Genetic relations between the Aves Ridge and the Grenada back-arc basin, East Caribbean Sea

Garrocq C., **Lallemand S.**, Marcaillou B., Lebrun J.-F., Padron C., Klingelhoefer F., Laigle M., Münch P., Gay A., Schenini L., Beslier M.-O., Mercier de Lépinay B., Quillévéré F., Boudhager-Fadel M & the GARAnti cruise team

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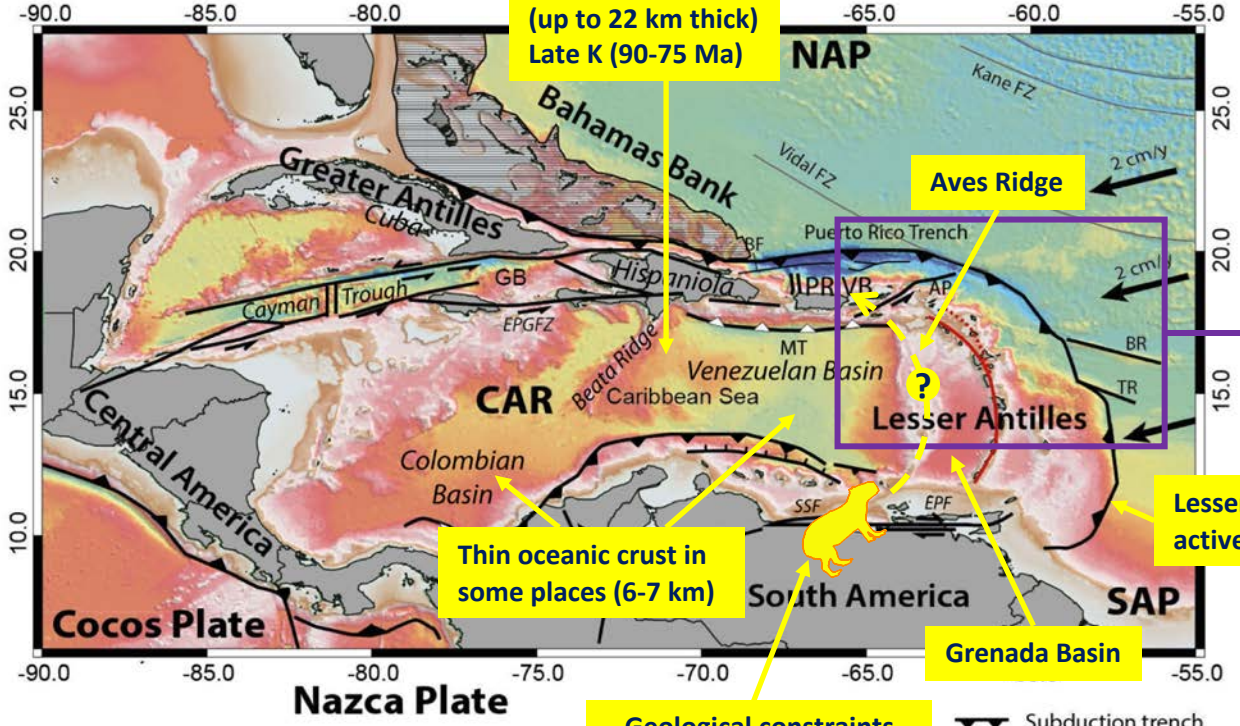
Caribbean Plateau (up to 22 km thick) Late K (90-75 Ma)



Thin oceanic crust in some places (6-7 km)

Lesser Antilles SZ active since Late K

Grenada Basin

Geological constraints on terrestrial fauna dispersal from S-America to the Greater Antilles ?

