

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

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New Exploration and Production Opportunities in Colombia: Lessons from Basin-Analyses Studies and a Look Forward

Renewed oil production in the Magdalena Basins, Eastern Cordillera and Llanos Basin of Colombia, largely through reinvigoration of abandoned areas, could result from recognition of untapped play concepts. The new play concepts are the result of integrated mechanical and thermal modeling, geohistory analyses, and palinspastic synthesis of sedimentary facies and thicknesses, which are based on apatite fission track analyses (AFTA), vitrinite-reflectance data, and analyses of growth strata and structure displayed in seismic data. These studies show that maturity of Cretaceous source rocks was controlled by unsteady and spatially variable histories of Cretaceous extension and burial under Upper Cretaceous-Cenozoic strata. The Upper Cretaceous-Cenozoic megasequence contains the main sandy reservoirs of Colombia and accumulated during crustal shortening. High synrift-heat-flow persisted until the Coniacian in the deepest Cretaceous marine depocenters. Early phases of oil generation were contemporaneous with Late Cretaceous-Paleogene formation of compressional structural and stratigraphic traps. The subsurface configurations of these new exploration targets are constrained by Eastern Cordillera stratal growth geometries. Such geometries were produced by progressive rotation of fold-limbs and point to advantages in the application of trishear and inclined-shear theories to exploration of the Eastern Cordillera, an approach not taken in many failed prospects in neighboring basins. The widespread occurrence of growth strata also pertains to enhanced recovery through improved subsurface mapping of synorogenic reservoirs. Such advances mean that new frontiers of Colombian oil industry are also found in the reevaluation of existing oil fields in addition to continued exploration with constrained oil-generation histories and alternative structural concepts.