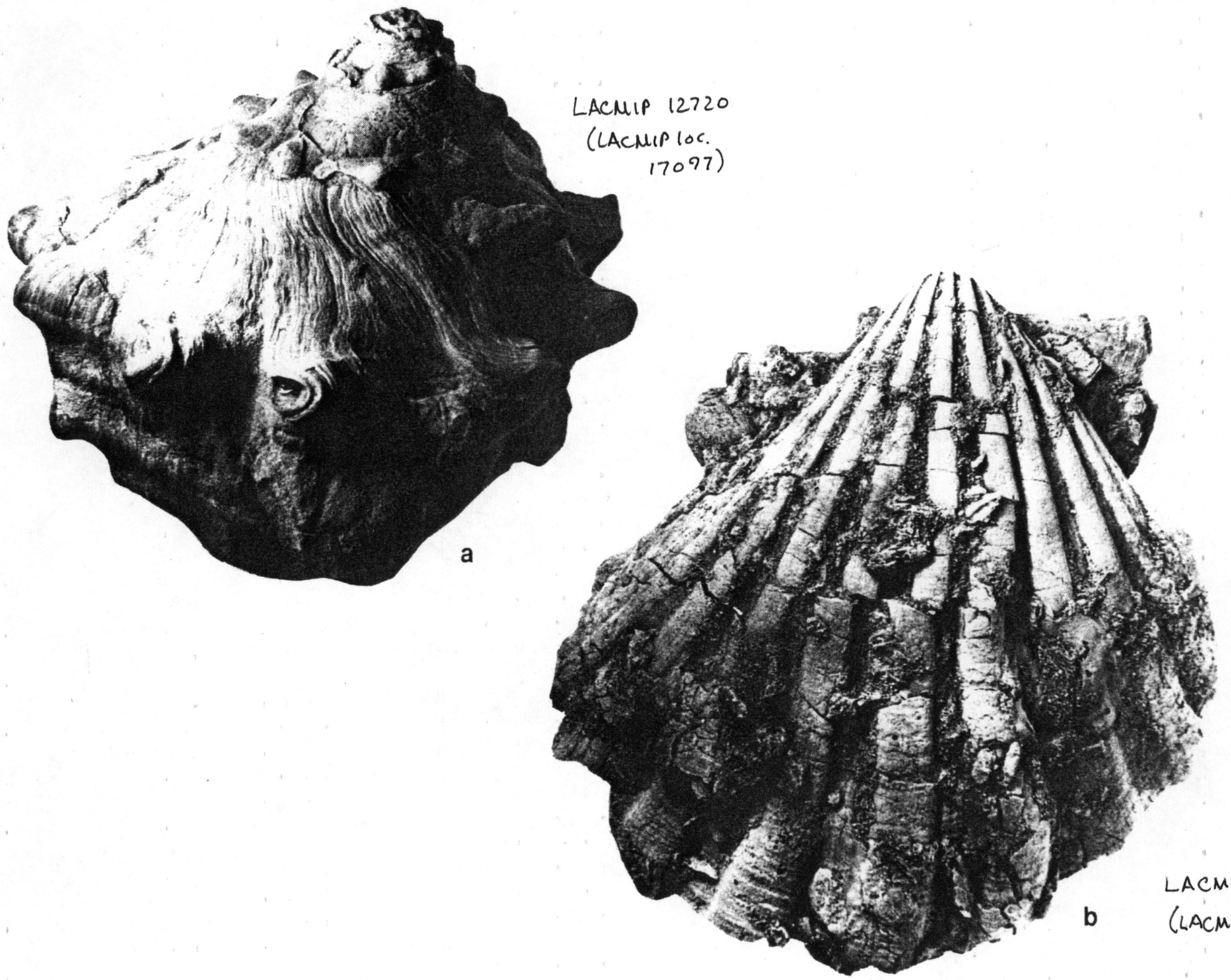

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Figure 4. Two representative macrofossils from the Vaqueros Formation, Big Mountain Oil Field area, north side of Simi Valley. Both specimens photographed by R. L. Squires; a) snail Rapana vaquerosensis imperalis, height 100 mm; b) clam Macrochlamis magnolia, height 130 mm.

example. A significant quantity of oil has been found in the Big Mountain Oil Field by the Unocal Corporation. Production is from the Sespe and Llajas formations.

