COMMENTS ON THE GEOLOGY OF THE TEJON EMBAYMENT FROM SEISMIC REFLECTION, BOREHOLE, AND SURFACE DATA

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Abstract

This paper describes a study of the temporal and spatial relationships of normal, thrust and strike-slip faults within the Tejon embayment, the southernmost subbasin of the San Joaquin Valley. Tejon embayment is comprised of a relatively complete sequence of Eocene and younger marine and non-marine clastic, volcanic and volcaniclastic rocks. New CALCRUST seismic reflection and industrial reflection data, borehole data, surface geology, and previous geologic studies were integrated to produce a set of interpreted geologic cross sections and a structure map.

The structure of the central embayment is dominated by buried normal faults which generally trend northeast, and which were active intermittently during Oligocene to Pliocene times. At the basin margin, these normal faults appear to be truncated and overlain by younger, largely buried thrust faults. The Springs fault is interpreted as a complex subvertical fault with associated reverse faults. At shallow depths, the White Wolf fault is probably segmented and consists of multiple strands. The active lower-angle segment can be related to shallow, buried thrust faults southwest of uplifted Comanche Point. West of Comanche Point, there currently is no escarpment along the trace of the White Wolf fault. Thrust faulting can explain the presence of exhumed normal faults at Comanche Point and in the Tehachapi Mountain foothills. The younger, active fold-and-thrust belt verges basinward, closing the Tejon embayment from the east, south and west.

The extensional and compressional features that we describe can be related to the regional history of the San Andreas fault system. The early Miocene Tunis volcanics are a part of a period of widespread volcanism in central California. The inception of northwest-southeast extension at Tejon embayment and the origins of other basins in southern California in late Oligocene-early Miocene time can be related to the early history of the San Andreas transform. Seismic data and faunal evidence suggest that the rapid deepening of the Tejon embayment occurred later, mainly in late early and middle Miocene time. This cycle of subsidence at Tejon embayment, and the broad distribution of post-early Miocene volcanic rocks in central California, are probably due to regional transtension which occurred south of the northward-migrating, unstable Mendocino triple junction. Plio-Pleistocene to Recent convergence at Tejon is consistent with a regional change in structural style from extension to shortening, associated with the opening of the Gulf of California at the close of the Miocene.

INTRODUCTION

Surface geological maps present a complicated display of thrust, reverse, normal and oblique-slip faults in the Tejon Embayment, the southern cul-de-sac of the San Joaquin Valley (Fig. 1). The history and displacement through time of these exposed structures and poorly known, buried structures in the central and eastern Tejon embayment are not well understood. In general, the Tejon area subsided during Miocene time. Hirst (1986; this volume) documented more than 800 m of Miocene paleorelief in the North Tejon Area, which indicates a structural history within the Tejon embayment which belies the present gentle topography at the surface. Active contractional structures in the San Emigdio Mountains to the southwest may project east into the Tejon embayment.

Hoots (1930) published the first comprehensive geologic study and map of the entire southern San Joaquin area. Many of the more recent surface maps (e.g. Dibblee, 1973; Dibblee and Nilsen, 1973; Bartow and Dibblee, 1988).