County, Montana, produces 30° gravity oil from the Amsden dolomite at an average depth of 6,200 feet. Discovery was made by the Atlantic Refining Company in August, 1955.

Prior published comment considers the oil pool to be an accumulation due to hydrodynamic tilt to the northeast of the axis of the Wolf Springs anticline, as contoured on top of the Amsden formation. Wells drilled during 1959 add regional information which casts doubt on the hydrodynamic thesis. An interpretation is offered whereby the oil pool localization is shown as being due entirely to stratigraphic factors.

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Oil Sands at Base of Pennsylvanian in Williston Basin

The strata discussed in this paper belong to the shale and lenticular sandstone sequence which has been called the Heath formation of Mississippian age in the Williston Basin. This unit is of economic importance as a source of oil in southwestern North Dakota.

Information has accumulated to indicate that these sediments are Pennsylvanian in age and are correlatable, at least in part, with the Tyler sandstone in the Sumatra area of central Montana. The name Tyler formation is, therefore, proposed for these sediments in North Dakota.

This formation is found over much of western North Dakota and may possibly be equivalent to sediments which occur over much of South Dakota. The Tyler of the Williston Basin in North and South Dakota rests unconformably on truncated Big Snowy (Otter and Kibbey) and on truncated Paleozoic strata. It is overlain by carbonates of the Minnelusa and (or) Amsden formations, and locally by sands and shales of the Jura-Triassic.

A dark gray to brown fossiliferous limestone which overlies the Tyler sediments in parts of North Dakota is believed to be a stratigraphic equivalent to the Alaska Bench member of the Amsden in Montana.

The Tyler formation varies from zero to 300 feet thick in North Dakota. A detrital deposit composed of preunconformity rock types has been recognized in cores and samples from the base of the Tyler. Over much of North Dakota the formation is black, carbonaceous, fossiliferous shale; however, over many areas the upper fifty per cent of the formation is dark red shale. Locally red, maroon, yellow and green shales occur in the upper twenty to forty feet of a predominantly black shale interval. Sands are developed more extensively in the black shale unit, but occur in some areas in the red shale. Toward its outer limits to the north and east in North Dakota, the Tyler becomes more sandy and red colors are dominant. In areas where the Tyler has red shales in the upper portion and dark gray to black shales below, the sequence appears to be lithologically similar to the Tyler formation in the Sumatra area of central Montana.

Apparent correlatives of the Tyler formation in South Dakota exhibit varicolored shales, and tan carbonates in the upper half, with dark green and black shales and dark colored limestones and sand in the lower half. A sand at the base, called Fairbanks by earlier workers, lies across the truncated edges of Madison and older Paleozoics.

The sands in the Tyler appear to be bar-type sand lenses which are channeled into the basal detrital beds, and occur interbedded with black to red and varicolored shales in higher parts of the unit. A near-shore lagoonal, fresh water to marginal marine environment seems apparent. Fossils indicate a Pennsylvanian age for these sediments in North and South Dakota and suggest correlation with "true Amsden" at least in part.

Tyler sand fields, in southwestern North Dakota have produced, since the first discovery in 1954, a cumulative total of 364,615 bbls. of oil as of July, 1959.

Cores from this formation on the Nesson Anticline have had good oil shows in well developed porous sands, and suggest that more oil is yet to be found in these strata.

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Ordovician and Silurian of Central and Southern Parts of Williston Basin

Ordovician and Silurian rocks, mainly dolomitic limestone and dolomite, underlie the eastern half of Montana, nearly all of North Dakota and a large portion of South Dakota. They reach a thickness of about 2,000 feet near the basin center (where the cover exceeds 12,000 feet) but are bevelled radially by pre-Devonian and later surfaces of unconformity. Only Ordovician rocks escaped removal from areas of present-day outcrop at the southern rim of the basin.

For historical reasons the outcrop and subsurface nomenclature of the stratigraphic column differ, but a series of sedimentary units which can be traced in basin-wide stratal continuity exists. The Bighorn dolomite of the Pryor-Bighorn Mountains in Montana is demonstrably continuous with and equivalent to the combined Red River, Stony Mountain and Stonewall formations of the northern part of the basin. Similarly, the Whitewood dolomite of South Dakota equates with a small section of the lowest Red River.

Sedimentary thickness and distribution maps reveal former contiguity of the Williston and Nebraska-Iowa-Illinois depositional areas. During pre-Stony Mountain sedimentation the northern Nebraska and northeastern Iowa areas lay on the southern flank of a Red River basin centered in North Dakota.

Ordovician sedimentation (post-Beekmantown Deadwood formation) commenced with deposition of a sandstone on an erosion surface cut across Cambrian and Precambrian rocks. It continued with a shale and sandstone formation (Winnipeg, Simpson) which overstepped the initial sandstone and behaved as a basal deposit to the overlying carbonates of the Red River (Viola), and Stony Mountain-Stonewall (Maquoqueta) formations.

The lower three-quarters of the Red River comprise an uninterrupted succession of marine fossiliferous limestones, highly dolomitized at their periphery, but the upper quarter is a strongly rhythmic carbonate-evaporite sequence. These evaporites spread over most of the basin interior, the earliest having the greatest extent.

An influx of shale in the lower part of the overlying Stony Mountain abruptly smothered the evaporite rhythms. Evidence of facies variation within the lower Stony Mountain, coupled with a shift in the center of maximum accumulation of later formations points to appreciable re-disposition of sedimentary influences. Evaporite rhythms returned after the shale incursion and lasted through the remaining Stony Mountain and the Stonewall formations.

Silurian rocks, the Interlake group (Hunton), are almost wholly dolomite, characteristically pale in color and micrograined. Evaporitic anhydrite beds occur locally but have either the spread nor the rhythmic succession of those in the Ordovician. Correlation and subdivision of Interlake group sections is much aided by the existence of several persistent sandy non-sequential