THE SIMI FAULT

The Simi fault is present along the base of the nearly straight foothills just north of the floor of Simi Valley. The fault, which parallels the Simi syncline and the Big Mountain anticline, trends in an east-west direction (Figure 1). The fault is part of the Simi-Santa Rosa fault system, which is about 30 miles (48 km) long. This fault system extends from the vicinity of Devil's Canyon, which is north of Chatsworth, to near the city of Camarillo. In Simi Valley, the Simi fault is not exposed because it is covered by alluvium.

The Simi fault system may have formed as early as 15 to 12 million years ago, but compressional forces since then have been responsible for most of the uplift associated with the fault. Recent studies indicate that the Simi fault has only a very low level of seismic activity, and, therefore, the fault is classified as being only potentially active. An "active" fault is one that has displayed movement within the last 10,000 years (Holocene time).

The Simi fault is not clearly understood. Most geologists believe that along most of its course, the northern side is uplifted and has been pushed out over the southern side by earthquakes related to compressional forces; thereby, producing a reverse fault (Figure 5). Some geologists believe that this reverse fault cuts into the earth at a relatively low angle and should be referred to as a thrust fault. The amount of vertical displacement of rock units cut by the Simi fault is about a mile (1.6 km) near the western margin of Simi Valley but only about 1,000 feet (300 m) in the vicinity of the Marr Ranch in the northeastern part of the valley.

There is also a small component of horizontal (sideways) slippage movement on the Simi fault. In a few places, such as the Chivo Canyon area on Marr Ranch in northeastern Simi Valley, exposures of the upper Santa Susana Formation and the Llajas Formation have been offset by the Simi fault and moved about 0.5 mile (0. 8 km) to the west relative to the exposures of these rock units on the other side of the fault (left-lateral offset) (Figure 1).

The Simi anticline lies just north of the Simi fault between Madera Road and Tapo Canyon Road. This anticline parallels the trend of the fault, and is the result of bending (or drag folding) of rock layers in the immediate vicinity of the Simi fault (Figure 5). Low amounts of oil and gas have been extracted from porous sandstones of the Llajas and Sespe formations.

The Cañada de la Brea (C.D.L.B.) reverse fault north of the Simi Valley Freeway in the northwestern part of Simi Valley (Figure 1) is another fault that has drag folds (Figure 5). The C.D.L.B. Oil Field has produced oil from these folds.

THE SAUGUS FORMATION

The Saugus Formation overlies the Modelo Formation, and an unconformity separates the two formations. The Saugus Formation is about 2,130 feet thick (650 m). The lower part was deposited in a shallow-marine environment adjacent to a wave-dominated river delta. The sandstones in this part of the formation are locally very rich in fossils. A total of 106 species of macrofossils have been collected. Most are shallow-marine, cool-water snails and clams (especially oysters and scallops). Some representative macrofossils are shown in Figure 6. Locally, the oyster shells are abundant enough to form limestone beds called oyster coquinas. Some of these coquinas have been commercially quarried as a source of calcium. Some of the Saugus Formation snail and clam species still thrive in cool, shallow waters off the coast of California.

Also found in the lower part of the Saugus Formation, which was deposited mostly during Pliocene time about 3 million years ago, are some brachiopods (lamp shells), bryozoans, scaphopods, barnacles, sea urchins, sand dollars, great-white shark teeth, and a small collection of the rare remains of birds (albatross), baleen whales, a beaked whale, and land plants (California Live Oak). The whale specimens are unstudied.

The upper part of the Saugus Formation, which was deposited during early Pleistocene time about 1.5 to 1 million years ago, was deposited by rivers crossing the subaerial (exposed) part of the river delta. The sandstones and conglomerates in this part of the formation have yielded the remains of horse, tapir, deer, and mastodons in the northwestern San Fernando Valley (see Lander, this volume).

At the boundary between the lower and the upper parts of the Saugus Formation, shallow-marine beds interfinger with river deposits. Sand and gravel quarries in Tapo Canyon on the northern side of Simi Valley are in the Saugus Formation.

The Saugus Formation is not accessible to the public anywhere in Simi Valley. Most exposures of the formation are along the north and northeastern margins of Simi Valley. Erosion prior to the deposition of the Saugus Formation in this area (Figure 1) removed several formations and allowed the Saugus Formation to directly overlie the Llajas Formation and, locally, overlie the Santa Susana Formation.

Terrace deposits locally overlie the Saugus Formation and other formations in the northern part of Simi Valley. These nonmarine deposits consist of river-transported debris derived from underlying rock units, especially from the Modelo Formation. The terrace deposits have yielded the remains of extinct, Pleistocene land mammals, including horse, ground sloth, and mammoth that lived about 500,000 years ago (see Lander, this volume). During the Pleistocene, southern California was much cooler and wetter than today.

