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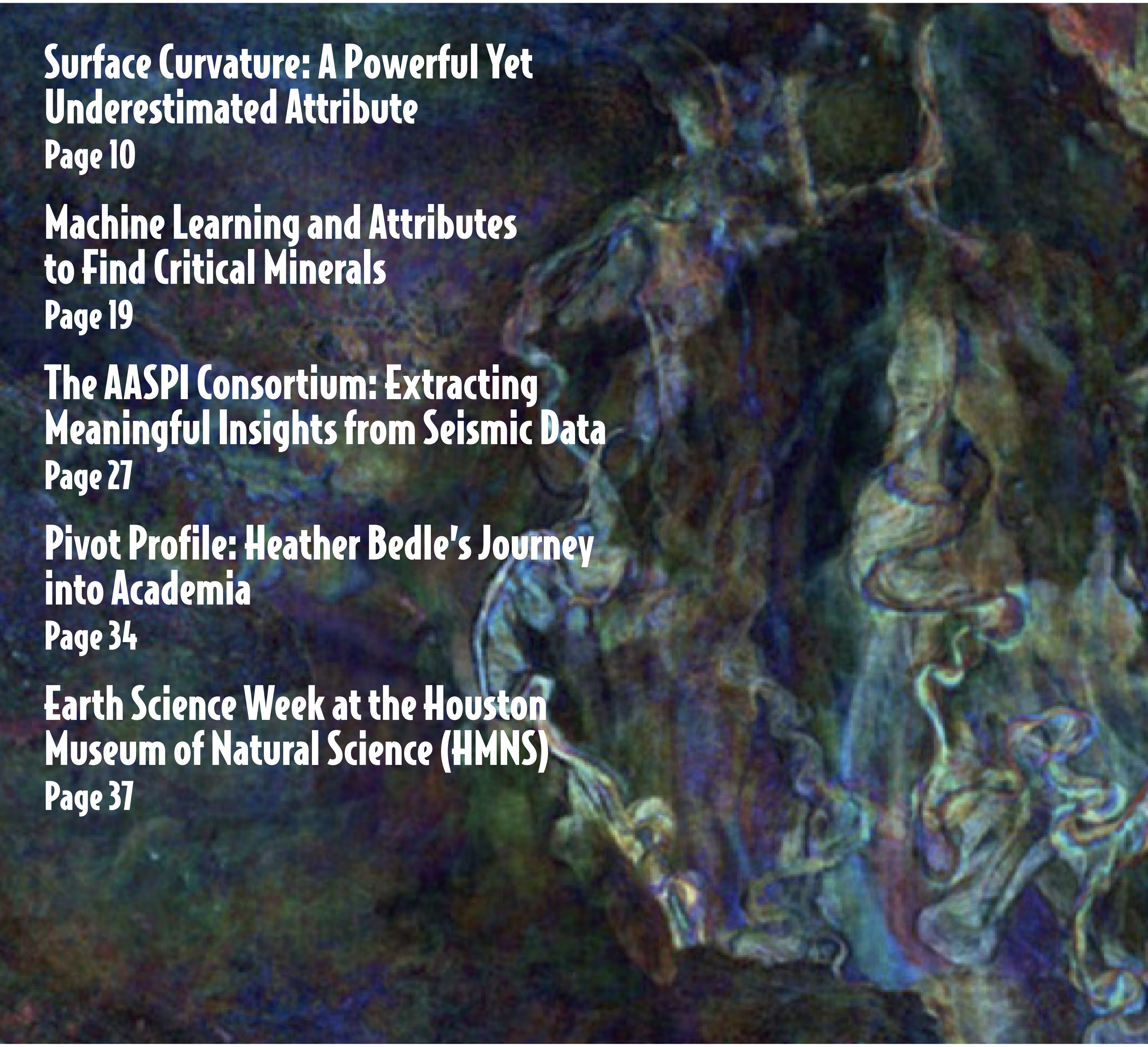

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In Every Issue

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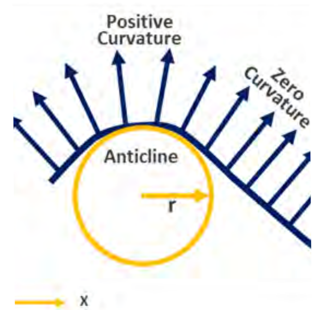
About the Cover: *The cover features a cropped and rotated image of a spectral decomposition (RGB blend) slice within the Miocene mega-sequence showing channel belts in the Keta Basin, offshore Benin. Taken from Rovira, 2024 (First Break, Vol. 42, July 2024).*

Technical Meetings

Features



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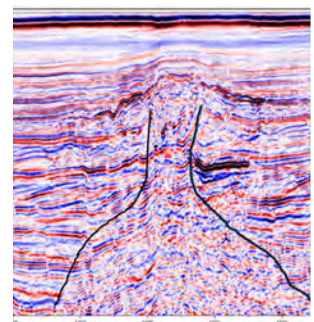
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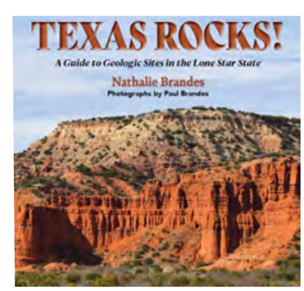

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President's Letter – November 2025

WELCOME TO NOVEMBER

Welcome to November — and to the unofficial start of the holiday season for many of us. Your Society's incredible volunteers continue to work hard to provide educational, social, and networking opportunities for our members. One recent event reminded me just how valuable organizations like HGS can be in shaping and supporting the professional journeys of geoscientists.

THE ART OF THE PIVOT AND GEOSCIENCE CAREERS

This past Wednesday, I attended the HGS General Lunch, where the topic was *The Art of the Pivot.* As many of our members have experienced, the geoscience business landscape has evolved rapidly since 2020 — and so have career opportunities for geoscientists. The "typical" career path I knew from the mid-1980s through the early 2020s looks very different from what many of our early- and mid-career professionals are navigating today. The panelists offered thoughtful perspectives on building resilience, staying relevant, and adapting successfully in a changing world.

Geoscientists possess a unique set of skills — we embrace uncertainty, think non-linearly, and thrive on solving complex puzzles

I CAME AWAY FROM THE LUNCHEON WITH TWO KEY TAKEAWAYS.

First, I was intrigued by the discussion around knowing when to pivot, identifying transferable skills, and building one's personal brand. For some, the idea of a career pivot might sound like stepping away from geoscience — but in reality, most of us make pivots throughout our careers. It may be an internal shift within your company, such as exploring commercial or marketing roles; a move from a major energy company to a mid-size, independent, or service organization; or perhaps an exciting opportunity in carbon capture or alternative energy.

The common thread was clear: geoscientists possess a unique set of skills — we embrace uncertainty, think non-linearly, and thrive on solving complex puzzles. Those qualities are invaluable across industries. Personally, I believe every business could use a few more puzzle solvers like us!

Second, the discussion emphasized the importance of networking and broadening connections beyond your current company. As our industry continues to evolve, being part of an organization like HGS is more valuable than ever. Local geological societies offer countless opportunities to make meaningful connections through technical meetings, educational programs, and social events.

While living in the fourth-largest city in the U.S. certainly comes with its challenges (hello, Katy Freeway!), Houston's size is also one of our greatest strengths. Our membership includes professionals from across the energy and geoscience spectrum — majors, independents, service companies, technology firms, and beyond. The HGS Board and its committees work tirelessly to offer events and programs that help members connect, learn, and grow. I hope to see many of you at one of these gatherings soon.

UPCOMING EVENTS

November 10 – 27th Annual Robert E. Sheriff Lecture

Join us for an evening featuring Dr. Jiaxuan Li, Assistant Professor of Geophysics at the University of Houston. His talk, "From Fiber-Optic Seismology to Geodesy: Operational Early Warning and Real-Time Imaging of Volcanic Eruptions," promises to be fascinating. The evening will also showcase technical posters from UH Earth Science students.

November 21 – Third Annual HGS Sporting Clays Shoot

A fun and relaxed way to connect with fellow members. Registration is open!

January 15, 2026 – Case Studies Seminar II

A one-day conference featuring real-world field studies, geological insights, and geophysical overviews presented by geoscientists with firsthand experience in drilling successes and challenges. Co-hosted by the Houston Geological Society and the Geophysical Society of Houston. Registration is open.

It's an honor to serve as your President, and I look forward to seeing you at an upcoming HGS event. ■

Lucia Torrado, HGS editor 2025-26
editor@hgs.org

Instantaneous Inspiration

I'm thrilled to start this letter by celebrating Ted Godo (2024-2025 HGS Editor) for receiving the *AESE Award for Outstanding Editorial or Publishing Contribution*. I had the pleasure of highlighting him in my first issue, and seeing him honored confirms that his work as editor is an inspiration!

As I sit down to write these letters, I often wonder what previous editors like Ted considered writing about. Should I share a personal experience? Highlight a recent HGS event? Reflect on a lesson learned in my career? Or maybe a bit of everything?

I also think carefully about what to bring to the table, trying to set aside personal bias while still offering something meaningful to our readers. However, I do admit that in this issue, the bias was a little bit inevitable, as it focuses on seismic attributes, which happens to be a favorite of mine. But being an editor is also about embracing topics outside my comfort zone, and hopefully the next issue will take us there — exploring ideas that challenge me and, I hope, engage you in new ways.

Which brings me to our readers: I warmly encourage you to contribute. Not just industry-focused topics, but research, education, environmental studies, fieldwork, technological innovations: any topic that deepens our understanding of the Earth. Your insights and experiences are what make this publication a true reflection of our community's diversity and expertise.

Your insights and experiences are what make this publication a true reflection of our community's diversity and expertise

MY INSTANTANEOUS INTRODUCTION TO ATTRIBUTES

So, I guess to answer my own questions above, I'll share a personal experience. The first time I saw a seismic volume on a computer during my first industry experience was eye-opening. A few days later, I was even more in awe watching a *variance* attribute being calculated for the first time. Back then, even a simple attribute could take hours, so we'd leave it running overnight, only to find the next day that the computer had crashed. We quickly learned to run it strategically during lunch breaks and into the afternoon, while working on other tasks. If I have to be honest, the experience was a "crash course" on seismic attributes, both literally and figuratively. So, you could say that my introduction to seismic attributes wasn't *phase*-d but rather *instantaneous*. Nowadays, I try to use them with as much *frequency* as possible, and whenever I see a new cool attribute, display, or geological feature, I can't help but want to take a deeper *dip* into it, since attributes do help build a geologic story with remarkable *coherence* (see what I did there? I may have also given away half of this issue's Word Breccia answers).

Seismic attributes have been around for a long time, and they still remain fascinating, so it's no coincidence that the cover image highlights an attribute. This issue not only explores seismic attributes but also celebrates the people who have dedicated their professional lives to further developing them.

IN THIS ISSUE OF THE BULLETIN

- ***Curvature Attributes as a Tool for Fault and Fracture Characterization***

In this *Technical Article*, Luis Bravo illustrates how curvature attributes offer a powerful way to map subtle faults and fractures that traditional seismic tools may overlook. Using data from the Cimarrona Formation in Colombia's Middle Magdalena Valley Basin, the study demonstrates how these attributes, integrated with seismic geomorphology principles, can reveal subtle structural and depositional elements essential for reservoir interpretation.

- ***Using Attributes to Locate Critical Minerals in Volcanic Facies***

Danial Mansourian, a researcher with the AASPI Consortium at the University of Oklahoma presents a novel workflow integrating seismic attributes with unsupervised machine learning to map volcanic facies in the Otway Basin, South Australia. Self-Organizing Maps (SOM) effectively differentiate sills, lava flows, and dykes, providing a new framework for identifying potential critical mineral repositories within volcanic systems.

- ***The AASPI Consortium: Building on Kurt Marfurt's Legacy Under Heather Bedle's Direction***

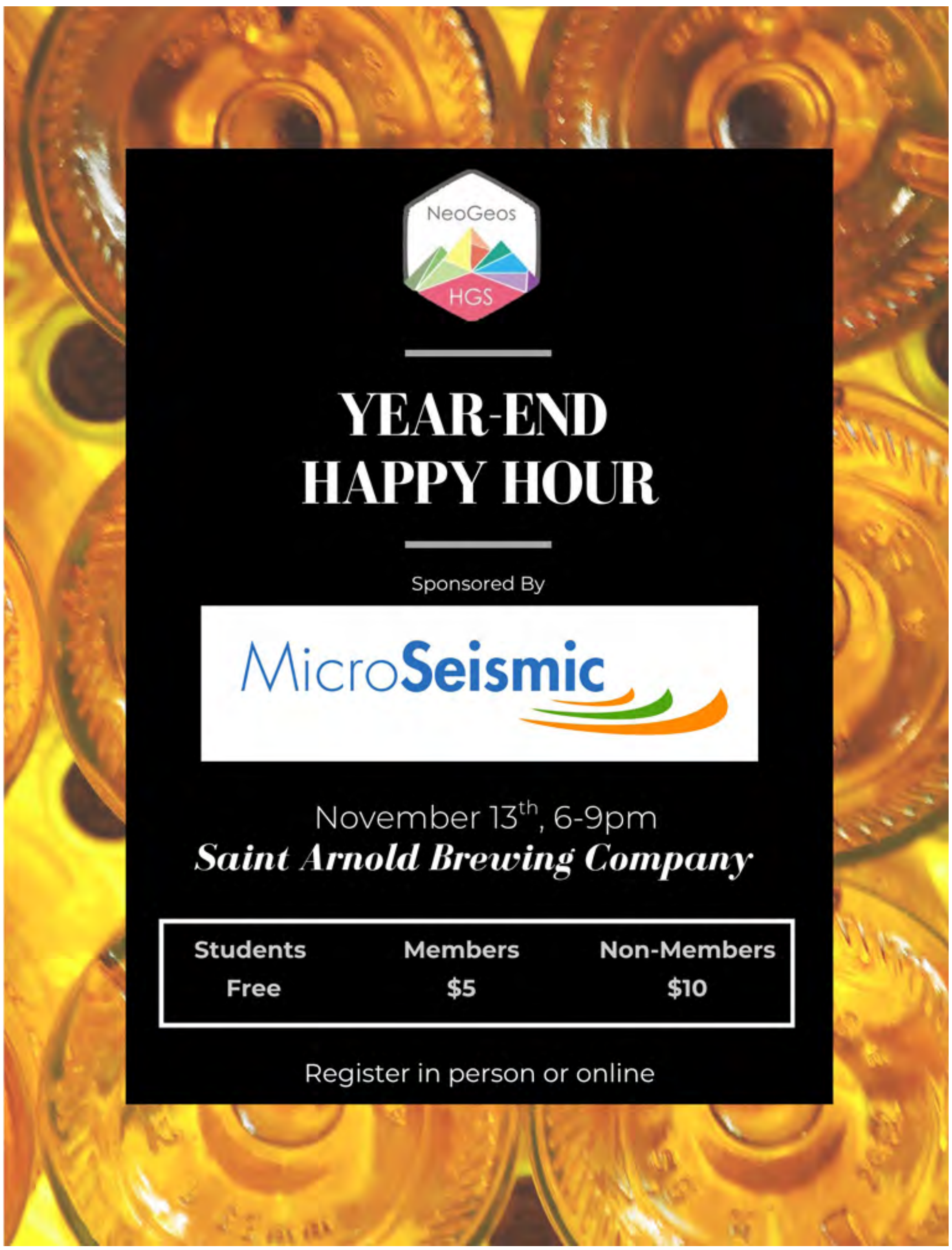
The Attribute-Assisted Seismic Processing and Interpretation (AASPI) consortium at the University of Oklahoma has spent nearly two decades advancing how geoscientists derive insights from seismic data. Founded by Dr. Kurt Marfurt and now led by Dr. Bedle and her team, AASPI continues to develop innovative tools that enhance subsurface interpretation, evolving from seismic attribute analysis to cutting-edge applications in machine learning and explainable AI.

- ***Pivot Profile: Heather Bedle's Journey into Academia***

One of the most formative parts of my experience as a research assistant at the University of Houston was having Dr. Heather Bedle as a mentor through the AAPG Student Chapter. Her energy, generosity, and unwavering belief in her students left a lasting impression. In this issue, we feature her fascinating journey from the defense industry, to oil and gas, and currently, into academia. Seeing how the AASPI consortium is so widely recognized and how she has become a respected leader in her field is both deeply impressive and -to anyone who knew her then- not surprising in the least.

- ***GeoPicks: On the Road for Thanksgiving? Follow Texas Rocks!***

Rasoul Sorkhabi provides a review of *Texas Rocks!* a book by Nathalie and Paul Brandes that takes readers on a geologic journey across the Lone Star State. From the ancient Grenville and Ouachita-Marathon orogenies to the Cretaceous Western Interior Seaway and Miocene basin extensional events, the book highlights six geologic regions of Texas. Perfect for travelers and rock enthusiasts alike, it's a must-have guide for exploring Texas' rich geological heritage.



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HGS University of Houston Sheriff Lecture

From Fiber-Optic Seismology to Geodesy: Operational Early Warning and Real-Time Imaging of Volcanic Eruptions

Norris Conference Center
Town and Country Bvd
November 10, 2025 | 5:00pm to 9:00pm

HGS Member $65.00 | Non-HGS Member $75.00 | Student $40.00

Fiber-optic sensing technologies, particularly Distributed Acoustic Sensing (DAS), are transforming geophysics by repurposing existing fiber-optic cables into dense arrays of strain sensors. This approach enables long-range, long-duration, and cost-effective monitoring across diverse environments. By exploiting the ultra-dense sampling of the seismic wavefield along telecommunication cables, fiber-optic seismology has advanced high-resolution seismic source characterization and subsurface imaging.

REGISTER NOW

Dr. Jiaxuan Li

Surface Curvature: A Powerful Yet Underestimated Attribute. An Example from Colombia

By Luis Alberto Bravo. Eng. MSc. Geophysicist, Independent Consultant. Bravola2@gmail.com

The understanding, characterization and mapping of fracture systems in an area are of vital importance for reservoir development. Seismic interpreters have used attribute maps for fault interpretation since the early days of 3D seismic exploration; however, the real challenge lies in the ability to resolve features as small as possible.

In post-stack seismic data analysis, attributes such as seismic coherence and semblance have been widely used to delineate faults and stratigraphic features across a variety of structural and depositional settings.

Geometric attributes based on the first derivative of a horizon surface, such as dip and dip azimuth, have long been employed for the same purpose. However, they cannot differentiate between asymmetric features such as faults or rapid changes in dip. Attributes based on second derivatives, or curvature attributes, have also proven very helpful in delineating flexures and faults whose offsets are insufficient to generate significant reflector disruptions.

