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Along-ridge distribution of petrological variations recorded in the Oman Ophiolite mantle

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To test the segmentation model for the mantle defined from basalt chemistry of present-day oceanic-ridges, we sampled the mantle part of the Oman ophiolite on a distance of about 420 km, all along the paleo-ridge axis. 280 samples were taken in homogeneous peridotites, which primary phases have been analysed in 174 samples and the major and trace element contents measured in 90 and 158 samples, respectively. The data show that the peridotites equilibrated at high temperature, 950-1000°C, and that the mineral and major and trace-element rock contents were not modified, neither during late serpentinisation and weathering processes, nor by more primary melt/rock interactions, except for the LREE that are slightly enriched. Overall, the primary minerals are strongly depleted in incompatible elements and the bulk-rocks magnesium-rich, aluminium and alkali poor, and strongly depleted in REE. But the mineral and rock chemistries vary considerably at the ophiolite scale. This is for instance well illustrated by melting estimations that range from 10 to up than 30%, with most values at about 20%. In this paper, we show that the variations of the peridotite chemistry are well organized when plotted along the paleo-ridge axis. This is true for all the 10 melting tracers tested in this paper, that display the same types of variations, one with a 100-160km long wavelength and the other, with a shorter 10-20km wavelength, making undulations within the larger ones. Whatever the wavelength is, each segment has a center marked by high values of all melting indexes and edges marked by the lowest values. This defines an along-strike melting segmentation, which allows to propose that the large segments were associated with large asthenospheric mantle upwellings and that the smaller ones rather relate to the uplift of superficial more molten mantle instabilities. By comparison with oceanic ridges models, we propose that the Oman large segments were of 2nd order type and the smaller segments of 3rd. Our data on

the geometry of the melting zones will allow to better modelise the dynamics of the mantle beneath ridges and opens new perspective for further characterizations of the segments in the Oman ophiolite.