

Large Scale Gravity Gliding in Thrust Belts, Recognition Criteria and Implication for Hydrocarbon Exploration

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Summary

On December 16th 1999, mud slides killed some 30,000 people in Vargas, North of Caracas. It also made thousands homeless in the Barlovento Depression characterized by a ten kilometer thick mud and silt substratum (geophysics). Barlovento is a triangular area bordered by basement rocks except to the East.

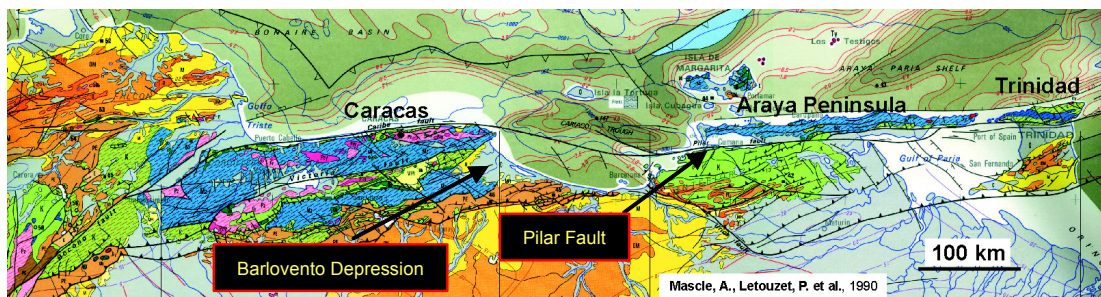
A geological and geometrical match was found between the missing sedimentary sequences of Barlovento and the southwestern part of Trinidad. However, no palinspastic reconstructions using structural models published for the areas could maintain the Trinidad area undeformed. Whereas the various reconstructions that combined strikeslip along the Pilar Fault and compression from the NW failed to reproduce the observations, the only model that could explain the match had to involve a very large scale gravity gliding of the complete "Cordillera Central" cover that would be now the Eastern Venezuela Thrust Belt or "EVTB" (Fig.1). The main reference for amount of expected strike slip is the Araya Peninsula.

Many well defined geological problems can be explained by the gravity gliding model, ten of them as well as the general ideas of the tectonic denudation of the "Cordillera Central" can be found in Chatellier (2003). Major well known structural features have been perfectly matched using their basement expression in the Cordillera Central and their sedimentary cover expression in the EVTB. Matching faults are numerous such as the San Francisco-Guarico couplets (see reconstruction in Fig 2). The Gravity gliding hypothesis reconciles the outstanding discrepancies between neotectonic and regional tectonic studies with respect to the amount of strike slip along the Pilar fault (respectively <40km to more than 475km), the 475km being due to gravity gliding and not strikeslip.

Most importantly, hundred of million of dollars could have been saved by not pursuing the search of non existing sand deposits in all areas adjacent to the Cordillera Central (Fig. 3); gravity gliding means little to no sedimentary erosion. Many other thrust belts should also exhibit gravity gliding, be it at a smaller scale; some of them are presently under study.

References

Chatellier, J-Y., 2003, Tectonic denudation of the Cordillera Central linked to the Eastern Venezuela Thrust Belt emplacement, AAPG Annual Convention Salt lake City, 6 page extended abstract.

