High Resolution Passive Seismic Tomography- a NEW Exploration Tool for Hydrocarbon Investigation, Recent Results from a Successful Case History in Albania

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Listening to the earth passively over time and using the collected information can provide structural and lithologic information of the subsurface. The present passive seismic tomography (PST) survey, deals with the investigation of a known hydrocarbon field in S. Albania. The objective of this study is to use P and S-wave travel times from natural microearthquakes to derive 3D *Vp* (structural) and *Vp/Vs* (lithologic) information of the area.

In the hydrocarbon industry, seismicity has been mainly used as a reservoir monitoring tool for mapping fluid movements, faults (e.g. Maxwell et al., 1998), and hydraulic fracturing. Recently, Zhang et al., 2009, used the induced, by the production, seismicity to perform a reservoir 3D *Vp* and *Vp/Vs* tomography. During the past few years, PST has also been successfully applied for regional hydrocarbon exploration, thus showing its potential to map large regions for a relatively low cost, compared to conventional 3D seismic surveys (e.g.Martakis et al., 2006). Tselentis et al., 2006, showed that this method can even be applied at a local scale.

It is common knowledge that we will be always faced with exploration activity in geologically complex areas, such as fold and thrust belts. Exploration in these areas is challenging, as well as expensive and is driving the oil exploration industry towards the application of state of the art techniques. PST applications fall into the aforementioned category. The rationale for the application of tomography as a complimentary imaging tool is threefold. Firstly, it is a cost effective way to image a large area, where the terrain is difficult and as a consequence, conventional seismic is expensive and can be of poor quality due to seismic penetration problems. Secondly, the technique has the additional advantage of being environmentally friendly, which is an important consideration in all operational activities today. Third, by using the 3D velocity model derived from the PST and reprocessing existing seismic data (e.g. PSDM) we can drastically increase their resolution (e.g. Martakis et al., 2006).

Data processing of PST data at a local scale for hydrocarbon exploration, is more complicated than simply applying off-the-shelf 3D inversion algorithms. To get the best resolution of the geological formations at the lowest cost, we tap an arsenal of technology: from initial velocity model selection to simultaneous earthquake hypocenter and 3D velocity-model and synthetic and real-data checkerboard tests.