3-D Seismic Interpretation of the Red Wing Creek Meteorite Impact Field, Williston Basin, Western North Dakota; Updated Drilling Results

Ben Herber[3], Paul Weimer[1], Renaud Bouroullec[2], Roger Barton[4], Dan Behringer[4]

[1]University of Colorado, Boulder, CO, United States.
[2]TNO, Utrecht, Netherlands.
[3]Shell, Houston, TX, United States.
[4]True Oil, Casper, WY, United States.

ABSTRACT

The Red Wing Creek Field in the Williston Basin, discovered in 1972, is one of a few well-known petroleum fields in the world to produce from a structure associated with a meteorite impact. An interpretation of a 3-D seismic dataset, covering 145 km2, was done to define the details of the structure and identify future drilling targets. The crater has a diameter of 9.1 km and can be divided into three unique structural zones. First, the central uplift complex has a maximum diameter of 5.1 km, and consists of an uplifted central core, composed entirely of strata of the Mississippian Madison Group, and a flanking inner rim. The seismic reflectivity within the central core is poor, but well log data indicates extensive stratigraphic repetition. The central core is surrounded by an annular rim (1.7 km wide), which is structurally thickened by imbricate thrusts that dip towards the central core. This rim comprises eight distinct radial sectors, segmented by nine high-angle, reverse faults. The second portion of the crater is a depressed annular trough with a maximum diameter of 1.5 km; its inner limit is bounded by antithetic normal faults and its outer limit by concentrically linked normal faults that dip toward the central part of the crater. This group of faults marks the edge of the third zone, the outer rim. The outer rim is slightly uplifted, relatively undisturbed, and its strata dip at a maximum angle of 8° away from the central crater. Prior to this study, the field had produced from 29 wells, all but one in the central core. The results of this study identified four new development targets; three horizontal wells were drilled into structural closures along the eastern outer rim, and one horizontal well in the northeastern portion of the inner rim. All wells were producers.