



Recent time evolution of the accretion processes at the mid-atlantic ridge north of the Azores: implications for the plume-ridge interaction

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This study focus on the evolution of the crustal structure of the Mid Atlantic Ridge north of the Azores platform (40°N to 45°N) between chron 3a (5.54 Ma) and the present. From our results, we derive some insights on the interaction between the Azores plume and the MAR.

Three domains are identified in the ridge morphology north of the Azores plateau. The first, south of 43°05'N is formed by six segments with lengths varying between 30 and 50 km. The off-axis pattern shows a complex time evolution of the ridge segmentation. The more robust segments of the study area belong to the southern part of this domain. The second domain is located between latitudes 43°05'N and 43°50'N. It corresponds to a change in the trend of the ridge axis from N-S to N15° and to a major relay-zone, 85 km wide. A single 40 km-long stable accretion segment can be identified. Elsewhere, the morphology is smooth, similar to morphologies found in the wide discontinuities of the SWIR. The third and northernmost domain lies between 43°50'N and the northern limit of the survey, 45°N, where four segments 25-30 km long are identified. Their morphology is similar to that of the segments south of the Azores plateau.

The average depth of the axial valley lies between 2500 and 3500 m while that of the ridge crests varies from 800 to 2000 m. These values show that the MAR north of the Azores plateau is exceptionally shallow when compared to other ridges with an equivalent spreading rate. The deepest part of the ridge corresponds to the wide relay-zone of the central domain. The shallow average depths may reflect a decreasing influence of the Azores plume towards the north up to 44°N latitude which roughly

correspond to the northern limit of the central domain. Off-axis, on the west flank of the ridge a topographic step corresponds to a structural limit between the rough topography of the near axial domain and the smoother topography of the adjacent basins. Between 43°N and $43^{\circ}40'$, the feature is synchronous with chron 3a and near $43^{\circ}50'$ N, it bends sharply to close up at the ridge axis. South of 43°N , the topographic step cannot be clearly identified in our data set, suggesting that it corresponds to crust older than chron 3a. South of our survey area it appears to merge with the outer limit of the Azores plateau.

The MBA reflects the pattern observed in the morphology. Two areas can be identified, one south of 43°N , characterized by large negative, roughly circular anomalies centered at the ridge axis and another north of $43^{\circ}50'\text{N}$, characterized by less marked negative anomalies. These two areas are separated by a broad zone of relatively positive anomalies, corresponding to the large relay-zone of the central morphological domain. We observe a pronounced long wavelength gradient with more negative values to the south of the study area. The crustal structure inferred from gravity data north of the Azores along the Mid-Atlantic Ridge between chron 3a and the present suggests that the plume influence on the accretion processes has been very small in the last 5 m.y.. Average crustal thickness is slightly lower than the 6 km world average and a normal ridge segmentation is established. The average crust is thicker south of a major relay-zone near $43^{\circ}40'\text{N}$, which suggests that the influence of the Azores plume does not extend north of this latitude.

The absence of a major topographic feature, such as the Jussieu plateau, north of the Azores and the stability of the ridge segmentation over the period studied suggests that the influence north of the platform is more likely a thermal effect and not a plume material flow along the axis. This thermal effect is observed in the long wavelength trends of both the topography and the MBA. The long-lasting persistence of the barrier to the Azores influence materialized by the $43^{\circ}40'$ relay-zone is coherent with this interpretation.