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Axial morphology of the East-Pacific Rise crest in the vicinity of its intersection with the Mathematician hot-spot: results of the PARISUB'2010 cruise.

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The PARISUB cruise was led in 2010 using the R/V L'Atalante, the Autonomous Underwater Vehicle (AUV) AsterX and the manned submersible Nautile (Ifremer). The goal was to investigate the processes that occur during the interaction between the Mathematicians hotspot and the East-Pacific Rise at 16°N. The present spreading axis has an elevation of at least 400m above the average depth of the North Pacific ridge, indicating a high magmatic production. Lava previously sampled in this area are enriched in incompatible elements and isotopically, revealing so the contribution of an enriched end member of the mantle, i.e. the plume

Surface geophysical data (multibeam bathymetry, gravity, magnetism) and near-bottom data (high-resolution bathymetry, gravity, magnetism, plume mapping) acquired during the cruise are used to measure tectonic structures, to individualize volcanic flows in relation with axial density variations and magnetic micro-anomalies. Here we present the results of the first high-resolution mapping of the ridge crest at 16°N using AUV and the geochemical compositions of the constitutive rocks. The maps, combined with visual ground truthing, show that most of the flows originate at the axial summit graben. Most often lava has drained fully or partially such that the point sources of the flow can be localized. Despite an expected high effusion rate, lobate flows predominate over sheet flows. Pillow flows are also well-represented, they constitute the most prominent volcanic structures of the area. The structure of the axial summit graben strongly varies along-axis. It is segmented with segments that trend differently (up to 5° of difference in their orientation). In some areas, the axial graben consists in one unique, well-depicted narrow graben. In other places, it consists in two narrow and parallel grabens. At last, at 15°46'N, the axial summit graben is much wider and it is constituted of numerous normal faults. At that location, the tectonic deformation is much less localized and the number of normal faults that form the graben is higher than elsewhere in the studied area, and the tectonic structures are little obscured by volcanic flows, compared to other segments of the axial graben. This area of widely distributed deformation coincides with a global slight change in the spreading center orientation. All these morphological characteristics as well as the estimated volumes of volcanic flows are here combined to the geochemical properties of the magmatic rocks, which document: conditions of melting, plume-ridge interactions, and hydrothermalism in this area.