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Structural Complexity and Implications of Success in New Discovery Wells in the Appalachian Thrust Belt in Tennessee

Deformational styles are important in the formation and preservation of reservoirs in the southern Appalachian thrust belt, in addition to the stratigraphically important petroleum sources and reservoirs. Success in drilling in the newly developed Swan Creek field in Tennessee, and analysis of existing and new seismic reflection data reveal that subthrust anticlines and faulted anticlines (mostly duplexes) are an important and previously overlooked trap in this region. At Swan Creek, an extensive flap of Lower Cambrian Rome Formation along the Clinchport thrust sheet has beneath it a complexly faulted footwall anticline that contains the 2-mile by 5-mile field. The Clinchport thrust serves as the roof of the duplex and the next thrust to the west, the Wallen Valley, serves as the floor. Imbricates within the duplex contain smaller folds and also serve to increase fracture porosity in the field. This structural style should be applicable to plays elsewhere in the southern Appalachians as well as in other foreland fold-thrust belts worldwide.

Fold-related faulting exists beneath some of the initially simple Middle Ordovician synclinoria in eastern Tennessee and suggest another structural style more complex than previously thought. Thrust faults die out upward into anticlines that at the surface exhibit no evidence of complex faulting at depth. This structural style is unexplored but is promising for gas here because of the greater thermal maturity of the rocks.