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Ophiolites of Different Tectonic Settings and Mantle Melt Origins

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Ophiolites are suites of temporally and spatially associated ultramafic to felsic rocks related to separate melting episodes and processes of magmatic differentiation in particular tectonic environments. Most ophiolites display a laterally discontinuous and vertically heterogeneous crustal architecture and varying geochemical characteristics, reflecting major differences in igneous and tectonic processes involved in the formation of ancient oceanic crust in different geodynamic settings. The magmatic and structural architecture of an ophiolite may reflect a product and complex interplay of successive melting episodes and processes of magmatic differentiation, spreading rate and geometry, intraoceanic faulting and deformation associated with tectonic extension, proximity to plumes or trenches, mantle temperature and fertility, and the availability of fluids during its primary igneous evolution. Ophiolite emplacement is a process that starts with displacement of oceanic lithosphere from its primary geodynamic environment and ends with its incorporation into mountain belts during orogenesis. We broadly categorize ophiolites into *subduction-related* and *subduction-unrelated* types. Subduction-related ophiolites include *suprasubduction zone* and *volcanic arc* types, whose evolution is governed by slab dehydration and accompanying metasomatism of the mantle, melting of the subducting sediments, and repeated episodes of partial melting of metasomatized peridotites. Subduction-unrelated ophiolites include *continental-margin*, *mid-ocean ridge* (*plume-proximal, plume-distal and trench-distal*), and *plume-type* (*plume-proximal ridge* and *oceanic plateaus*) ophiolites that generally have (MORB) compositions. Subduction-related ophiolites develop during the closure of ocean basins, whereas subduction-unrelated types evolve during rift-drift and seafloor spreading. In this talk, we discuss various petrogenetic models for the formation of these different ophiolite types and the crustal-mantle processes involved in their evolution. Geochemical and tectonic fingerprinting of Phanerozoic and Precambrian ophiolites within the framework of this new ophiolite classification is an effective tool for identification of the geodynamic settings of oceanic crust formation in Earth history, particularly in the early Precambrian.

Key words: Ophiolite classification, plumes, mid-ocean ridges, suprasubduction zone settings, volcanic arcs

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