But why is curvature so useful in fracture characterization? Because fractures occur when brittle rocks bend. As the curvature of a surface increases, so does the stress along it, and in the case of carbonates, this deformation typically culminates in fracturing.

Curvature attributes have been successfully applied to fault and fracture prediction and have been correlated with open fractures observed in outcrops and production tests.

Surface-based curvature attributes can reveal subtle structural and depositional elements that are not apparent in other types of visualizations. The combined application of these tools along with visualization techniques, stratigraphic principles, and depositional environment studies, constitutes the foundation of Seismic Geomorphology, a key tool for reservoir characterization.

This article presents an example of the application of curvature attributes computed on a seismic horizon surface corresponding to fractured limestone of the Cimarrona Formation, located in an area of the Middle Magdalena Valley Basin of Colombia.

WHAT IS CURVATURE?

Curvature is a two-dimensional property that quantifies how much a curve deviates from a straight line. In two dimensions, curvature can be defined as the radius of the circle tangent to a curve. If a 2D cross-section is taken through a mapped surface or horizon (see **Figure 1**), and normal vectors to the surface are drawn at regular intervals along the horizon, then, where the horizon is flat, the corresponding vectors are all parallel, and therefore the curvature is zero. Where the horizon has an anticlinal shape, the vectors diverge, and the curvature is defined as positive; where it has a synclinal shape, the vectors converge, and the resulting curvature is defined as negative.

SCALE OF ANALYSIS

The curvature of a horizon is commonly used to infer the deformation state of a stratum. It is assumed that areas subjected to greater deformation, where the calculated curvature is high, tend to concentrate faults and fractures. Bergbauer et al. (2003) computed curvature at different wavelengths by filtering the input horizon and concluded that images at different wavelengths

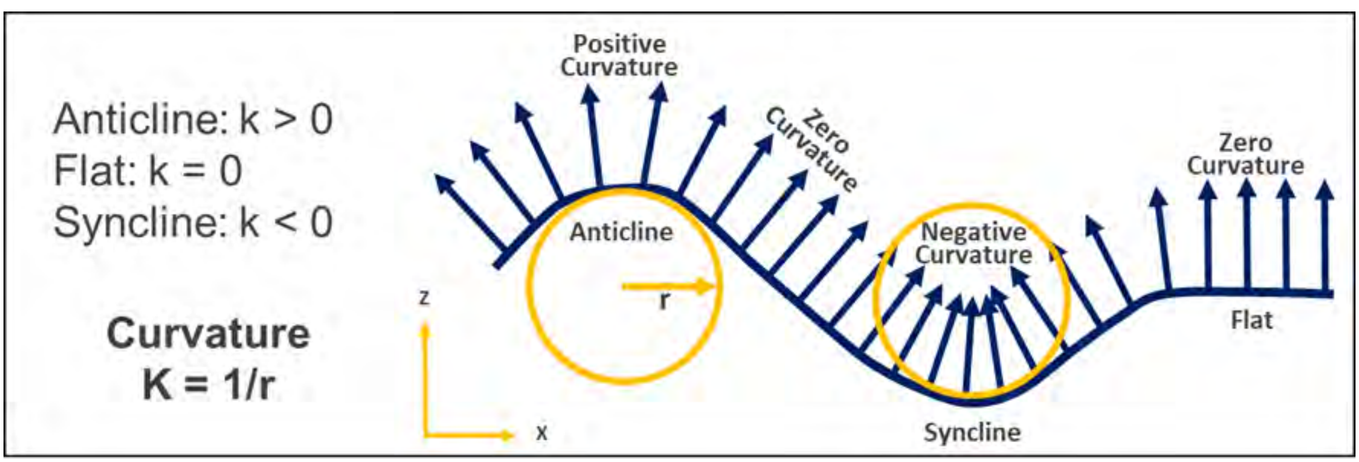

Figure 1. *Definition of curvature in two dimensions. Synclinal features exhibit negative curvature, while anticlinal features exhibit positive curvature. Modified from Roberts (2001).*

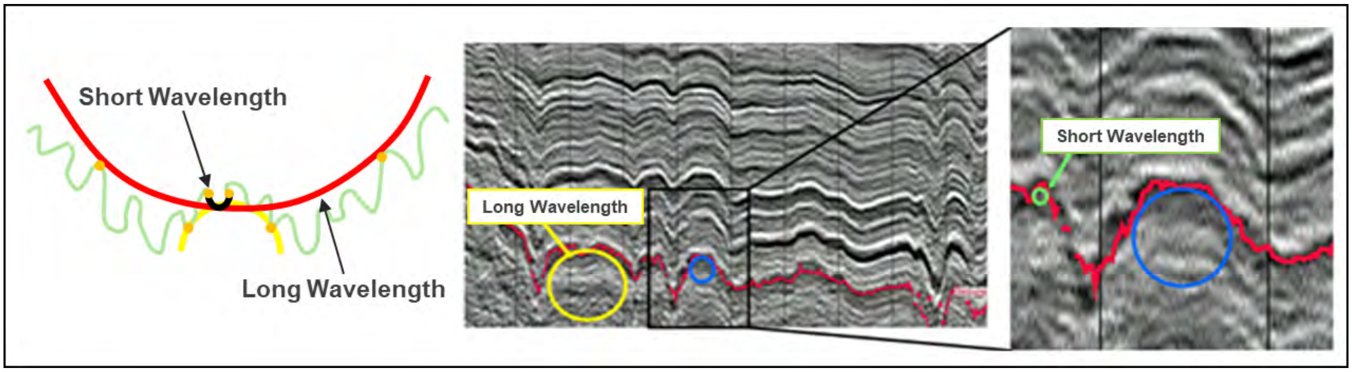

Figure 2. *Different scales in curvature analysis. Note that different features can be observed depending on the analysis scale, providing varying perspectives of the same geology. Modified from Blumentritt et al. (2006); Hart et al. (2007).*

provide distinct perspectives of the same geology.

The sampling of a horizon's geometry considers surface undulations at all scales: long wavelengths, short wavelengths and noise, all of which are included in the curvature computation.

The way curvature is defined directly influences the scale of the feature being observed. By varying the size of the analysis window (or aperture), different wavelength characteristics can be highlighted. With a small aperture, the black event in **Figure 2** is illuminated; a wider aperture enhances the red event; and an intermediate aperture highlights the yellow event.

DEFINITION OF CURVATURE IN THREE DIMENSIONS

When extended to three dimensions, the concept employs orthogonal planes intersecting the surface to measure curvature at a specific point. As illustrated in **Figure 3**, the intersection of two orthogonal planes with the surface defines the maximum curvature (Kmax) and the minimum curvature (Kmin). Other orthogonal planes can describe the normal curvature in the dip direction (Kdip), the direction perpendicular to it (Kstrike), and the curvature along structural contours (Kcontour).

Among the infinite number of normal curvatures that pass through a point on a surface, there exists one that defines the largest absolute curvature, this is called the **maximum curvature** (kmax) and the perpendicular one is the **minimum curvature** (kmin). These represent the extremes of the normal curvatures, and any other normal curvature can be derived from these principal curvatures, as expressed by the Euler curvature equation (Roberts, 2001):

$$k_i = k_{max} \cos^2\delta + k_{min} \mathrm{sen}^2 \delta$$

where δ is the angle between the plane of a particular normal curvature ki and the plane of maximum curvature kmax. This equation establishes that any normal curvature ki can be derived from the principal curvatures (Roberts, 2001):

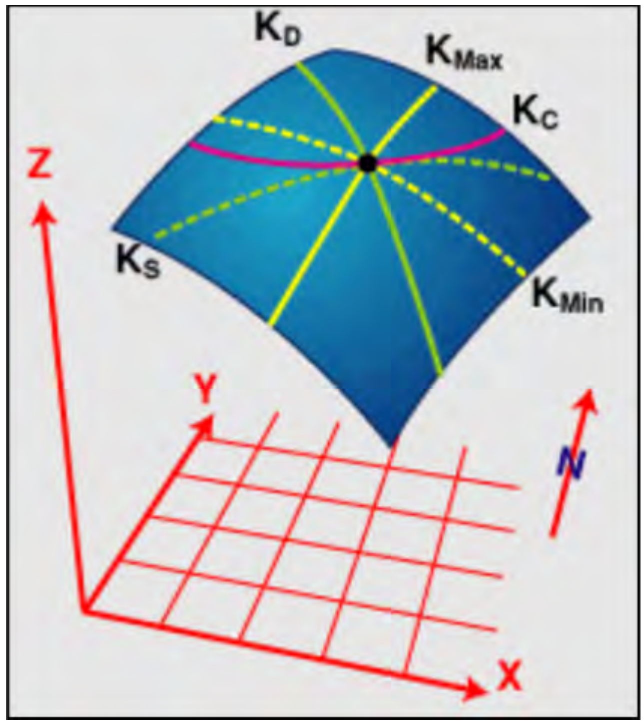

Figure 3. *Intersection of orthonormal planes to a surface defining maximum and minimum curvatures. Adapted from Hart et al., 2007; modified after Roberts, 2001.*

The **Gaussian curvature** can be defined as the product of the principal curvatures and provides a measure of the surface deformation.

The **Mean curvature** is the average between the maximum and minimum curvatures. It is generally dominated by the maximum curvature and, therefore, they often appear visually similar. When combined with other attributes, it can provide additional useful information.

The **Dip curvature** is extracted along the direction of maximum dip and measures the rate of change of dip in that direction. The curvature extracted perpendicular to the dip direction is the

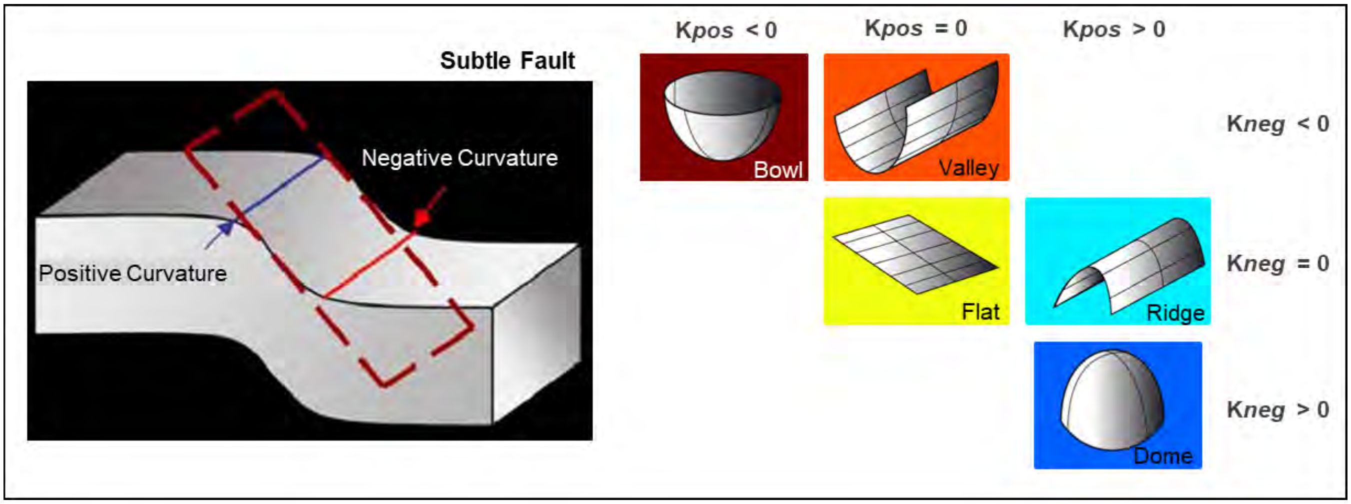

Figure 4. *Geologic curvature classification. High values are observed where horizons are "bent" rather than "broken." Modified from Bergbauer (2003); Mynatt et al. (2007).*

Strike curvature. Strike curvature divides surfaces into ridge and valley. This curvature can be used to examine the influence of a mapped surface on processes such as hydrocarbon migration and drainage efficiency. By defining its connectivity, this attribute can help understand regional migration pathways.

The **Curvedness** curvature attribute describes the overall magnitude of surface curvature, independent of its shape. It represents a general measure of the total amount of curvature present in a surface.

The **Shape Index** is a combination of maximum and minimum curvatures that provides a quantitative definition of local surface morphology, independent of scale. With an appropriate color scale, it describes morphology in terms of bowl, valley, flat, ridge, and dome forms. This attribute is not affected by the absolute magnitude of curvature (except for flat surfaces), thus allowing the highlighting of subtle faults, lineaments, and other structural patterns (Roberts, 2001; Chopra et al., 2007). **Figure 4** shows the classification of the main types of curvature present in geology.

The **Most Positive and Most Negative** curvatures are derived by searching among all possible normal curvatures for the most positive and most negative values, respectively. These enhance faults and small linear features on the surface and are therefore considered among the most useful for interpreting discontinuities associated with faults and flexures.

The Most Positive curvature, with higher positive values, highlights domal and anticlinal features. Conversely, negative values of "Most Positive" indicate bowl-like features. The Most Negative curvature, defined by the most negative curvature value, emphasizes synclinal and bowl-shaped structures, while positive values indicate domal features.

SURFACE CURVATURE: FILTERS

Because curvature is closely related to the second derivative of a surface, its quality is highly sensitive to the level of noise contamination. There are many possible sources of noise in mapped surfaces. The most common in seismic horizon interpretation and in derived attributes include random noise, spikes, and footprint effects (Hall, 2007). By filtering the surface of interest, curvature can be computed at different wavelengths, providing distinct perspectives of the same geology.

Horizons interpreted from noisy seismic data or contaminated with spikes during tracking may produce erroneous curvature measurements. For this reason, it is advisable to apply a spatial filter to the surface before curvature computation, carefully removing noise while preserving the geometric detail of the horizon.

Different types of filters can be applied for this purpose, including:

Median filter, known as an edge-preserving filter. It enhances laterally continuous events by reducing noise. The filter samples data within a chosen aperture along strike and dip, replacing the central sample value with the median of all values within the aperture.

Mean filter, the most common of the linear smoothing algorithms. It tends to remove background noise and, when applied to an interpreted surface, enhances long-wavelength curvature components while suppressing short-wavelength ones.

Maximum filter computes the local maximum value within a selected aperture, whereas the Minimum filter computes the local minimum.

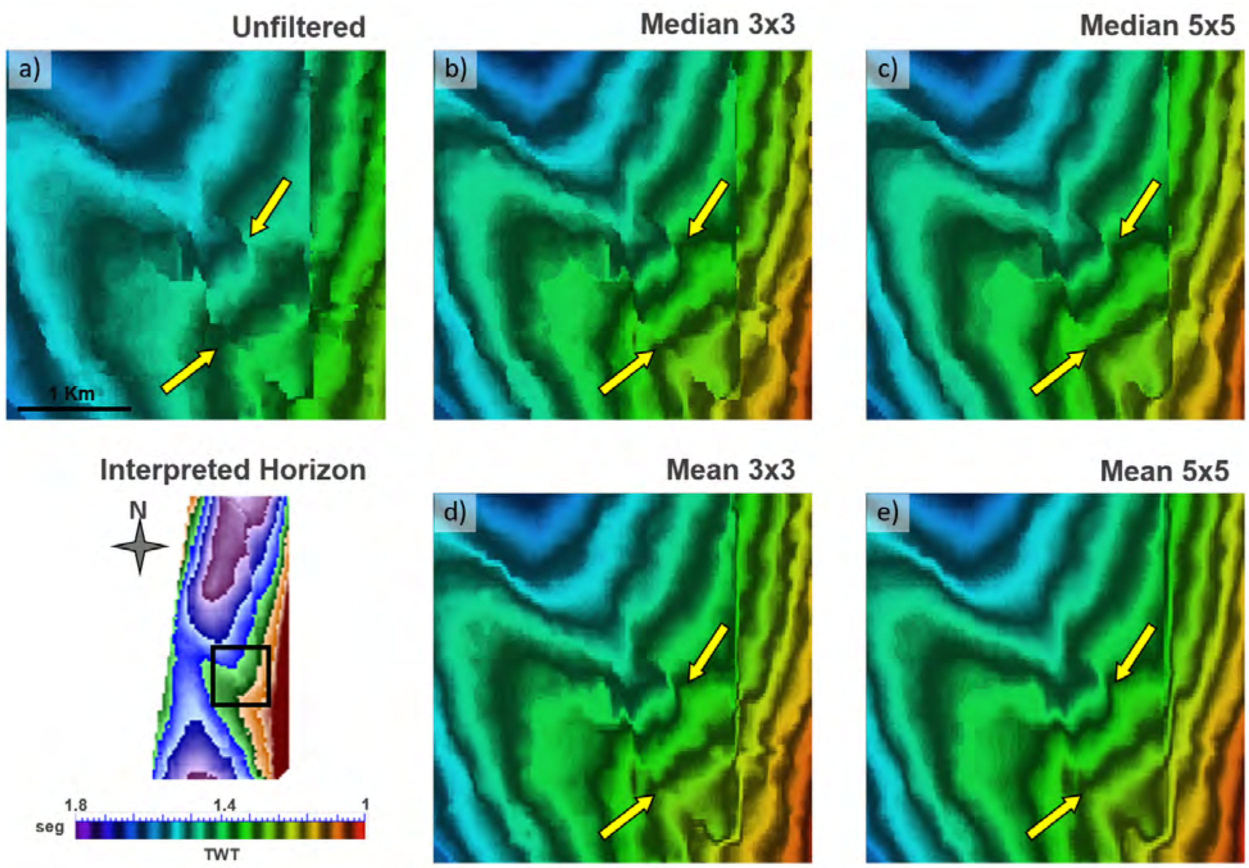

Figure 5. *Impact of spatial filters on an interpreted surface. (a) No filter; (b) median filter with 3×3 trace aperture; (c) median filter with 5×5 trace aperture; (d) mean filter with 3×3 trace aperture (e) mean filter with 5×5 trace aperture.*

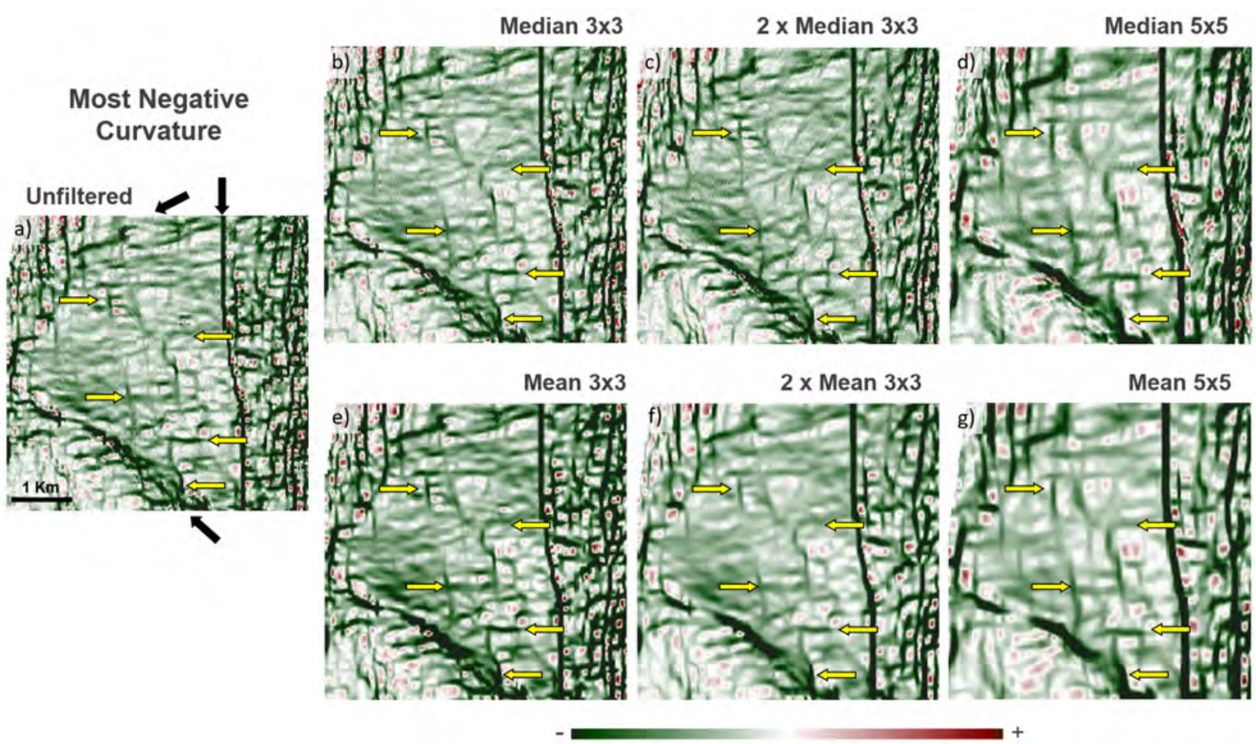

Figure 6. *Impact of filter use on the computation of "Most Negative" curvature. (a) Unfiltered (b) one pass of 3×3 median filter (c) two passes of 3×3 median filter (d) one pass of 5×5 median filter (e) one pass of 3×3 mean filter (f) two passes of 3×3 mean filter (g) one pass of 5×5 mean filter. Black arrows indicate major faults defining the field structure; yellow arrows highlight subtle events emphasized by the curvature attribute.*

The preparation of the surface for curvature computation represents a compromise between effectively removing noise and preserving resolution, avoiding excessive smoothing that could obscure geometric details of the horizon.

