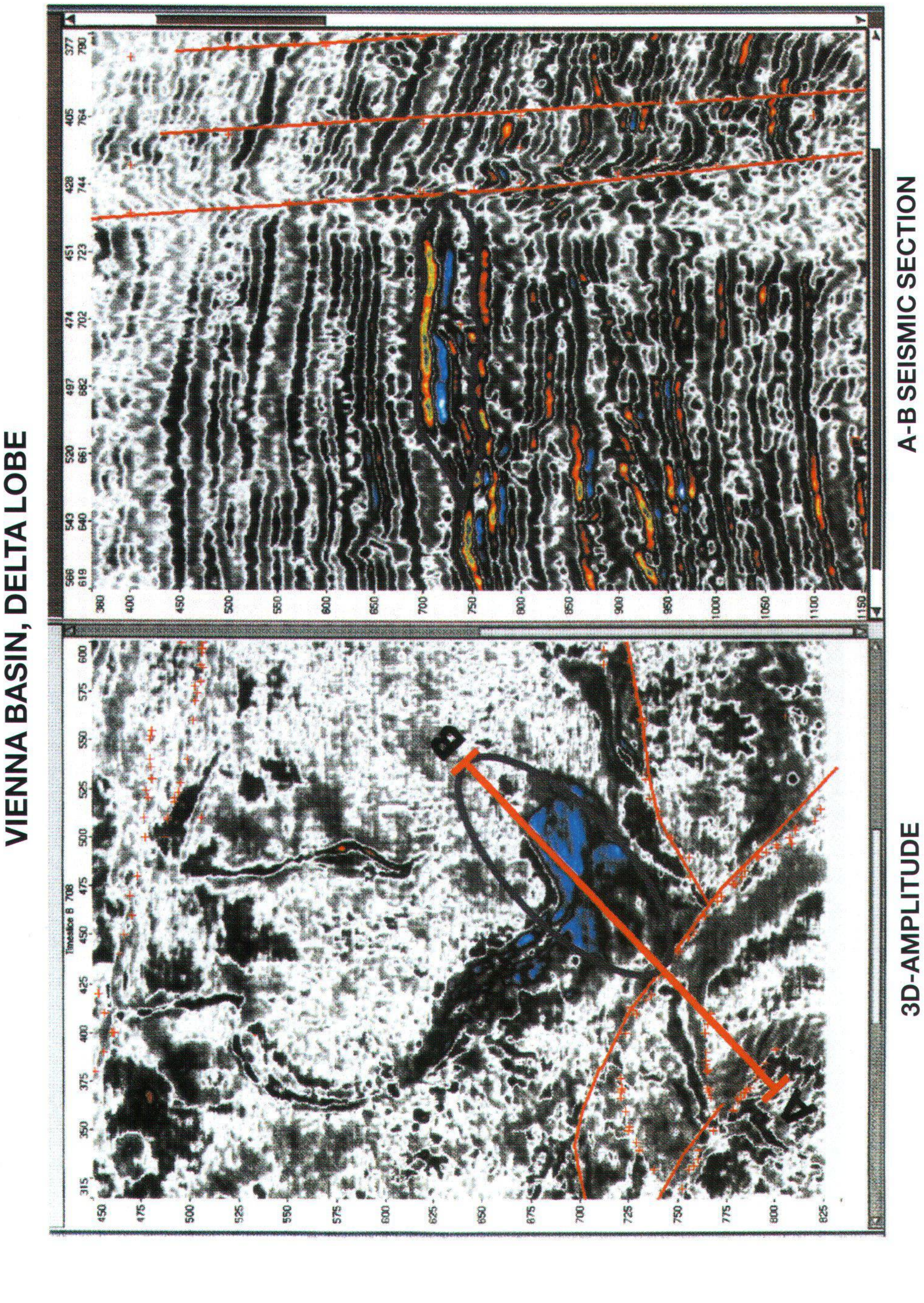

Fig. 2: Example of a subtle trap from the Vienna Basin in Austria. Explanation see text.

be able to much more translate subsurface observations into robust geologic and engineering models in the shortest possible time which will integrate the skills of geologists, geophysicists and engineers.

An example of a subtle trap from the Vienna Basin in Austria, considered as a mature oil and gas province, is shown in Figure 2. In an area of about 3000 sq. km 50 oil and gas fields have been discovered among those the giant Matzen field discovered in 1949 with recoverable reserves of over 500 MMBO. In 1992 a decision was made to revisit the Vienna Basin with modern 3D seismic. The better understanding of paleoenvironment and facies evaluation of the Upper Miocene channel delta sequence has led to many new oil and gas discoveries resulting in an economic revival of an „old" basin. This example shows a channel with an accompanying delta complex of Miocene age. The horizon slice illustrates the horizontal distribution of the various sediment complexes (channels, crevasse splays, prograding delta lobes etc.). The seismic cross-section AB illustrates the seismic response for this depositional system. A major gas field, Tallesbrunn, was found in the prograding sand wedges of this delta.

In conclusion, it can be said that 3D seismic data is not just infilling the gaps in 2D. It certainly leads to new insights about geological processes, resulting in a reduced E&P risk.

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