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Occurrence and petrology of the axis stage felsic rocks in the northern Oman ophiolite

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At mid-ocean ridges, a critical interface for heat and mass exchange between the lithosphere and hydrosphere is the magma–hydrothermal transition (Gillis and Coogan, 2002). A distinctive feature of ophiolitic upper gabbros is the presence of leucocratic rocks in vein networks and/or discrete bodies that commonly contain partially resorbed xenoliths of basaltic material. These presence of felsic rocks in ohiolite suites has been reported by numerous authors, and are called plagiogranite (Coleman and Peterman, 1975). These lithologies are attributed to partial melting of basaltic material, extreme fractional crystallization of basaltic melt, or a combination of these two end-members (Pedersen and Malpas, 1984).

Lippard et al. (1986) classified the felsic rocks in the Oman ophiolite into three stages; high-level intrusives (axis stage), late intrusives, and younger granites associated with emplacement. Rollinson (2009) described similar classification of the felsic rocks in the Oman ophiolite, and discussed petrogenesis of these felsic rocks. This paper describes field occurrences, petrography, and petrochemistry of the felsic rocks in early (axis stage) intrusive rocks.

The early (axis stage) felsic rocks characteristically intrude into the boundary between lowermost sheeted dike complex and upper gabbro. We investigate felsic rocks intrude into the boundary between lowermost sheeted dike complex and upper gabbro, which includes sheeted dikes as large blocks less than 10 m from the main stream of the Wadi Rajimi (Rollinson, 2009). Felsic rocks associated with the sheeted dikes from eastern margin of the Lasail complex and the Wadi Barghah are also investigated, which are intruded by upper gabbroic rocks and quartz diorites. We also investigate felsic rocks intrude into the sheeted dike complex near the quartz dioritic to tonalitic intrusion in the Wadi Khabiyat. These sheeted dikes are infiltrated by quartz dioritic vein networks, which sometimes occurs as pockets and patches. In some places, sheeted dikes are composed of hornblende and pyroxene hornfels cut by quarts dioritic vein networks. These occurrences resemble to the anatectic migmatites of axial magma chamber roof exposed in the Troodos ophiolite, Cyprus, described by Gillis and Coogan (2002).

Gillis and Coogan (2009) describes disequilibrium melting models to explain relatively lower REE concentrations in early felsic rocks. Disequilibrium melting models assume that the concentration of an element in a melt is simply controlled by its concentration in the constituent minerals and the relative proportions in which they dissolve into the melt (e.g., Bea, 1996). Incompatible element concentrations sometimes lower in the quartz dioritic vein compared with the values predicted by equilibrium melting of sheeted dikes, this discrepancy can be explained by disequilibrium melting model. Disequilibrium melting may play a significant role on the petrogenesis of axis stage felsic rocks.

Keywords: Oman ophiolite, plagiogranite, axis stage, oceanic crust, petrochemistry