Depositional Mechanisms of Biosiliceous Lithofacies in the Upper Modelo Deep-water Clastic System, Eastern Ventura Basin, Lake Piru, California

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Abstract

The Upper Miocene Modelo Formation is a clastic-rich stratigraphic equivalent of the well-studied Monterey Formation deposited, in part, as a submarine fan in a tectonically complex bathymetric environment. In the Upper Modelo Formation, Lake Piru area, Eastern Ventura basin, fine-grained sedimentary rocks intercalated with deep-water clastics are abundantly biosiliceous (porcelanite, chert and siliceous mudstone) and display sedimentary structures that are rare in sand-free Monterey depositional environments. These provide evidence for downslope transport and resedimentation of original hemipelagic deposits of near-pure diatomaceous sediment into the overbank-levee of the channel-lobe transition environment, that with diagenesis, produces a remarkably cherty biogenic siliceous lithofacies for most of the non- epiclastic fines within this deepwater turbidite system. The combination of extremely biosiliceous rocks (90% SiO_2) intercalated with clastic shale, siltstone and sandstone, plus sedimentary features in the siliceous rocks, such as massive and graded speckled beds, sandy or silty chert, organic-laminated chert, depositional loading and biosiliceous slumps, provide evidence for downslope resedimentation by gravity flows from local bathymetric highs with a distinct provenance from the deep-water clastics. These mechanisms help explain lateral variation in stratigraphic thickness and silica content documented in the subsurface of the Santa Barbara, Santa Maria and San Joaquin basins. Field and lab analysis, including documenting sedimentary structures, lithofacies relations, microfacies, and optical petrographic and SEM-EDS composition, leads to a classification of opal-CT biosiliceous lithofacies within southern Lake Piru. This can be applied to other mixed biosiliceous-clastic fan systems like the Tarzana and Stevens fans or the Los Angeles and San Joaquin basins.