To determine the impact of median and mean filters on curvature calculations over the horizon surface, the Most Negative curvature was computed both on the unfiltered surface and on the filtered versions.

Curvature computed from surfaces processed with median filters shows very subtle variations (**Figure 6b, c** and **d**). Because the median filter preserves edges, events remain visible and even enhanced compared to the original map.

In contrast, surfaces derived from the mean filter (**Figure 6e, f** and **g**) appear progressively "cleaner" as the number of samples within the filter increases. Subtle events disappear, and larger-offset faults become more prominent. Although both filters smooth random oscillations, the mean filter tends to eliminate short-wavelength details, the primary focus of this study.

SURFACE CURVATURE: ANALYSIS WINDOW

Among the parameters that must be considered when performing curvature computations, one of the most important is the number of samples included in the calculation.

The minimum wavelength resolvable for surface curvature is determined by the minimum spacing between samples. By varying this spacing, either by filtering the surface beforehand or directly during computation, results at different wavelengths can be obtained, providing distinct perspectives of the same geology.

To illustrate the impact of varying the spatial analysis window on the computation of the Most Negative curvature for the horizon of interest, curvature maps were generated using different aperture sizes over the same area as shown in **Figure 6**.

In general, the same lineaments can be identified in all maps in **Figure 7**. However, as the aperture increases, the lineaments corresponding to short-wavelength events gradually disappear, while longer-wavelength features begin to emerge. Another interesting effect of increasing the analysis aperture is that when the curvature is calculated at a wavelength greater than the target wavelength occurs a superposition of events of different wavelengths is observed due to aliasing, illustrated in the curvature images by the yellow arrows.

The minimum wavelength resolvable for surface curvature is defined by the minimum sampling interval or the "grid" spacing used to construct the surface. In the horizon surface corresponding to the Cimarrona Formation limostone, a 3×3-trace spatial aperture combined with a median filter proved

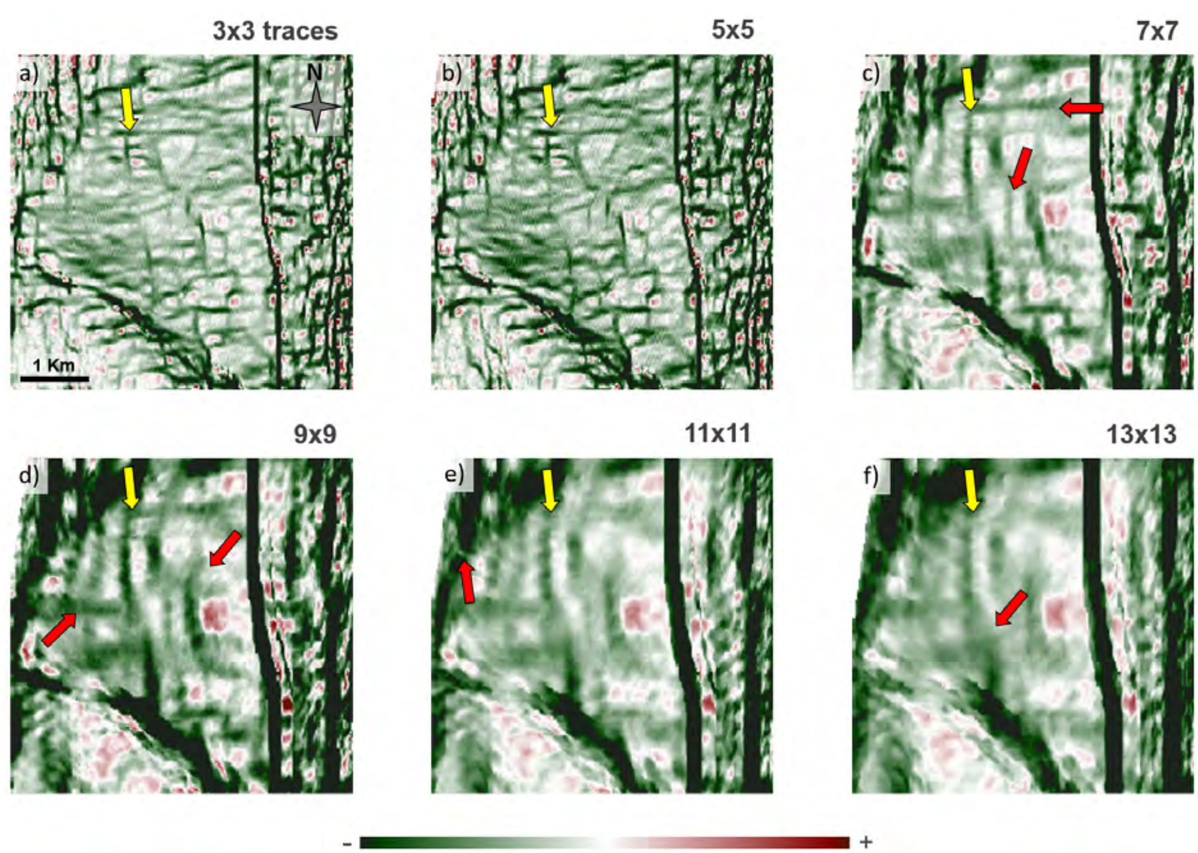

Figure 7. *Impact of varying the spatial analysis window on the computation of "Most Negative" curvature. Spatial aperture of (a) 3×3 (b) 5×5 (c) 7×7 (d) 9×9 (e) 11×11 and (f) 13×13 traces, respectively. Note that as aperture increases, short-wavelength lineaments (yellow arrows) gradually disappear, while longer-wavelength events (red arrows) become more apparent.*

effective in highlighting the short-wavelength events that were the focus of this study.

CURVATURE: APPLICATION AND DISCUSSION

Various geological features can be highlighted at different wavelengths; however, it is difficult to predict precisely which type of curvature will be most appropriate in any given situation. Therefore, it is recommended to test different combinations of curvature type and aperture size depending on the objective of the analysis. If an interesting result is obtained, adjusting the color bar and illumination angle can enhance the visualization of events of interest, whether small-scale stratigraphic features or structural elements. The seismic response of the carbonate from the Cimarrona Formation represents a highly competent horizon, whose surface provides excellent quality input data for curvature analysis.

Below, the results obtained from the calculation of different types of curvature on the surface of the horizon of interest are presented and briefly discussed; a more extensive analysis of each case can be found in Bravo (2010).

Different types of curvature are illustrated in **Figure 8**. The Dip curvature shows the variation along the dip direction. The highest values identify lineaments corresponding to faults that cut across the field structure, indicated by black arrows. The Contour and Strike curvatures are visually very similar; both represent curvature perpendicular to dip and efficiently highlight short-wavelength flexures related to the axes of the field's synclinal structure (yellow arrows).

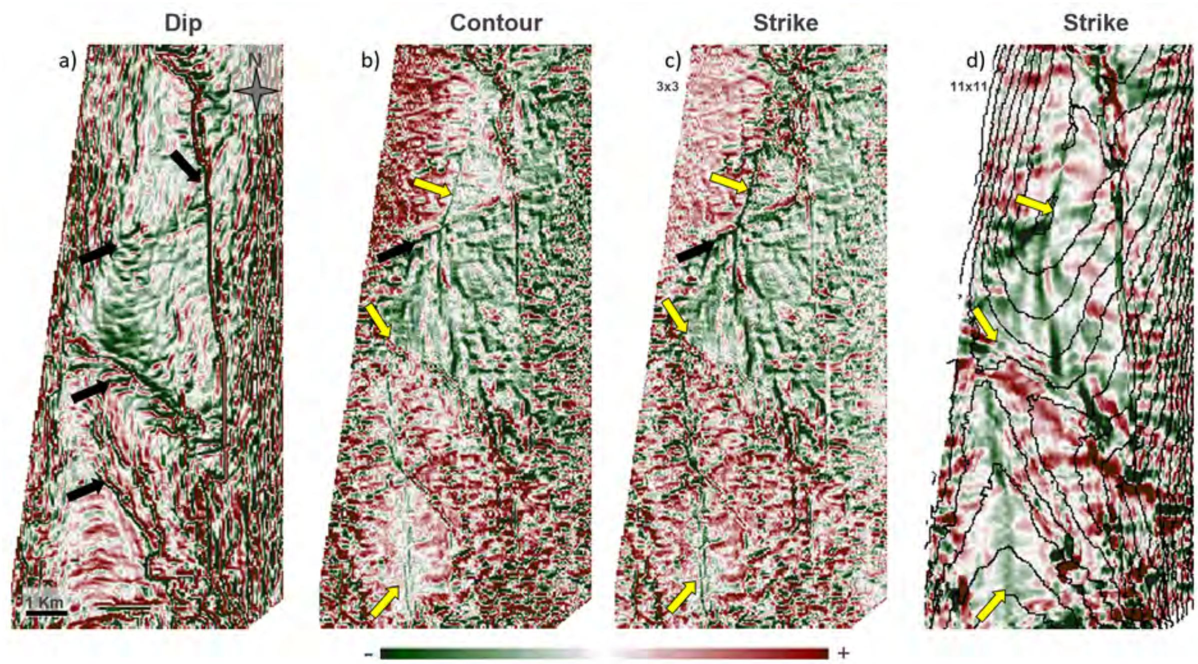

Figure 8. *Curvature computed on the horizon surface. (a) Dip curvature (b) Contour curvature (c) Strike curvature (d) Strike curvature overlaid with structural contour map in two-way time (twt). Note that a spatial aperture of 3×3 traces enhance short-wavelength events in (a), (b) and (c), whereas in (d) with a larger wavelength, the structural axes become clearly visible.*

Other types of curvature are shown in **Figure 9**. Curvedness curvature attribute describes the total amount of curvature present on the surface, revealing different aspects of the fault pattern depending on the spatial analysis window. Relatively small Curvedness values indicate areas where the surface is less "bent". The Mean curvature on the Cimarrona Formation horizon is dominated by the maximum curvature and, like previous attributes, delineates both interpreted faults (black arrows) and some trends introduced by the interpreter during amplitude tracking (yellow arrows). The maximum absolute values of the "Gaussian" curvature (red and blue colors) appears to correlate closely with the interpreted faults on the horizon, while minimum values (green) correspond to less deformed areas. This suggests that this attribute is less effective for delineating small-offset faults.

Similar to the attributes discussed above, the Shape Index in **Figure 10**, allows a scale-independent definition of surface morphology. This means that a bowl or dome shaped feature maintains the same form whether analyzed with a 3×3 trace or 11×11 trace aperture. By appropriately adjusting the color scale in the Shape Index attribute, specific structures on the horizon surface can be examined, highlighting short-wavelength geological features with positive (dome or crest) or negative (bowl or valley) shape index values.

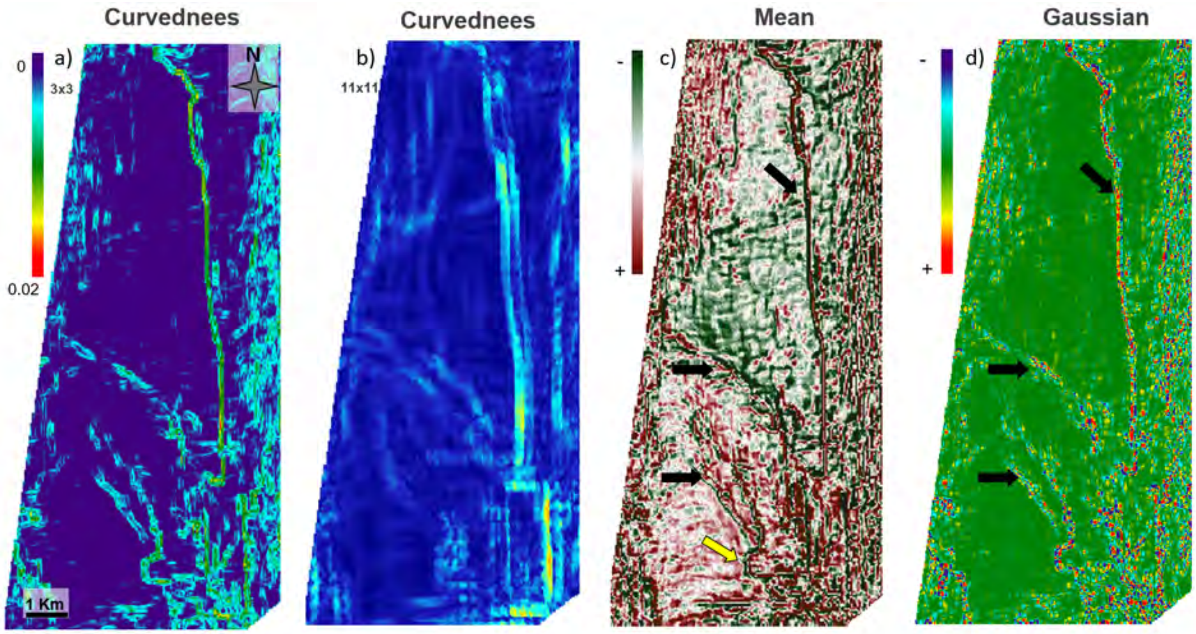

Figure 9. *Curvature computed on the horizon surface. (a) Curvedness (3×3 aperture) (b) Curvedness (11×11 aperture) (c) Mean curvature (d) Gaussian curvature. Note the sensitivity of the Curvedness attribute to the spatial analysis window aperture.*

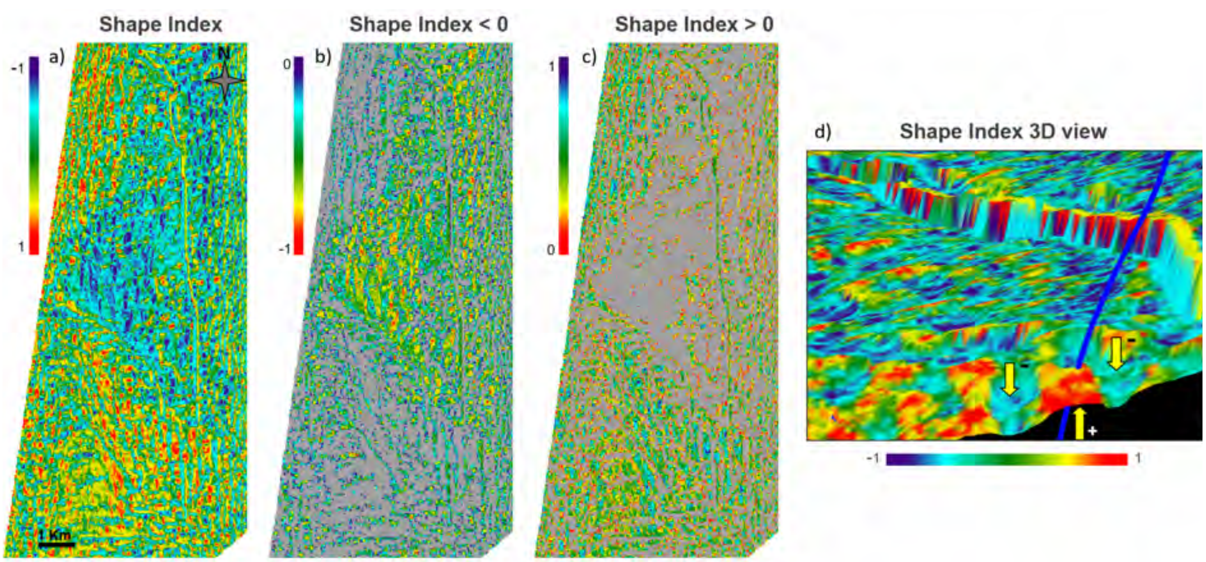

Figure 10. *Classification of geological features according to the Shape Index on the target horizon surface. (a) Total Shape Index (b) Negative Shape Index (c) Positive Shape Index (d) Shape Index 3D view. Yellow arrows indicate structures with positive and negative shape index values, respectively. As the shape index approaches zero (0) the geological features become increasingly elongated.*

