

Three tuff sequences are composed of massive and bedded crystal tuff; 2 are composed of massive and bedded pumiceous vitric-crystal tuff. All five sequences have massive and sometimes laminated fine-grained vitric upper portions. Crystal-rich and pumiceous tuff sequences probably reflect different settling and/or eruptive histories.

Crystal tuff sequences originated from crystal-rich magmas or from crystal enrichment by gravity sorting of pyroclastic debris settling through long water columns, possibly as a result of vulcanian-type submarine eruptions. Bedded crystal tuff was deposited from a series of ash falls and tuffaceous turbidities. Widespread slumping of bedded crystal tuff produced massive crystal tuff.

Pumiceous tuff sequences probably formed from Katmai-like eruptions. Thick, nonwelded pumiceous vitric-crystal tuffs commonly overlain by thin-bedded pumiceous tuffs were produced from submarine pyroclastic flows covered by contemporaneous ash falls.

Fine-grained vitric tuff formed from slow settling of very fine ash. The ash was possibly the finest size remnants suspended in settling columns after major eruptions and/or was produced by weaker ash falls. Rare cross bedding is evidence for some current reworking. Tuff thickness, grain-size trends, paleocurrent indicators, and paleogeography suggest a southern volcanic source, possibly the buried Luling overthrust front in Texas.

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STRATIFICATION IN WILLOW CREEK ALLUVIAL FAN, EUREKA VALLEY, INYO COUNTY, CALIFORNIA

Stratification in the entrenched main channel in the upper 5 mi (of 12) of Willow Creek fan was analyzed by means of continuous-strip photos and sections spaced 2,000 ft apart. Average and maximum bed thicknesses decrease, respectively, from 1.7 and 6.0 ft near the fan head to 1.0 and 3.9 ft downfan. Individual beds extend from 10 to >500 (700?) ft, although few beds extend >200 ft.

Gravel forms *pack* (framework), *pack-float* (transitional), and *float* ("puddingstone") fabrics. Most cobbles and boulders are subspherical and subround, and thus usually do not form distinctly oriented fabrics. Stream deposits exhibit distinct channel geometry, pack fabric, and little silt and clay. Mudflow fabrics vary from pack to float. Some are uniform; others grade laterally from float to pack within 25 ft. Mudflows show high length:thickness ratios; the majority of mudflows lack graded bedding. The ratio of mudflows to stream deposits exceeds 70% and increases downfan.

Float beds generally contain <40% gravel and >15% silt and clay, whereas pack beds usually contain >60% gravel and variable amounts of silt and clay. All deposits are poorly to extremely poorly sorted, and range from strongly coarsely skewed to symmetrical. Silt forms most of the matrix of mudflows, whereas clay ranges from only 1% to 7%. In the silt-clay fraction, feldspars exceed quartz, and clay minerals are minor in amount, the result of semiarid climate (17 in. rainfall/year), dominance of granitic rocks with large feldspar phenocrysts in the drainage basin (>60%), and predominantly mudflow transport.

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CONTRIBUTIONS OF SEISMOLOGY TO PLATE TECTONICS

The hard observational facts of seismology have been and are being used to test and develop the hypotheses of continental drift, sea-floor spreading, plate tectonics, and related matters. Three kinds of evidence are particularly important in such studies: (1) seismicity, (2) focal mechanisms, and (3) wave propagation and inferred earth structure. The quality and quantity of such evidence, especially types (1) and (2), increased rapidly in the 1960s as a result of new observational facilities, particularly the World-Wide Standardized Seismograph Network, established under the United States VELA Uniform Project.

In general, evidence from seismology strongly supports and contributes greatly to the new tectonics. Many major and previously unexplained observations, such as the spatial distribution of deep earthquakes and the worldwide pattern of seismicity and focal mechanisms, fall neatly into place. No serious obstacles to the new tectonics are found in seismology.

Present research on this topic is directed toward development and refinement of the model so as to explain the seismologic observations in greater detail. Many major, challenging topics for investigation remain.

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SALT RIDGE-SALT DOME ORIGINS IN GULF COAST AREA

A working hypothesis of salt-ridge, salt-dome formation in the Louisiana Tertiary was formulated in 1957 to explain the observed phenomena along the Caillou Island, Timbalier Bay, Bay Marchand, West Delta Block 30, Venice, and Delta Duck trend: (1) regional down-to-the-north faults of very large stratigraphic throw on the southerly sectors of the domes; (2) a salt, deep-water facies shale ridge connecting Caillou Island, Timbalier Bay, and Bay Marchand at depth; (3) shallow occurrence of older deep-water shales beneath a condensed section on the upthrown sides of down-to-the-north faults; and (4) thick "normal" facies sections on the north flanks of the domes.

Application of results of seismic, bathymetric, and core data from the Gulf of Mexico continental slope gathered and interpreted by Lamont-Texas A&M and Shell groups shows that these phenomena are the results of wavelike salt ridge formation basinward from a prograding shelf edge due to differential loading.

Such ridges are present on the continental slope and the major down-to-the-north fault planes are postulated to coincide with the northern faces. The salt ridge grows asymmetrically in cross section, lifting the thinly covered upthrown block and allowing a thicker ponding of sediments on the landward downthrown block. Deep-water shales covering the early ridge roots join the diapiric action of the salt and are confined to the upthrown block until the salt breaks upward through the northward-dipping fault plane. As the salt is further buried by the prograding shelf sediments, it may leave the linear control of the fault and form individual domes with the commonly recognized pattern of shallow salt dome faulting and oil and gas accumulation.