Olivine fabric and mineral compositions in the Maqsad area of the Samail massif, the southern Oman ophiolite

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In this study, we conducted structural and chemical analysis of oriented samples of 17 harzburgites and 4 dunites collected from the Maqsad area of Samail massif in the southern Oman ophiolite. We investigated the degree of partial melting and the mantle-melt reaction with relation to mantle diapir structure.

The crystallographic preferred orientation (CPO) of olivine grains were measured in highly polished XZ thin sections using a scanning electron microscope equipped with an electron-back scatter diffraction system at Shizuoka University. After plotting the results in the Vp Flinn plot expanded for olivine fabric types [1,2], the fabric type of peridotites in this study are summarized as follows. The distribution of A type is limited in the southeastern part where the diapir structure has been identified [3], whereas D type is dominant in the peripheral part of the diapir. Minor amounts of AG type and E type are also observed in the peripheral part. From these, the olivine in the southeastern part (diapir area) of this study area is likely to have been deformed under high temperature whereas the peripheral part was deformed at slightly lower temperature. The CPOs of olivine in both areas do not show any influence from the presence of H2O except for only one sample with E type CPO. Moreover, strong alignment of [100] to the vertical orientation was observed in the southeastern part (diapir area) of this study area. Since vertical mantle flow has been estimated in this diapir area, our results are consistent with the previous study [3,4].

The Cr# (=Cr/[Cr+Al] atomic ratio) of spinel in the harzburgites and dunites are as high as 0.55-0.58 in the central part of the southeastern part (diapir area) and along the paleo-ridge axis running in the NW - SE direction [3,4]. On the other hand, the Cr# of spinel in the peripheral part is 0.41-0.55 indicating slightly less depleted than in the central part. In addition, the REE abundance of clinopyroxenes in the central part of the diapir area is lower than in the peripheral part being consistent with the distribution of spinel Cr#.

We consider that the upwelling rate in the southeastern part (diapir area) may have been greater than the peripheral part possibly due to higher temperature in the focused vertical mantle flow. This model is consistent with the distribution of the Cr# of spinel: the degree of melting was greater in the diapir area where Cr# of spinel are higher than the peripheral part. The strongly focused pipe-like model for axis location [3,5] is well fitted by our observations in this study.

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Keywords: Oman ophiolite, crystalographic preferred orientation, olivine, fabric, peridotite, mantle flow