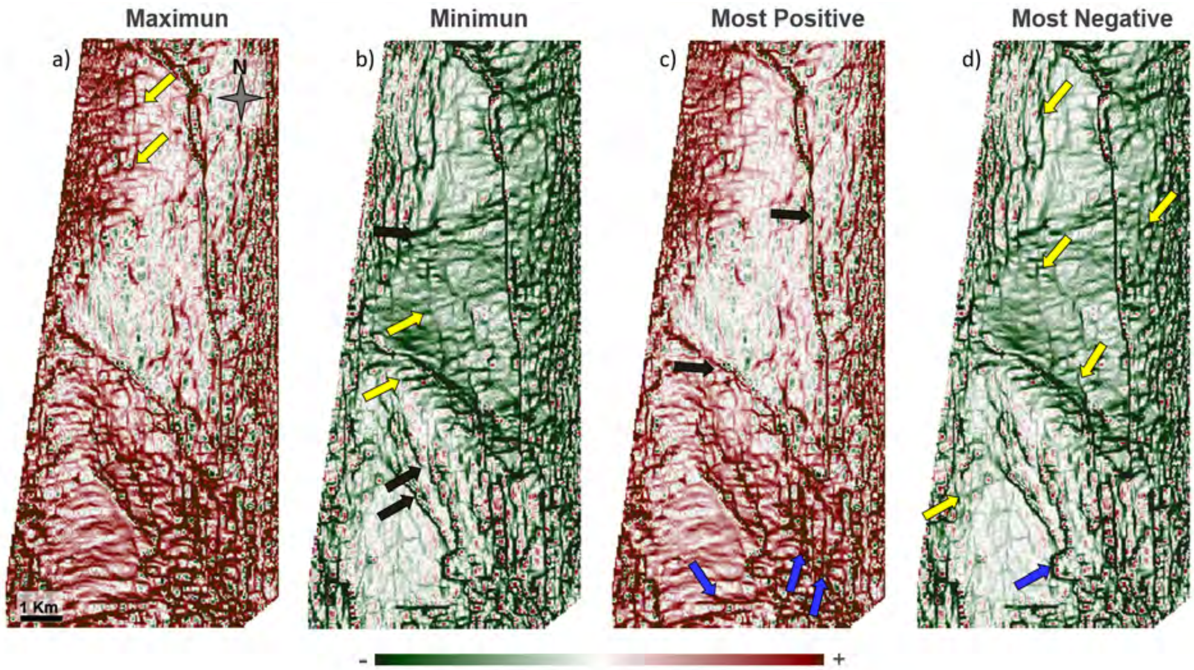

Figure 11. *Curvature computed on the horizon surface. (a) Maximum curvature (b) Minimum curvature (c) Most Positive curvature (d) Most Negative curvature. Black arrows indicate faults that cross the field structure; yellow arrows highlight short-wavelength flexures; blue arrows indicate trends introduced by manual interpretation.*

The Most Positive and Most Negative curvature attributes can be considered the most valuable for interpreting discontinuities associated with faults and/or flexures. The "maximum" and "most positive" curvature attribute maps in the Cimarrona Formation show very similar results, as do the "minimum" and "most negative" attributes, demonstrating ambiguity in the results for these attributes (**Figure 11**).

Several lineaments can be identified across the attributes. Some converge at maximum absolute curvature values, clearly delineating faults that cut across the synclinal structure, which locally dominate the curvature spectrum in the vicinity of faults (black arrows in **Figure 11**). Other trends, generated by the interpreter during horizon tracking, are indicated by blue arrows in Figure 11. Consistent minor lineaments not previously observed in the interpretation or in other attributes, correspond to short-wavelength flexures on the horizon surface, highlighted by yellow arrows. In these attributes, a fault may be represented by the superposition of positive and negative curvature values.

CONCLUSIONS

Curvature attributes applied to a surface can reveal valuable information for visualizing seismic geomorphology related to discontinuities, faults, folds, and flexures.

In the Cimarrona Formation, they proved highly useful for identifying short-wavelength flexures associated with fractures in carbonates.

The Most Positive and Most Negative curvature attributes enabled a more detailed interpretation of small-offset faults and flexures compared to other attributes, while the Strike curvature proved particularly effective in highlighting short-wavelength flexures associated with the axes of the field's synclinal structure.

Each curvature attribute tends to emphasize different geological and/or structural features. Because curvature is closely related to the second derivative of the surface, it is highly sensitive to random noise and spikes that may have been introduced during reflector tracking, therefore the surface-based analysis is significantly influenced by the interpreter's ability to correctly perform this task.

Curvature is independent of surface orientation; therefore, curvature values do not change if the surface is rotated or tilted. This is not the case for first-derivative methods (e.g., *Dip or Dip-Azimuth*), where rotation or inclination alters the attribute values.

Applying spatial filters to the horizon surface prior to curvature computation is a crucial step for obtaining reliable results. Special care must be taken to use appropriate filters that remove noise while preserving the geological features of interest, considering that the minimum wavelength for surface curvature is determined by the minimum spacing between the samples or the "grid" with which it is constructed.

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WELCOME TO NEW MEMBERS, EFFECTIVE OCTOBER 2025

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Locating Volcanic Facies to Find Critical Minerals Through the Lens of Seismic Attributes and Machine Learning

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SUMMARY

Critical minerals (CM) play a pivotal role in sustainable resource development, with volcanic facies (VF) being one of their sources of exploration. These minerals often accumulate in some VF and scatter in the tectonic fractures due to hydrothermal processes. Seismic attributes provide a powerful tool for identifying VF by enhancing the interpretation of subsurface features, fractures, and lithological variations. This study presents a novel integration of targeted seismic attribute selection with unsupervised machine learning (ML) to differentiate between volcanic facies types in the context of critical mineral exploration. We use a suite of 22 seismic attributes to study an area in the Otway Basin in South Australia. Six attributes, such as root mean square (RMS) amplitude, dip, Hilbert transform, sweetness, relative acoustic impedance, and amplitude volume transform (AVT) were selected as the most optimal attributes in locating sills and lava, whereas sweetness, similarity, AVT, and aberrancy were optimal to map dykes. These attributes were used to create unsupervised ML models based on Self-organizing maps (SOM) and Independent Component Analysis (ICA). Our results show that the SOM method is more helpful in discretizing between sills and lava as well as showing dykes. Unlike previous approaches that rely on singular attributes or supervised classification, our methodology demonstrates that specific attribute combinations processed through SOM can effectively discriminate between closely related volcanic features such as sills, lava flows, and dykes. This enhanced discrimination capability provides a new framework for identifying potential critical mineral repositories within volcanic systems.

INTRODUCTION

Critical minerals are essential in energy-related technologies and are increasingly sought in industry. Volcanic facies form in specific depositional and structural environments and host mineralization (Sheriff and Geldart, 1995; Brown, 2011). To study volcanic facies, an interpreter should find a relationship between the volcano, geological setting, and magma (Kereszturi and N´emeth, 2013; Zeng et al., 2023). Subsea volcanoes have certain facies that include tuff-filled craters, lava, sill, and dykes (Moore, 1985; Loucks and Reed, 2022). Volcanic facies can be studied using geophysical surveys (Garcia et al., 2012) such as seismic methods (Jackson et al., 2013). Among seismic techniques, seismic attribute calculation is a beneficial method for delineating volcanic facies (Loucks et al., 2023; Zeng et al., 2023). Seismic attributes are calculations and algorithms extracted from seismic volumes (Subrahmanyam and Rao, 2008; Chopra and Marfurt ,2005). Seismic attributes, whether geometric or physical, can aid in interpreting volcanic facies by studying their lithology, physical geometry, and discontinuity (Bischoff et al., 2019; Subrahmanyam and Rao, 2008). In this study, we evaluate the significance of seismic attributes in characterizing and identifying volcanic facies. Moreover, we assessed the use of unsupervised ML techniques to form a ground for discriminating between different volcanic facies.

GEOLOGIC SETTING

The seismic data belongs to the Otway Basin's Flanagan survey (Figure 1a). This basin is located 50 kilometers southeast of the Australian coast. It borders to the south with the Sorel Basin and on the east side with King Island Heights. The Otway basin is a NW-oriented multi-stage rifted passive zone that extends to the NW coast of Tasmania and formed after the opening of Gondwana and the south ocean. The lithospheric stretching has led to the creation of synchronous volcanoes, grabens, and volcanic facies

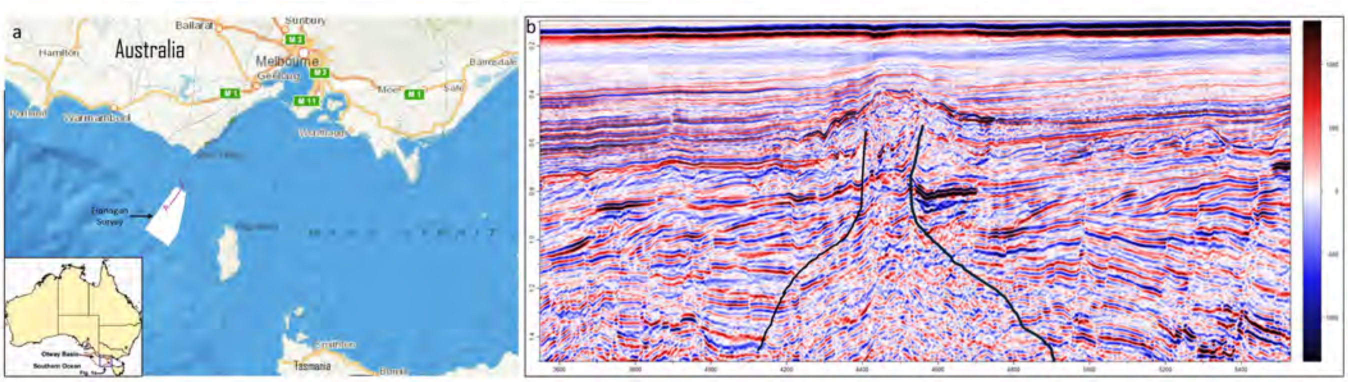

Figure 1. *(a) Geological setting (b) Seismic amplitude (A-A') showing a volcano in the middle segment of the panel*

at the time of separation, which are now buried (Holford et al., 2017; Reynolds et al., 2017; Kumar et al., 2022; Niyazi et al., 2022)

METHODOLOGY AND WORKFLOW

We calculated over 22 seismic attributes, both geometric and instantaneous. First, the data were cropped to reduce the computational load, then attributes were applied to the cropped volume. After checking the best results of each attribute and correlating the best ones with geology, we finalized the list of attributes to the final six: Hilbert transform, sweetness, relative acoustic impedance, AVT, RMS amplitude, and dip. We later added similarity and aberrancy to target vertical features such as dykes and faults. Selected attributes were thereafter used in ML algorithms. In particular, two unsupervised ML algorithms were run to delineate volcanic facies. Self-organizing maps (SOM) and Independent Component Analysis (ICA) were selected in individual steps to target specific facies (**Figure 2**).

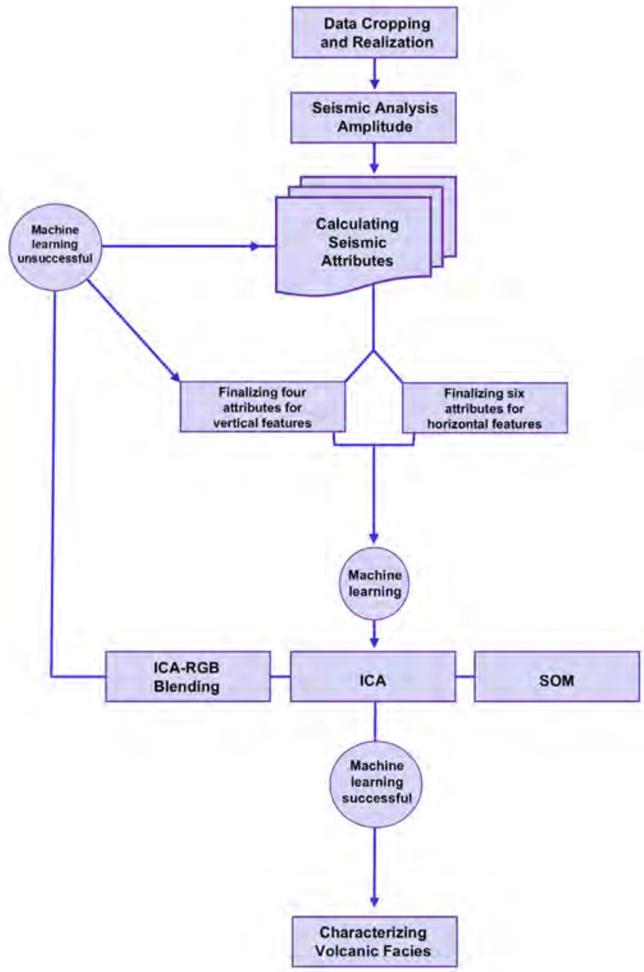

Figure 2. *Workflow to perform an unsupervised seismic facies analysis to differentiate between VFs*

Self-Organizing Maps

SOM is an ML technique that is helpful in dimension reduction, clustering, data visualization, and organizing information in a rational order (Guthikonda, 2005). At a fundamental level, it receives high-dimensional data and projects it into lower-dimensional data. Therefore, SOM projects the input seismic attributes into simplified 2D maps in a topologically ordered fashion while maintaining the main topological structure of the input data to discover patterns in the data set, which does not require labeled data. Moreover, SOM outputs a grid of nodes or neurons in a lower dimension than the input data (Klose, 2006). In this research, we use this algorithm for horizontal and vertical geologic bodies. Separate steps and workflows were developed with different attributes targeting horizontal and vertical features.

Independent Component Analysis

ICA is an ML method that extracts independent components from a large data set. The main objective of ICA is to separate statistically independent sources in a non-Gaussian manner from a mixture of original input datasets (Hyvarinen and Oja, 2000, Lubo-Robles et al., 2019). We used ICA to attempt to discriminate between sill and lava and find vertical features such as dykes and faults.

RESULTS AND DISCUSSION

We study the existence of volcanic facies in our seismic volume. **Figures 3 to 5** show some of the selected attributes that best describe the interpreter VF along vertical sections AA' and BB'

AVT processes seismic data to enhance the changes in seismic amplitude and energy signals. Figure 3 demonstrates the results of AVT amplitude applied to our data. This attribute managed to highlight some features that appear to be potential sills and lava

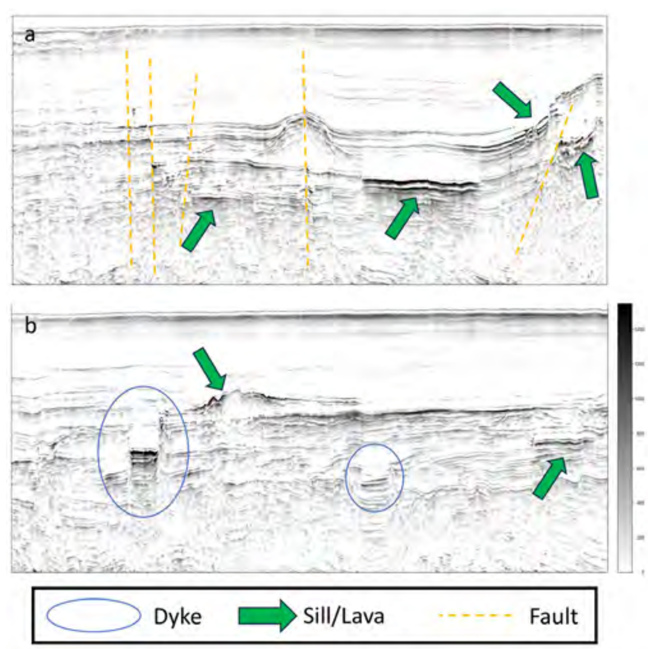

Figure 3. *AVT Attribute*

(green arrows). Normal faults are delineated using this attribute, and grabens are also visible. Distinguishing between sills and lava is not easy in this Figure, as both signals tend to be similar.

RMS amplitude (**Figure 4**) helps with distinguishing between sill and lava. This attribute calculates the square root of the average amplitudes over a time window and provides a measure of the total energy of the seismic signals. **Figure 4** shows that the energy signals received from sills (yellow arrows) are stronger than those from lava (black arrows). This could be because sills have coarser grains than lava, and with lava being porous, it propagates a lower energy. This attribute managed to characterize sill and lava individually. This can help locate critical minerals more easily because, depending on the composition of the magma, rare earth elements and minerals such as niobium, zirconium, nickel, cobalt, platinum group elements, titanium, monazite, graphite, etc., have the potential to develop in some sills (Barnes et al., 2010; McLemore et al., 2025)

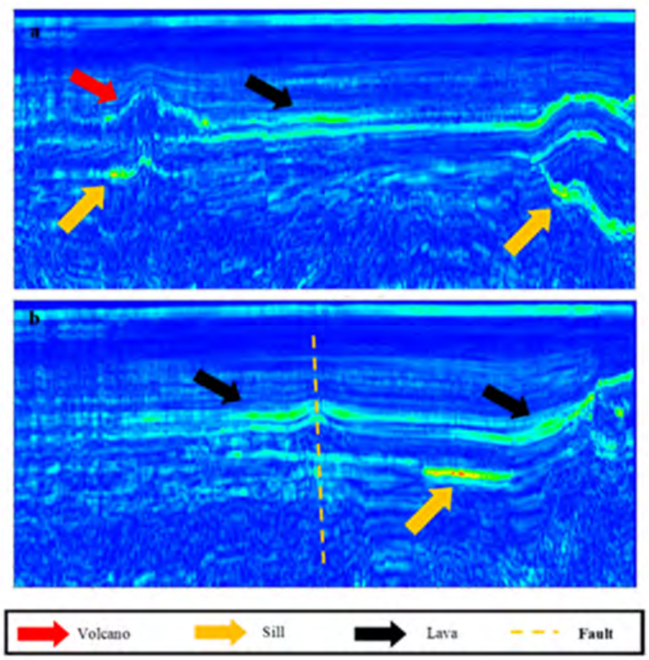

Figure 4. *RMS amplitude selected slices*

Hilbert transform (**Figure 5**) delineated between the top and the bottom of the sills. It analyses the 90-degree phase- shifted signals and the amplitude and phase by pronouncing energy variations, focusing on boundaries. **Figure 5** shows that the Hilbert transform managed to characterize the top and the bottom of the sills (red arrows) and distinguish between them and the lava (black arrows). After the selection of successful attributes for sill detection, these were used as input for SOM and ICA to better understand the variations of volcanic facies in our study area (**Figure 6**).

Figure 6 shows that the SOM algorithms managed to characterize between sills and lava accurately. The assigned colors of this algorithm are different for these two different features. The red arrows represent the sill formations where the top and the bottom of sills are represented with two different assigned colors compared with the middle core, while lava has been identified with only one color. However, the ICA result (**Figure 6b**) treats both sill and lava similarly, making interpretation more difficult as it fails to distinguish between them.

