

tion in the saline environment, through K^+ adsorption and/or cation exchange, of either degraded illites or mixed-layered illite-smectite derived from nonsaline fluvial channels. This conclusion is supported by results of laboratory studies conducted on fresh and brackish water clays with seawater. The observed environmental variations in clay mineral assemblages may have important implications on paleogeographic interpretations.

There are two clay-mineral zones in the shallow-marine facies of the deltaic complex. Clays west of Oliktok Point have markedly lower illite/smectite and illite/kaolinite ratios than clays east of the Point. These lateral variations probably are related to differences in clay-mineral sources rather than depositional environments.

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CONTINENTAL-MARGIN SEDIMENTATION OF EOCENE TEJON FORMATION, WESTERN TEHACHAPI AND SAN EMIGDIO MOUNTAINS, CALIFORNIA

The Tejon Formation was deposited from early to late Eocene time in a variety of shallow-to-deep marine environments along the western margin of the North American continent. It crops out in east-west-trending mountain ranges along the southern margin of the Great Valley of California. These ranges offer the only exposures of Eocene rocks underlying the Valley on the north. On the basis of new megafaunal data, deposition of the Tejon commenced in the early Eocene with the Uvas Conglomerate Member, a shallow-marine basal conglomerate and sandstone that rests unconformably on pre-Tertiary crystalline basement rocks. The Uvas records a slow transgression of the sea from west to east. It grades upward into the Liveoak Shale Member, consisting of shales, siltstones, and thinly bedded, fine-grained sandstones. The Liveoak was deposited seaward of the Uvas in middle and late Eocene time; it grades laterally eastward into shallow-marine sandstones and conglomerates and laterally westward into hemipelagic foraminiferal shales. The Metrala Sandstone Member was deposited by the westward-retreating, late Eocene sea. It is a locally conglomeratic, shallow-marine sandstone that overlies the Uvas in the easternmost part of the area, and the Liveoak in all other areas. It grades laterally westward into thinly interbedded, fine-grained sandstones and shales deposited in deeper water, and farther west into the hemipelagic shale facies of the Liveoak. The Reed Canyon Siltstone Member, the uppermost member of the Tejon Formation, discontinuously overlies the Metrala and was deposited during the late Eocene in shallow-marine environments, including probably lagoonal areas behind barrier islands. Thus, the Tejon Formation records an advancing and retreating shoreline across a narrow continental shelf, bordered on the east by alluvial plains and on the west by an irregular continental borderland containing deep-sea basins in which submarine fans were being deposited.

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SEDIMENTATION AND TECTONICS IN EARLY TERTIARY CONTINENTAL BORDERLAND OF CENTRAL CALIFORNIA

The most prominent Eocene paleogeographic elements of central California were the Sierran continental landmass on the east and the Salinian continental borderland on the west, both underlain by granitic crust and separated by a trough-shaped, deep-marine area underlain by oceanic crust. These linear elements trended approximately north-south, parallel with the edge of the continent. Erosion of the Sierran area yielded clastic detritus that was transported westward and deposited in successive fluvial, near-shore, shallow-marine, and deep-marine environments. The Salinian borderland, which probably had been detached from the Sierran landmass by pre-Eocene right-

lateral faulting along its eastern edge, consisted of irregular island uplands interspersed with deep marine basins. Detritus eroded from these islands was deposited as submarine fans within the borderland basins and on the sea floor on the east and west. Microfossils indicate deposition in basins of bathyal to abyssal depths and unrestricted access to the ocean. The early Tertiary submarine-fan deposits are similar throughout the central Coast Ranges, and contain assemblages of proximal and distal turbidites, deep-sea conglomerates, grain-flow deposits, and hemipelagic shales. They differ from most modern deep-sea fan deposits and typical flysch sequences in that they are very thick, limited in areal extent, and consist mostly of coarse clastic detritus. The conglomerates contain coarse clasts, including boulders, and have very thick, irregular bedding. Proximal sandstones consist of Bouma *ae* to *abcde* sequences that are very thickly bedded and amalgamated, poorly graded to ungraded, commonly structureless, and contain large mudstone rip-up clasts and dish structures. Distal sandstones contain more complete Bouma sequences, a greater variety of sedimentary structures, and are graded. The borderland region was tectonically active during sedimentation, so that island source areas and depositional basins formed and changed abruptly. Submarine fan sedimentation was rapid, but the supply of sediment was probably not continuous for long periods of time. Paleocurrent directions are varied, reflecting the irregular distribution of source areas and depositional basins.

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DETERMINATION OF SOME PALEOHYDRAULIC PARAMETERS

New river measurements combined with existing laboratory evidence show that, in a river reach where traction motion as well as net sediment deposition take place, the mean applied bed shear stress is equal to the critical shear stress required to move particles of median bed material size. Consequently, application of Shields' relation between shear stress and material size permits the determination of mean applied shear stress at an ancient depositional site from the grain-size distribution of the sediment. Furthermore, by applying laboratory values for the friction factor, determined for the appropriate bed configuration, we can calculate the paleoflow velocity by the Darcy-Weisbach relation. This method for the determination of paleoflow velocity is generally applicable to any sedimentary deposit if a reasonable estimate of the friction factor can be made.

For rock units containing climbing ripple cross-lamination, we can go one step farther and determine the rate at which the sediments were accumulated. The rate of bedload transport has a known functional relation to the mean velocity of the overlying column of water as determined in the first part of this study.

Very high rates of sedimentation are found to exist in nature. Late Pleistocene deltaic sediments in the Truckee Canyon of Nevada, locally contain climbing ripple cross-laminated units indicating a local rate of aggradation of 0.1 mm/sec or 36 cm/hr.

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SAND-DISPERSION PATTERNS PRODUCED BY WAVE-CURRENT AND TIDAL-CURRENT INTERACTIONS IN NEARSHORE TIDAL

In mesotidal nearshore zones, patterns of sedimentation commonly are dependent on the characteristics of the interactions between wave surge and tidal flow. Sedimentary processes associated with waves alone or with tidal currents alone are generally insufficient for explaining the distributions, orientations, textures, and structures of bedforms in zones exhibiting wave-surge/tidal-current interactions. The resultant forces produced by the interaction of wave surge and tidal currents generally