

Keasey Formation, which is Oligocene in age. The Keasey Formation consists of Tuffaceous, fossiliferous siltstones and mudstones that were deposited in a deep, cool water environment.

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**The Cowlitz Formation: Stratigraphic Relationships and Depositional Environment in the upper Nehalem River - Wolf Creek area, northwestern Oregon**

Recent discovery and development of a gas field near Mist, Oregon, has promoted an interest in the Tertiary stratigraphy of the Oregon Coast Range. Reservoir sandstones in the Mist area are part of the Cowlitz Formation, which is late Eocene in age. Geologic mapping of surface outcrops in the upper Nehalem River - Wolf Creek area provided an opportunity to interpret stratigraphic relationships and to postulate a depositional environment of the Cowlitz Formation. The upper Nehalem River - Wolf Creek study area is located in E½T3N, R6W and T3N, R5W, which is approximately 30 km south of the Mist gas field.

In the upper Nehalem River - Wolf Creek area, the Cowlitz Formation positionally overlies and flanks the upper part of the Tillamook Volcanics. The Tillamook Volcanics (upper part) consist of mostly subaerial basalt flows with interbedded basaltic sandstones and conglomerates and minor basaltic pyroclastic rocks. The volcanic sedimentary interbeds were deposited in subaerial paleochannels. Geochemically, the flow rocks range from 49.9 to 59.8 percent SiO<sub>2</sub> and are characterized by high total alkalis, total iron, titania, and phosphate. Major oxide concentrations, REE patterns, and Ta-Hf-Th ratios indicate that the Tillamook Volcanics formed in an oceanic island tectonic setting. The Tillamook Volcanics formed a paleotopographic volcanic high on the westward side of the late Eocene continental shelf during deposition of the Cowlitz Formation.

The Cowlitz Formation was deposited on a nearshore, shallow marine shelf. Mudrock, heterolithic, and sandstone lithofacies were deposited in offshore, transition, and shoreface zones, respectively. Hummocky cross-stratification and parallel-laminated sheet sandstones indicate storm-influenced deposition on the shelf. All lithofacies are characteristically micaceous and carbonaceous. Sandstones are clean (<5 percent matrix), moderately well-sorted arkoses. Major detrital components are quartz, plagioclase, K-feldspar, and mica. Detritus in the Cowlitz Formation was derived mostly from a continental plutonic and/or metamorphic source area.

The Cowlitz Formation is unconformably overlain by the