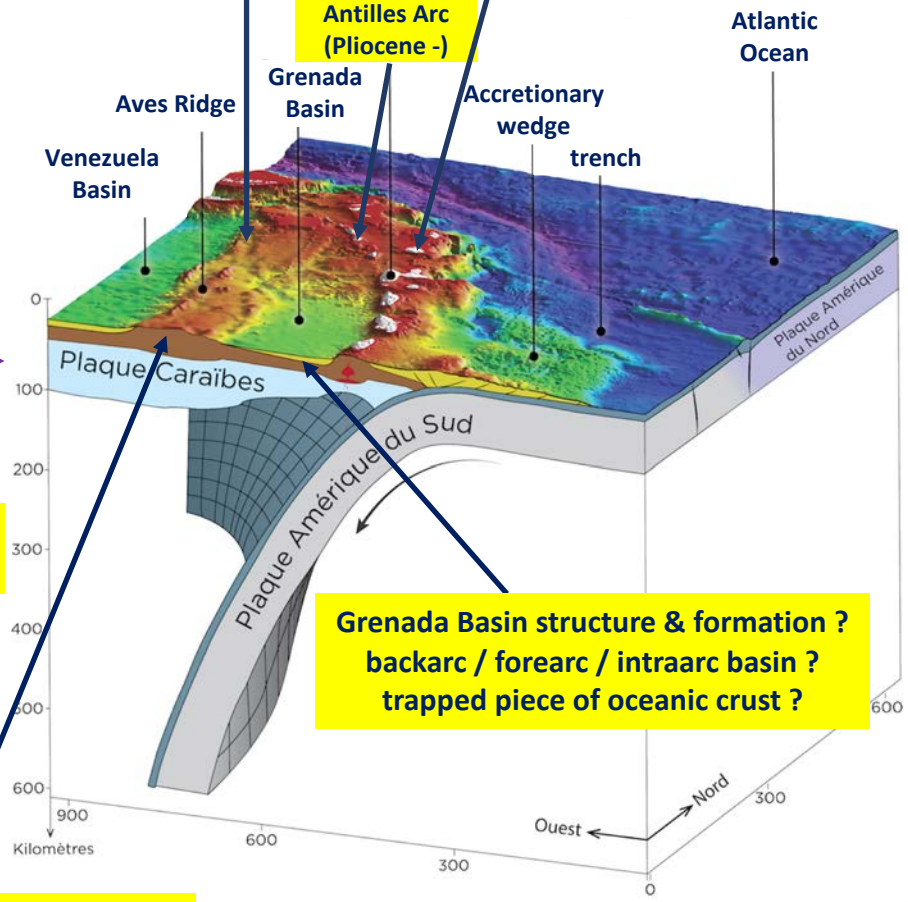
Subduction trench
Thrust faults
Strike-slip faults
Normal faults

-9000 -8000 -7000 -6000 -5000 -4000 -3000 -2000 -1000 0 (m)

Greater Arc of the Caribbean Late K - Paleocene

Outer Arc Eocene-Miocene

Active Lesser Antilles Arc (Pliocene -)



Grenada Basin structure & formation ?
backarc / forearc / intraarc basin ?
trapped piece of oceanic crust ?

Aves Ridge structure & deformation with special attention to Cenozoic vertical motion (Gaarlandia landbridge test ?)

