

Tephrochronology of the Monterey and Modelo Formations

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Abstract

The age and correlation of the Monterey and Modelo Formations has been predominantly based on biostratigraphy. Until recently, tephra (volcanic ash beds and tuffs) in the Miocene Monterey and Modelo Formations have been largely ignored. We combine tephrochronology and biostratigraphy to provide more precise numerical age control for eight sedimentary sequences of the Monterey and Modelo Formations from Monterey to Orange Counties in California. We correlate 38 tephra beds in the Monterey and Modelo Formations to 26 dated tephra layers found mainly in non-marine sequences in Nevada, Idaho and New Mexico. We also present geochemical data for an additional 19 tephra layers in the Monterey and Modelo Formations, for which there are no known correlative tephra layers, and geochemical data for another 11 Monterey-age-equivalent tephra layers found elsewhere. Tephra layers in the Monterey and Modelo range in age from 16 to 7 Ma. The majority were erupted from volcanic centers of the Snake River Plain (SRP), northern Nevada to eastern Idaho, and the Southern Nevada volcanic field (SNVF). We identify tephra from five super eruptions deposited as much as 1200 km from the eruptive source: [12.08 Ma Ibex Hollow Tuff (SRP), 11.87 Ma Rainier Mesa (SNVF), 11.31 Ma Cougar Point Tuff XI (SRP), 11.08 Ma Cougar Point Tuff XIII (SRP) and 8.99 Ma McMullen Creek (SRP)]. This initial tephrochronology provides new time-stratigraphic markers that assist with correlation of Monterey Formation deposition (e.g., condensed sequence) with non-marine sequences and events (e.g., Clarendonian mammalian faunal stages) in western North America.