STRUCTURAL HISTORY OF THE NAKHCHIVAN STRUCTURE, SOUTH CASPIAN BASIN

Pitcher, D. M. and Cogswell, J. M.
ExxonMobil Exploration Company

The Nakhchivan structure is a large (20 x 10 km) north-south trending anticline that is located approximately 100 km south of Baku, Azerbaijan Republic, in the South Caspian Basin. Nakhchivan is a slightly asymmetric, detached buckle-fold. Deformation has been accommodated on two detachment horizons and modified by late stage breakthrough thrusting and crestal normal faulting. The structure lies at the northern end of a fold trend that extends for about 60 km along structural strike. In general, this greater fold trend is characterized by westward vergence with breakthrough thrusts along the west flank. The breakthrough thrust system is segmented along strike and the segments appear spatially related to stepovers in the axes of major en echelon folds. The en echelon stepover at the southern end of the Nakhchivan prospect has a more marked displacement than the stepover to the south, and is also associated with a change from west-vergent thrusts to the south to an east-vergent thrust in the southern Nakhchivan block. The east-vergent thrust is spatially restricted to the en echelon stepover zone and, as a relay structure, is does not continue farther to the north within the Nakhchivan structure. A large mud volcano complex located within this relay zone separates the east-vergent thrust from another west-vergent thrust in the northern par of the structure. Poor seismic data quality beneath the mud volcano complex prohibits direct mapping of the between the two thrust.

Initial structuring is relatively weak and is interpreted to have occurred along a detachment within the Sabunchi Formation. Datumed seismic sections and isochrons within the lower and upper Surakhany intervals show thickening that is related to repeat section along the thrusts. In addition, the successive isochrons also show a change in orientation of fold axes from North/Northwest to North that is interpreted to be related to a change in the location of the early thrusts.

The main phase of structural evolution at Nakhchivan is related to a deep-seated thrust and detachment that began to move at the end of Productive Series deposition. The detachment zone for this thrust is deep, and is interpreted to be within or above the late Oligocene/early Miocene Maikop Formation based on regional seismic interpretation and structural balancing. This thrust cuts up-section, almost to the top of the Balakhany Formation, and the associated buckle folding deforms the older, shallower thrusts. Datumed seismic section show thickening in the core of the fold indicating most of the accommodation for this folding occurred below Balakhany Formation. Isochrons show a distinct change in the trend of the fold axes from North to North/Northwest.

A late phase of deformation at Nakhchivan consisted of breakthrough thrusting that is interpreted to have occurred at the end of deposition of the Apsheron Formation. Datumed seismic sections show a dramatic change in strain rate above this interval, indicating a rapid increase in structural growth. Isochrons and attribute extractions show channelized systems that are diverted around the paleo-high during this phase of growth. The final stage of deformation consists of very young, extensional faulting across the crest of the structure. These faults have modern, seafloor expression and are still active.