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Lacustrine and Marine Sequences - How They Differ in Phase and Architecture

Lacustrine high-frequency depositional sequences (duration of less than one million years) have generally no direct phase relationship with coeval marine eustatic ones, because they are generally controlled by different external factors. This is particularly well illustrated in Pliocene strata in the Caspian Sea, which are dominated by sedimentation cycles reflecting the 20,000-year, 100,000-year and 400,000-year Milankovitch cycles in precession and eccentricity. These are the astronomical factors that control insolation at low latitudes. In contrast, the marine dO18 curve for the Pliocene shows a distinct peak in the frequency spectrum at 40,000 years, which is the period of the earth's obliquity cycle, the astronomical factor that has the dominant influence on insolation at high latitudes and therefore the growth and decay of polar ice sheets. Global eustatic sea level and corresponding marine sequences record, therefore, a different astronomical signal than do the low-latitude lacustrine one.

Lake sequences also differ from their marine counterparts in stratal stacking patterns because of the direct linkage between sediment supply, riverine discharge, and lake levels. A typical sequence in a marginal marine setting will consist of lowstand fluvial sandstones followed by transgressive estuarine heterolitics, and shallow marine mudstone with subordinate sandstone associated with late transgression and highstand. This is capped by a dominant package of regressive delta front sandstones deposited during the subsequent falling stage. In typical lake margin sequences, in contrast, there is no sandstone associated with the falling stage because lake levels fall due to a deficiency in riverine inflow and hence very limited or no clastic sediment supply at that stage.