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EDITED AND REVIEWED BY
Derek Keir,
University of Southampton,
United Kingdom

*CORRESPONDENCE
Jingshou Liu,
liujingshou@126.com

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Editorial: Unconventional reservoir geomechanics

Jingshou Liu[1]*, Wenlong Ding[2], Shimin Liu[3], Kouqi Liu[4] and Dadong Liu[5]

[1]School of Earth Resources, China University of Geosciences, Wuhan, China, [2]School of Energy Resources, China University of Geosciences, Beijing, China, [3]Department of Energy and Mineral Engineering, G3 Center and Energy Institute, The Pennsylvania State University, University Park, PA, United States, [4]Institute of Energy, Peking University, Beijing, China, [5]State Key Laboratory of Petroleum Resources and Prospecting, China University of Petroleum, Beijing, China

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Editorial on the Research Topic
Unconventional reservoir geomechanics

Unconventional resources, which can be regarded as an alternative for the conventional resources, have been a hot Research Topic over the past decades. Many countries, including the United States, Russia, Canada, and China, have effectively promoted the exploration and development of shale oil and gas, tight oil and gas and coalbed methane. Despite their great potential, the economic hydrocarbon production from these resources is hampered by our poor understanding of reservoir geology and limited engineering technology. In recent years, considerable progress has been made in the study of *Unconventional reservoir geomechanics* due to commercial development. *Unconventional reservoir geomechanics* encompasses the fields of structural geology, petroleum geology, rock mechanics, and petroleum engineering, aiming to solve a wide range of mechanical problems that arise during the exploitation of unconventional resources. Moreover, multiscale geomechanics-based geoengineering method have been employed in laboratories by more and more researchers.

It was a great honor to be invited to serve as the team of Guest Editors for this Research Topic. Upon the opening of this topic, it received a great response from relevant academic communities. This Research Topic collects 15 papers from different disciplines, which helps international readers deepen geological understanding and solve engineering problems through geomechanics. A wide range of research was presented, including geomechanics experiments (e.g., Cheng et al.; Wang et al.; Yang et al.), the prediction of reservoir fracture characterization (e.g., Li et al.; Yang et al.; Mi et al.), the numerical simulation of stress fields (e.g., Feng et al.; Xu et al.) and case studies (e.g., Wang Q et al.; Wang et al.; Xu et al.). The study of reservoir geomechanics is significant for guiding unconventional oil and gas exploration (e.g., stress field simulation, fault sealing evaluation, fracture activity prediction, etc.) and development (e.g., wellbore stability analysis, fracture propagation in hydraulic fracturing, casing damage prediction and protection, etc.).

At present, the exploration and development of oil and gas are moving towards deep and ultradeep reservoirs. In addition, the development of tight unconventional reservoirs is playing an increasingly important role in the oil and gas industry. For example, some wells in the Tarim Basin in China have reached more than 8,000 m, and the ultradeep rocks are in an environment of high temperature, high pressure and high *in situ* stress. Traditional reservoir geomechanics theory has limitations in guiding the development of deep resources and deep engineering (Xie et al., 2021; Xu et al., 2022). Whether it is the

development of ultradeep reservoirs or tight unconventional reservoirs, reservoir geomechanics will play an increasingly critical role (Zoback and Kohli, 2019). With the in-depth development of multidisciplinary intersections, reverse engineering, 3D printing technology, multiphysics field coupling theory, and other methods that have been introduced to reservoir geomechanics, a number of new research results and technologies have emerged. In the future, the development of reservoir geomechanics will focus on the *in situ* mechanical properties of deep to ultradeep rocks (Xie et al., 2021), evolution of rock mechanical properties and their geomechanical response (Laubach et al., 2019; Liu et al., 2022a), formation mechanism and distribution prediction of unconventional reservoir fractures (Zhang et al., 2021; Li et al., 2022), and development of commercial software for numerical simulation of *in situ* stress in complex structures (Liu et al., 2017; Liu et al., 2022b; Zou et al., 2022).

Author contributions

All authors listed have made substantial, direct, and intellectual contributions to the work and approved it for publication.

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Conflict of interest

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