POSTER SESSION

Fold and thrust belt along the western flank of the Eastern Cordillera of Colombia: style, kinematics and timing constraints derived from seismic data and detailed surface mapping

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The Middle Magdalena Valley (MMV) of Colombia is an asymmetrical, intermontane depression bordered by the Central and Eastern Cordilleras. The basin here is a Tertiary sedimentary wedge, which thickens to the east below the foldbelt exposed along the western flank of the Eastern Cordillera. The base of the wedge is defined by an easterly dipping regional unconformity which truncates pre-Tertiary strata below it, and by progressively onlapping Late Eocene/Miocene sediments above it. This surface has acted as the main conduit for migration of oil from kitchen areas located within the foldbelt to traps within the basin. More than 3.5 BBOE reserves have been discovered since the first discoveries in the early 1900s. These were sourced by the Upper Cretaceous La Luna Formation and reservoired in Eocene to Oligocene fluvial sandstones.

The foldbelt exposed along the eastern margin of the basin consists of a polydeformed west-verging thrust belt. Seismic data, synkinematic deposits and field relationships indicate that west-verging compressive structures developed in Late Paleocene/Early Eocene time, Middle Miocene (?) time, and during the major Mio-Pliocene Andean orogenic phase. Structural inversion is evident in the hinterland portion of the foldbelt where Jurassic/basal Cretaceous rocks are exposed in the cores of northeasterly trending, north and south plunging anticlinoria. In the middle portions of the foldbelt, the hinterland inversion structures deflect into thin-skinned structures detaching at Middle and Late Cretaceous levels, forming more classical fault bend and fault propagation geometries. Outer portions of the foldbelt exhibit a series of N-S trending inversion-related anticlines, which have yielded most of the hydrocarbons in the basin (e.g. Provincia, La Cira-Infantas, Opon fields.)

In this poster we summarize the evidence for polyphase deformation at the western flank of the Eastern Continued on pg. 17

Cordillera of Colombia along the eastern margin of Middle Magdalena Valley. The sequence of events and related evidence is outlined below:

1. In latest Campanian to Maastrichtian time, uplift of the Central Cordillera is signaled by the presence of extensive alluvial fans (i.e. Cimarrona Fm.) These consist largely of coarse conglomerates and sandstones containing milky quartz pebbles derived from the crystalline rocks of the Central Cordillera.
2. Continued uplift of the Central Cordillera in Paleocene/Eocene time is signaled by the presence of thick sequences of alluvial debris (although mainly restricted to the Upper Magdalena Valley)
3. Folding and thrusting occurred in the eastern area of the present day MMV and along the western flank of the Eastern Cordillera. Synkinematic deposits containing large fragments of mainly Cretaceous cherts are preserved as piggybacks to the main thrust sheets. Relief generated by this Early Paleogene foldbelt constrained the axis of Upper Eocene sediments to the present day crestal zone of the Eastern Cordillera (Villamil and Restrepo-Pace, 1997,1998) and contributed to tilting of the MMV basement by flexural loading.
4. An east-dipping "Late Paleocene/Early Eocene" unconformity developed. It is recognized seismically throughout the MMV. Along the western flank of the Eastern Cordillera this unconformity consists of a deeply scoured surface which beveled the Paleogene, westerly-vergent, thin-skinned thrust-belt.
5. In Late Oligocene/Early Miocene time, a series of intercutaneous wedges developed at the thrust front. Age constraints have been derived from onlapping relationships within the basal Miocene fluvial deposits.
6. Late Miocene reactivation and exhumation of the Late Paleocene/Early Eocene foldbelt occurred in a break-back sequence. In the field, tilted Paleogene synkinematic deposits and a refolded Late Paleocene/Early Eocene unconformity may be observed. In the hinterland, major inversion of the Mesozoic extensional faults occurred, with concomitant deposition of molassic sediments in the MMV (i.e. top section of the Real Group.)

Current resolution of Tertiary stratigraphy precludes better dating of deformational events. Poor correlations and simple structural models have resulted in erroneous burial history curves and hydrocarbon maturation and migration models for the foldbelt area. Large exposures of oil-saturated Upper Eocene sands within the mapped area may indicate that these formed part of early traps (Late Oligocene/Early Miocene?) breached during the later stages of deformation (Late Miocene-Pliocene).

Regionally, timing of the eastward propagation of deformation within the central and eastern Andean ranges argues for a crustal scale forward-breaking sequence of thrusting: latest Campanian to Maastrichtian uplift of the Central Cordillera, Paleocene-E. Eocene thrusting in the MMV and along the western flank of the Eastern Cordillera, and ultimately inversion and major uplift of the entire Eastern Cordillera in Late Miocene/Pliocene time. Kinematically, the driving element of deformation would have been the obliquely accreting western terranes of the Central and Western Cordilleras of Colombia, which transfer their easterly component of convergence through a basal crustal scale detachment as depicted by Dengo and Covey (1993), Cooper et al. (1995), Roeder and Chamberlain (1995) and this paper. An easterly-transported crustal scale wedge below the MMV would cause structuring along the western flank of the Eastern Cordillera as a series of backthrusts.

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