TECTONO-STRATIGRAPHIC CONTROL ON THE MIGRATION OF HYDROCARBONS, LİMANKÖY AREA, WESTERN BLACK SEA

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Two deepwater offshore wells were drilled in Western Black Sea by Turkish Petroleum Corp. and ARCO Turkey Inc. in 1999. Limanköy-1 and Lmanköy-2 wells, while encountering gas accumulation did not prove existence of economically significant quantities of gas. It is suggested here that the reason for insufficient gas accumulation is tectonic and stratigraphic controls on the migration pathway from the source to the reservoir. This interpretation, if correct, will point to the direction of exploration activity in the region.

Introduction

The two Limanköy wells were drilled in the summer of 1999 by TPAO and ARCO in the Turkish Economic Zone of the Western Black Sea. The wells were located approximately 80 km N of the city of Istanbul and approximately 6.5 km apart from each other. The well locations were selected on the basis of structure as well as stratigraphic features interpreted as channels. The main targets were Pliocene and Miocene sandstones, which also displayed AVO anomalies. Basin analysis had indicated that hydrocarbons could not be generated at present depths but had to come from deeper parts of the basin where the prolific Oligocene-L.Miocene Maikopian shales are buried greater depths.

Results

The Limanköy-1 and wells were drilled to 2756 and 3326 m. TD, respectively. The wells penetrated the Pliocene to L. Miocene section. As expected, there were several sandstone intervals with gas shows as well as a blanket of diatomite and diatomaceous shales. The diatomaceous lithologies, above the sandstone section had high micro porosity and gas saturations (above 50%) but very low permeability. The sandstone intervals in the lower section had medium to high porosities with good permeabilities but very low gas saturations. Geochemistry data from cuttings indicated that M.Miocene to Plicene section enveloping the diatomaceous lithologies had fair to good source rock potential, but was immature at present depths. In contrast, the L. Miocene section, which included most of the sandstones, had little source rock potential. The wells did not penetrate the Maikop shales, which are correlated to be present in the region.

Discussion

Interpretation of the well results followed several avenues. Total lack of gas charged reservoirs was a possibility but certainly not the case. Structural problems, i.e. drilling the flank, may be the case for some reservoir levels but not confirmed for most levels (similarly, fault leakage cannot explain absence of economic quantities of gas in all cases since a four-way dip closure was present for some reservoir intervals). This elimination process to explain the well results leaves behind the possibility of source rock, maturation and migration problems.

Structural and stratigraphic evaluations of 2D and 3D seismic data in a more regional framework point to the interpretation shown in Figures 1 and 2. The fault running NW-SE to the SW of Limanköy wells appears to be active through the Neogene (Figure-3). The Limanköy block, rising with respect to land and sediment source, therefore would not be able to receive most of the coarse clastics coming from near-shore areas. Intermittent lowstand coarse sediments passing across the fault plane, would in time be separated from the main channel body (itself defined by the fault) presumably filled with coarser sediments. The channel body is expected to open to basin to the Northeast of the Limanköy block with passing the south of the block. This area, though lacking seismic definition, is the most likely location of a submarine fan.

It is suggested in this study that hydrocarbons hypothesized to be generated in the deeper parts of the basin could move through the channel system outlined in Figures-1 and 2. However, both stratigraphic and structural discontinuities would make it difficult for gas migration to cross the fault to Limanköy block.

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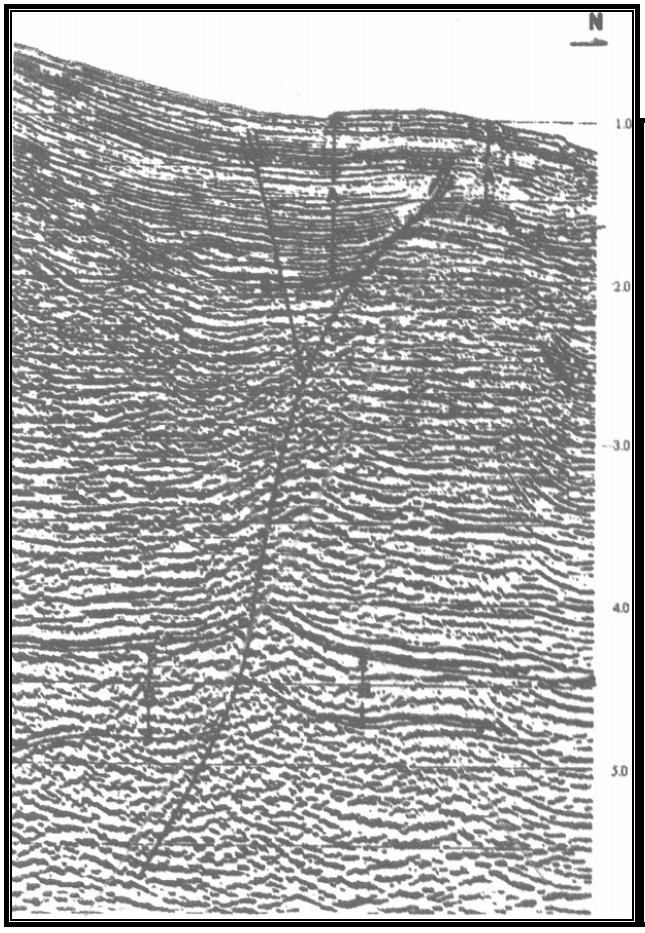

