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3D seismic visualization from a geological perspective: examples from shallow water and deep-water environments

SPEAKER

Henry W. Posamentier

Anadarko Canada Corporation

In recent years, 3D seismic has become an essential tool for the interpretation of subsurface stratigraphy and depositional systems. Seismic stratigraphy in conjunction with seismic geomorphology, calibrated by borehole data, has elevated the degree to which seismic data can facilitate geologic interpretation. 3D seismic data has enabled interpreters to visualize details of complex depositional systems that can be incorporated into borehole planning for exploration as well as development needs so as to improve risk management significantly. Common techniques for geologic visualization include 1) imaging stratigraphic horizons, 2) time slicing and flattened time slicing, 3) interval attribute analysis, 4) voxbody interpretation and mapping, 5) 3D perspective rendering, and 6) opacity rendering.

Stratigraphic horizons can be interpreted and horizon attributes – such as reflection amplitude, dip magnitude, dip azimuth, and curvature – can then be imaged directly in 2D or 3D space. Techniques such as variable illumination can enhance geomorphologic interpretations and, when integrated with stratigraphic analyses, can yield insights regarding distribution of source, seal, and reservoir facies. Stratigraphic intervals bracketing sections of geologic interest can be evaluated for amplitude and frequency content and can contribute to geologic interpretations. Time slices and flattened time slices can bring to light geologic features that other techniques might overlook. Voxel picking can further bring out features of geologic interest. This method involves auto-picking of connected voxels of similar seismic character, a technique that can illuminate discrete depositional elements in three dimensions. Similarly, opacity rendering, which makes opaque only those voxels that lie within a certain range of seismic values, can further bring out features of stratigraphic interest. Examples of fluvial, shallow marine, and deep marine are shown. A variety of visualization techniques are applied to these examples in an effort to illustrate the variety of interpretation techniques available to the geoscientist. These examples will highlight the integration of seismic stratigraphic and seismic geomorphologic analyses essential for maximum benefit to be derived from geologic analyses of 3D seismic data.

BIOGRAPHY

Henry W. Posamentier is the General Manager of Geoscience and Technology for Anadarko Canada. Prior to joining Anadarko in 2001, he was with Veritas Exploration Services (2000-2001), the Atlantic Richfield Co. (1991-2000), Exxon Production Research Co. and Esso Resources Canada, Ltd. (1979-1991), and at Rider University, Assistant Professor of Geology (1974-1979).

Dr. Posamentier's research interests have been in the fields of sequence stratigraphy and depositional systems analysis, where he has published widely. Most recently, he has employed an interdisciplinary approach using 3D seismic visualization integrated with borehole data to interpret depositional systems and develop basin-fill histories, in particular with reference to deep-water depositional settings. In conjunction with this, he has been active in advancing the discipline of seismic geomorphology. In 1971-1972, Dr. Posamentier was a Fulbright Fellow to Austria. He has served as an AAPG Distinguished Lecturer to the United States (1991-1992), an AAPG Distinguished Lecturer to the former Soviet Union (1996-1997), and an AAPG Distinguished Lecturer to the Middle East (1998-1999).