© Iturralde-Vinent & MacPhee, 1999

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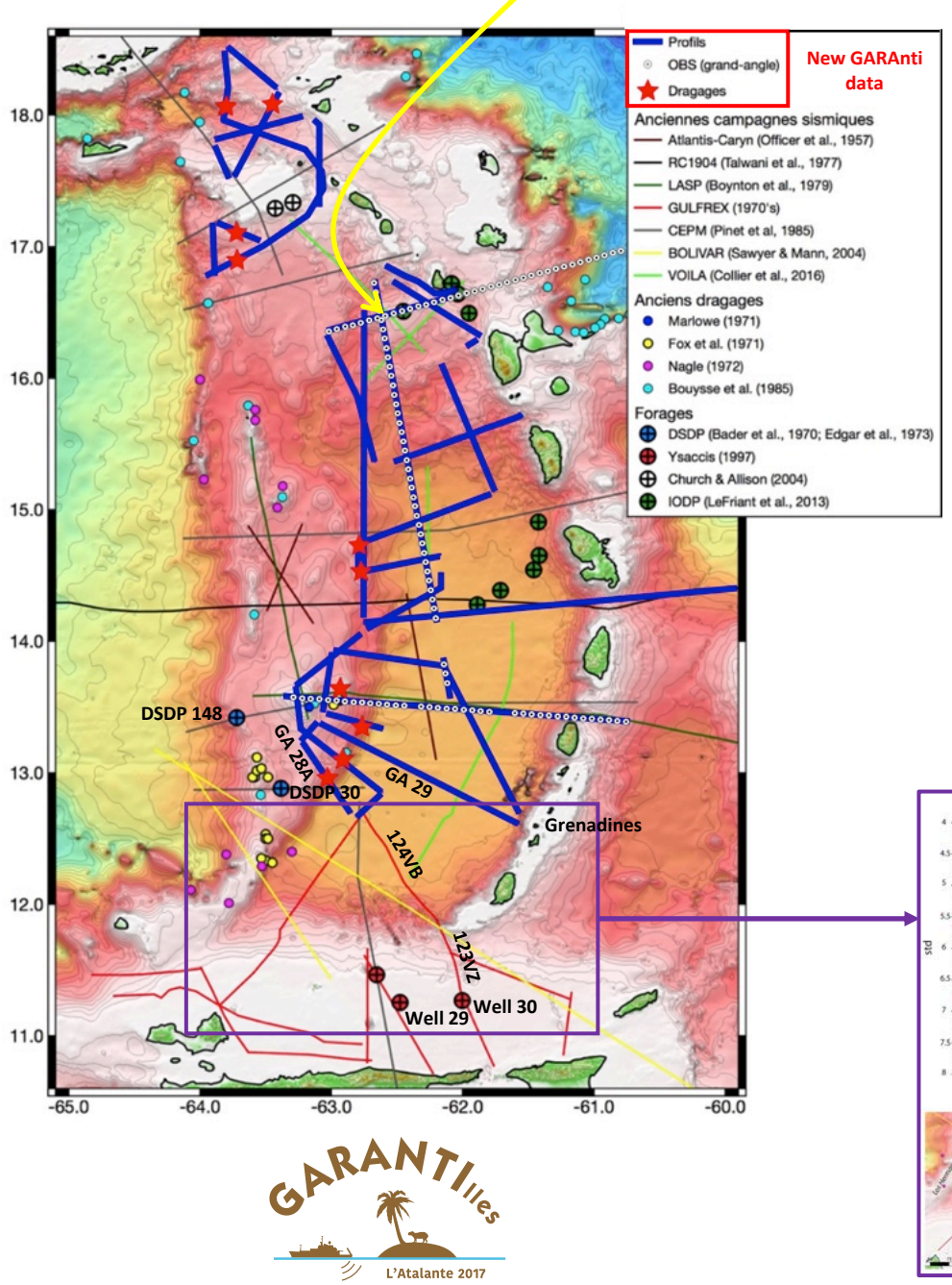
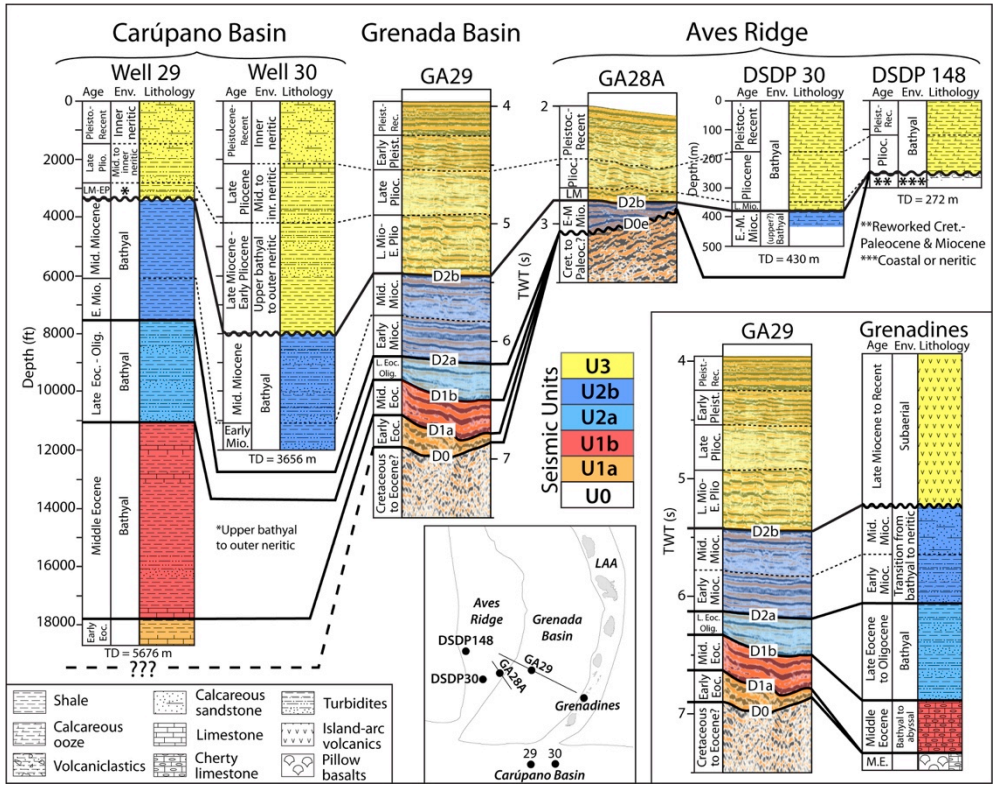
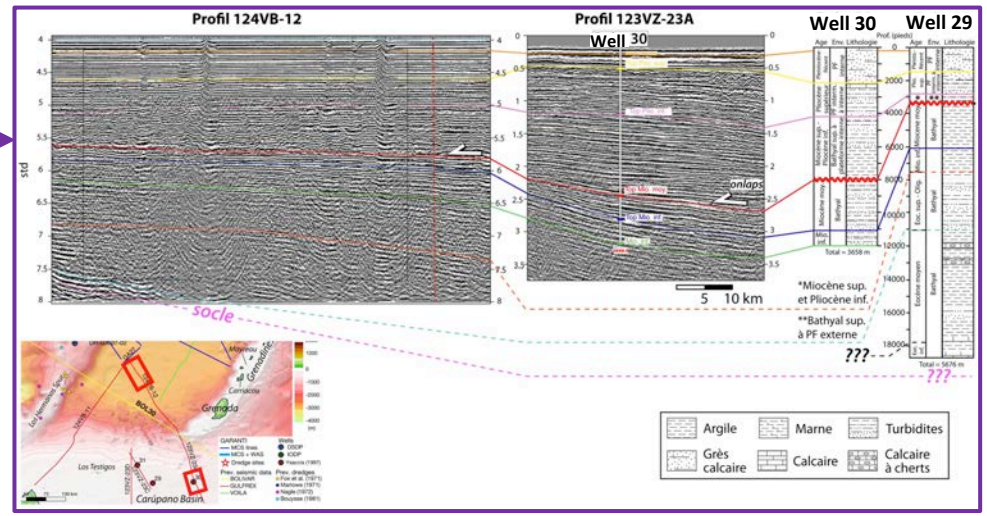
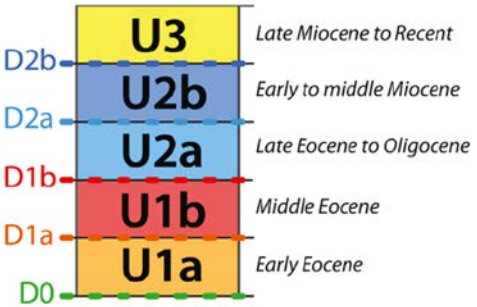
Follow next presentation on the Deep structure of the Grenada Basin from wide-angle seismics, bathymetric and gravity data, by Padron, Klingelhoefer et al.