Figure 1. Seismic section through Limankoy

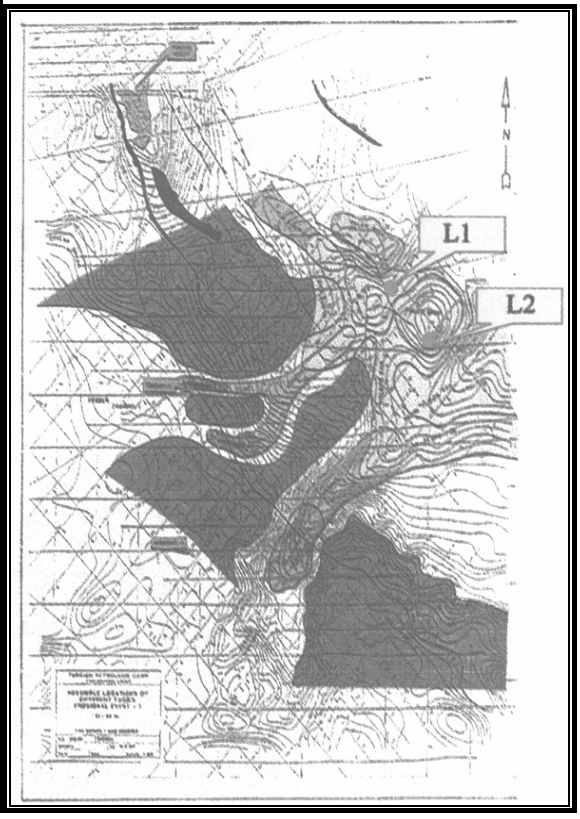

Figure 2. Base Pliocene depth

Figure 3. Intra-Miocene time

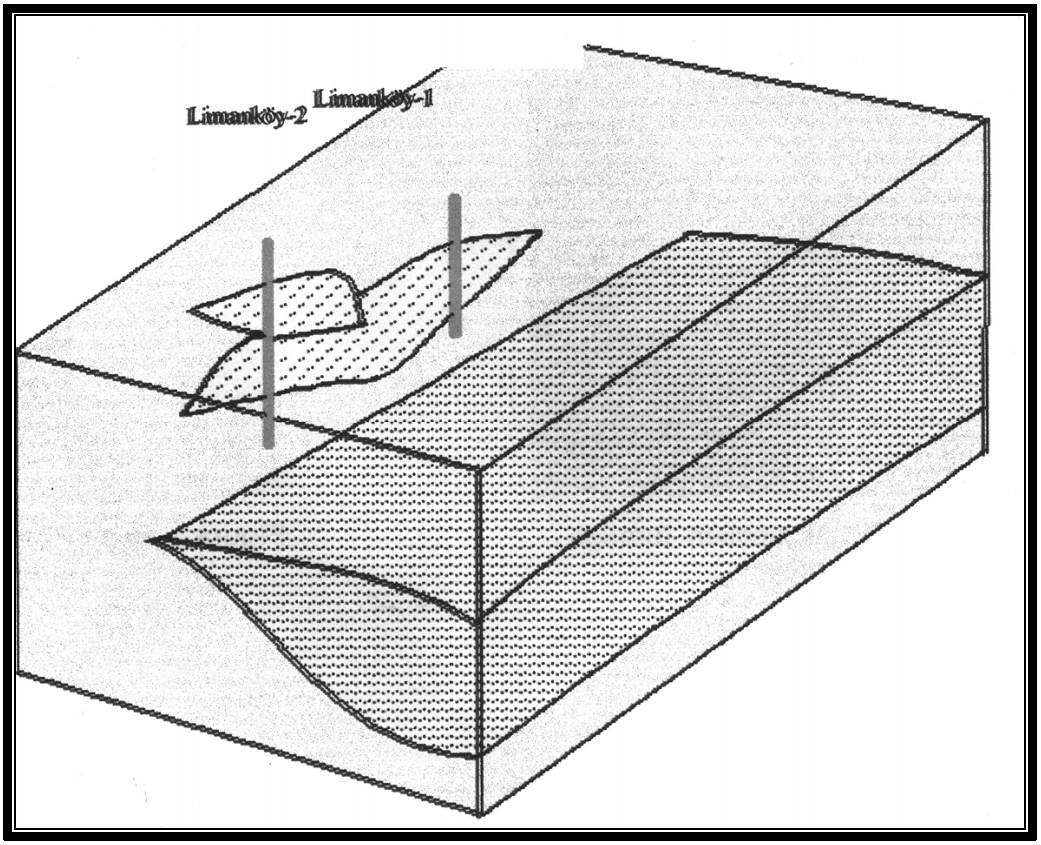

Figure 4. Conceptual