frontiers | Frontiers in Earth Science

TYPE Editorial
PUBLISHED 15 September 2022
DOI 10.3389/feart.2022.1013940

OPEN ACCESS

EDITED AND REVIEWED BY
Martyn Tranter,
Aarhus University, Denmark

*CORRESPONDENCE
Yunyan Ni,
niyy@petrochina.com.cn

SPECIALTY SECTION
This article was submitted to Geochemistry, a section of the journal Frontiers in Earth Science

RECEIVED 08 August 2022
ACCEPTED 12 August 2022
PUBLISHED 15 September 2022

CITATION
Ni Y, Hu Q, Li M, Zhang T and Gong D (2022), Editorial: Isotopic geochemistry of natural gas.
Front. Earth Sci. 10:1013940.
doi: 10.3389/feart.2022.1013940

Editorial: Isotopic geochemistry of natural gas

Yunyan Ni[1]*, Qinhong Hu[2], Maowen Li[3], Tongwei Zhang[4] and Deyu Gong[1]

[1]PetroChina Research Institute of Petroleum Exploration and Development, Beijing, China, [2]Department of Earth and Environmental Sciences, University of Texas at Arlington, Arlington, VA, United States, [3]Sinopec Petroleum Exploration and Production Research Institute, Beijing, China, [4]Bureau of Economic Geology, University of Texas at Austin, Austin, TX, United States

KEYWORDS

China, natural gas, shale gas, helium, CO_2, isotope geochemistry, natural gas

Editorial on the Research Topic
Isotopic geochemistry of natural gas

After decades of development guided by coal-derived gas theories, China's natural gas exploration has made significant progress, with natural gas becoming an important component of China's energy supply mix. With an increasing demand for clean energy, China's annual domestic gas production has increased from 130×10^9 m^3 in 2014 to 209×10^9 m^3 in 2021. China has also changed from a gas-poor country to a major gas-producing country. Eight years have passed since four Research Topic were published on natural gas in Chinese sedimentary basins: three on natural gas geochemistry in the journals of *Organic Geochemistry* (2005; 2014) and *Energy, Exploration & Exploitation* (2014), and another on the geology of giant gas fields in China in the journal of *Marine and Petroleum Geology* (2008). Drilling targets for natural gas exploration have been becoming very complex, extending from conventional traps to more unconventional "continuous" accumulations and to deep-and-ultra-deep seated petroleum plays. More efficient and cost-effective exploration and development of such resources put forward higher requirements for gas research, including the aspects of isotope geochemistry.

As suggested by Professor Jinxing Dai, Member of the Chinese Academy of Sciences, we organized this thematic Research Topic on Isotope Geochemistry of Natural Gas. It contains 13 articles, covering four broad themes: gas-source correlation of conventional natural gas; isotopic geochemistry and origin of unconventional gas (shale gas and tight gas); geochemistry of non-hydrocarbon gases (CO_2, He, etc.); and geological controls on hydrocarbon gas occurrence. The Issue introduces important progress and achievements that have been made in natural gas geochemistry and exploration in China over the past several years.

Three articles focus on the molecular composition and isotopic geochemistry of conventional natural gases, by presenting the latest results in the Sichuan, Tarim, and Junggar basins, respectively. A scheme of natural gas classification was developed, with case studies illustrating the complexity in the chemical composition and hence the origin of natural gases in different basins. Results indicate that four types of gases occur in the

Junggar Basin, whereas the Middle Triassic Leikoupo Formation in the Sichuan Basin hosts natural gases derived from either sapropelic or humic organic matter.

The past several years have been a successful period for China in developing shale gas resource in tectonically relative complex regions, and has made China the first country outside of North America to achieve large-scale economic shale gas development. With the discovery and development of giant shale gas fields such as Fuling, Changning-Weiyuan, and Zhaotong, China's shale gas production reached 22.9 × 10^9 m^3 or slightly more than 10% of total domestic gas production in 2021. Three articles in this Issue are devoted to the in-depth discussion of shale gas geochemistry and origin of the Upper Ordovician-Lower Silurian Wufeng-Longmaxi formations, using stable carbon, hydrogen, and mercury isotopes.

Helium is an important strategic resource and has great significance for national energy security. With a total of three articles, this Issue has made comprehensive and in-depth studies of the helium gas geochemistry in the Ordos and Bohai Bay Basins. Results from both basins indicate that helium is of a crustal origin, and is likely derived from the radioactive decay of U and Th in the rocks and minerals, with no significant contribution from atmospheric or mantle-derived helium. Geological factors controlling the potential of large helium gas accumulation are explored in the context of deep sedimentary strata and deep geofluids. The occurrence and origin of non-hydrocarbon gases, such as CO_2 and tight gas, and light hydrocarbon gas are also discussed.

Natural gas has attracted more and more attention as the main clean energy resource in the global transition to green energy. With the exploration and development of natural gas resources increasingly targeting fields that are unconventional, in greater burial depth, or with greater stratigraphic complexity, the isotope gas geochemistry is expected to play a more important role in helping exploration geologists and development engineers to understand the gas systems, and come up with creative solutions for cost-effective and sustainable development. Results presented in this thematic Research Topic will certainly provide an excellent source of references for those involved in upper stream natural gas research and production, particularly for those who are working in tectonically complex basins.

Author contributions

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

Conflict of interest

YN and DG were employed by PetroChina Research Institute of Petroleum Exploration and Development.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note