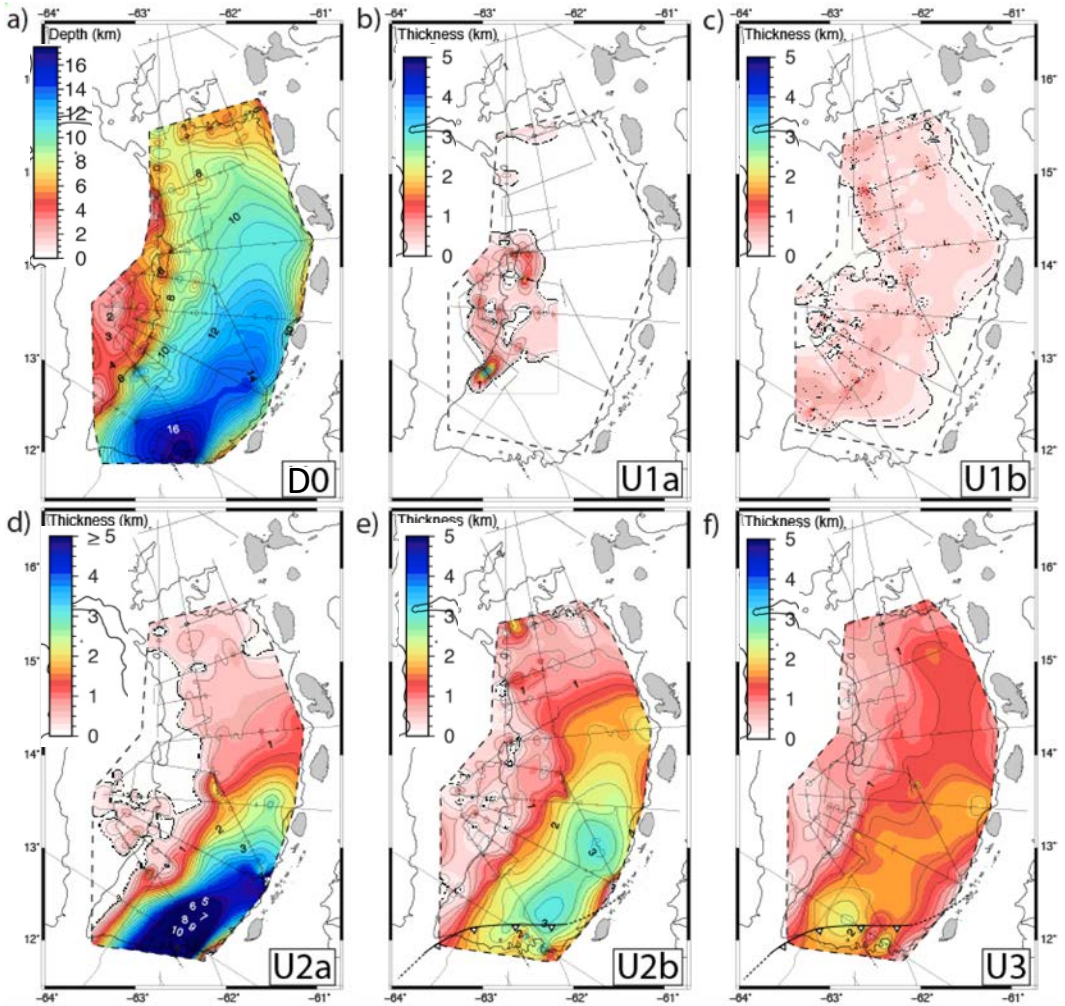


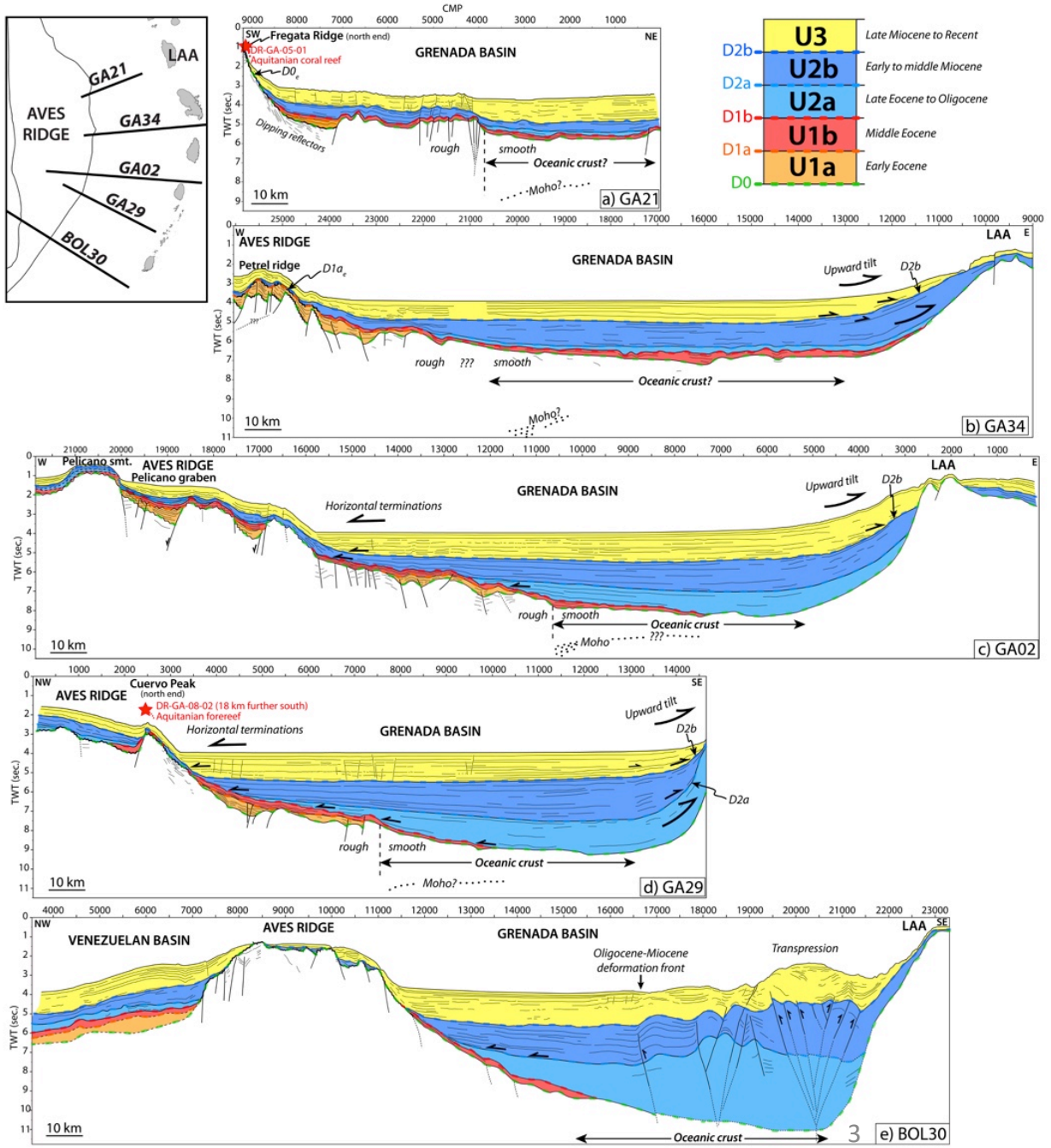
Correlation of GARAnti seismic facies with offshore well data & onshore geological observations



