STRATIGRAPHY AND PETROLEUM OCCURRENCE, GREEN RIVER FORMATION, RED WASH FIELD, UTAH

By

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T 1130

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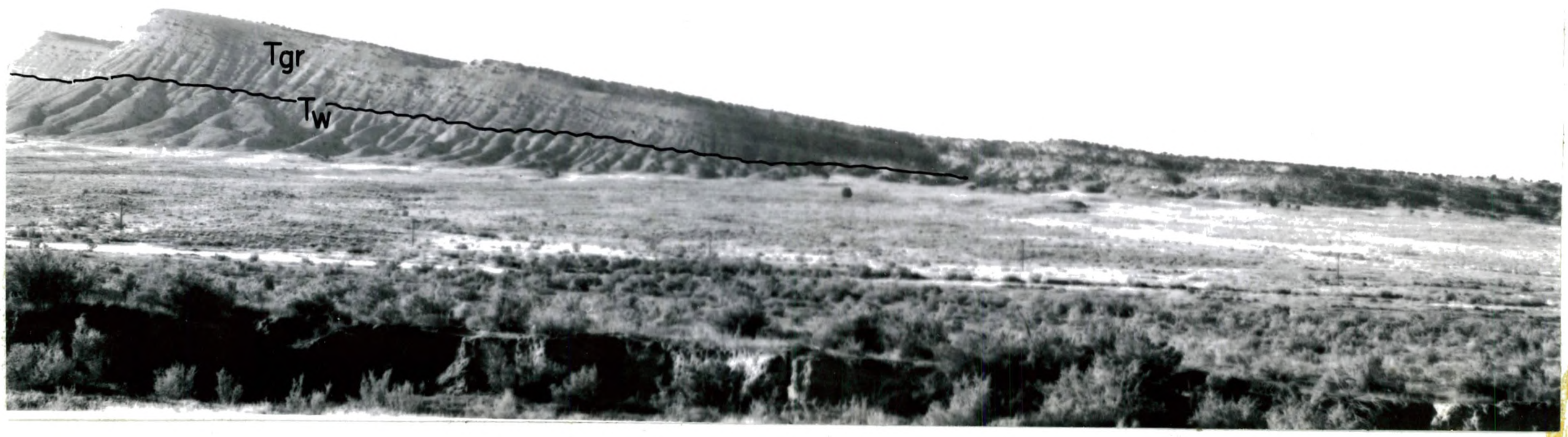

Raven Ridge, looking south from U. S. Highway 40,
T. 6 S., R. 25 E., Uintah County, Utah.
Tw = Wasatch Formation, Tgr = Green River Formation.

ABSTRACT

This investigation is concerned with the stratigraphy and sedimentation of the shore phase of the lacustrine lower part of the Green River Formation (Eocene) present in the Red Wash-Raven Ridge area and the origin and accumulation of petroleum. The area is located in the northeastern part of the Uinta Basin, where the trend of the basin axis changes from east-northeast to southeast. North and northeast of the axis, the Eocene formations are well exposed and constitute Raven Ridge. South of the axis, the Green River Formation dips gently north and northwest. A minor anticlinal nose in the main Red Wash area plunges northwesterly.

The Green River Formation has an average thickness of 3000 feet. The thickness decreases from more than 4000 feet in the southwest to almost zero in the north as a result of depositional thinning and interfingering with the underlying Wasatch Formation and overlying Uinta Formation. Time stratigraphic delineation of five major intervals, defined

at Raven Ridge and extended into the subsurface, reveals three, or possibly four, major facies. These facies are (respectively from north to south): a variegated shale facies, assigned to the Wasatch Formation or to the Uinta Formation; a sandstone facies; an ostracodal limestone facies; and a black shale facies. These facies represent respectively the fluviatile, nearshore, offshore and axial lacustrine environments. In the upper portion of the Green River Formation the ostracodal limestone and black shale facies are replaced by the marlstone and oil shale facies. There are detailed differences in the lithologies of each major facies within the stratigraphic units. Changes of facies boundaries with time, show that the Green River Formation contains a transgressive sequence followed by a regressive sequence of deposition. Facies distribution in each major stratigraphic interval indicates that the regional shoreline orientation was west-northwest and that it remained stable throughout Green River deposition. Shoreline orientation, indicated by ripple marks in Raven Ridge outcrops, is west-southwest, is a local deviation from the general shoreline orientation, and cannot be correlated with subsurface trends of sandstone bodies.

An isopach map of the lower part of the Green River Formation indicates thickening toward the center of the former lake and local thickening in the sandstone facies in the Red Wash area. The sandstone facies is interpreted as having been deposited in a deltaic environment. Detailed studies were made of the lower part of the Lower Green River Formation (Douglas Creek Member) where the sandstone facies is extensively developed and where more data are available. Sandstone isolith patterns, detailed electric log cross sections, and the sequence of sedimentary structures exhibited in cores, suggest the presence of two delta types: (1) a bar-finger or deep-water delta in the West Red Wash-Wonsits Valley area, with branches in the Brennan Bottom and Horseshoe Bend areas, characterized by continuous sandstone reservoirs; and (2) a shoal-water delta of the main part and eastern part of the Red Wash-Walker Hollow area, characterized by complicated interlensing of sandstones and numerous shale intercalations. Porosities and permeabilities are generally higher in the shoal-water sandstones than in the bar-finger sandstones. Intensive small-scale burrows are present in the intercalated shales and in the interdistributary bay environments.

In the upper portion of the lower part of the Green River Formation (Garden Gulch Member) sandstone beds are very thick and are restricted to the northernmost part of the basin. They constitute the southern extremity of a cuspate delta which was deposited when the lake was at its maximum stage of transgression. Paleocurrent data, based on 81 observations of cross-stratification, indicate the sandstones at Mormon Gap (in Raven Ridge) form a separate bar-finger deposit that prograded from a more easterly source.

Oil occurs primarily in the sandstone facies of the lowermost part of the Green River Formation. Its entrapment is facilitated by the lenticular nature of deltaic sandstone reservoirs. Each lens is a separate reservoir with its own pressure system and oil-water contact. Gas is produced with the oil, but also occurs in separate reservoirs in the eastern part of the Red Wash field. Variation of oil types in the area is related to local changes in depositional environment. The stratigraphic position of oil occurrence, the nature of the reservoirs, and the facies control of oil type, indicate the oil is of very local origin and has no genetic relationship with oil-shale kerogens.

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Frontispiece: Raven Ridge, from U. S. Highway 40.