Magnetic, acoustic and seismic data unveil the TAG Segment tectonic evolution (26˚N)

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Spreading processes associated with slow-spreading ridges are a complex interplay of volcanic accretion and tectonic dismemberment of the oceanic crust, resulting in an irregular seafloor geometry made up of blocks created by episodes of intense volcanic activity, or exhumed during tectonic uplift. These blocks undergo highly variable evolution, such as tilts or dissection by renewed tectonic extension, depending on their positions with respect to the spreading axis, core complexes, detachment or transform faults. Here, we use near-seafloor magnetic and acoustic data collected over the TAG Segment of the Mid-Atlantic Ridge and two seismic profiles, together with published magnetic data to constrain their evolution and disclose the local tectonic history. Our results reveal that block tilt does not simply increase with the distance to the spreading axis, as previously suggested. External parameters such as detachment faults indeed play a key role in modifying blocks movements, sometimes initiating tectonic tilts in the other direction. Moreover, our data also illustrate the relation between geology and hydrothermal activity, as fluids rise vertically within basins but preferentially follow the fault network separating different crustal blocks.

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