Welcome to the October 2025 Edition of GEOHORIZONS!

As many of you know, GEOHORIZONS is typically published twice a year, in June and December. However, to coincide with the 15th Biennial SPG Conference and Exposition taking place this week in Jaipur, we are pleased to bring you this special October issue.

On behalf of the entire editorial team, I extend a warm welcome to all delegates attending the SPG Conference and Exposition. We are excited to have you here and are confident that the next few days will be both engaging and enjoyable. Make the most of it!

This special issue is filled with content that caters to both the technical and general interests of our diverse readership. It opens with an insightful interview with **Mr. Om Prakash Sinha**, Director (Exploration), ONGC. We are also proud to include a memoir by **Dr. D. V. R. Murti**, former Block Manager at ONGC, offering a valuable reflection on his professional journey.

One of the technical highlights of this issue appears in our Expert Answers column, where we address a long-standing challenge in seismic acquisition: streamer feathering, which has traditionally hampered the high data repeatability essential for 4D (time-lapse) seismic surveys. While solutions like ocean-bottom cables have been employed, though at high cost, the growing use of ROV-deployed ocean-bottom nodes now offers a more practical and consistent alternative, improving data quality significantly. To shed light on this development, we turned to three international experts: **Vetle Vinje, Philip Ringrose, and Martin Landro**, whose insights are both timely and thought-provoking.

In the feature article section, we present nine technical papers spanning a wide array of topics. **Barens et al.** in their paper entitled '*Applications of oil and gas interpretation and modeling practices to windfarm soil characterization*' introduce a workflow that adapts wind farm geotechnical data (boreholes, 2D seismic) for use with hydrocarbon reservoir modeling techniques to create a detailed 3D model of soil behavior and shear wave velocity. This enhanced subsurface characterization ultimately provides the necessary small-scale shear strength and uncertainty data required for selecting optimal wind turbine foundation designs.

India's National Green Hydrogen Mission (NGHM) aims to position green hydrogen as a core decarbonization strategy, with a target of 5 million tonnes of annual production by 2030. **Bisht et al.** in their paper entitled '*Green hydrogen in India: A techno-economic and policy roadmap for decarbonization and energy transition*' analyze the techno-economic feasibility of green hydrogen, evaluating its potential integration into hard-to-abate sectors while addressing key challenges like high capital costs and the need for government incentives and infrastructure expansion to achieve cost parity with grey hydrogen.

In their paper entitled '*Spectral-Element FWI: Redefining FWI for complex imaging, an offshore Australia example*', **Purcell et al.** present the Spectral-Element Method (SEM) as a high-accuracy alternative to conventional Finite-Difference (FD) methods, using

unstructured meshes and high-order polynomial approximations to accurately model seismic waveforms despite complex geological interfaces and heterogeneous subsurface structures. Through the integration of GPU acceleration, SEM is shown to deliver superior full-waveform modelling and inversion results, particularly in challenging scenarios with intricate seabed geometries, as demonstrated by field data from offshore Western Australia.

Wu et al., in their paper entitled '*Success and opportunities of advanced full-waveform inversion on ocean bottom seismic data*', presents the application of Ocean Bottom Seismic (OBS) data combined with advanced Full-Waveform Inversion (FWI) techniques to address significant subsurface imaging challenges, such as shallow gas absorption and pronounced azimuthal anisotropy. In particular, the development and implementation of Viscoacoustic FWI (Q-FWI) and Orthorhombic FWI (ORT-FWI) are demonstrated to generate high-resolution velocity models, substantially improving hydrocarbon exploration in geologically complex environments.

In their paper entitled '*AVO analysis and seismic reservoir characterisation in a deepwater reservoir in KG Basin: An integrated approach',* **Banerjee et al.** discuss an integrated geophysical study in the Krishna-Godavari Basin utilizing advanced seismic reprocessing, rock physics, and AVO analysis to successfully identify classical hydrocarbon anomalies in a Miocene- Pliocene slope fan complex. The subsequent simultaneous angle-dependent seismic inversion produced volumes of P-Impedance, V_P/V_S, and density, which refined reservoir characterization, thus reducing exploration risk and improving the delineation of future drilling prospects.

