The Spencer Formation in Yamhill and Washington Counties, Oregon, is exposed in a narrow belt 27 km long, from 1/4 to 3 km wide and with a maximum thickness of about 400 m. The formation is composed entirely of sandstone with interbedded thin layers of mudstone in the uppermost member. The sedimentary structure and paleoecology indicate a shallow marine depositional environment. The upper member of the Spencer Formation contains more quartz, plagioclase, and hornblende than does the lower member, but K-feldspar is less than that of the lower member. Shallower water conditions
for the deposition of the upper member are indicated by sedimentary structures and the abundance of pebbly lenses and coaly material. Eighteen species of megafossils collected from the formation indicate that the Spencer Formation is of the Tejon stage (late Eocene of the West Coast).

The Spencer Formation in the study area is unconformably underlain by fine sediments of the Yamhill Formation of late Eocene (Narizian) age, which are in turn underlain by the upper middle Eocene Tillamook Volcanics. The Spencer Formation is overlain by a unit previously mapped as "Oligocene Marine Sediments Undifferentiated" (Schlicker and Deacon, 1967). For this thesis, these sediments were separated into three units, partially mapped in the northern part of the study area: (1) A separate mudstone, siltstone, and sandstone unit called in this thesis the Stimson Mill bed which intertongues with and overlies the Spencer Formation. The stratigraphic position of this unit is uppermost Eocene, not Oligocene as previously interpreted; (2) a thick sequence of interbedded basaltic and carbonaceous fine sandstone, pebbly sandstone, and thin-bedded shale of the Gries Ranch Formation which overlies the Stimson Mill bed of early Oligocene age; (3) a sandstone and mudstone unit, probably the middle Oligocene Pittsburg Bluff Formation which overlies the Gries Ranch Formation. To the east of the study
area, these units are unconformably overlain by the late Oligocene Scappoose Formation, which is, in turn, unconformably overlain by the Columbia River Basalt Group of Miocene age.

Very well-developed faults with stratigraphic displacement occur throughout the study area, and sills and dikes intrude some of the Eocene and Oligocene rocks.

The considerable thickness of the shallow marine Spencer sandstone unit, along with its good porosity and permeability, well-developed faults, and intertonguing relationship with the overlying unit, suggest that this unit is favorable for the development of good stratigraphic and/or structural oil traps.