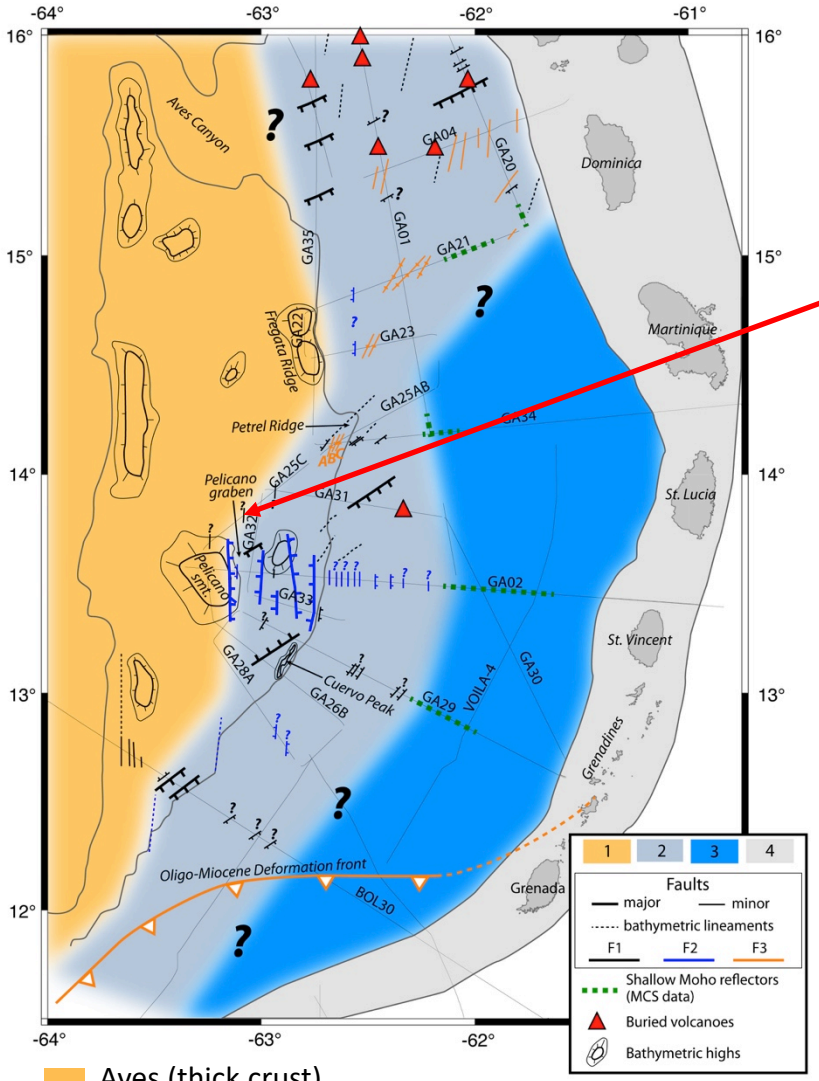
GARANTIlles
L'Atalante 2017

- Asymmetrical southern basin (basement depth, sedimentary filling)
- Rifting occured from Paleocene to Early Eocene
- Evidences for stretching of the eastern flank of Aves Ridge
- No evidence for a conjugate margin on the western side
- Shallow Moho attests for the presence of oceanic crust in the SE part
- Spreading occurred during Middle Eocene
- Rise of the southern Lesser Antilles volcanic Arc since Late Oligocene





This line has been reinterpreted from Aitken et al. (2011)



Aves (thick crust)

