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A-volcanic seafloor generation at a melt-poor ultraslow-spreading ridge: Southwest Indian Ridge 61-67°E

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The Southwest Indian Ridge (SWIR) is among the world's slowest spreading ridges (1.4 to 1.5 cm/yr). Ultraslow-spreading ridges are known to expose large expanses of mantle-derived peridotites in the seafloor, and could offer similarities, in terms of magmatic and tectonic processes, with the early stages of oceanization at so-called "non-volcanic" rifted margins.

Our study focuses on the most melt-poor (seismic crustal thickness about 3.5 km ; Muller et al., 1999) portion of the SWIR, near the Rodriguez triple junction. We report on a large set of new off-axis data, covering about twice the area of Iceland, and extending to maximum crustal ages about 28 myrs. This is the first extensive off-axis data set for a melt-poor ultra-slow spreading ridge. It is therefore the first opportunity to study the temporal evolution of spreading processes in this environnement. Due to very low sedimentation rates, details of basement morphology are apparent even in the oldest parts of our study area. We have been able to identify 3 types of seafloor, two of which show no evidence for a volcanic upper crustal layer. The following paragraphs give a brief description of these two types of a-volcanic seafloor. In our talk, we will adress two principal questions : 1- how do these a-volcanic terranes form, and 2- are they truly amagmatic regions of the axis ?

One type of a-volcanic seafloor present in our study area has been described previously as " corrugated surfaces " in many other regions of slow to intermediate spreading oceans. Corrugated surfaces in our study area are remarkably abundant: we counted 39 such surfaces, about as many as have been identified to date throughout the World's oceans. These 39 corrugated surfaces range in dimensions from 4 to 73 km in the along-axis direction (i.e. along-axis extension of inferred large offset normal fault at the time of their formation), and from 4 to 30 km in the spreading direction (i.e. cumulated offset along these faults over their period of activity). A few of these surfaces are juxtaposed in a pattern suggesting that they formed as part of a long-lasting episode of large offset axial normal faulting. The most spectacular of such episodes appears to have affected a ridge length of more than 100 km, and to have lasted 6 myrs.

The other type of a-volcanic seafloor identified in our study area has no previously described equivalent, although it does correspond to the off-axis expression of the so-called " amagmatic ridge segments " that have been described at the SWIR and Gakkel ultra-slow ridges (Dick et al., 2003; Michael et al., 2003; Sauter et al., 2004). It occurs in the form of broad, spreading-perpendicular or oblique ridges, with a smooth, locally rounded topography. We called this type " smooth a-volcanic seafloor ". It lacks volcanic features and exposes ultramafics even when on axis. This is very different from observations made at the Mid-Atlantic Ridge where basalts are always present on axis, but where peridotites or gabbros are locally exposed on rift valley walls. Smooth a-volcanic seafloor represents about 40% of our mapped area, and appears to have been emplaced simulataneously on both flanks of the ridge, in marked contrast with corrugated surfaces.

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