Other Facies and their Genesis

We further investigated the data set to identify other volcanic facies

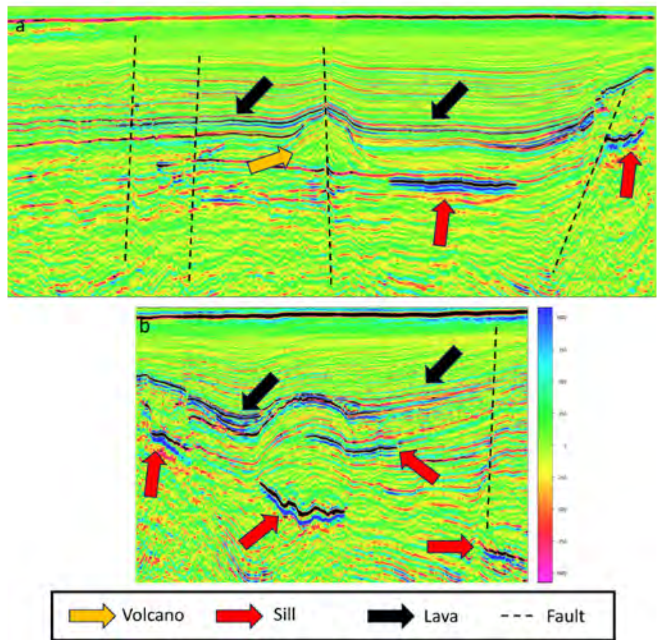

Figure 5. *Hilbert transform slices*

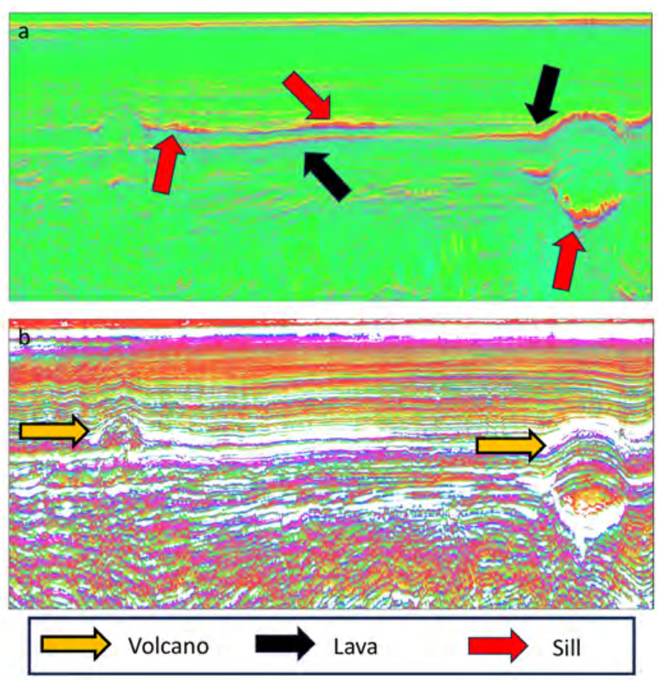

Figure 6. *Machine learning results: (a) SOM (b) ICA*

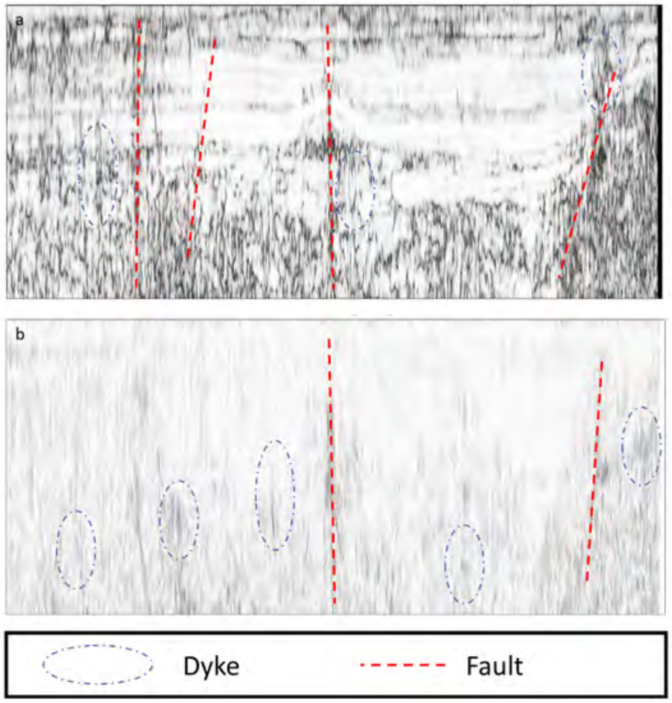

Figure 7. *Potential dyke depiction. (a) aberrancy (b) similarity showing potential dykes*

such as tuffs, and dykes. The most challenging part of our study was delineating the dykes. These geological bodies are thin and vertical, which makes them hard to visualize in seismic profiles. Zeng et al. (2023) used a combination of frequency domain attributes and RGB blending next to similarity for mapping these bodies. We attempted to use geometric attributes (**Figure 7**) to follow their approach.

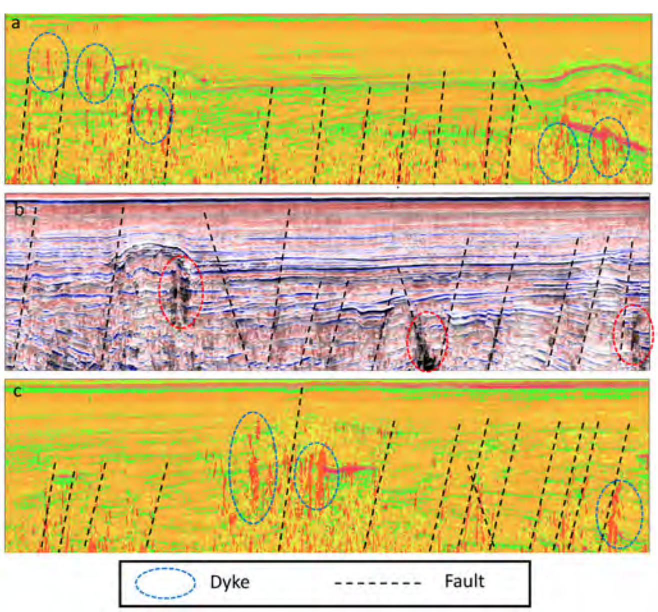

Figure 8. *Unsupervised machine learning models of potential dykes (a, c) SOM (b) ICA*

Table 1. *Success and Failure of Methodologies*

Target Volcanic Facie	Finalized successful attributes	Machine learning method	Success
Lava Flow	relative acoustic impedance sweetness envelope RMS	ICA	
Sill	RMS Hilbert transform AVT envelope	SOM	
Dyke	Similarity Aberrancy sweetness	SOM/ICA	
Pyroclastics	Envelope Sweetness AVT RMS GLCM		
Volcano	Envelope RMS amplitude	ICA	

**Green color indicates success, and red color indicates the failure of the methodology*

As seen in **Figure 7**, simple use of geometric attributes can shed some light on the potential existence of vertical features, yet the resolution and accuracy can be insufficient. To improve our results, we used a combination of similarity, aberrancy, AVT, and sweetness and used SOM and ICA to map the dykes and attempt to distinguish between them and surrounding faults (**Figure 8**).

Figure 8 shows that ML works for unmasking vertical features. The dashed ovals mark what we believe to be the dykes in this zone. The formation of the volcanoes appears to follow the pattern of major faults in the region. These faults occurred deeper than the volcanoes, forming a root to originate the volcanic facies. After the volcanoes were developed, they created an uplift force that created the surrounding secondary faults (**Figure 8**).

Seismic attributes have successfully unmasked the volcanic facies (**Table 1**). Sill, lava, and dykes have spread over the tectonic activities, faults, and volcanoes. The existence of dykes in this region goes back to the separation of Gondwana where magma was transported to the surface via dykes and faults, and this was established by Jackson (2012) and Kumar et al. (2022). During the separation, extensive tectonic stresses led to widespread magmatic activity and the emplacement of large dyke swarms across various continental fragments. As the supercontinent rifted apart, lithospheric extension created deep fractures that facilitated the intrusion of magma, forming the dykes (Will & Frimmel, 2013). However, these features are too steep and hard to map. **Figure 7** shows that geometric attributes have located vertical features that we interpret as sub-volcano dykes. **Figure 8** presents the results of SOM and ICA applied to selected attributes targeting those dykes. The analysis reveals that these intrusions are predominantly located around volcanoes and faults. While some faults are filled with intrusions, others exhibit no evidence of such features. Our analysis reveals three distinct types of vertical features:

(1) faults, (2) faults filled with magmatic intrusions, and (3) dikes, which are purely magmatic intrusions. The interpreted dikes (blue ovals in **Figure 8**) extend from the base of the volcanoes to the surface, occurring independently of faults but predominantly around and beneath the volcanic structures (Calvès et al., 2011). Dyke intrusions tend to be cut by sills (**Figure 8c**) as they normally occur first geologically. More focus on RGB blending and frequency tuning in future attempts can delineate the dykes with better accuracy (Zeng et al., 2023).

CONCLUSIONS

We used 22 seismic attributes to study volcanic facies in a geological setting south of Australia. Our findings indicate that some geometric and instantaneous (also spectral?) seismic attributes can differentiate between volcanic facies and their backgrounds. Six of our attributes (RMS amplitude, dip, Hilbert transform, sweetness, relative acoustic impedance, and AVT) managed to delineate features such as sills and lava. In addition, ML found volcanic facies. While ICA failed to differentiate between sill and lava, SOM characterized between those two. Furthermore, our analysis with the selected attributes (similarity, aberrancy, sweetness, and AVT) have shown that other volcanic facies such as dykes exist in the region. Both SOM and ICA managed to delineate the dykes and distinguish between them and faults. This workflow aids exploration geologists in identifying volcanic facies associated with critical minerals by providing optimized seismic attribute combinations and ML parameters. By enhancing the differentiation of similar volcanic features, it reduces drilling uncertainty and improves targeting efficiency, ultimately boosting the success of critical mineral exploration in volcanic terrains worldwide. Finally, more research is required to study the existence of other volcanic facies in the region.

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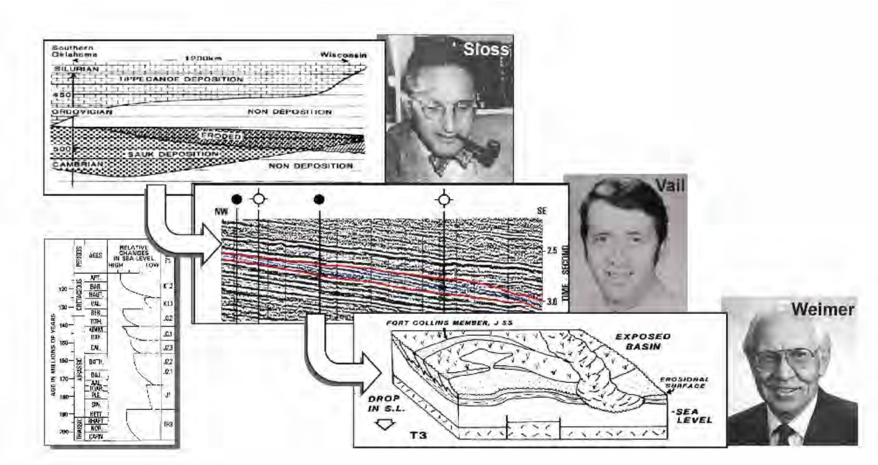
The GCSSEPM Foundation 41st Annual Perkins-Rosen Research Conference

17-19 November 2025 Houston, TX

Cycles and Sequences, So What?

A 21st century perspective in memory of Peter Vail, Bob Weimer, and Larry Sloss

Announcement and Call for Papers



With the recent passing of Pete Vail and Bob Weimer and the approaching 50th anniversary of the publication of AAPG Memoir 26, not to mention the recent retirements of the 1st generation that grew up with Memoir 26 and the rise of new generations of practitioners and innovative techniques, it is a propitious time to take stock of sequence stratigraphy in particular and applied stratigraphic analysis in general: where it came from, where's it going, and what's it good for…and to pass along hard-won practical lessons.

This year's conference features a hybrid program of short talks by practitioners who worked with Vail, Weimer, and Sloss, as well as those who have applied and expanded their concepts, hands-on exercises, discussions, case-study talks, and panel discussions that illustrate each of four focus areas:

- **Historical Perspectives** on the development of present-day integrated stratigraphic analysis since Sloss (e.g., incorporation of high-resolution age control and seismic, expansion to non-marine systems, etc.).
- **Regional- to basin-scale** concepts and applications (e.g., cycle chart uses and abuses, tectonic influences, systematic changes in reservoir-target age across a basin, etc.).
- **Play- to field-scale** concepts and applications (e.g., incised valleys, resource plays, sub-unconformity plays).
- **Practical applications** and tools for energy and other resources (groundwater, GCS/CCUS, H2 storage) and planets.

This program will offer opportunities to examine classic data sets in a series of collaborative exercises, affording a shared experience to focus discussion of foundational concepts…and assumptions…considering more than 50 years of application, experience, and innovation. We welcome industry and academic practitioners who have tested, applied, improved, and expanded these concepts, students and practitioners who would benefit from understanding their development and application, and researchers looking for new opportunities to advance these concepts.

We invite a diverse set of papers illuminating the history of integrated stratigraphic analysis and the near-term and long-range future, especially those that explore the practical application of such analyses to hydrocarbon and critical mineral exploration, groundwater, geothermal, and emerging resource exploitation, and the interpretation of the geological history of Earth and Mars. Student posters and presentations are encouraged.

Organizing Committee - Conveners

Kevin Bohacs: bohacsk@gmail.com; KMBohacs GEOconsulting LLC, Houston, Texas
Art Donovan: art.donovan@tamu.edu; Professor & Director UROC, Texas A&M University
Jack Neal: jeneal2022@gmail.com; Consultant, Houston, Texas
Keith Shanley: keith_shanley@oxy.com; Geological Consultant, Oxy Petroleum, Denver, Colorado
Steve Sonnenberg: ssonenberg@mines.edu; Colorado School of Mines, Golden, Colorado

Important Dates and Deadlines Perkins-Rosen Research Conference 2025:

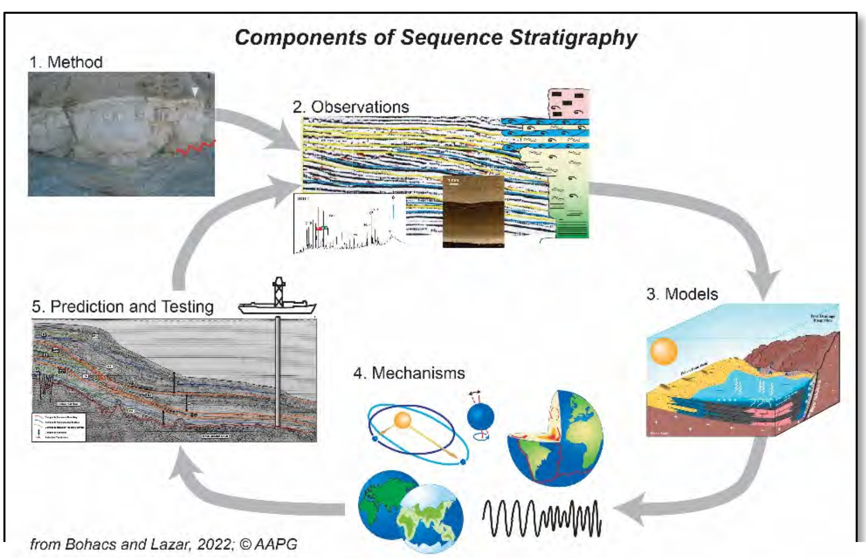
June 1, 2025	Expression of interest: Provide title of presentation and brief abstract
June 30, 2025	Preliminary Program Announced
August 4, 2025	Abstracts, Extended Abstracts and Full papers due
October 3, 2025	Final revised manuscript and illustrations due
November 17-19, 2025	Conference in Houston

Abstract submission opening soon at: https://sepm.org

Venue to be announced soon at: https://sepm.org

The GCSSEPM Foundation supports and follows the SEPM Code of Conduct

For more information, or to sponsor the Conference, contact John R. Suter, Executive Director, The GCSSEPM Foundation at gcssepm1@gmail.com.



The Houston Museum of Natural Science Committee and the Educational Outreach Committee present:

GEMS Day

November 8, 2025 | 9:00 am – 1:00 pm.

Grand Hall and Glassell Hall

Join us for this annual event on **November 8th from 9:00 am – 1:00 pm.** GEMS (Girls Exploring Math and Science) Community Booths will be in the Grand Hall and Glassell Hall, providing interactive activities and giveaways. Past STEM Days have included touchable museum specimens, virtual reality experiences, and more! With admission to the museum, Girl Scouts will also have an opportunity to visit booths run by local troops and schools, competing for Scholarship Award! Girls Exploring Math and Science (GEMS) is presented by CITGO Petroleum Corporation.

HOUSTON MUSEUM *of* NATURAL SCIENCE

HOUSTON GEOLOGICAL SOCIETY 1923

From Attributes to Intelligence: The Evolution of AASPI and the Thoughtful Integration of Machine Learning in Seismic Interpretation

By Heather Bedle, Ph.D. and David Lubo-Robles, Ph.D.

The Attribute-Assisted Seismic Processing and Interpretation (AASPI) consortium at the University of Oklahoma has spent the better part of two decades working to enhance how geoscientists extract meaningful insights from seismic data. From its origins under Dr. Kurt Marfurt's leadership to its current focus under our direction, AASPI has maintained a consistent goal: developing tools that help geoscientists see more clearly into the subsurface as a means to enhance their interpretations.

What began as work in seismic attribute development has gradually expanded to include machine learning and explainable artificial intelligence (AI) techniques. This evolution reflects our ongoing effort to balance computational capability with geological understanding — a balance that we continue to refine as both technology and industry evolves.

THE FOUNDATION YEARS: KURT MARFURT'S CONTRIBUTIONS

AASPI was founded with a straightforward mission: to develop and refine seismic attribute techniques that could reveal geological features not readily apparent in conventional seismic displays. In these early years, the consortium focused on understanding what geological story each attribute could tell. Coherence attributes revealed faulted systems. Curvature attributes highlighted structural features such as anticlines and synclines. Spectral decomposition analyzed relative changes in bed thickness uncovering potential thin-bed reservoirs sequence boundaries

Kurt established several principles that continue to guide our work:

- ***Geological Context First:*** Technical developments should serve geological understanding
- ***Industry Collaboration:*** Close partnership with sponsors ensures practical applicability
- ***Educational Mission:*** Training graduate students in both theory and application
- ***Knowledge Sharing:*** Distributing developments through publications, conferences, and software

During this period, AASPI researchers published in leading journals and trained graduate students who went on to implement these techniques throughout the industry, extending AASPI's influence well beyond Norman, Oklahoma.

