AAPG Annual Meeting
March 10-13, 2002
Houston, Texas

Ian W. Moxon[1], Steve A. Graham[2] (1) BP Canada Energy Co, Calgary, AB (2) Stanford University, Stanford, CA

Forearc Basin Architecture: A Guide to Discerning Tectonic and Eustatic Controls on Convergent Margin Deposits

Continental margin forearc basins contain a nearly continuous record of active margin sedimentation during plate convergence. Forearc basin stratigraphic architecture reflects shifts in basin accommodation space, which derive from the interplay of tectonics, sediment supply, and eustasy acting upon the arc-trench gap. Seven second-order to third-order sequences can be identified in Jurassic-Paleogene fill of the California Great Valley forearc basin, illustrating variations in the control of tectonics, sediment supply, and eustasy on forearc basin evolution.

Syn-depositional structuring and sediment supply controlled filling of the immature Jurassic to Early Cretaceous forearc basin. Increased sedimentation and tectonic subsidence rates in the Late Cretaceous axial trough, and transgressive lapping of strata onto the west-sloping Sierran arc flank, reflect flexural subsidence of the arc flank that was coeval with increased plate convergence rates, and underthrusting of the accretionary Franciscan Complex beneath the outer forearc basin.

Forearc basin filling ensued during latest Cretaceous through uplift of the accretionary complex, and development of an axially-migrating succession of submarine fans, overlain by prograding slope and fluvial-deltaic facies shed off the arc. Eustasy gained importance in the Paleogene shelved forearc basin, as third-order transgressive-regressive cycles overprinted a structurally-deforming complex of troughs and ridges in the outer forearc.

Immature, underfilled forearc basins are shaped principally by tectonic driving mechanisms, including ponding behind the accretionary wedge, intrabasinal faulting, basement flexure, and arc inflation/deflation. Crestal bathymetry of the accretionary wedge controls whether deep or shallow marine facies fill the forearc basin. Eustasy exerts more influence on mature, filled shelfal forearc basins.