Subduction of both the Iapetus and Rheic oceans began relatively soon after their opening. Vestiges of both the Iapetan and Rheic oceanic lithospheres are preserved as supra-subduction ophiolites and related mafic complexes in the Appalachian-Caledonian and Variscan orogens. However, available Sm-Nd isotopic data indicate that the mantle source of these complexes was highly depleted as a result of an earlier history of magmatism that occurred before the Iapetus and Rheic Oceans existed. We propose that this oceanic lithosphere was captured from the adjacent Paleopacific lithosphere, in a manner analogous to the Mesozoic-Cenozoic "capture" in the Atlantic realm of the Caribbean plate. The early phase of magmatism rendered this lithosphere more buoyant than surrounding asthenosphere, which facilitated its preservation. This hypothesis may explain the premature closing of the Iapetus Ocean, and the distribution of collisional events and peri-Gondwanan terranes in the Appalachian-Caledonian and Variscan orogens.