The Upper Triassic Martin Bridge Formation (Wallowa Terrane, Oregon): A Potential Carbonate Petroleum Reservoir?

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The Late Paleozoic to early Mesozoic Wallowa terrane is one of the four tectonostratigraphic terranes of the Blue Mountains Province, northeastern Oregon and western Idaho. It is locally disrupted by volcanic intrusions and obscured by the two-kilometer thick Neogene Columbia River Basalt. The Wallowa terrane contains Upper Triassic reef facies and remnants of a drowned tropical carbonate platform represented by the Martin Bridge Formation. The Martin Bridge also is characterized by deeper water facies of fine-grained, dark, organic-rich, calcareous mudstones and shales. This unit in turn is overlain by the impermeable mudstones and argillites of the Late Triassic to Early Jurassic Hurwal Formation. Triassic rocks commonly host petroleum in the Middle East and other regions of the world. Unfortunately most exposed rocks of the Wallowa terrane are so strongly affected by contact metamorphism as to essentially thwart prospects for preservation of any useful petroleum resources.

In pure, muddy, dark gray to soot-black limestone outcrops of the Martin Bridge Formation, northern Wallowa Mountains, Oregon, we discovered unusually high values of carbon (maximum 3.1%) represented by organic matter and microcrystalline graphite. The petrographic analysis of this limestone reveals that skeletons and shells have been completely impregnated, and preserved by oil. However, within the rock, oil may have been driven off by heat from late Mesozoic batholithic bodies forcefully intruded into the country rock of the Martin Bridge. We further suggest that magmatic heat associated with the terrane accretionary processes volatized the oil and contact metamorphism altered petroleum remnants into graphite. Since the effects of the thermal metamorphism are attenuated relative to distance from the plutons, one might postulate that some Triassic limestone deposits of the Martin Bridge, escaped thermal maturation and survived to retain some of the host oil. We therefore suggest future deep exploration of the great volume of Upper Triassic carbonate rocks beneath the Columbia River Basalt.