THE SIMI ALLUVIUM

The youngest deposit in Simi Valley is the alluvium, which is unconsolidated sediment that underlies the floor of Simi Valley. The alluvium, which has been deposited by modern streams flowing across the valley floor, is several hundred feet thick. As mentioned earlier, Simi Valley is a westwardly plunging syncline. Groundwater, therefore, flows toward the western end of the valley, and the water table (depth to free-flowing underground water) is very shallow. Artesian water would flow in this area if rainfall and surface drainage were sufficient. If Simi Valley experienced a wet year, groundwater flowing westwardly in permeable beds (aquifers) within the alluvium would build up high hydrostatic pressure. If a well or fracture intersected any of the aquifers, there would be a flowing well or an artesian spring.

In retrospect, the Simi Valley region is a geologically complex area that has had a dynamic and varied history during the last 75 million years. The type of sediment deposited at any given time was dependent largely on geologic events occurring along the western edge of the North American continent. Simi Valley has been profoundly affected by the change from a subduction margin to a slipping transform margin that occurred about 30 million years ago and is presently still affecting western California from the Mexican border to north of San Francisco. Simi Valley also has seen a profound change in marine climate from warm and tropical to cool and temperate. For most of the last 75 million years, Simi Valley has been covered by deep to shallow seas. Startling with Chatsworth Formation time and ending with lower Saugus Formation time, the sea advanced seven times across Simi Valley. Only during Sespe Formation time did the ocean retreat from the area for a relatively long interval. The present-day condition of Simi Valley is just a continuation of the retreat of the ocean that began when the upper part of the Saugus Formation began to be deposited about 1.5 to 1 million years ago.

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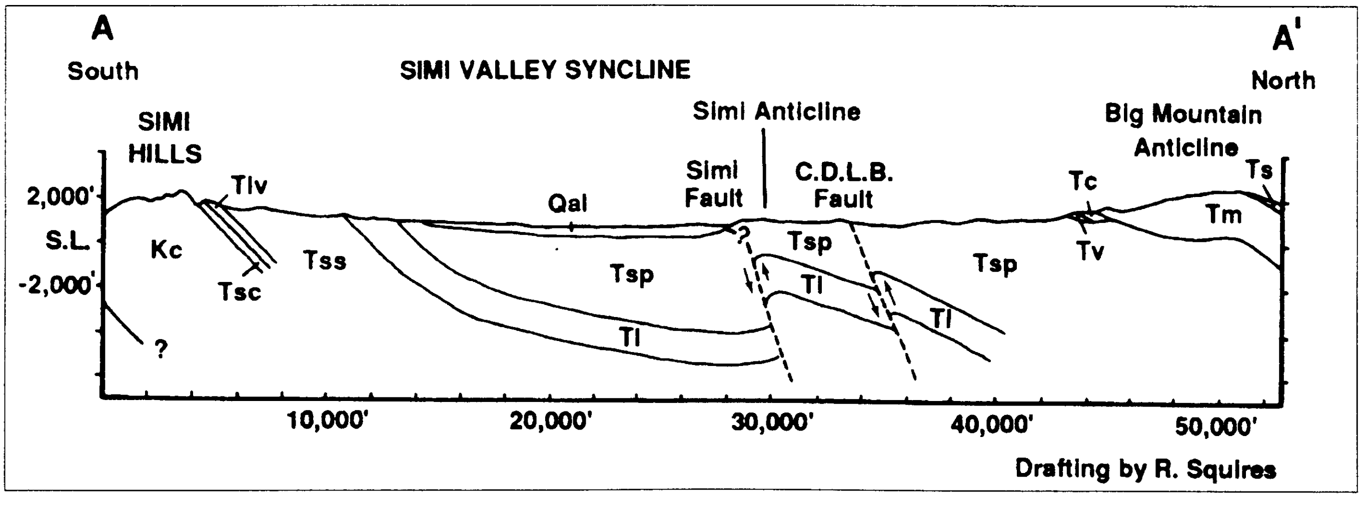
Figure 5. Geologic cross section of western Simi Valley along a longitude coincident with A-A' in Figure 1. Modified from Collender (1991, cross-section A) in Blake and Larson (1991). Horizontal scale equals vertical scale. Geologic symbols same as those used in Figure 1.



Drafting by R. Squires