



## The Mid-Atlantic Ridge Axis-Romanche transform fault East intersection: an ultra-cold slow spreading style

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SMARTIES cruise scientific party

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### Abstract

We present here preliminary results of the SMARTIES cruise at the eastern ridge-transform intersection between the Mid-Atlantic Ridge and the Romanche transform fault, in the Equatorial Atlantic. The slow spreading ridge axial and near-axial domains reveal a complex structure reflecting the influence of the large offset Romanche transform fault.

Thermal models predict large edge effects at the intersection between long-offset transforms and mid ocean ridge segments, potentially affecting the whole system down to the lithospheric mantle. The effects of these extreme low temperatures on the tectonic and melting evolution are poorly understood. In 2019, we explored the Eastern intersection between the Romanche transform and the Mid-Atlantic ridge during the SMARTIES cruise. In this region, the ridge axis is expected to show significant effects due to the lateral cooling induced by the large offset transform fault. Detailed geophysical and bathymetric data of the area were acquired, along with direct sampling during 25 manned submersible dives onboard the Nautilie.

We observed a remarkable change in the structural patterns along the ridge axis away from the transform fault. Over a distance of nearly 100 km, the ridge morphology shows a drift from pure extension to transtension associated to reduced melt supply. This results in a long oblique axial domain, forming a relay zone between the roughly north-south ridge axis in the south and the area close to the transform fault. Throughout the area, faulting trends are oblique to both the main spreading axis direction and the transform fault direction.

The transform near the RTI shows evidence for the shift of the Principal Transform Displacement Zone (PTDZ) and of intense deformation within the transform domain. Six Nautilie dives explored the northern wall and the damage zone of the Romanche, and the deep nodal basin at the RTI. The north wall exposes a thick basalt unit covered with old indurated sediments and extinct coral reefs. On the southern flank of the Romanche, eight dives surveyed fragments of old Oceanic Core Complexes (OCCs) and an active large OCC located at the RTI that exposes mylonitized peridotites and that appears dissected by multiple normal faults. The southern ridge axial domain, explored through nine dives, is formed by actively tectonized and partially disrupted volcanic ridges. A large faulted tectonic ridge located along an oblique relay zone shows traces of high-T hydrothermal activity consistent with black-smoker type venting, recently overprinted by low temperature diffuse venting.