In their paper entitled '*Probabilistic lithofacies classification with machine learning application for improved confidence in subsurface modelling*, **Singh et al.** demonstrate the benefits of probabilistic facies classification for subsurface modeling using multiple machine learning algorithms. The Multilayer Perceptron (MLP), proved superior to Random Forest and Convolutional Neural Network classifiers, achieving high accuracy and F1-scores in blind tests. Crucially, the probabilistic output successfully captured geologically meaningful facies transitions and accurately identified key gas-bearing facies in the Hugoton gas field, in southwest Kansas, USA.

In his paper entitled '*Uncertainties in upstream oil and gas: The role of integrative technology*' **Banerjee** says present day exploration requires focusing on complex, deep, and stratigraphically variable plays which necessitates not only advancements in seismic imaging technology, but also a high level of integration and collaboration across disciplines. He exemplifies the management of uncertainties in trap, reservoir, and connectivity, as demonstrated by examples in near-field exploration and deep-water channel development.

In his paper entitled '*Explaining the Mumbai High offshore negative gravity anomaly, India*', **Nanda** explains the intriguing large negative free-air gravity anomaly (Mho) on the inner shelf of the west coast continental margin of India, which overlaps a huge Archean basement high beneath the Mumbai High oilfield that is normally expected to show positive anomaly. Based on well data interpretation, the study finds the encountered Deccan trap in the basement are intrusive basalts younger than the Deccan Trap flood basalts and hypothesizes that the pronounced negative Mho is caused by the emplacement of a localized magma pond situated beneath a down-warped Moho.

Facing challenges in hydrocarbon exploration due to poor seismic imaging in the structurally complex and tectonically active northeastern margin of India, **Ghosh et al.** in their paper entitled '*Structural mapping using ground magnetic data and enhanced derivative techniques in the Assam-Arakan Basin, northeastern India'* utilized ground magnetic data and a suite of enhanced derivative techniques to successfully delineate both shallow and deep-seated subsurface structures. This integrated approach provided valuable clarity on fault systems, basement highs, and possible intrusive bodies, offering an improved structural framework for guiding future exploration in the Assam-Arakan Basin where seismic data is inconclusive.

Mancini et al. in their tutorial paper entitled *'Elastic Multiparameter Full-Waveform Inversion: basic theory,*

practice, and examples - a tutorial' describe Full-Waveform Inversion (FWI), a wave-equation-based technique that has evolved from acoustic velocity model building into a robust elastic, multiparameter (MP-FWI) framework capable of estimating V_P, density, and V_S. The tutorial outlines the theoretical basis, discusses methods for overcoming challenges like parameter trade-offs and cycle-skipping, and demonstrates how elastic MP-FWI successfully generated high-resolution elastic parameter volumes and excellent reflectivity images in a North-West Shelf of Australia case study.

In the SPG news column, we cover the recent activities of various SPG Chapters.

We are grateful to all the authors for their valuable contributions and hope our readers find the articles both enlightening and engaging. As always, we welcome your feedback and thoughts on this edition of GEOHORIZONS.

We trust that this special issue will not only inform and inspire but also reflect the vibrant discussions taking place this week at the SPG Conference in Jaipur.

Happy reading and enjoy the conference!

- *Satinder Chopra,* **Chief Editor**

View of Athabasca Glacier, located along the Icefields Parkway, at the southern tip of Jasper National Park, Alberta, Canada. Outcrop rocks are Lower Paleozoic carbonates and siliciclastics that are exposed along the eastern slopes of the Canadian Rocky Mountains. Photo taken by Rob Taerum along Wilcox Trail, 3 August 2008.