more of the following sedimentary structures: trough cross-beds, ripple laminations, horizontal laminations, convoluted laminations, or massive bedding. Additional features present include vertical accretion deposits, lateral accretion deposits, and crevasse splay deposits. A statistical analysis of the several facies and the contacts between them resulted in interpretation of the environments of deposition as a meandering river and associated flood plain. The lower half of the section, including a significant number of coal beds and carbonaceous shales, was deposited primarily within the flood-plain basin, whereas the upper part of the section, with coarser grained siltstones and sandstones, implied deposition closer to the channels.

In addition to the sedimentologic analysis, a petrographic study of the coal beds was conducted. Results of a maceral analysis indicate a probable freshwater origin for the coals. Identification of the plant fossils found over the coal beds reveals a freshwater flora, and the mode of preservation indicates deposition in a crevasse splay deposit.

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Sedimentary Processes on Continental Shelf Off Southern California

Depositional processes characterizing San Pedro continental shelf have been extensively investigated by the University of Southern California (USC) and the U.S. Geological Survey (USGS).

Data collected during 1973-76 by USC document the sedimentologic framework of San Pedro shelf. Textural patterns can be explained as responses to long-term oceanic processes; however, no unique transport directions can be inferred from the data. Almost all bed forms observed have been small-scale, wave-generated ripples, the distribution of which reflects increasing biogenic activity with decreasing energy levels seaward. Owing to biological reworking, no stratigraphic evidence of these ripples was preserved in cores. Mesoscale current lineations resolved on sonographs indicate sediment transport transverse to isobaths. Forty-day records taken in April to June 1978, with two USGS Geoprobe tripods and moored transmissometers, show several significant features: (1) near-bottom transport is seaward with mean speeds of about 1 cm/s in shallow water (22 m) and 3 cm/s near the shelf break (68 m); (2) although mean speeds are low, instantaneous currents caused by tides and surface waves exceed threshold velocities at the shallow site; and (3) currents from internal waves can increase ambient nearbottom energy levels sufficiently to entrain sediment.

Integration of data from USC and USGS investigations provides information necessary to understand the fair-weather dynamic processes that affect sediment transport and deposits on a narrow southern California shelf.

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Paleobiologic Evidence for Cretaceous Tides, Western Interior Basin, North America

Modern intertidal environments contain a suite of diagnostic physical sedimentary structures and macroinvertebrate organisms. The former are often used in the identification of ancient intertidal paleoenvironments; the latter are rarely used. Yet the conservative evolution of intertidal organisms and their distinctive adaptive morphologies, expressed as preservable biogenic structures and/or shells, facilitate their identification in ancient strata. The habitat ranges of modern intertidal organisms are narrowly restricted within the intertidal zone. Groups of organisms with roughly equivalent habitats constitute distinct, low-diversity communities. In general, the total number of taxa in the intertidal biota and, accordingly, the number of recognizable communities increase with increasing tidal range. We propose that: (1) fossil intertidal organisms and their traces can be used to recognize Mesozoic and Cenozoic intertidal paleoenvironments; and (2) the diversity and number of distinct paleocommunities recognizable among such faunas can be used to determine, at least qualitatively, paleotidal range. We have applied these concepts in a study of Cretaceous nearshore and marginal-marine strata in the western interior basin. Obligate or habitat-selective intertidal organisms occur along both shorelines of the interior Cretaceous seaway from northern Alberta to the Gulf of Mexico. Different groups of paleocommunities characterize exposed, wave-dominated, sandy coasts and low-energy, vegetated shorelines in marginal-marine settings. The compositions of the paleocommunities along low-energy shorelines further vary with paleosalinity, permitting recognition of broad salinity gradients in Cretaceous estuarine settings. Faunal evidence indicates that Cretaceous tides extended throughout the interior Cretaceous seaway. The tidal range was generally greater along the western shoreline than along the eastern shoreline.