EOLIAN-FLUVIATILE (CONTINENTAL) ORIGIN OF ANCIENT STRATIGRAPHIC TRAP FOR PETROLEUM IN WEBER SANDSTONE, RANGELY OIL FIELD, COLORADO[1]

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ABSTRACT: An ancient stratigraphic trap for petroleum exists in continental deposits at Rangely oil field, about 24 km south of Dinosaur National Monument, where the eolian Weber Sandstone (Pennsylvanian-Permian) intertongues with the Maroon Formation of fluvial origin. The stratigraphic trap developed as a result of the progradation of eolian dunes toward the ancient Uncompahgre uplift. Fine silt and conglomeratic material brought into the dunes along the margins of the dunefield became impermeable layers--due to postdepositional diagenetic cementation and intrinsic textural properties. The conditions which created the stratigraphic trap at Rangely may have developed in other areas along the margins of ancient Pennsylvanian uplifts in Colorado, Wyoming, and Utah.

Analysis of cores from Rangely oil field indicates that porosity and permeability within the oil-productive sandstone is affected by primary and secondary diagenetic processes. Reduction of porosity and permeability in the reservoir sandstones is due to burrowing and contortion of laminations, which destroyed or modified previously well-sorted laminations of sandstone units. Cementation is most complete in the burrowed and contorted intervals.

Evidence for eolian origin of the Weber Sandstone near Dinosaur National Monument includes: (a) large scale tabular-planar cross-stratified units with few horizontal symmetric ripples, but many low-relief, asymmetric ripples oriented up and down slipface deposits; (b) raindrop imprints on slipface deposits at Deerlodge Park, Colorado; (c) characteristics of contorted stratification, lamination style, and burrowing that exactly match those of modern eolian deposits and some inferred ancient eolian deposits, and which can be interpreted in the light of known eolian processes; (d) interbedding of well-sorted quartz sandstones and poorly sorted, mica-rich siltstones and conglomerates at Rangely oil field, which is interpreted to be interbedded eolian dune and fluvial sediments; (e) consistent southward transport directions in the Weber Sandstone are more compatible with a wind-driven depositional system than a marine depositional system, since steady ocean currents flowing south to southeast would be forced to flow upslope toward the ancient Uncompahgre and Front Range uplifts; (f) absence of appreciable clay or chert in the Weber Sandstone in the study area, in contrast to the occurrence of these minerals in marine rocks of the Weber Sandstone farther west; (g) thin, lenticular carbonates (usually only .31-.61 m thick) restricted to extensive diastems in the Weber Sandstone in the study area which indicate that the carbonates were deposited in non-marine ponds associated with interdune areas; (h) striking differences between the lenticular, brecciated, unfossiliferous dolomites in the Weber Sandstone and the thick, fossiliferous cherty limestones of approximately the same age in marine deposits within the Weber Sandstone, and the older underlying Morgan Formation.

Shortly after deposition, the eolian deposits of the Weber Sandstone became saturated with water and were then subjected to penecontemporaneous deformation that produced complex folding and breaking of laminations.

INTRODUCTION

The origin of the thick, clean, well sorted, very fine-grained sandstones of the Weber Sandstone of northeast Utah and northwest Colorado has long been a matter of importance to geologists involved in drilling for oil in this formation. In particular, a number of studies (Bissell, 1964; Emmett, et al., 1972; Larson, 1975; Lupe and Ahlbrandt, 1975), has indicated that the vast "blanket" sandstones of the Weber-Tensleep system include several different depositional sub-systems, each with unique properties of porosity and permeability and associated oil and gas production characteristics. The object of this study has been to examine the excellent outcrops of the Weber Sandstone which occur within Dinosaur National Monument and adjacent areas (Fig. 1) and cores from Rangely oil field, Colorado, and to describe in detail the sedimentary features of individual depositional units. From this information, it has been possible

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