Stretched Aves crust – transition with oceanic crust

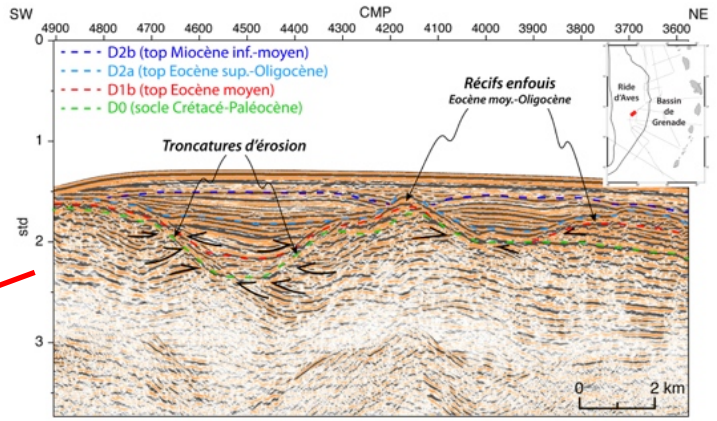
Oceanic crust

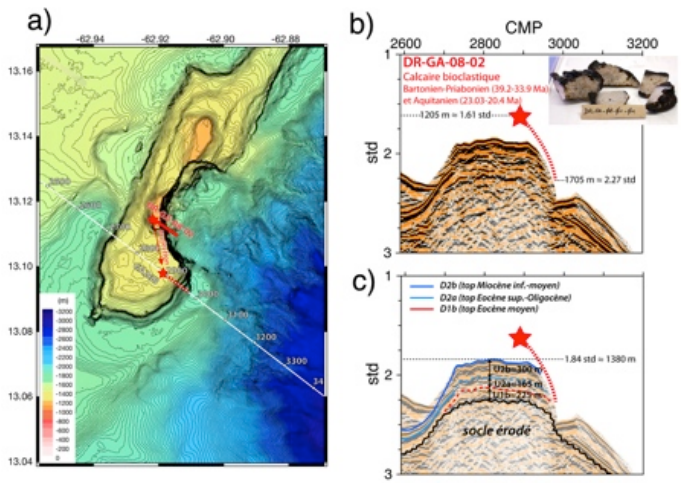
Lesser Antilles

Paleocene – Early Eocene normal faults

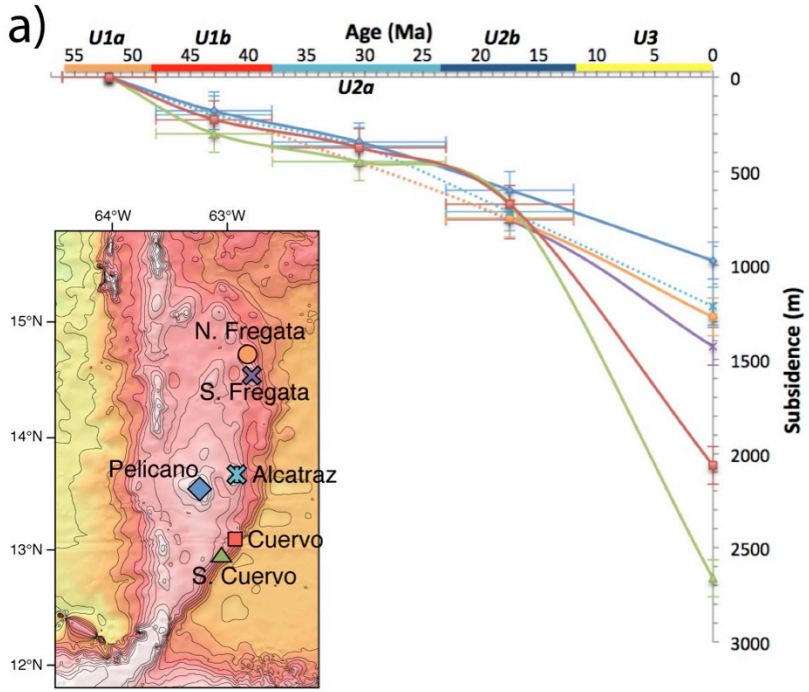
Reactivated inherited Cretaceous - Paleocene faults