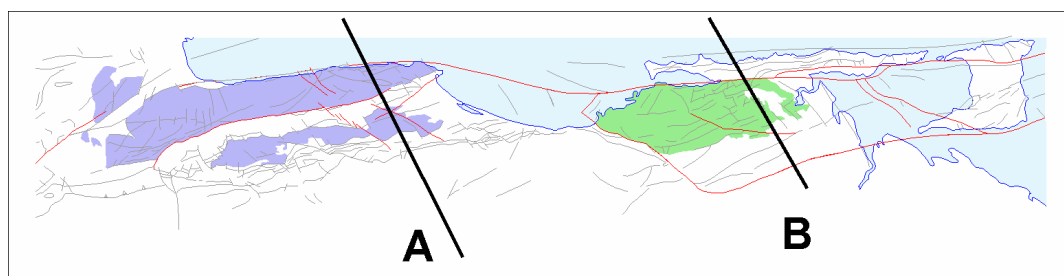


Cordillera Central

Eastern Venezuela Thrust Belt

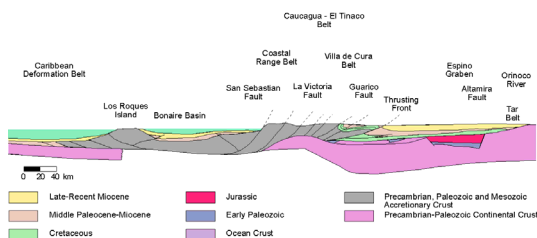
Missing cover

Found cover

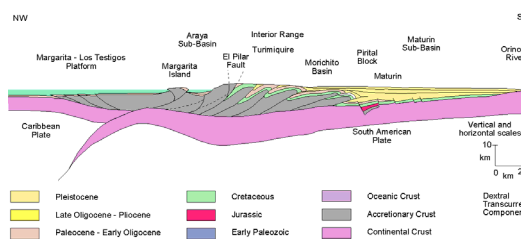


Section A

Section B

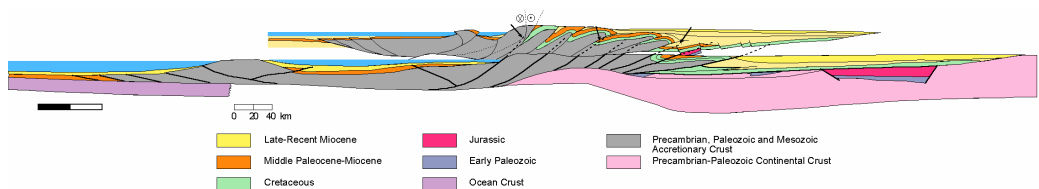


From Yoris and Ostos 1997



From Yoris and Ostos 1997

**A successful match after reconstruction:
The Eastern Venezuela could be the missing cover of the Cordillera Central**



Only modification relates to getting the two parts to the same scale

Palinspatic reconstruction based on existing published cross-sections; there is a match despite the two sections not being ideally located (originally from the same spot)

Figure 1: Regional setting of a large scale gravity gliding in Venezuela – in map view and cross-section

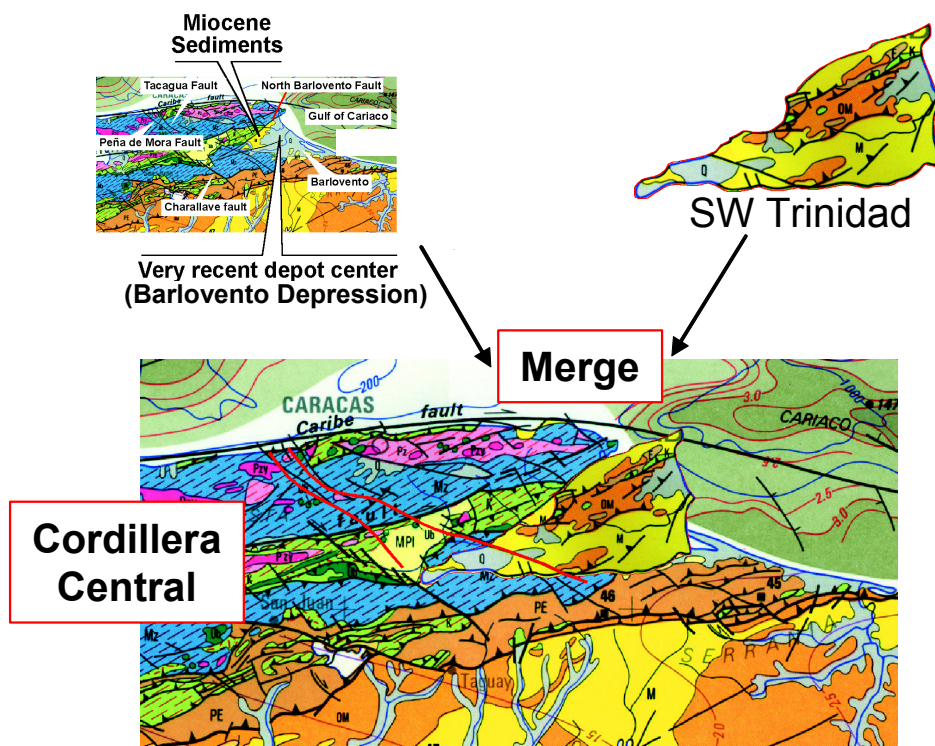
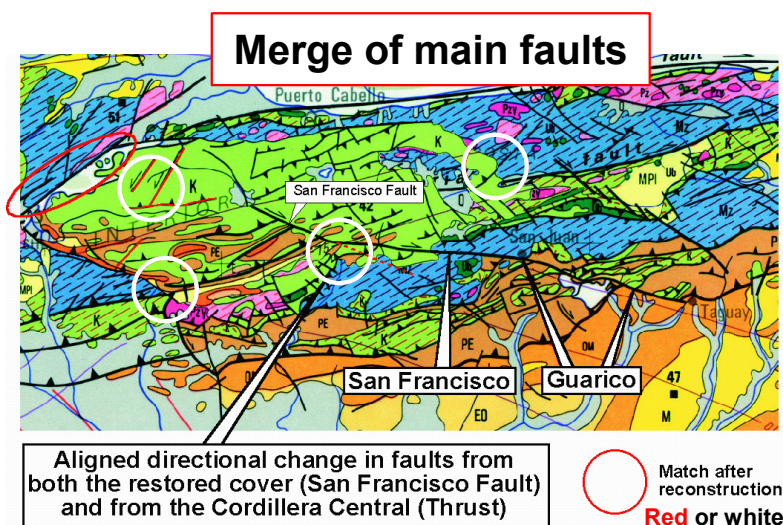
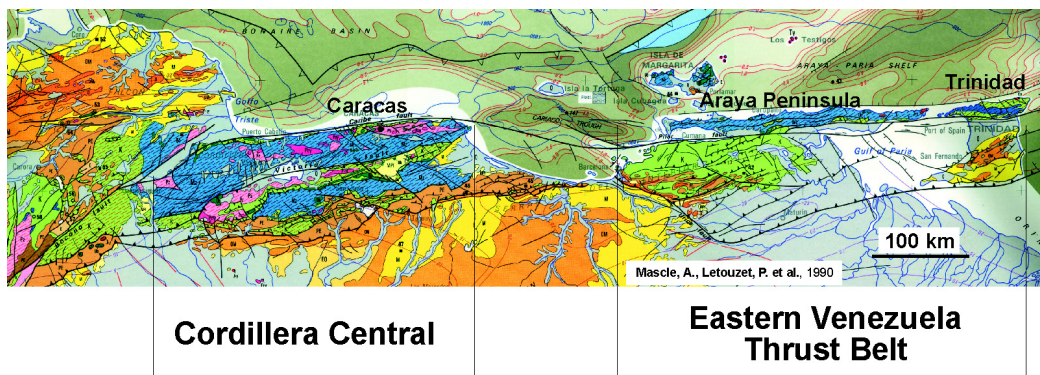
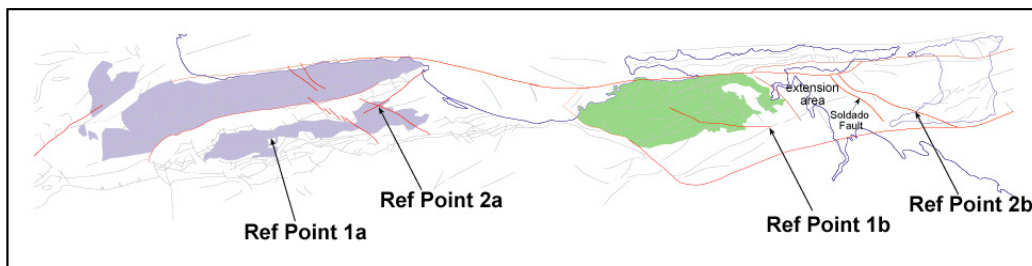
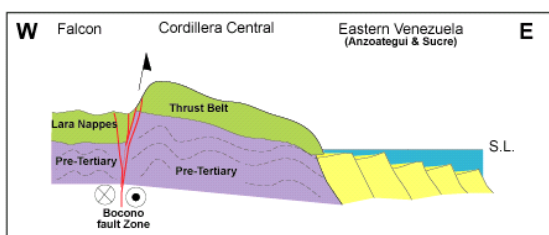


