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Subduction Initiation Record (SIR) in Suprasubduction Zone Ophiolites

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The internal structure-stratigraphy and geochemical characteristics of suprasubduction zone (SSZ) ophiolites in different orogenic belts indicate a seafloor spreading origin in forearc-incipient arc settings during the initial stages of subduction. In general, there is a well-developed magmatic stratigraphy in the extrusive sequences of these ophiolites from older MORB-like lavas at the bottom towards younger island arc tholeiite (IAT) and boninitic lavas in the upper parts. A similar progression of the lava chemistry also occurs in crosscutting dike swarms and sheeted dikes, indicating increased subduction influence in the evolution of ophiolitic magmas through time. Lherzolitic peridotites in structurally lower parts of the upper mantle sequences of these ophiolites represent the residue after MORB melt extraction. Harzburgite and harzburgite-dunite associations higher up in the mantle sequences and below the mafic-ultramafic cumulates (transitional Moho) are crosscut by networks of orthopyroxenite (opxt) veins, which include hydrous minerals (amphibole). These orthopyroxenite veins represent a reaction product between the host harzburgite (depleted, residual peridotite) and the migrating Si-rich (boninitic) melt. The harzburgite-dunite-opxt suites characterize melt-residue relationships and melt migration patterns in the mantle wedge during the initial stages of subduction and incipient arc construction. Thus, most SSZ ophiolites display a lateral and vertical progression of melt evolution in their crustal and upper mantle components that traces different stages of subduction initiation-related magmatism, reminiscent of the forearc magmatism in some of the modern arc-trench rollback systems as in the Izu-Bonin-Mariana and Tonga-Kermadec subduction factories. The along-strike continuity for more than 1500 km of this well-documented chemostratigraphy and geochemical progression in different ophiolite belts is strong evidence for spontaneous subduction initiation followed by rapid slab rollback in ancient ocean basins. I will discuss the global SSZ ophiolite record in light of our new ophiolite classification and evaluate the secular trends in SSZ ophiolite evolution in Earth history through time.

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