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The Hydrocarbons of the South Caspian Basin: How Exploitation Depends on the Understanding of Neogene Paleoclimate

The latitude of the South Caspian basin put it in a 'Mediterranean' zone where the climate has oscillated from wet to very dry every 20,000 years, in response to insolation changes driven by variations in the Earth's orbit (Milankovitch cycles). This land-locked sea responded by major changes; the "sea" level changed probably more than 100 meters vertically and shorelines migrated probably several hundreds of kilometres laterally during each cycle. About a dozen such cycles occurred just during deposition of the Pereriva Suite, implying that there are (at least) an equal number of internal unconformities within just this interval of the reservoirs of the Productive Series. In addition, there is a major unconformity at the base of the Pereriva. There are probably about 50 unconformities within the Balakhany Suite.

The Caspian database also reveals that some fundamental paradigms in sequence stratigraphy require major revision before they can be applied to predict lacustrine reservoir architecture. Among these is the observation that the sequence boundary (lowstand exposure surface) essentially coincides with the maximum flooding surface because there is hardly any clastic sediments deposited in an enclosed lake during lake level fall -- there is no fluvial discharge to get them there. Also, sequence boundaries in the South Caspian have no time relationship to those formed by global eustasy; they are neither in- nor out-of-phase. This is because levels of the Caspian Sea are driven by low-latitude insolation, which is mostly controlled by 20,000-year precession and 100,000-year eccentricity cycles. In contrast, global eustasy is controlled by polar ice volumes, which change in response to high-latitude insolation that is heavily influenced by obliquity changes on 40,000-year time scales.