Late Oligocene – Early Eocene inversion

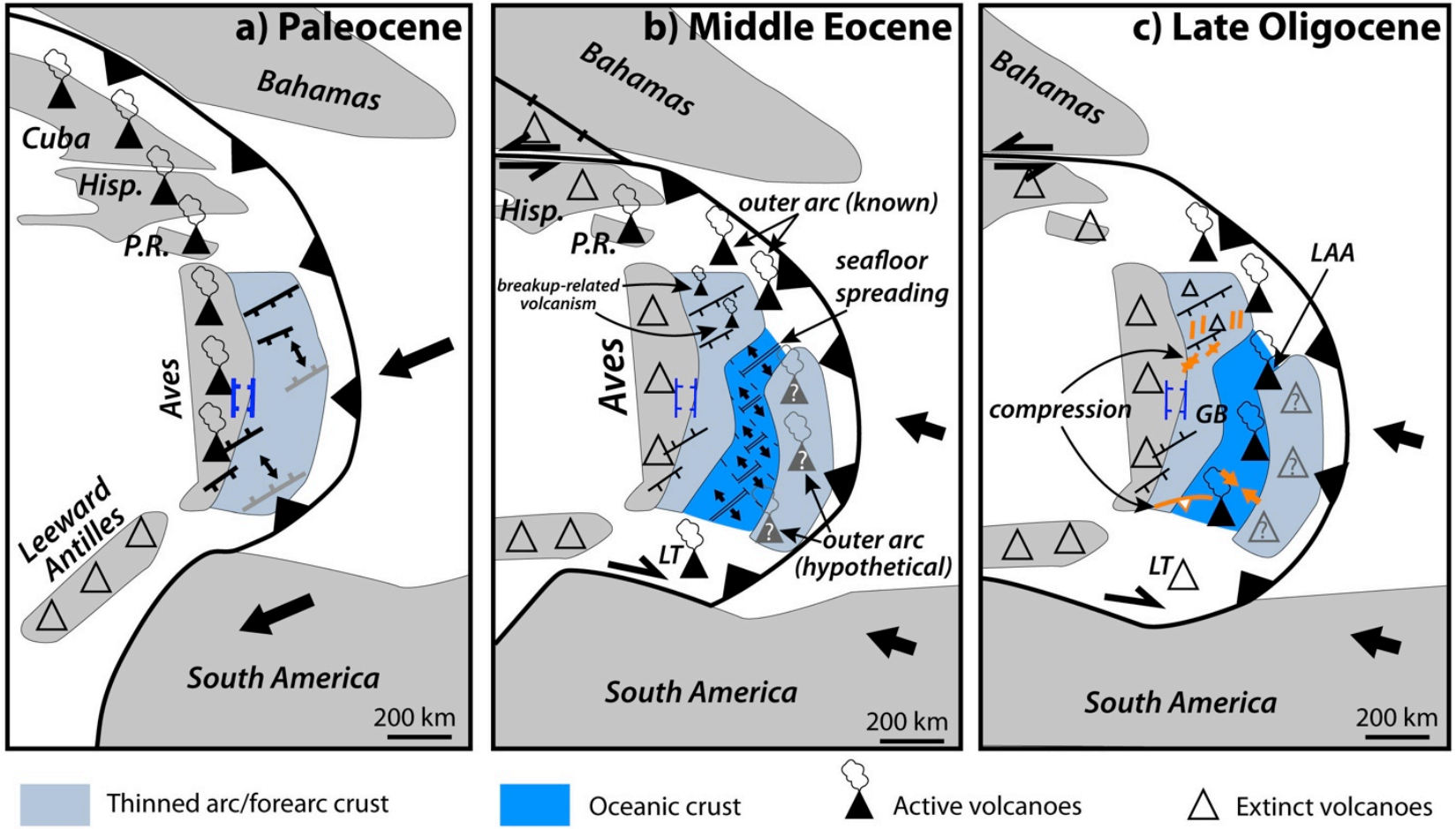




- Evidences for subaerial erosion of Aves Ridge including the transitional area prior to Early Eocene
- Only basement pinacles (ancient volcanoes ?) recorded the continuous subsidence of the ridge since Early Eocene with a halt or slow-down during Late Eocene – Oligocene and then a acceleration since the Middle Miocene



- A large part of the subsidence is explained by basement stretching and regional flexure under sedimentary and volcanic load
- Dynamic topography resulting from mantle flow within a complex 3D geodynamical setting probably superimposes



Formation of the Grenada Basin

- Aves Ridge extended further east in Late Cretaceous and hosted a volcanic Arc
- Paleocene to Early Eocene intra-arc rifting (NW-SE) south of Guadeloupe
- Lack of direct evidences for Middle Eocene arc volcanism (buried ?)
- Middle-Eocene spreading in SE-part only, over a width larger than the present Grenada Basin
- Late Eocene new arc intrudes the eastern part of the oceanic basin
- Basin inversion occurs during Late Oligocene until Middle Miocene in the southern part of the basin as it collided with South America margin

Landbridge or not for faunal dispersal ?

- Evidences for a residual paleotopography until Paleocene when the volcanic arc was active on the Aves Ridge
- Only low topography islands distant by ~50 km each other emerged until Middle Miocene, while the main surface of the Aves ridge drowned since Early Eocene

For further information: 2 companion papers published in early 2021

JGR Solid Earth
RESEARCH ARTICLE
10.1029/2020JB020472
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Crelia Padron[1,2], Frauke Klingelhoefer[2], Boris Marcaillou[3], Jean-Frédéric Lebrun[4], Serge Lallemand[5], Clément Garrocq[5], Mireille Laigle[3], Walter R Roest[2], Marie-Odile Beslier[3], Laure Schenini[3], David Graindorge[6], Aurelien Gay[5], Franck Audemard[7], Philippe Münch[5], and the GARANTI Cruise Team

next presentation

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10.1029/2020JB020466
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This study is a contribution of the GAARAnti ANR Project