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Diagenesis of Tertiary Arkoses, Santa Ynez Mountains, Santa Barbara and Ventura Counties, California

The stratigraphic distribution of authigenic minerals in feldspar-rich sandstones from tectonically active settings is important in determining reservoir quality. Scanning electron microscopy (SEM), optical microscopy, and X-ray diffractometry were utilized to determine the types and distribution of secondary minerals in Paleogene sandstones of the Santa Ynez Mountains, and to determine their paragenesis. Four main types of authigenic minerals are present: (1) early-stage phyllosilicate pore linings and pore fillings; (2) silicate overgrowths on quartz, plagioclase, and K-feldspar grains; (3) middle-stage zeolite (laumontite) replacement; and (4) late-stage calcite replacement. The honeycomb structure and high iron and magnesium content indicate that the clays are *montmorillonite* or *chlorite* type or possibly a close mixture of the two. Microanalyses show that regardless of the composition of the nucleus all plagioclase overgrowths are chemically pure albite. Authigenic albite also occurs as fracture fillings in plagioclase grains. K-feldspar overgrowths were recognized on both microcline and perthite grains. SEM photographs of quartz overgrowths reveal the same paragenetic sequence as described by E. Pittman; isolated incipient overgrowths with well-developed rhombohedral and prism faces which coalesce to partly or completely envelop the nucleus. Within the most deeply buried sandstones laumontite occurs as (1) patches interstitial to framework grains; (2) alterations within plagioclase grains; and (3) displacive patches along the cleavage of detrital biotite. Some interstitial laumontite may be pore filling, but most is believed to be replacement of calcic plagioclases. The analyzed laumontite is a pure Ca-Al hydrous silicate with only minor amounts of sodium, potassium, and iron. The first appearance of laumontite in the eastern and central parts of the basin is at vitrinite reflectivities of 1.1 and 1.3% R_o respectively, corresponding to an estimated paleotemperature of 200°C. Calcite ranges from less than a few percent to almost 50% in some samples and is the latest authigenic mineral, replacing quartz, feldspar, and in rare instances laumontite. The authigenic minerals present in the lower Paleogene sandstones of the Santa Ynez Mountains render them ineffective as reservoirs.

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Plate Tectonics, Basin Analysis, and Exploration

The purpose of basin analysis in exploration is to predict oil and gas occurrence. Successful prediction requires (1) an understanding of the physical processes of generation, migration, and trapping of oil and gas, and (2) a certain minimum of geologic information. Capabilities of basin analysis are expanded as we develop better links between the theory of plate tectonics that has revolutionized global geology and the specific geologic events and processes that determine oil and gas occurrence on the scale of a basin. By developing reliable tectonic models of physical processes, the artful prognosticator can obtain improved results in exploration of frontier provinces where geologic information is severely limited.

In these circumstances, plate tectonics can be directly and reliably applied to problems of the pattern and timing within a basin of structures, subsidence, uplift, igneous activity, and thermal maturation, as illustrated by North Atlantic basins, California, Alaska, and elsewhere. An advantage of the tectonic approach to basin analysis is that it stimulates an integrated review of geologic and geophysical data with emphasis on timing of geologic events. It remains questionable whether plate tectonics can be applied to problems of the distribution of source and reservoir rocks or of hydrocarbons on the scale required for exploration of a basin.

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Resedimented Conglomerates in Submarine Channel, Miocene Flysch of Northern Appennines, Italy

The Marnoso-arenacea Formation (Miocene) near Bologna contains a well-exposed, turbidite-filled channel. Conglomerates are restricted to the basal 50 m of the channel-fill sequence, where they are interbedded with sandstones and a few thin pelites. The beds were studied along an 800-m section running at a high angle to the trend of the channel axis, and although broad correlations can be made between closely spaced sections, individual beds generally cannot be traced from one section to the next. The conglomerate beds are pebble to cobble grade, and are up to 10 m thick; bases are sharp and commonly planar; tops have abrupt gradations to sandstones. Structures indicating bottom traction of clasts are absent, but imbrication of platy clasts indicates southeast-flowing currents. Most of the long axes of clasts plunge to the northwest. Most beds are clast supported, but in some, there are so many soft intraformational clasts that the clasts derived from outside of the basin are widely dispersed, and there is no well-developed clast fabric. Graded bedding is very uncommon, but individual beds are not texturally homogeneous from bottom to top. Abrupt changes in sorting, in places marked by layers of intraformational clasts, occur in many beds. In a few exposures, these changes coincide with gently inclined surfaces of lateral accretion. The clasts are considered to have been deposited rapidly from the bases of sandy turbidity currents. Individual beds of conglomerate likely were built by both lateral and vertical accretion of gravel layers deposited from several currents.

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Geophysical Investigations for Pilot Plant for Nuclear-Waste Isolation in Southeastern New Mexico

A thick salt bed, the Salado Formation, is present in the northwestern part of the Delaware basin. In an area about 30 mi east of Carlsbad, Eddy County, New Mexico, this salt bed is being investigated as a possible site for a pilot plant for radioactive-waste isolation. Geophysical investigations have been carried out at the pro-