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Neogene evolution of western boundary of the Manabí basin controlled by the Jama Fault System

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Along the Ecuadorian convergent margin, new on-shore industrial multichannel seismic reflection data (2012 ESMERALDAS from SHE) is used to improve our understanding of the fore-arc Manabí basin stratigraphy and deformation history. The Manabí basin is the largest fore-arc basin of Ecuador. It is bounded to the North by the Canandé fault, to the south by the Chongón-Colonche Cordillera, to the East by the Andean Cordillera and to the West by the central part of Coastal Cordillera structured by the Jama fault system. In the northwestern part of the Manabí basin, at the contact with the Coastal Cordillera, we recognized four seismic mega-sequences (MS1 to MS4) above the acoustic basement (Ub), separated by three regional unconformities (U1 to U3). These mega-sequences are tied to the Ricaurte-1 drill core (SHE) providing age and lithologic controls of the seismic stratigraphy interpretations.

The preliminary results of the analysis of the sedimentary record highlight the history of the western Manabí basin subsidence and of the Coastal Cordillera uplift during the Neogene. The main stages of evolution are the followings.

1) Deposition of mega-sequence MS1 in the Manabí basin depocenter ending by the Lower Miocene. The onlapping pattern of reflection to the west indicates that a structural high in the Coastal Cordillera area predates the deposition of this mega-sequence. MS1 is truncated by the regional unconformity U1 recording a tectonic deformation stage enhanced by the early Middle Miocene climato-eustatic changes.

2) Deposition of mega-sequence MS2 controlled by a main normal fault (Jama fault system). This fault leads to the formation of a half-graben, filled by fan-shape reflection geometries of this mega-sequence during the late Lower to early Middle Miocene. During this extensive deformation stage, the development of a rollover deforms the mega-sequence MS1. To the West of the main fault, the Coastal Cordillera area records a relative uplift. To the East, the unconformity U2 that truncates MS2 merges with U1.

3) The mega-sequence MS3 of Middle Miocene age is widely distributed across all the area, downlapping apparently to the East on U1, suggesting a direction of sediment transport from West to East. The lower part of this mega-sequence is affected by the activity of synthetic and antithetical faults associated to the main fault. At the top of MS3, unconformity U3 marks a sharp change in the direction of sediment transport from East to West.

4) Inversion of the pre-existing extensional main fault probably after the deposition of the Upper-Miocene mega-sequence MS4. During this deformation stage, MS4 is folded and then eroded at least since the Pliocene.