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Editorial

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Editorial: Geoenvironmental issues related to gas hydrates, part I

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Last two decades, global warming has been an important issue for countries due to temperature rise and its potential environmental risks. With several international agreements, many countries aim to reduce their carbon emissions significantly. By the 2050s, zero-net carbon is the main target by giving up fossil fuels (mainly oil and coal). Among fossil fuels, natural gas is considered a 'relatively clean energy resource'. Gas hydrates have been important targets for countries to increase their energy resource alternatives and reduce their dependence on environmentally harmful/risky energy resources (i.e., coal, nuclear energy). Since the beginning of the 2000s, many gas hydrate exploration, drilling, logging, and coring activities have been implemented in Canada, the USA, Japan, China, Korea, India, and other countries (Xie *et al*., 2022). Short-term gas hydrate production trials (maximum duration of 60 days) were conducted in Canada, the USA, Japan, and China between 2002 and 2020 (Chen and Merey, 2021). Currently, the gas hydrate industry can drill and complete gas hydrate wells safely, and logging and coring operations can be implemented safely. However, currently, there is no gas hydrate production method for feasible and safe gas hydrate exploitation. Research about gas hydrates has increased tremendously over the past two decades and the number of papers being published on gas hydrates has also increased markedly during the last few years. Therefore, we are pleased to present the themed issues on gas hydrates in *Environmental Geotechnics*. Twelve articles have been accepted in the themed issues and online in 2020 (i.e. Kang *et al*., 2020; Zhu *et al*., 2020), among which one (Nian *et al*., 2022) has been published in issue 2, five published in this issue and six scheduled in the next issue. Some short introductions of the articles in this issue are given below:

In the first paper of this issue, Zhu *et al*. (2022) analyzed the creep behaviours of methane hydrate-bearing sediments at different conditions by using the tri-axial experimental setup. The study revealed that the confining pressure, temperature, and stress level affected the creep characteristics. Gas hydrate production trials in the South China Sea in 2017 and 2020 have shown that silty-clay bearing hydrates are also targets for gas production as well as coarse sand-bearing hydrates. The second paper (Wang *et al*., 2022) experimentally analyzes the mechanical behaviours (i.e., tri-axial compressive strength, the Mohr circles, and failure envelopes at different gas hydrate saturations) of hydrate-bearing clayey sediments in the conditions of the South China Sea. Geophysical studies are important to investigate gas hydrate potential and collect essential data (i.e., gas hydrate saturations) for implementing drilling, coring, and logging operations. The third paper (Liu and Meng, 2022) examined the responses of the widely used theoretical models to hydrate-bearing sediments affected by hydrate saturation, porosity, and clay content in the conditions of the Blake Ridge area and Mallik Field. The forth paper (Zhang *et al*., 2022) analyzed the 2D seismic data in the western South China Sea. In the study area, many gas hydrate indicators (i.e., gas chimneys, mud diapirs, and mud volcanoes) were detected. The final paper (Chen *et al*., 2022) tried to review the latest analysis of gas hydrate tests in terms of both engineering progress and policy trend. The exploitation of gas hydrates is dynamic and new technology and policy trends are proposed and applied.

Although Japan and China have successfully tested offshore gas hydrate productions, the process remains far from commercially viable. Some of the chief obstacles to widespread gas hydrate production, however, are geoenvironmental and not technological (Szakal, 2021; Zhu *et al*., 2021). We are involved in several gas hydrate projects and co-author three articles in the hydrate issues including a comprehensive review (Chen *et al*., 2022 in this issue), numerical simulations (Feng *et al*., 2020 in next issue) and analogy experiments (Zhu *et al*., 2020 in next issue). Gas hydrate production is still at the research and development stage and further scientific studies are essential concerning gas hydrate production trials, gas hydrate geomechanics, and gas hydrate-related geoenvironmental risks (i.e., methane leakage, sand production, seafloor subsidence, and submarine landslide). For this reason, the gas hydrate in dustry wants to extend the duration of gas hydrate production trials for collecting more long-term reliable data by using advanced *in-situ* and well-monitoring technologies. For this purpose, long-term gas hydrate production (at least a year) is planned in the Prudhoe Bay of Alaska, the USA in 2022/2023 (Collett *et al*., 2022).

We hope the twelve articles published in the themed issues on gas hydrates of *Environmental Geotechnics* are expected to generate a significant impact in the gas hydrate research field for years to come. *Environmental Geotechnics* greatly acknowledges the authors and reviewers contributing to the special issues.

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