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Geologic-Seismic Waveform Approach to Finding Subtle Porosity and Traps: Example from Frisco Formation (Devonian, Hunton Group), Oklahoma

The Frisco Formation is a middle Lower Devonian limestone (Amsden, 1957) within the Hunton Group (Upper Ordovician-Lower Devonian) (Amsden, 1957; 1970; 1975). In the Anadarko Basin, the Frisco Formation consists of skeletal packstones and grainstones, whose main components are pelmatozoans, bryozoans, brachiopods, and locally corals (Amsden, 1975). Depositional intergranular

porosity has been mostly obliterated through syntaxial cementation on pelmatozoans, and mechanical and chemical compaction. Secondary porosity, which formed during sub-aerial exposure of the Frisco, occurs locally at the top of the formation in the form of partly leached grains, vugs, and solution channels. This secondary porosity is best developed close to areas where the formation was completely eroded — areas which often correspond to Middle Devonian paleo-structures.

Hydrocarbon accumulations in the Frisco Formation are mainly in stratigraphic traps situated downdip from areas where the formation has been severely truncated. The Woodford Shale (Upper Devonian-Lower Mississippian) unconformably overlies the Frisco Formation throughout most of the study area and provides a source, trap, and seal for reservoirs within the Frisco.

Geophysical identification of Frisco Formation porosity is possible using relative amplitude (RAM) processing. Where the Woodford Shale overlies nonporous, high-velocity Frisco or older Hunton strata, the resulting reflection coefficient causes a well-developed amplitude peak on RAM-processed seismic sections. However, where the Frisco Formation is porous, a lower reflection coefficient between the two formations produces a relative amplitude diminishment and subsequent break-up of the Woodford-Frisco peak.

Using RAM-processing seismic sections, in conjunction with available geologic data, allows mapping of Frisco Formation porosity and truncated margins, and identification of potential hydrocarbon traps. The West El Reno field, Canadian County, Oklahoma, produces gas and condensate from an outlier of the Frisco, and provides a template for this technique.