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Segregation vesicles, cylinders and sheets in vapor-differentiated pillow lavas: examples from Tore-Madeira Rise and Chile Triple Junction

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A detailed field and laboratory study was conducted on internal segregation structures of two hand-size vapor-differentiated pillow lavas. They were dredged respectively on the Josephine seamount, Tore-Madeira Rise (TMR), and on a small quaternary volcanic edifice located on the continental edge of the trench close to the Chile Triple Junction (CTJ). Both pillows display a combination of four main types of segregation structures (spherical vesicles, pipe vesicles, vesicle cylinders and vesicle sheets) described so far only within sub-aerial basalt flows typically 2-10 m thick. In particular, the samples offer a remarkable exposure of the transition between pipe vesicles and cylinders. We show that the vesicle sheets are not generated by the same mechanism in both occurrences: they do not seem to be connected to cylinders in the CTJ pillow as they are in the TMR pillow. The two pillows are geochemically distinct, the TMR being alkaline and the CTJ calc-alkaline. Two types of internal differentiation are proposed. The first one implies the extraction of the residual liquid from the host lava and transport towards the segregation structures, whereas the other one results from *in situ* crystallization within one given structure. In the latter case, glass composition is highly dependant on the nature of the neighbouring crystallizing minerals. The degree of crystallization required to produce a crystal framework strong enough for generating the segregation structures seems to be lower in pillows (ca. 25% crystallization) than in vapor-differentiated basaltic lava flows (35% crystallization).