THE TRANSITION: EVOLVING WITH THE INDUSTRY

When Heather took on leadership of AASPI in 2020, the consortium faced both opportunity and challenge. Kurt had built a solid foundation, but the industry was changing rapidly, and a pandemic was creating economic uncertainties. Artificial Intelligence was emerging in geoscience with significant promise, but also with the risk of reducing geological interpretation to algorithmic "black boxes" where decisions were made without geological context.

Rather than simply adopting machine learning as a way to accelerate traditional tasks, we chose to ask a different question: How can we use the pattern recognition capabilities of AI while maintaining the geological insight that makes interpretation valuable? This question continues to guide our approach – to us, AI techniques aren't about speed and rapid analysis, but improved interpretation and decision making.

Our current approach to AI differs from much of what we see elsewhere in the industry. While many groups focus on using AI to automate and accelerate existing workflows, we're more interested in using it to reveal patterns that enhance geological interpretation and reservoir characterization.

This approach involves several key elements:

- ***Pattern Discovery:*** Rather than automating horizon picking or facies classification, we use ML to highlight subtle patterns that might otherwise go unnoticed, then rely on geological expertise to interpret these patterns in context.
- ***Explainable AI:*** We work to understand not just what algorithms predict, but how they make those predictions. This transparency helps build geological confidence in results.
- ***Visualization:*** We view advanced visualization as the bridge between machine learning capabilities and geological understanding, presenting complex information in ways that work with human pattern recognition abilities.

- ***Geoscientist-Centered Workflows***: Our processes are designed to keep geoscientists at the center of interpretation, using AI to inform rather than replace decision-making.

Central to AASPI's continued success is our dedicated team of researchers and technical specialists. **Dr. David Lubo-Robles**, our Research Scientist and Computing Lead, plays a pivotal role in translating our research innovations into robust, user-friendly software implementations. David's expertise in geoscience, AI architectures, software development, and high-performance computing mixed with his proactive nature ensures that our advanced algorithms and AI workflows are accessible to geoscientists working with real-world datasets and computational constraints.

Under David's technical leadership, AASPI has maintained its reputation for delivering cutting-edge software that works reliably in industry environments. His contributions extend from the development and optimization of geoscience-focused algorithms to user interface design, ensuring that our innovations reach their full potential in practical applications.

AASPI CURRENT RESEARCH DIRECTIONS

AI integration in geophysical interpretation presents both opportunities and challenges. The opportunity lies in detecting subtle patterns in complex data; the challenge is maintaining geological context with increasingly sophisticated algorithms.

Our approach addresses key issues: We use explainable AI to understand algorithmic decisions, rely on geological context to distinguish real features from artifacts, and emphasize visualization to manage workflow complexity. Looking ahead, we are expanding explainable AI capabilities, integrating diverse geophysical data types, exploring real-time applications, and focusing on sustainable energy applications like CCUS and geothermal.

In this light, AASPI's current research spans several interconnected areas:

Distance Quadrant Attributes and Stratigraphic Analysis

Recent work has focused on distance quadrant attributes, developed through collaboration between Heather Bedle, David Lubo Robles, and Warren and Dennis Neff. Distance quadrant attributes represent a new approach to detecting fluids through an AVO technique, as well as geological features at scales below traditional seismic resolution. These attributes are being studied across various geological settings and AVO classes to evaluate their effectiveness in detecting sub-seismic resolution stratigraphic features. Students including Noor ul huda Choudhry, Valentina Tellez, and Alexandre de Castro Medeiros are investigating how these attributes perform as inputs to AI algorithms, examining their ability to reveal geological patterns that might otherwise be missed in conventional analysis.

AI for Seismic Facies Analysis

Hilmi Putra's work focuses on developing unsupervised learning approaches for seismic facies analysis that maintain geological interpretability, following on initial application of explainable AI by Dr. David Lubo-Robles in supervised learning applications. By incorporating explainable AI techniques such as SHAP (SHapley Additive exPlanations), we can understand which seismic attributes contribute most to different facies analysis, providing insight into the physical processes that create these seismic signatures.

Advanced Input Analysis for AI architectures

Understanding which data types provide meaningful inputs to machine learning algorithms remains a fundamental challenge in geophysical interpretation. Yasin Uzum is investigating how inversion products can be optimally integrated into AI workflows for reservoir characterization, while Ruhi Sahin focuses on the role of AVO attributes in these same applications. Both students are studying not just whether these inputs improve results but examining why they provide value and how they relate to underlying rock properties and depositional environments. This work helps establish guidelines for when and how different geophysical data types should be incorporated into AI workflows.

Danial Mansourian is applying this same philosophy to volcanic systems, combining seismic attributes with unsupervised and supervised ML algorithms to improve detection and interpretation of volcanic features. His work has potential applications in both geothermal exploration and critical mineral resource assessment, where understanding volcanic architecture is essential.

AI-Enhanced Interpretation Tools

Aniq Ahmad is working to integrate segment anything models (SAM) into AASPI for seismic facies characterization and horizon picking. This work explores how advanced computer vision techniques can be adapted for geophysical interpretation while maintaining the geological context that makes interpretation meaningful.

Understanding AI's Impact on Interpretation

April Moreno's research examines how choices in dimensionality reduction techniques, AI algorithms, and parameterization affect geological interpretation outcomes. This work addresses a critical question: how do the technical decisions we make in implementing AI workflows influence the geological conclusions we draw from the results?

Continued Attribute Development

AASPI continues to advance its foundational work in seismic attributes. Jared Brown is studying the relationship between fault damage zones and whether these features can be imaged using geological seismic noise in combination with coherence attributes. This work aims to improve subsurface knowledge of seals and hazards, with particular applications to carbon capture, utilization and storage (CCUS) and geothermal projects where understanding fault zone integrity is critical.

Emerging Energy Applications

AASPI's expansion into CCUS, geothermal energy, mineral exploration, and hydrogen storage demonstrates how attribute-based approaches and thoughtful AI integration can address new energy challenges. Each application requires understanding the specific geological processes at work and developing appropriate technical tools to characterize them.

THE AASPI CONSORTIUM: PARTNERSHIP FOR INNOVATION

What we try to do at AASPI is maintain geological understanding as the foundation for technological development. This approach offers several benefits: techniques grounded in geological principles tend to remain useful as technology evolves, explainable results build practitioner confidence, students learn critical thinking about tool application, and geological context enables broad applicability across different settings.

AASPI operates as an industry-sponsored research consortium, bringing together leading energy companies with cutting-edge academic research. This partnership model creates unique value for all participants: companies gain access to advanced research capabilities and emerging talent, while students work on real-world problems with industry-quality datasets.

AASPI's work depends on collaboration between academia and industry. Our sponsors provide real-world problems and feedback, while our alumni serve as advocates and sources of practical insights throughout the industry.

For Current and Prospective Sponsors: The AASPI consortium offers direct access to our research developments through annual licensing of our comprehensive software suite. Sponsors receive the latest versions of our software, including recent enhancements to AI workflows, improved seismic attribute calculations. Our annual sponsor meetings provide direct interaction with research teams and early access to emerging technologies.

For Industry Professionals: Many geoscientists working at current sponsor companies may not realize their organizations have access to AASPI software and expertise. If your company sponsors AASPI, you have access to our complete software suite, technical support, and consultation services. Contact your technical management or reach out to us directly at aaspi@ou.edu to learn about accessing these resources.

The consortium model also provides unique opportunities for technology transfer and talent development. Many of our graduates join sponsor companies, bringing deep expertise in both geological interpretation and advanced computational techniques. This creates lasting value that extends well beyond the formal sponsorship period. Additionally, AASPI's commitment to knowledge sharing has led to significant investments in knowledge-sharing, benefiting a wider community:

- ***Enhanced Website:*** Our redesigned platform at ou.edu/mcee/labs/aaspi provides comprehensive documentation, software access, and research updates

- ***LinkedIn Presence:*** Our company page connects AASPI with industry professionals and provides updates on research developments

- ***YouTube Channel:*** Video tutorials and workflow demonstrations help users understand both the technical implementation and geological context of our methods

These platforms serve a crucial function beyond simple information sharing—they help build a community of practice around thoughtful application of advanced geophysical techniques.

THE FUTURE OF AASPI

As AASPI evolves, our mission remains consistent: helping geoscientists extract meaningful insights from seismic data. AI offers opportunities to better understand subsurface geology, but requires careful implementation that keeps geological understanding central.

This represents our contribution to the ongoing conversation about geophysical interpretation's future: computation supporting geology, with innovation grounded in seeing more clearly into the Earth's subsurface. We continue learning how advanced tools can enhance geological capabilities while preserving the interpretive skills that make our work valuable. ■

Dr. Heather Bedle is the Director of the AASPI Research Group at the University of Oklahoma. She can be reached at hbedle@ou.edu. Dr. David Lubo Robles serves as Research Scientist and Computing Lead. He can be reached at davidlubo@ou.edu. For information about consortium participation, software access, or technical support, contact aaspi@ou.edu. Current sponsors can access the latest software releases at mcee.ou.edu/aaspi/software. Learn more about AASPI at ou.edu/mcee/labs/aaspi.

The AASPI Group photo from September 2025.

Left to right: Hilmi Putra, Noor ul huda Choudry, April Moreno-Ward, Ruhi Sahin and Aniq Ahmed at OSU's TechFest in Spring 2025.

AASPI students and alumni at IMAGE 2025.

AASPI Annual Meeting in January 2025.

AASPI Annual Meeting in January 2025.

AASPI group in the Geosciences Computer lab in Fall 2024.

AASPI students and alumni at IMAGE 2025

Spring 2025 graduation with Marcus Maas (PhD), Heather Bedle, and Hy Tran (MS)

HGS General Lunch

Giving Back, Moving Forward: Building Networks Through Geoscience Volunteering

Panelists: Ryan Ruppert, Robert Merrill, and Amanda Johnston

Ever wondered how volunteering can enrich your career, expand your network, and make a real impact on the next generation of geoscientists? Join us for an engaging panel discussion featuring geoscientists who have volunteered their expertise to support students and colleagues around the world. You'll hear how volunteering opened doors, built skills, and fueled passions. Discover how to get involved, balance commitments, and make a difference. Also, connect with like-minded peers and leaders in the geoscience community.

Whether you're an experienced geoscientist or just starting your career, you'll leave with actionable ideas for giving back and a renewed motivation to support the next generation of talent.

November 19, 2025
11:30am - 1:00pm
Oxy, 5 Greenway Plaza

Members: $30
Students: $25
Non-Members: $35

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Ryan Ruppert


Robert Merrill


Amanda Johnston

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Date & Time:

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8am - 5pm

Location:

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Houston Geological Society 1923

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Pivot Profile
From the Defense Industry to Sustainable Futures: Dr. Heather Bedle's Journey into Academia

By Lucia Torrado

Dr. Heather Bedle's career path has been anything but linear. Before joining academia, she spent over a decade in the industry, holding engineering roles in the defense sector at Raytheon and Northrop Grumman and later working at Chevron as a senior geophysicist. Her journey began with an interest for math and physics that carried her through her undergraduate degree at Wake Forest University. Throughout those years, she often found herself as the only woman in the classroom, an experience that sparked her determination to one day serve as a visible role model for other women in science.

She often reflects on how much she admired her high school biology teacher: one of the few women with a Ph.D. she had ever encountered at that age. That example planted a quiet but enduring aspiration: to encourage more women to see a place for themselves in scientific careers. When she eventually made the leap to academia, it was fueled by that purpose and by a deep-seated love of mentorship. "With my love of mentoring and working with younger, curious student minds who see the world and science as an open realm of possibilities, the transition to academia — even with the giant pay cut! — was easy" she happily shares.

Heather's time in the industry proved invaluable, providing a foundation of the professional skills that are keys to success, from communication to a diligent work ethic — skills she now passes on to her students. She credits those years with shaping the professional habits that have supported her success in academia.

THE PIVOT TO ACADEMIA

The transition, however, was far from effortless. "Oh, it was tricky for sure" she candidly admits. After years in the industry, Heather entered academia without the traditional research portfolio or established academic network that most early-career professors have. She had never written a research proposal or hardly written a journal manuscript, and she had limited teaching experience beyond graduate school as she recalls "My first classes were okay (I hope!), I had to spend time constantly reorganizing and improving".

Those early challenges became a crash course in academic life. She learned to write proposals and publish research through persistence and self-teaching, while simultaneously designing and refining her courses from scratch. Teaching quickly became one of her favorite aspects of the profession, though it demanded constant evolution. Even now, in her 10th year of teaching, she continues to adapt her lectures and methods to better connect with each new generation of students.

She also discovered that academia, unlike industry, is not simply a job that she can "unplug" from daily, but a lifestyle, one that requires constant intellectual engagement and a deep personal investment. "Although that takes quite a bit of energy, academia always keeps me on my toes!" she replies with enthusiasm when asked about what she loves about academia. The boundary between work and life can blur, but for Heather, that immersion has brought meaning and purpose to her career.

FINDING JOY IN MENTORSHIP AND DISCOVERY

Heather proudly shares with me that the most rewarding part of academia has always been watching her students grow into confident scientists and professionals. She describes every graduation season as both heartbreaking and exhilarating, a cycle of farewells and new beginnings that keeps her inspired.

Her passion for mentorship is matched by an enduring curiosity that has led her into new and sometimes unexpected areas of study. While her background is firmly rooted in geophysics, she has become increasingly drawn to interdisciplinary research that connects geology, particularly with "trying to understand the social psychology and politics of energy preferences and climate opinions. I've even learned quite a bit more about religion and economics in this pursuit". A pursuit that opened her eyes to how complex, human, and multifaceted the energy transition truly is.

That curiosity ultimately led to her current role as Director of the Sustainable Energy Systems Program at the University of Oklahoma, a groundbreaking interdisciplinary initiative that brings together students from diverse academic backgrounds -engineering, business, policy, environmental science, and beyond- to explore the future of sustainable energy. The program emphasizes collaboration and dialogue across disciplines, encouraging students to grapple with the realities of balancing innovation, economics, and environmental responsibility.

COMPLEXITY MEETS SUSTAINABLE ENERGY

As her career evolved, Heather found herself surprised not only by her success but by how much her intellectual perspective had broadened. Early in her career, she found comfort in the predictability of physics and geology, disciplines where outcomes could often be quantified or modeled. Over time, she learned to appreciate the unpredictable nature of human behavior and decision-making, especially in fields like energy policy and sustainability.

This realization marked a turning point in her teaching and research philosophy. Rather than seeking singular solutions, she now emphasizes nuance, empathy, and systems thinking. Her approach to energy challenges recognizes that progress depends on integrating technical innovation with social understanding and compromise.

This philosophy defines the Sustainable Energy Systems Program, which embraces complexity rather than avoiding it. By uniting diverse perspectives, the program reflects Heather's conviction that the future of energy — and of science itself — lies in interdisciplinary collaboration and the willingness to listen across boundaries.

INSPIRING THE NEXT GENERATION OF ENERGY LEADERS

In this inaugural year of the Sustainable Energy Certificate Program, Heather's enthusiasm is infectious. She views the program as a mutual learning opportunity, not only for students but for herself. Each student brings their own disciplinary perspective, and she finds herself constantly learning from their insights and questions.

Looking ahead, her ambitions include expanding the program's partnerships with industry, bringing in guest lecturers, and creating a project-based research component that connects students directly with real-world energy challenges. Her vision is to form teams of students from different majors who can tackle practical problems and propose innovative, interdisciplinary solutions…experiences that will prepare them to lead in a rapidly changing energy landscape.

Heather's journey is a testament to resilience, curiosity, and the power of mentorship. For those of us who once sat in her classroom, it's both inspiring and deeply rewarding to see her impact now ripple through a new generation of scientists and engineers. Her story reminds us that success in science isn't just about knowledge: it's about creating pathways for others to follow. ■

GSH/HGS

CASE STUDY SEMINAR II

Lessons from Missed Opportunities and Surprise Successes

Thursday, January 15, 2026
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One Day Conference with Real Life Exploration Stories!
Learn from Senior Geoscientists!

Morning Session 1 "Practical Paths to Informed Decisions"

- **Systematic Exploration, Geologic Insight, Professional Networks, and Business Actions Leading to the Discovery of Unconventional Resources in The Permian Basin Wolfcamp Formation** Bill Fairhurst, Riverford LLC
- **Risking Exploration Prospects – Lessons From the Dark Side** Mark Shann, Westlawn Offshore Americas
- **Pendleton Field: A Case Study of the Horizontal Development of the Fractured Saratoga Chalk, Sabine Parish LA** Julie Garvin, Garvin Exploration

Session 2 "Look Back Studies and New Ideas In Mature Areas"

- **The Sedimentology, Depositional History and Reservoir Modelling of Zama Field, Offshore Mexico** Steve Cossey, Cossey and Associates; Pasley, James; White, Howard
- **Lessons from Understanding Structural Styles of the Central Graben in the UK and Norway** Rich Sears, Retired, Shell

"The Unfair Advantage: Engineering a Memorable Career in the Energy Sector"
Special Luncheon Presentation by Scot Fraser, Aurivos

Afternoon Session 3 "Petroleum System Fundamentals"

- **The Opening up of Mauritania Offshore, the Promise, a Discovery, the Disappointment, A Second Wave, and What Was Never Tested** Brian Frost, Retired, Anadarko
- **The Importance of "Co-Opetition" Among Players: The Case of the Vaca Muerta Unconventional Play,** Daniel Minisini, ExxonMobil,
- and Fernando Sanchez Ferrer, GeoPark
- **New Value from Old Wells – A Case for Revisiting Dry Holes** Matt Flannery, Stratum Reservoir

Session 4 "Integration of Geology and Geophysics in Play-Based Portfolios"

- **Understanding Strawn Deposition and Production in Southern Oklahoma Using Machine Learning-** Deborah Sacrey, Auburn Exploration
- **Reflecting on my Experience on the Exploration Project in Suriname – Lessons Learned from Seeing Both Sides of the Table ,** Scotty Salamoff, Bluware
- **Forensic Science in Geophysics: Unlocking the Value of Vintage Subsurface Data** Rene Mott, Empress Exploration

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Co-Chairs Katya Casey (GSH) and Linda Sternbach (HGS)

HGS-HMNS Earth Science Week Event at the Museum of Natural Science

By Barbara Hill

Beginning in 1998, the American Geosciences Institute (AGI) sponsors an annual Earth Science Week (ESW) during the second week of October to raise awareness and appreciation of the importance of Earth Sciences' role in all aspects of society. To kickoff Earth Sciences Week in Houston, the Houston Geological Society and the Houston Museum of Natural Science held an Earth Science Week event at the Museum on October 11, 2025. The theme of this year's AGI ESW was Energy Resources for our Future. The event consisted of five stations that emphasized different aspects of Earth Sciences in Texas. The stations included Texas Geology and Local Fieldtrips, Giveaways and Salt, Everyday Uses of Common Rocks and Minerals, Micropaleontology and Marine Environments, and Fossil Wood.

