Interbasinal Age Control of the Monterey Formation Based on Multi-discipline Age Models and Correlation of Key Facies to the Miocene Climatic Events

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Abstract

The Monterey Formation is a unique early to late Miocene stratigraphic unit known for pelagic siliceous and calcareous biogenic sediments deposited in the marginal basins of California. A high-resolution analysis of several key reference sections using a multi- discipline approach based on biochronology (benthic foraminifera, siliceous microfossils, and calcareous nannofossils), magnetostratigraphy, tephrochronology, and strontium isotopic stratigraphy. These sections include Newport Bay (Los Angeles Basin), Topanga Canyon (Ventura Basin), Naples Beach (Santa Barbara Basin), Mussel Rock (Santa Maria Basin), Type Luisian (Salinas Basin), and Chico Martinez Creek (San Joaquin Basin). Using this approach, a series of age-depth plots were constructed based on a graphic correlation methodology to show stratigraphic distribution trends of key Monterey lithofacies within the studied sections. A comparison of the sedimentation curves shows a Monterey deposition succession that is divided into four phases. Phase A (~18 to 14.7 Ma), is indicative of the lower Monterey deposition. Phase B (14.7 to 13.1 Ma), is an interval composed of laminated and phosphatic-rich and organic-rich claystone. Phase C (13.1 to 10.0 Ma), is characterized by condensed gaps and the transition to an increase in sedimentation rate associated with more siliceous-dominated strata. The final stage, Phase D (Post 10.0 Ma), represents an increase in sedimentation rate related to an influx of terrigenous sediments in the overlying siliceous-rich interval of the Monterey, Sisquoc, and equivalents units. Intervals of high organic-matter preservation are observed throughout the middle to early late Miocene in all four basins. The strata with high organic carbon preservation occur in the (Relizian to Luisian); however, the maximum values are found within the Luisian to lower Mohnian stages. Phosphatic-rich sediments occur within the Langianand Serravallian intervals. Also, condensed intervals are well developed in the more distal basins but with reduced occurrence in the more proximal Chico Martinez Creek section. Siliceous-rich sediments, especially porcelanite, chert, and siliceous shales, occur in the upper Monterey and overlying Sisquoc and equivalent units, Late Mohnian to Delmontian.