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Along-arc segmentation and interaction of subducting ridges with the Lesser Antilles Subduction forearc crust revealed by MCS imaging

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Among the seismic surveys carried out in the framework of the EU - THALES WAS RIGHT project in the Lesser Antilles subduction zone, the SISMANTILLES II cruise of N/O ATALANTE (IFREMER, PI M. Laigle) collected 3 375 km of multi-channel reflection seismics with its 4.5 km long, 360 channels streamer.

This survey focuses on the updip portion of the contact zone between the forearc and oceanic crusts, a proxy of the updip limit of the sismogenic portion of the subduction megathrust fault. The geometry of the survey has been designed based on the results of a preliminary SISMANTILLES cruise with N/O NADIR (2001, IFREMER). It consists in a grid of profiles comprising 7 north-south strike-lines (300 km long and spaced by 15 km) crossed by 12 dip-lines (150 km long and spaced by 25 km), with an Ocean Bottom Seismometer network (OBS) deployed on the nodes of this MCS grid.

We present the 12 dip-line transects spaced at about 25 km from each other and sampling a 280 km long segment of the subduction, from offshore Martinique Island in the south up to offshore Antigua Island in the north. They all have been processed on board with CGG-Veritas Geovecteur and Geocluster softwares up to post-stack time-migration with constant water velocity. Some profiles have been reprocessed at IFM-GEOMAR (Kiel, Germany) in the frame of a EU-TMR project with pre-stack depth migration (PSDM) processing after deconvolution and multiple attenuation and will be presented instead.

The 12 dip-line transects reveal the trenchward-dipping forearc basement, the transition between the forearc sedimentary domain and the accretionary prism, as well as the arcward-dipping decollement and oceanic crust. The forearc basement can be followed beneath the 4 westernmost crossing strike-lines, reaching distances of 160-190 km from the volcanic arc, and up to 5 s twt beneath the sea-bottom reflection. In the northern half, together with the previous survey, 4 dip-lines reached out over the deformation front of the accretionary wedge over the incoming Atlantic lithosphere of the North American plate. The downgoing decollement and oceanic crust are imaged from the deformation front over a distance of approximately 75-80 km, and the signal can be followed down to the sea-bottom multiple, 6-7 s twt beneath the sea-bottom reflection west to the easternmost crossing strike-line ($\sim$ 12-15 km depth).

A first-order result is the tremendous along-strike variations in the forearc domain of its basement topography and basin thickness, as well as in the frontal part of the accretionary domain of the decollement and oceanic crust topography. A second first-order result is that these dip-lines reveal images that illustrate different stages of the upper-plate deformation induced by the oblique subduction of the two WNW-ESE aseismic ridges (topographical highs): the Barracuda ridge in the northern part, previously identified by the first survey to prolongate beyond the deformation front beneath the frontal accretionary wedge, and now also the Tiburon ridge in the southern part. Here, the PSDM processing reveals a detailed image of a system of faults associated to the ongoing and past deformation of the sedimentary basin which implies active faulting of the forearc crust itself.