At the Texas Geology and Local Fieldtrips station, volunteers explained various aspects of Texas geology using outcrop samples of llanite and Eagle Ford and Wolfcamp Formations. Participants visiting this station were also given postcards featuring the geological map of Texas. Stone City Bluffs—Whiskey Bridge was featured as a local field trip and visitors were given information explaining the location of the fieldtrip site, as well as what could be seen at the site and what fossils might be found. Samples of recently collected fossils were available for viewing and children visiting this station were encouraged to sift a sample of the disaggregated material from the Main Glauconite Beds at this site and to see which fossils they could separate out.

Children visiting the Giveaways station were encouraged to begin their own rock and mineral collection and were given small samples. The Giveaways station contained hand specimens of granite, limestone, halite/rock salt, and marble, representing igneous, sedimentary, and metamorphic rocks. The granite used was from an unknown location, the limestone was an Egyptian nummitic limestone which is the same type of rock used in the pyramids, halite/rock salt was from the Hockley salt mine, Texas, USA, and the marble was Alabama White Marble from Alabama, U.S.A. The fossil was an Eocene shark's tooth from Morocco. Small samples of the listed rocks and shark's teeth were given to

HGS volunteers (left to right): Michelle Pittenger, Kyra Bennett, Elsa Kapitan-White and Kelly McNair at the Every Day Uses of Common Rocks and Minerals table.

Fossil wood table. Volunteer Rosa Campos (left) and Scott Singleton (right).

children visiting this station to encourage them to begin or add to their own rock and mineral collection. A take-home craft in which children could build their own diamond octagon was also handed out. Earth Science Week resource kits from AGI and large hand specimens of rock salt were distributed to educators. The importance of salt domes in the energy industry was discussed by volunteers and brochures on how salt forms were distributed.

Everyday Uses of Common Rocks and Minerals featured a matching challenge for children and adults. The station contained hand samples of various rocks and minerals that represented raw material and finished products that were from one or more of the rocks and minerals. Raw materials included chunks of graphite and children were encouraged to write or draw on a piece of paper with the chunk, garnet amphibolites and vials of raw garnet grit, rock salt, chrysocolla, Alabama White Marble, sphalerite, magnetite, pyrite, Woodford Shale, gold flake, and spodumene. Finished products included a pencil, garnet sandpaper, copper wires, pennies, galvanized screws, raw sulfur, motor oil, plastic, magnets, a cell phone, TUMS, a round salt box, and a Cheerios box. Children were given a pencil and some small garnets as 'prizes' for participating. All participants were also given printed material with information about each of the raw materials and their common uses, with a call-out to those rocks and minerals used in electronics and lithium batteries.

At the Micropaleontology and Marine Environments station, children and adults were able to view various microfossils through microscopes. Numerous examples of microfossils were available and the microscopes were kept busy all day. Modern dinoflagellates were also available for viewing and information about bioluminescence was discussed with visitors.

Petrified palmwood, Texas' state rock, and other pieces of petrified wood from various locations were laid out for hands-on and microscopic viewing at the Fossil Wood station. Detailed explanations of petrified wood forms were provided. Children were also given a piece of petrified wood as a giveaway at this station.

Although an official tally of the number of people visiting the various stations was not taken, the event was well attended with a steady stream of families stopping by throughout the day. Volunteers gave away 200 Texas geology map postcards, 100 fieldtrip informational brochures, 150 samples each of granite, limestone, rock salt, marble, and garnets, 165 salt brochures, 200 diamond octagon crafts, and 100 pencils.

HGS thanks the following for their donations: United Salt Corporation for the Hockley Mine rock salt; Kocurek Industries for samples of the Eagle Ford and Wolfcamp Formations and Alabama White marble; anonymous donors for their donations of granite, limestone, and shark's teeth; Barton Mine Corporation for its donation of various grits of garnet; and Scott Singleton for providing the fossil wood.

The event would not have been possible without the cooperation and collaboration between the Houston Geological Society and the Museum of Natural Science and the volunteers from both organizations who helped plan the event and then shared their time and expertise with children and adults throughout the day.

HGS volunteers included Lynn Travis, Janet Combes, Sharon Choens, Inda Imega, Nancy Englehart-Moore, Barbara Hill, Mike Nault, Scott Singleton, Dorene West, Larry Welch, Rosa Campos, Michelle Warner, Michelle Pittenger, Sage Betts, Elsa Kapitan-White, Kelly McNair, and Kyra Bennett.

HMNS volunteers included Elissa Forand (HMNS Director of Volunteers), Mohsen Kariminia, Itze Soliz, and Bob Bruce, as well as several previously listed HGS members who are also volunteers at the Museum. ■

Volunteers from the Micropaleontology table, co-sponsored by HGS and Society for Sedimentary Geology's (SEPM) local societies NAMS (North American Micropaleontology Section) and GCSSEPM (Gulf Coast Section of SEPM).
Left to right: Sage Betts (HGS/SEPM) and colleague, Mike Nault (SEPM), Dorene West (HGS Science and Engineering Fair Committee Chair), Mhosen Kariminia (SEPM), and Larry Welch (HGS).

Give-away and salt table.

HGS ENVIRONMENTAL & ENGINEERING DINNER MEETING

The Importance of Ethics in the Geosciences by Gordon Magenheim

This presentation will discuss the importance of ethics in the geosciences as they apply to the Texas Geoscience Practice Act and licensed Texas Professional Geoscientists and satisfies the annual one-hour ethics requirement for Texas Professional Geoscientists. This presentation will provide an overview of geoscience ethics, present case histories of selected ethics violations identified by the Texas Board of Professional Geoscientists (TBPG), a review of TBPG's Code of Ethics, and a discussion of TBPG's Compliance process.

November 12, 2025

Los Tios Restaurant (9527 Westheimer RD)
Social 5:30 p.m.
Dinner 6:30 p.m.
Presentation 7:30- 9:00pm

REGISTER NOW

Cost

$35
Pre-registered members
$40
Non-members &
Walk-ups

HGS IS GETTING A

NEW WEBSITE

NEW WEBSITE SPONSORSHIP OPPORTUNITIES

Dear HGS Supporters,

HGS is excited to announce that we are developing a NEW WEBSITE for our members!

We invite you to be a sponsor for HGS's new website and expand your network!

See three sponsorship levels below:

GOLD LEVEL $3,000

- Company Logo on HGS website front page with link to 1-page space for advertisement.
- Sponsorship level active for 2 years

SILVER LEVEL $2,000

- Company Logo on HGS website front page with link to 1/2 page space for advertisement.
- Sponsorship level active for 1 year

BRONZE LEVEL $1,000

- Company Logo on HGS website front page with link to 1/4 page space for advertisement.
- Sponsorship level active for 1/2 year

HGS's NEW Website:

- Fresh new webpage format
- More intuitive, user-friendly design
- Easy access to HGS member sites
- Improved navigation to HGS and external links
- New access for event registration

Regards,
Penny Patterson
HGS President 2024-2025

Patty Walker
HGS President 2025-2026

Please see accompanying payment form.
Or contact HGS office: (713) 463-9476
email: andrea@hgs.org

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BRONZE LEVEL $1,000

- Company Logo on HGS website front page with link to a 1/4 page for advertisement.
- Sponsorship level active for 1/2 year

Company Name: ______________________________

Sponsorship Level: ____________________ Amount Enclosed: ______________

Contact Name: ______________________________

Street Adress: ______________________________

City: ______________ State: ____________ Zip Code: __________

Phone: ____________________ Fax: ____________________

Email: ______________________________

Please submit your company logo with the form and payment. Please email form to office@hgs.org
Payment by credit card or check. Please make checks payable to: **Houston Geological Society**.

Name of Card Holder: ____________________ Card Type: ____________

Card Number: ____________________ Expiration Date: __________ CVC: ________

HOUSTON GEOLOGICAL SOCIETY | 713-463-9476
14811 ST. MARY'S LANE, SUITE 250, HOUSTON, TX 77079

Congratulations to Ted Godo — AESE's 2025 Outstanding Editorial Contribution of the Year

By Catie Donohue

The Houston Geological Society proudly congratulates Ted Godo, former editor of the HGS *Bulletin,* on receiving the 2025 Outstanding Editorial Contribution of the Year award from the Association of Earth Science Editors (AESE). The award was presented at AESE's annual meeting, held this past month in Bloomfield, Indiana.

This national recognition highlights Ted's outstanding leadership and dedication, not only during his time as editor of the *Bulletin* but also throughout his distinguished career in geoscience communication. During his tenure, Ted elevated the *Bulletin* into a vibrant publication that not only shared technical insights but also reflected the energy and diversity of the Houston geoscience community.

Ted's editorial approach emphasized both technical rigor and accessibility, showcasing the wide range of disciplines represented within HGS membership. He encouraged submissions from new and seasoned authors alike, helping members see their work in print and sparking valuable discussion across the society. Beyond his editorial oversight, Ted personally authored more than a dozen articles, using his platform to highlight evolving topics in petroleum geology, environmental science, and the broader energy transition. His enthusiasm for clear, well-crafted communication contributed to increased engagement, stronger member participation, and a year of notable growth for the society.

The AESE—an organization of editors, publishers, and scientists founded in 1966—works to promote excellence in the editing and publication of earth science information. As digital media have transformed scientific communication, AESE continues to recognize individuals who uphold high editorial standards and encourage thoughtful, accurate science writing. Ted's award from this organization reflects both his personal commitment and the strong reputation of Houston's geoscience community for professional excellence.

Like HGS, AESE is a volunteer-based organization. Geoscientists who are passionate about improving the quality of earth science publications or wish to nominate outstanding work are encouraged to visit earthscieditors.org for more information.

The HGS thanks AESE for honoring Ted's achievements—and offers special appreciation to Ted for his leadership, creativity, and lasting impact on the *Bulletin*. We look forward to continued excellence under current editor Lucia Torrado and the future editors who will build upon this strong foundation. ■

Volunteer with HGS

Annual Events

Every year the HGS has annual social events, and we need volunteers to help us organize and set up on the day of!

These include events such as:

- Golf Tournament
- Shrimp Peel & Crawfish Boil
- Skeet Shoot
- Pickleball Event
- Field Trips

Committees

HGS committees such as Educational Outreach and Continuing Education provide geoscience learning resources to students and the local geoscience community. These groups are always looking for volunteers! If you or someone you know is interested in lending a hand, please contact the HGS Office!

Interested in Volunteering?

The HGS is always looking for energetic members to become volunteers for the society! As the largest local geological society in the country, we depend on the support of our members to help us organize and execute our many activities. Committees such as Educational Outreach, Continuing Education, and our annual social event committees are always looking for extra helping hands! Contact the HGS Office at office@hgs.org to learn more!

THIRD ANNUAL HGS SPORTING CLAYS SHOOT

FRIDAY, NOVEMBER 21, 2025
7:30AM - 1:30PM

$950 / 4 Person Team

$245 / Individual

- *Includes 4-man cart, 12 or 20 gauge ammo*
- *Gun Rentals are available from the venue*
- *$50 / 4 Person Flurry Competition, includes ammo & targets*

Gun Raffle, Mulligans, Silent Auction Door Prizes, breakfast, lunch and drinks included

Sponsorship Opportunities Available!

CLICK HERE >

WESTSIDE SPORTING GROUNDS

10120 PATTISON RD., KATY, TX 77493

Registration & Sponsorship Info: www.hgs.org or call 713-463-9476

Monday, November 10, 2025

5:30 – 9:00 p.m.

HGS Members/Emeritus/Honorary Life $65
Students $25 • Non-Members & Walkups $75
Norris Conference Center, Citycentre
816 Town and Country Blvd #210 • Houston, TX 77024
https://www.hgs.org/civicrm/event/info?id=2686

Dr. Jiaxuan Li
Assistant Professor of Geophysics ,
University of Houston

The 27th Anniversary Lecture

The Robert E. Sheriff Lecture Series

Sponsored by the Department of Earth and Atmospheric Sciences at University of Houston and the U.H. Geoscience Alumni Association

Learn about University of Houston geoscience program with Dr. Tom Lapen, Department Chair, Dr. Robert Stewart and Dr. Paul Mann. As well as the departmental Outstanding Alumni Award. There will be a poster session early in the evening on current thesis and dissertation research of the U.H. students.

Join the meeting early to meet the next generation of geoscientists from the University of Houston!

The Robert E. Sheriff Lecture Series was initiated in 1999 by the University of Houston Geoscience Alumni Association to honor Dr. Sheriff as an educator, scholar, and proponent for the geosciences. The series has recently been co-sponsored by the Houston Geological Society.

The Sheriff Lecture mission is to

bring some of the best known geologists and geophysicists in the world to the Houston community to share ideas relevant to exploration geology and geophysics, and to showcase geoscience activity at the University of Houston.

A full list of the Student Posters will be available on the HGS Website.

Department of Earth
and Atmospheric Sciences
**College of Natural Sciences
and Mathematics**

HGS General and North American Dinner Meeting

R.E. Sheriff Lecture

From Fiber-Optic Seismology to Geodesy: Operational Early Warning and Real-Time Imaging of Volcanic Eruptions

Fiber-optic sensing technologies, particularly Distributed Acoustic Sensing (DAS), are transforming geophysics by repurposing existing fiber-optic cables into dense arrays of strain sensors. This approach enables long-range, long-duration, and cost-effective monitoring across diverse environments. By exploiting the ultra-dense sampling of the seismic wavefield along telecommunication cables, fiber-optic seismology has advanced high-resolution seismic source characterization and subsurface imaging.

Recently, we introduced fiber-optic geodesy, a method that leverages low-frequency DAS (LFDAS) recordings to monitor quasi-static ground deformation caused by magma intrusions. Compared to conventional ground- or satellite-based geodetic measurements, fiber-optic geodesy offers lower noise levels and higher spatiotemporal resolutions, enabling real-time monitoring and imaging of magmatic processes.

We applied this approach to the ongoing eruption sequence near Grindavík, southwest Iceland, through two phases of DAS deployments. In the first phase (Nov 2023 to Nov 2024), we converted a 100-km telecom cable into a DAS array. Distinct LFDAS signals consistently emerged tens of minutes before each eruption. Since April 2024, we have operated an LFDAS-based early warning system in collaboration with the Icelandic Meteorological Office (IMO), successfully issuing alerts for two eruptions while avoiding false alarms for non-eruptive ones. Geodetic inversions of LFDAS signals enabled unprecedented spatiotemporal resolution of magma intrusions. In the second phase (from February 2025), IMO deployed an ASN OptoDAS interrogator to monitor two telecom cables, with a total length of 150 km, integrating early warning with real-time imaging. The addition of a 50-km northern cable further improved azimuthal coverage and inversion resolution.

These results demonstrate fiber-optic geodesy as a powerful tool for monitoring ground deformations. It shall find wide applications both onshore and offshore, using existing telecommunication infrastructure or dedicated fiber deployments. ■

BIOGRAPHICAL SKETCH

Dr. Jiaxuan Li joined the University of Houston as an Assistant Professor of Geophysics in January 2025. Prior to this appointment, he was a Postdoctoral Scholar at the California Institute of Technology (2020–2024). He earned his PhD in Geophysics from the University of Houston in 2020 and his BS in Geophysics from Peking University in 2015.

Dr. Li's research focuses on applying fiber-optic sensing technologies to study seismic and geodetic processes and to image subsurface structures across diverse environments, including crustal, volcanic, and glacial settings. His broader interests also encompass geothermal energy development, carbon sequestration monitoring, and the dynamics of deep earthquakes.

Wednesday, November 12, 2025

5:30 – 9:00 p.m.

HGS Members/Emeritus/Honorary Life $35
Non-Members & Walkups $40
Los Tios Restaurant
9527 Westheimer RD, Houston
https://www.hgs.org/civicrm/event/info?id=2686

Gordon Magenheim

The Importance of Ethics in the Geosciences

This presentation will discuss the importance of ethics in the geosciences as they apply to the Texas Geoscience Practice Act and licensed Texas Professional Geoscientists and satisfies the annual one-hour ethics requirement for Texas Professional Geoscientists. This presentation will provide an overview of geoscience ethics, present case histories of selected ethics violations identified by the Texas Board of Professional Geoscientists (TBPG), a review of TBPG's Code of Ethics, and a discussion of TBPG's Compliance process.

BIOGRAPHICAL SKETCH

Gordon Magenheim, P.G., C.P.G., C.H.M.M., Cgeol., is the Compliance and Outreach Program Manager for the Texas Board of Professional Geoscientists based in Austin, Texas. Gordon has been a practicing geoscientist for over 46 years and has a background in coal and lignite resource assessment and mining, environmental geology, stratigraphy, groundwater contaminant delineation, and field safety. Gordon is also a health and safety professional and holds several safety-related certifications from the Board of Certified Safety Professionals. Gordon served in the U.S. Army and U.S. Army Reserve in a variety of capacities and command levels and retired after 28 years of service with the rank of Lieutenant Colonel.

Gordon received a Bachelor of Arts in Geology, a Master of Science in Environmental Science (Environmental Geology), a Master of Arts in Emergency and Disaster Management, a Master of Public Administration in Emergency Management and is currently a candidate for a Master of Science degree in Occupational Safety and Health. Gordon is a member of the Houston Geological Society, the Geological Society of America, the American Institute of Professional Geologists, and the Geological Society of London (Chartered Geologist).

Wednesday, November 19, 2025

11:30 a.m. – 1:00 p.m.

HGS Members/Emeritus/Honorary Life $30
Students $25 • Non-Members & Walkups $35
Location – 5 Greenway Plaza (Oxy's office), Houston, TX 77046
Park in visitor parking in the garage; proceed to security desk on Plaza level for registration; parking validated by security
https://www.hgs.org/civicrm/event/info?id=2672
Event Contact: Andrea Peoples

Ryan Ruppert,
Robert Merrill,
Amanda Johnston

Giving Back, Moving Forward: Building Networks Through Geoscience Volunteering

Ever wondered how volunteering can enrich your career, expand your network, and make a real impact on the next generation of geoscientists? Join us for an engaging panel discussion featuring geoscientists who have volunteered their expertise to support students and colleagues around the world. You'll hear how volunteering opened doors, built skills, and fueled passions. Discover how to get involved, balance commitments, and make a difference. Also, connect with like-minded peers and leaders in the geoscience community.