Figure 2: Example of fault match between the denuded cordillera and the proposed displaced sedimentary cover

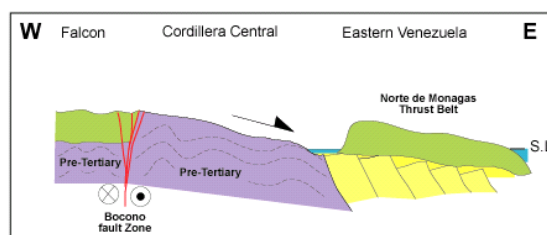


Using various reference points one can propose that:
a) The Western part of the Eastern Venezuela Thrust Belt has glided some 475 km towards the East
b) Trinidad has glided about 540km from its original position

Schema of mechanism involved



PRE-LATE PLIOCENE



LATE PLIOCENE TO PLEISTOCENE

Erosion of the Cordillera Central did not take place
The three exploration areas are not expected to have received detrital sediments from the Cordillera Central

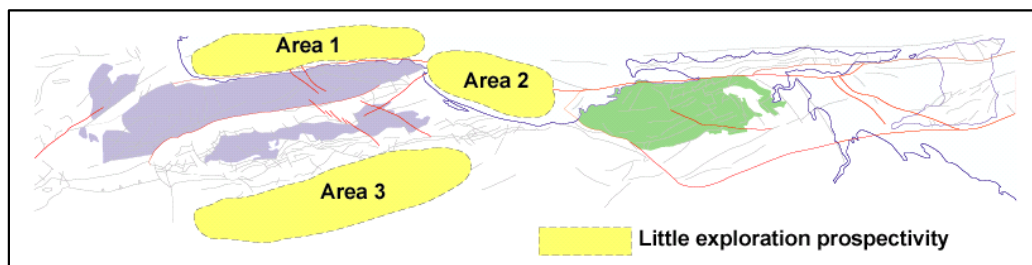


Figure 3: Large scale gravity gliding: Schema of mechanism involved and implication for oil exploration