Grand Junction Geological Society

http://www.gjgs.org/

This Month's Presentation

Jay Scheevel

Scheevel Geo Technologies LLC.
Grand Junction, CO

Will present a talk on

Detailed Stratigraphic Architecture of the Mesaverde Group Determined from Principal Component Analysis of 3D Seismic Data, Piceance Basin

Coauthor: Steve Cumella
Bill Barrett Corp.

The speaker will present in person although we will also have Zoom available.

Guests Are Always Welcome

Abstract and Speaker's Bio Are on The Next Page.

Meeting Time and Location

February 18, 2026

Joint meeting with the CMU Geology Students

6:30 p.m.

Saccomanno Lecture Hall (Room 141) in the Wubben Science Building at Colorado Mesa University

Zoom Details

Andres Aslan is inviting you to a scheduled Zoom meeting.

Topic: GJGS Feb meeting

Time: Feb 18, 2026 06:00 PM Mountain Time

Join Zoom Meeting

https://coloradomesa.zoom.us/j/86780179066

Meeting ID: 867 8017 9066

Note: Zoom opens a half-hour earlier than the actual meeting to give people ample time to connect.

Important Announcements

Almost everyone has paid his/her dues, but if you have not yet done so, please do it how so we can plan for 2026.

Thanks.

Abstract

Detailed Stratigraphic Architecture of the Mesaverde Group Determined from Principal Component Analysis of 3D Seismic Data, Piceance Basin

Jay Scheevel – Scheevel Geo Technologies LLC., Steve Cumella – Bill Barrett Corp.

The primary limitation of 3D amplitude data employed in evaluation of stratigraphic and structural features lies in the fact that its resolution is limited by the frequency content of the data. This is not a new problem. The long-standing goal of all acquisition and processing flows to achieve the maximum resolution of the final product while minimizing noise. Despite the advanced state of modern signal processing, the signal content still limits the effective resolution of amplitude data.

Our goal has been to push the resolution limit significantly higher by departing from standard approaches to signal processing of seismic amplitude data. We recognize that the final migrated 3D seismic dataset is, by virtue of its uniformity of signal character and spatial distribution and because of its excessive statistical mass, ideally suited for purely statistical analysis.

We apply a common linear statistical approach, principal components analysis (PCA), to the analysis of seismic amplitude data (Scheevel and Payrazyan, 2001). The result is a compact description of the original signal compressed into the fewest possible independent attributes (the most significant PCs). PCA has no presumptions about the signal character, so all elements of statistically significant signal content are revealed.

The statistical variations are clustered into similar categories and rendered onto the seismic cube as "seismic facies". These seismic facies are indicative of changes in seismic signal. The geometry of the facies classes reveals details of the stratigraphy and structure that are difficult or impossible to interpret from the original amplitude data alone.

Overall, the improvement in the vertical and lateral resolution of stratigraphic features is dramatic.

Continued on next page.

Bio

Jay Scheevel

Jay Graduated from University of Illinois with a BS in Geology in 1979, from Texas A&M (Center for Tectonophysics) with an MS in 1981 then worked for Chevron from 1981 to 2002. Jay has worked in the US Rocky Mountains, Permian Basin, California, and internationally in West Africa, the Middle East, Indonesia, Australia, Papua New Guinea, the North Sea, Canada and South America. For Chevron, he worked as a geologist and geophysicist in both exploration and production/development and in research at Chevron's research facility. Jay has served worldwide and as an instructor in the Reservoir Characterization, Geostatistics and Structural Geology.

Since 2002, Jay has operated a consulting and technology company in Grand Junction, Colorado which specializes in advanced geophysics and reservoir description, 3D geological/geophysical modeling, complex well design and geosteering, well supervision and wellsite geology. Jay also provides onsite training and mentoring in all areas of geology, geophysics, and reservoir characterization.

Continued from previous page.

These windowed, PCA-based seismic facies are an "unsupervised" facies classification that simply subdivides the seismic amplitude signal (Figure 2a) into an arbitrary number of facies, based on significant changes in the PCs computed from windows of amplitude data and clustered by proximity in PC n-dimensional space. The facies are presented in the form of a cube of colored regions, each color representing a distinct seismic facies (Figure 2b).

The second approach is a "supervised" stratigraphic horizon mapping, which we refer to as a pattern match (PM) cube. The vertical pattern is defined by the ordered sequence of "unsupervised" seismic facies within the seismic facies cube. The supervision is provided few interpreted points along a geologic horizon of interest, such as a flooding surface or sequence boundary. A vertical pattern-matching filter designed from the interpreted points, that highlights the seismic facies pattern most similar to the interpreted points. The PM filter is applied to the entire facies cube, resulting in a horizon-specific PM cube. The PM cube is a high-resolution attribute cube designed to specifically for identifying and mapping anything similar to the interpreted feature.

A PM cube can be computed for any number of target horizons, with each PM cube used as a high-resolution tool that is unique to the reflection character of the horizon of interest. Any PM cube can be combined with those of several other horizons can be to create a hybrid-attribute cube that allows more complete high-resolution visualization of the entire stratigraphic section. Such a hybrid cube is shown in Figure 2d.

References

Scheevel, J.R., Payrazyan, K., 2001 Principal Component Analysis Applied To 3D Seismic Data for Reservoir Property Estimation. Paper 56734., SPE Reservoir Evaluation & Engineering, February 2001.

Scheevel, J and S.P. Cumella, 2009, Extracting sub-bandwidth detail from 3D amplitude data: An example from the Mesaverde Group, Piceance Basin, Colorado, U.S.A.,: SEG The Leading Edge, v.28 no. 11, November 2009. pp. 1362-1367.