Whether you're an experienced geoscientist or just starting your career, you'll leave with actionable ideas for giving back and a renewed motivation to support the next generation of talent.

BIOGRAPHICAL SKETCHES

Ryan Ruppert After receiving his bachelor's and master's degrees in geology from the University of Iowa, Ryan has pursued a 26-year career with ExxonMobil, including roles in exploration, development, production, and research. Most recently, Ryan was the was the Subsurface Technical Team Lead from Gate 1 to Final Investment Decision on the Payara Project, the third development in ExxonMobil's Guyana portfolio. He's currently the Senior Geoscience Advisor to the Guyana Stabroek Block, working technical and strategic initiatives critical to the venture's success. In his free time, he can be found with his wife and two teenage sons, watching sports, enjoying the outdoors, and traveling.

Dr. Robert Merrill brings more than 48 years of experience in the oil and gas industry, specializing in domestic and international exploration. Over the course of his career, he has held technical and staff positions with companies including American Stratigraphic Company, Cities Service Company, Occidental, Unocal, and Samson. In 2005, Dr. Merrill founded Catheart Energy Inc., an independent exploration and consulting company dedicated to pursuing both conventional and unconventional oil and gas opportunities. He continues to maintain a consulting practice focused on portfolio evaluation.

Alongside his industry work, Dr. Merrill has been deeply engaged in professional service and humanitarian initiatives. He has served on numerous committees and boards, including the American Geological Institute and the Houston Geological Society. He has been a member of the SEG Geoscientists Without Borders Committee since 2015 and currently serves as its chair.

Dr. Merrill earned his BA in Geology from Colby College, and both his MS and PhD in Geology from Arizona State University. He is an Honorary Member of the AAPG, a Fellow of the Geological Society of America, and a Fellow of the Geological Society of London. He served as Secretary and President of the American Institute of Professional Geologists.

Amanda Johnston is a dedicated exploration geologist with a strong passion for volunteering. Amanda is currently serving as an exploration geologist at TotalEnergies. Previously, she previously spent five years at Hess Corporation, where she gained valuable hands-on experience in exploration, development, and operations across a variety of basins.

Amanda has been deeply committed to volunteerism and professional development. A longstanding member of the Houston Geological Society (HGS), Amanda served on the Student Expo Committee for over seven years, culminating in leadership roles as Vice Chair (2020) and Chair (2021-2023). She is the Education Coordinator for the AAPG Imperial Barrel Award Competition and she organized the AAPG Bufalo Bayou Educator's Hike, a program that provides K-12 teachers in the Houston area with tools to enhance geoscience education.

NOVEMBER 2025

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
RESERVATIONS The HGS prefers that you make your reservations online through the HGS website at WWW.HGS.ORG. If you have no internet access, you can e-mail OFFICE@HGS.ORG, or call the office at 713-463-9476. **Reservations for HGS meetings must be made or cancelled by the date shown on the HGS website calendar, normally that is 24 hours before hand or on the last business day before the event**. If you make your reservation on the website or by email, an email confirmation will be sent to you. If you do not receive a confirmation, contact the HGS office at OFFICE@HGS.ORG. Once the meals are ordered and name tags and lists are prepared, no more reservations can be added even if they are sent. **No-shows will be billed.**					Make your reservations online at hgs.org	1
2	3	4	5	6	7 **Rock Salt Giveaway** →	8 **HGS Night with Mercury Chamber Orchestra** →
9 **Rock Salt Giveaway** →	10 **The 27th Annual Robert E. Sheriff Lecture** *From Fiber-Optic Seismology to Geodesy: Operational Early Warning and Real-Time Imaging of Volcanic Eruptions* *Page 46*	11	12 **HGS E&E Dinner Meeting** *The Importance of Ethics in the Geosciences* *Page 48*	13 **HGS NeoGeos Happy Hour**	14	15
16	17	18	19 **HGS General Luncheon Meeting** *Giving Back, Moving Forward: Building Networks Through Geoscience Volunteering* *Page 49*	20	21 **Third Annual HGS Sporting Clays Shoot** *Page 45*	22
23 / 30	24	25	26	27 HGS office closed	28 HGS office closed	29

INSTRUCTIONS TO AUTHORS

Materials are due by the first of the month for consideration to appear in the next month's publication. Submissions should be emailed to editor@hgs.org. The Editor reserves the right to reject submissions or defer submissions for future editions.

Text should be submitted as a Word file. Figures or photos may be embedded in the document or submitted separately. The following image formats are accepted: tif, .jpg, .png, .psd, .pdf.

Feature submissions, e.g., GeoPicks, should be approximately 600 words. Technical papers should be approximately 2000 words or less (excluding references).

We Are The HGS

Mike Allison , HGS member since November 2003

Mike Allison is an Emeritus Member of the HGS. He grew up in Stuart, a small town north of Palm Beach, Florida, where his father introduced him to scuba diving at a young age and dived off Andros, in the Bahamas and Grand Cayman when he was 15! An experience that sparked his lifelong curiosity about the natural world. Inspired by Jacques Cousteau, Mike initially pursued marine biology at the University of Miami before discovering his true calling in geology, he recalls: "I transferred as a Geology Major and never looked back"

Organizations, like the HGS, are so important to the geoscience community here in Houston and elsewhere

After earning his geology degree, Mike began his career like many in the oil and gas industry, as a mud logger in East Texas during the late 1970s: an experience that offered both adventure and invaluable lessons in the oilfield. Mike was fortunate that he was exposed to geology in every job he did on his way to getting his Master's in Geology from the University of Tennessee, Knoxville in 1984. He worked as an assayer with Anaconda Mining in Salt Lake City, in customer support with the Boeing Flight Simulator team in Seattle, and watching St. Helens erupt proved to be some of the pivotal events in his career.

Once he completed his master's degree, Mike worked at Gulf Oil and Chevron, where he worked on the Gorgon Project, Perth, Australia. He subsequently worked for Landmark Graphics, Devon Energy, Fleetwood and Fieldwood Energy, including five years in Perth, Australia, supporting the Gorgon Project. In 2017, following his retirement from the oil and gas industry, Mike founded Raptor Aerial Services LLC, a drone mapping company that has since completed over 3,300 flights and 100 drone survey projects, covering parts of Texas, Arkansas, Colorado, Virginia, New Mexico and Guatemala. His passion for integrating remote sensing, mapping, and geology continues to bridge science and technology.

An active contributor to HGS, Mike has served as Treasurer-Elect and Treasurer on the HGS Board, and has taught Continuing Education courses on drones and drone mapping. Reflecting on the role of professional societies, he notes: "Organizations, like the HGS, are so important to the geoscience community here in Houston and elsewhere. Our profession is evolving as we expand beyond oil and gas. Energy resources (of all sorts), environmental impact, space exploration, and education are some of the areas we play an important role in."

We Are The HGS is a series that highlights the careers and contributions of HGS members with the intention of building community. Would you like to be featured in We Are The HGS? Send a note to editor@hgs.org.

WORD BRECCIA – A GEOLOGY WORD JUMBLE

Unscramble the words below and rearrange the circled letters to find the answer to the clue.

AVRIAENC O _ _ O _ O _ _

TUCERVRAU _ O _ _ _ O _ _ O

ELUTPIDMA O _ _ _ _ O _ _ _

NEUQRYCEF _ _ _ O _ _ _ _ _

MHTUIZA O _ O _ _ O _

HINT: These are examples of _ _ _ _ _ _ _ _ _ measures of a seismic characteristic of interest.

Unscrambled Word Breccia (October issue):
Spinifex, Olivine, Ultramafic, Skeletal, Pyroxene and Komatiite.

Houston Geological Society www.hgs.org

Advertise with HGS

The Houston Geological Society has many advertising opportunities to help you promote your business. The money raised through advertising helps the HGS to be able to support continuing education, networking, outreach to students, student scholarships, and young professional activities. Check out some of our advertising opportunities below!

Vendor Corner

Promote your business with a booth at an in-person luncheon or dinner meeting. HGS will also post your logo, website/social link(s) and a brief company summary on the HGS website below the technical meeting's announcement and abstract.

HGS Bulletin

Published 10 months out of the year and available digitally on the HGS website, the HGS Bulletin is an outstanding technical journal sent electronically to all current members and to subscribing libraries around the world.

HGS Event Sponsorship

Promote your business at a meeting. Along with the opportunity to reach a global audience, HGS will promote your business on the event page, on our social media, and at the technical talk.

Website Sponsor

Support the HGS by advertising on our website. Sponsors have the opportunity for their ad to appear in high-visibility areas of our site. Calendar ads are displayed on the left navigation of the Calendar page as well as on the Home page, while a limited number of banner ad spaces are available on the large banner at the top of the Home page.

HGS Weekly Newsletter

The HGS Weekly Newsletter is published digitally every week, and reaches a global community of 8,000+ people. HGS will promote your business with an ad of your design or your logo and a link to your website or social media.

To learn more about advertising rates and how you can promote your business with us, visit our website or contact the HGS Office at 713-463-9476 or office@hgs.org.

HOUSTON GEOLOGICAL SOCIETY 1923

ROCK SOLID GUESS!

HINT: The HGS Educational Outreach Committee hosted a party for this mineral, but what exactly is this picture? Photo from Giuseppe Fallica.

HINT: Dr. Heather Bedle's favorite rock sample — and if you read carefully, you'll spot its name in our Earth Science Week write-up! Photo courtesy of Heather Bedle.

Rock-Solid Answers (October issue):

1. Richat Structure: The Eye of the Sahara

The Richat Structure or Guelb er Richat, located near Ouadane in the Adrar region of Mauritania, is a symmetrical dome of eroded sedimentary and volcanic rock. The outermost rings measure approximately 40 km (25 miles) across.

2. Komatiite

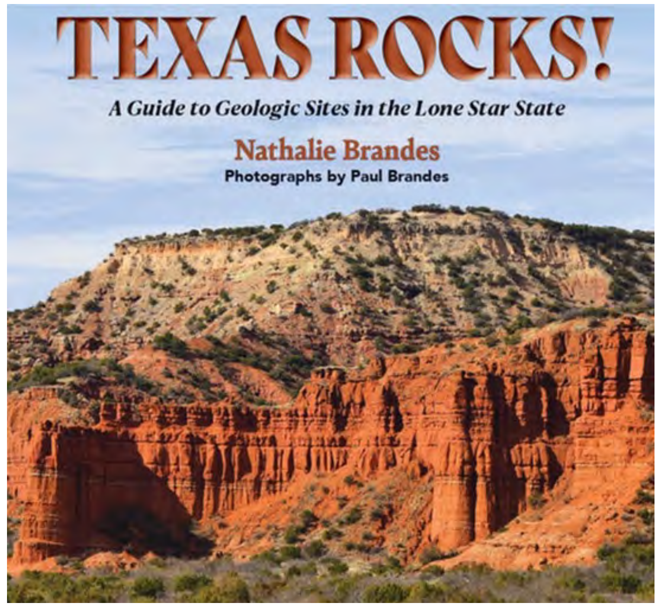
A thin section of a komatiite showing skeletal olivine crystals in a groundmass of skeletal pyroxenes. Sample from the Belingwe greenstone belt, part of the Zimbabwe Craton. XPL image, 2x (Field of view = 7mm).

A Book Review of *Texas Rocks*!

By Rasoul Sorkhabi, PhD, University of Utah, Salt Lake City

In October 2024, the Geological Society of America (GSA) acquired Mountain Press Publishing Company's award-winning geology series — Roadside Geology, Geology Underfoot, and Geology Rocks! Mountain Press continues to distribute these titles from its facility in Missoula, Montana, but the acquisition marks a new chapter for GSA, extending its reach into popular science.

In 2025, GSA and Mountain Press published a new book: Texas Rocks! A Guide to Geologic Sites in the Lone Star State. This is a joint venture between husband-and-wife geologists Nathalie Brandes (author) and Paul Brandes (photographer), both graduates of the New Mexico Institute of Mining and Technology and Michigan Technological University. The couple, who live outside of Houston, had previously published New Mexico Rocks!



The book opens with an introduction to the geologic history of Texas. Two major orogenies -the Grenville (about 1.3 billion years ago) and the Ouachita-Marathon (Late Paleozoic) — both trend northeast–southwest and form the geologic backbone of the Lone Star state. The north-south-trending Cretaceous Western Interior Seaway, which once linked the Arctic Ocean to the Gulf of Mexico, is another defining feature. Later, the Miocene basin extensional event further shaped the eastern part of Texas.

The Brandes divide Texas into six regions: 1) the High Plains; 2) the North-Central Plains; 3) the Coastal Plains; 4) Central Texas (Llano Uplift); 5) the Edwards Plateau; and 6) Basin-and-Range Province. Divisions 4 and 5 lie entirely within Texas, while the other regions extend into Oklahoma, New Mexico, and Louisiana.

After this overview, the book presents 80 geological sites, each described over two pages with location maps and field photographs. Some highlights include:

- The Guadalupe Mountains National Park, showcasing Permian reefs
- The Coal Creek Serpentinite (Grenville age)
- The Packsaddle Schist in Llano (Grenville age)
- Padre Island, the longest barrier island in the world
- The 1901 Spindletop oil gusher

Although Texas is best known for its oil and gas production -about 43% of U.S. crude oil and 29% of natural gas- this guidebook emphasizes that the state also offers world-class outcrops, mining sites, and state parks for sightseeing and geologic training.

I found Texas Rocks! to be an illustrative, informative, and engaging guidebook. I learned a great deal from it, and I believe it will serve both geologists and general readers well. ■

GeoPicks features recommendations from fellow geoscientists like resources, experiences, or tools. Do you have a favorite you'd like to share? Send it to us at editor@hgs.org.

General Dinner Meeting on Artificial Intelligence and Machine Learning for Geoscientists

The September 29th general dinner meeting featured an informative talk by Sashi Gunturu, founder and CEO of Petrobytes Corporation. Gunturu explained that geoscience workflows can be cut from weeks to hours using a generative artificial intelligence (AI) approach. While geoscientists are still needed to QC and interpret data, leveraging new AI/ML tools can dramatically increase the efficiency of routine data tasks.

Thanks to Kristen Jones and Meagan Wall (StratoChem Services North America, Inc) for volunteering to assist with logistics at the event, which was held at the Spaghetti Western. ■

Luncheon on Emerging Plays in the Lower 48

By Caroline Wachtman (2025-2026 Vice-President)

The general lunch meetings series is off to a great start! For September's lunch, Bryan Bottoms of Detring Energy Advisors, gave an insightful talk filled with information about the key plays and operator trends in the continental US. Nearly 50 professionals attended the talk that was held at Oxy's office in Greenway Plaza.

Thanks to Kristen Jones and Meagan Wall (StratoChem Services North America, Inc) for volunteering to assist with logistics and thanks to Magly Cabrera (Ubiterra) for photographs.

HGS Membership Application

Houston Geological Society
14811 St Mary's Lane Suite 250 Houston
TX 77079
Phone: (713) 463-9476
Email: office@hgs.org

Active Membership

In order to qualify for Active Membership you must have a degree in geology or an allied geoscience from an accredited college or university or, have a degree in science or engineering from an accredited college or university and have been engaged in the professional study or practice of earth science for at least 5 years. Active Members shall be entitled to vote, stand for election, and serve as an officer in the Society. Active Members pay $40.00 in dues.

Associate Membership

Associate Members do not have a degree in geology or allied geoscience, but are engaged in the application of the earth sciences. Associate Members are not entitled to vote, stand for elections or serve as an officer in the Society. Associate Members pay $40.00 in dues.

Student Membership

Student membership is for full-time students enrolled in geology or an allied geoscience. Student Members are not entitled to vote, stand for elections or serve as an officer in the Society. Student Member dues are currently waived (free) but applications must be filled out to its entirety. Student applicants must provide University Dean or Advisor Name to be approved for membership.

Membership Benefits

Digital HGS Bulletin

The HGS Bulletin is a high-quality journal digitally published monthly by the HGS (with the exception of July and August). The journal provides feature articles, meeting abstracts, and information about upcoming and past events. As a member of the HGS, you'll receive a digital copy of the journal on the HGS website. Membership also comes with access to the online archives,with records dating back to 1958.

Discount prices for meetings and short courses

Throughout the year, the various committees of the HGS organize lunch/dinner meetings centered around technical topics of interest to the diverse membership of the organization. An average of 6 meetings a month is common for the HGS (with the exception of July and August). Short courses on a variety of topics are also planned throughout the year by the Continuing Education Committee. These meetings and courses are fantastic opportunities to keep up with technology, network, and expand your education beyond your own specialty. Prices for these events fluctuate depending on the venue and type of event; however, with membership in the HGS you ensure you will always have the opportunity to get the lowest registration fee available.

Networking

The HGS is a dynamic organization, with a membership diverse in experience, education, and career specialties. As the largest local geological society, the HGS offers unprecedented opportunities to network and grow within the Gulf Coast geological community.

Please fill out this application in its entirety to expedite the approval process to become an Active/Associate member of Houston Geological Society.

Full Name ____ Type *(Choose one)*: Active Associate Student

Current Email *(for digital Bulletin & email newsletter)*_____________________

Phone ______________

Preferred Address for HGS mail____

This is my home address _____ business address ____

Employer *(required)*_________________________ Job Title *(required)*__________________ Will you volunteer? ___ (Y/N) Committee choice: __________________

Annual dues Active & Assoc. for the one year *(July 1st-June 30th)* **$40.00**_____

Student **$0.00**_____

OPTIONAL Scholarship Contributions- Calvert/HGS Foundation-Undergraduate **$5.00**_____

Total remittance_____

Payment:

Check #___________

Credit card: V MC AE Discover

Credit Card#_________________________

CVV code (req'd): _____ Expiration: _____ (mm/yy)

Signature: ________________________ Date: _________

To the Executive Board: I hereby apply for membership in the Houston Geological Society and pledge to abide by its Constitution & Bylaws.

Company*(required, mark 'in transition' if unemployed)*____

Company Address ____________________

City *(Work)* _______________ **State** *(Work)* ________________ **Postal Code** *(Work)* _________________

School *(required)*____

Major *(required)*_________________________________ **Degree** *(required)*_______________________

Year Graduated ________________

School *(optional)*____

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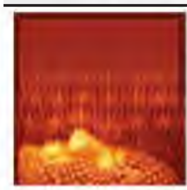

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Mount Rundle is one of Banff's most iconic peaks, rising sharply above the Bow Valley. Its striking tilted slopes consist of Mississippian-age limestone of the Rundle Group, uplifted and folded during the Laramide orogeny. Photo courtesy of Atif Hariz.