SEQUENCE STRATIGRAPHY
OF THE GREAT VALLEY BASIN
IN THE CONTEXT OF
CONVERGENT MARGIN TECTONICS

Ian W. Moxon
Department of Geology
Stanford University
Stanford, California 94305

ABSTRACT

Biostratigraphic, paleobathymetric, and sedimentologic data spanning the entire history of the Great Valley were correlated regionally within the San Joaquin and Sacramento Valleys. Three transverse chronostratigraphic sections, and one depth section through the Coast Ranges outcrop belt, were constructed using these data. These correlations form the basis for dividing the basin-fill into seven stratigraphic sequences, generally bounded by unconformities: (1) the Coast Range ophiolite; (2) Kimmeridgian to Tithonian volcanic- and ophiolite-derived debris; (3) Tithonian to Valanginian terrigenous basinal sediments; (4) Hauterivian to Albian terrigenous sediments; (5) Albian-Cenomanian to Maastrichtian-Danian terrigenous sediments; (6) Paleogene terrigenous sediments; and (7) Neogene terrigenous sediments; this last sequence will not be discussed here.

Key stratigraphic, structural, and age data that characterize each sequence are synthesized, and are accompanied by a review of the geology and tectonic models for the Franciscan complex and Sierra Nevada. Finally, reconstructions of plate motions between North America and plates of the Pacific basin are briefly reviewed, affording comparison with the forearc sedimentary sequences, and with some of the major metamorphic, structural, and igneous events in the Sierra Nevada and the Franciscan complex. These comparisons establish the broad plate kinematic framework within which coeval evolutionary patterns in different parts of the convergent margin system can be viewed.

Although this study is in large part descriptive, it yields several new results. (1) Changes in plate motions were generally expressed in the basin as sequence boundaries or changes in sedimentation (e.g. ~135 Ma, ~100 Ma, ~80 Ma), although correlations are less precise for the Early Cretaceous and Late Jurassic. (2) Transverse structural boundaries separating differentially-subsiding subbasins were much more important in the Great Valley forearc basin than has been recognized in the past. (3) Oblique extension including possible pull-apart basin formation occurred in the northern Sacramento Valley, either episodically or continuously, from Kimmeridgian to Hauterivian-Barremian time. This style of deformation has been underestimated in the Great Valley, and correlates with a period of left-lateral oblique plate motion including short-lived (~10 m.y.) oblique divergence (Page and Engebretson, 1984). Serpentinite diapirism was also active at this time (Carlson, 1981). (4) A regional unconformity occurs in the San Joaquin Valley throughout the Diablo Range, placing Turonian, Cenomanian, or Albian sediments on top of Tithonian or Valanginian sediments; the unconformity corresponds to as much as 6 km of terrigenous basinal sediment in the Sacramento Valley.

INTRODUCTION

The Sacramento and San Joaquin basins together comprise the Great Valley of California, an elongate northwest-trending trough approximately 750 km long and 80 km wide (Fig. 1). The Great Valley is an asymmetric synclinorium whose axis lies near the western margin of the Quaternary fill (Fig. 2). Mesozoic and Cenozoic clastic strata about 15,240 m in maximum thickness form a westward-thickening wedge filling the basin. Quaternary alluvium covers the eastern two-thirds of the basin-fill, whereas the western third of the basin-fill is exposed in the Coast Ranges as an upturned, generally eastward-dipping homocline. Upper Jurassic to Upper Cretaceous strata 7,620 to 12,192 m thick, overlapped by 0 to 3,048 m of Tertiary sediments, comprise this homoclinal outcrop belt. The Tertiary strata thicken basinward (to the east) of the homocline, and taper over Sierra basement, forming a lenticular body in transverse section (Fig. 2).

The Great Valley lies between the Sierra