KIDNEY, ROBERT L., Tenneco Oil Co., Englewood, Colorado, and
DAVIS, THOMAS L., Colorado School of Mines, Golden, Colorado

Seismic Reflections Study of Depositional Patterns of Lower Cretaceous Strata, Eastern Powder River Basin

A reflection seismic study in the Newcastle, Wyoming area was undertaken to determine if recurrent movement along basement-controlled faults influenced depositional patterns of the Lower Cretaceous Newcastle Formation. This depositional model was developed from subsurface and surface geology by Robert J. Weimer, James J. Emme, Cathey Farmer and Lawrence O. Anna. Presence of basement-controlled faults was inferred from subsurface data from indirect evidence, such as repetitive thinning of Lower Cretaceous isopach intervals. There is, however, no direct evidence of faulting from the subsurface data. Therefore, the purpose of this paper is to present geophysical evidence which supports the depositional model.

Presence of basement-controlled faulting in the study area is confirmed by the reflection seismic data. Faulting is indicated by: (1) offset of reflecting horizons, (2) offset varies with depth, (3) change of dip rate in fault zone, and (4) amplitude and wave character variations. Newcastle Fault Zone (northeast-southwest orientation) was identified from the seismic data. Recurrent, incremental movement has

Earth Science Bulletin, 1982

taken place along this fault zone since Precambrian time. Faulting or influence of faulting persists at least into the Lower Cretaceous rocks.

Lateral lithology changes within the Newcastle Formation are identified by comparing synthetic seismograms with seismic data. Thick, high-net-sandstone zones (channel sandstones) are characterized by significantly larger amplitudes than thin, low-net-sandstone and shale zones (channel margin and marginal marine facies).

Basement-controlled faulting was the major factor influencing depositional patterns of the Newcastle channel sandstones in this study area. Channel sandstones are found within grabben-block areas while channel margin and marginal marine sediments are found at all structural positions.

The geophysical-geological model used for this study has wide application in the exploration for hydrocarbons, uranium and ground water throughout the eastern Powder River Basin. Similar models can be developed for strata of other ages in areas of sparse well control using seismic reflection data.