considered for evaluating fluctuations in carbonate compensation, and in plate reconstructions.

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Clay-Mineral Variability in Suspended Sediments of San Francisco Bay System

Semiquantitative determinations of the clay-mineral composition have been made on nearly synoptic samples of surface-suspended sediments collected seasonally from throughout the San Francisco Bay system. The relative amounts of chlorite plus kaolinite are generally highest in the northern reach of the system, whereas illite always is dominant in the southern reach. The amount of montmorillonite is low throughout the system. Replicate samples, formed from low and varied suspended-sediment concentrations, show that the difference in clay-mineral composition between the northern and southern reaches is not due to the natural, within-station variability, or to an apparent enrichment of illite, such as that produced experimentally. The difference apparently reflects a change in the sources of suspended clay-mineral particles in the bay system. In the northern reach the dominant source is the Sacramento and San Joaquin Rivers; secondary sources include resuspension by waves and tidal currents and, perhaps, offshore deposits. In the southern reach most suspended clay-mineral particles must come from resuspension by waves and tidal currents; the fluvial contribution is small. Several lines of evidence suggest that the relations between the composition and the source of clay-mineral particles may, in turn, be a function of grain size.

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Geologic Environments of Geothermal Resources

Geothermal resources have been developed most extensively in areas of youthful magmatism, principally along active volcanic chains. In the terminology of plate tectonics, this includes crustal rifts and spreading centers, behind-the-trench subduction zones, and regions of extension along suspected transform faults. Lacking Quaternary volcanism, emplacement of batholiths is suspected in subduction-zone and transform-fault environments. Examples of the volcanic environment are Matsukawa, Japan, and Ahuachapan, El Salvador. The Geysers, California (although exhibiting Quaternary volcanism), is an inferred batholith.

In areas of thinned crust, such as the Basin and Range province, heat transfer via water circulating along fractures may create geothermal resources within the upper 2 to 5 km in the absence of youthful magmatism. Elsewhere, very deep circulation of water (3 to 10 km) along folded and faulted structures may create lower grade geothermal resources. These may be extremely abundant, and if developable represent a vast source of energy. Finally, breakdown of montmorillonite above the 150°C-isotherm in very deep sediment-filled basins may create geopressured hot-water resources, as along the Gulf Coast. Salt diapirs may serve as heat pipes from depths of 10 to 15 km.

Reservoir may be simply fault zones, in any region of active tectonism, or may be fractured silicic-volcanic and sedimentary rocks, highly porous and fractured basalt lavas, or solution-tunneled carbonate rocks. Storage capacities of shattered granitic and metamorphic rocks are unknown, but locally may be great. Recent tectonism is important in maintaining open fractures for circulation and storage. Rapid facies changes in young volcanic rocks may limit reservoir capacity. At The Geysers, basement is fractured metasedimentary and metavolcanic rock of great thickness and lateral extent.

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Active Surface Faulting, Texas Coastal Zone

Surface faulting in the Texas coastal zone is the result of natural activation of subsurface faults, originating in the Tertiary section, and of man-induced activation from extensive ground-water withdrawal and subsequent decline of the piezometric surface. Several lines of evidence indicate that widespread surface faulting has occurred by natural activation in the Quaternary. The extrapolation of subsurface Tertiary faults to land surfaces is coincident with active surface faults, aerial photographic lineations, rectilinear-drainage patterns and growth faults in the shallow Pleistocene Alta Loma sand. Topographic escarpments coincident with active faults in the Houston area existed before major groundwater withdrawals.

However, ground-water withdrawal is the primary mechanism for fault activation in Harris and Galveston Counties. The faults probably are partial hydrologic barriers causing differential consolidation of the shallow aquifers. Data from tiltmeters across active faults show that vertical movement is coincident with piezometric-surface declines. Surface faults which appear to be up-to-the-coast faults have subsurface equivalents that dip down to the coast. Subsidence profiles across active faults and surface traces of extrapolated faults commonly show increased subsidence on the upthrown side or on both the upthrown and the downthrown side with the fault remaining in a zone of minimal subsidence.

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Comparison of Diagenetic and Weathering Microtextures on Quartz Sand from Meadowcroft Rock Shelter, Avella, Pennsylvania

Quartz sand samples from localities at the Meadowcroft archeologic site, Avella, Pennsylvania, were examined with the scanning-electron microscope for surface microtextural variation and were compared with grains collected from the cliff above the site. Many carbon-14 dates within the sediment pile at the site provided an excellent time framework which makes it possible to examine weathering features over well-defined intervals of time. Before weathering, grains have two predominant features: upturned plates which probably represent original grain morphology and quartz-crystal overgrowths which were formed later by diagenesis. Addi-