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HKU Astrobiologist Joins National Effort to Map Out China's Tianwen-3 Mars Sample Return Mission

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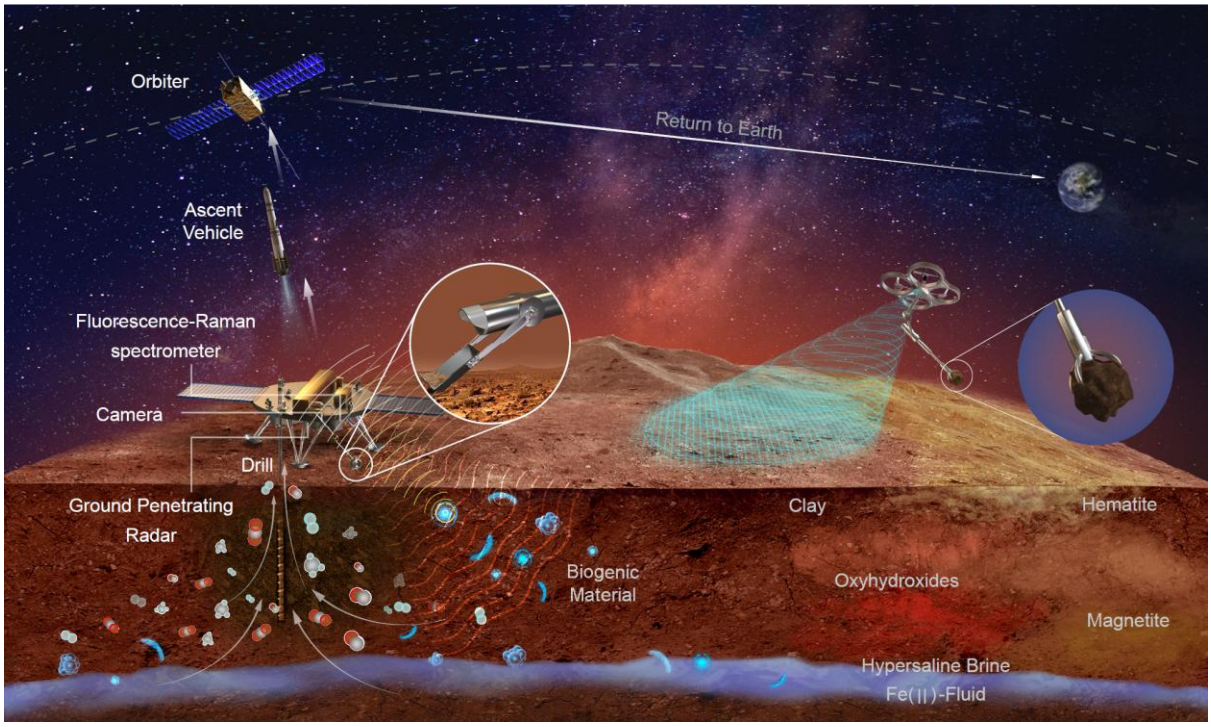

Figure 1. *Schematic of the Chinese Mars Sample Return mission, where the lander will drill 2 metres deep to collect the samples and scoop the surface materials with a robotic arm and drone.*

The origin of life is one of the most fundamental and enduring questions of mankind and one of the three greatest Origin Questions in the natural sciences. Recently, China has officially launched its Mars Sample Return (MSR) mission, Tianwen-3, marking a significant step forward in planetary exploration. The mission aims to bring Martian samples back to Earth, where advanced laboratory instruments will be employed to conduct comprehensive analyses, seeking to determine whether life ever existed—or may still exist—on Mars. Professor Yiliang LI, an astrobiologist from the Department of Earth Sciences at The University of Hong Kong (HKU), serves as a core member of the Tianwen-3 scientific team and a co-author of a recently published perspective article in *Nature Astronomy* outlining the mission's objectives. His role mainly involves leading an HKU group that is working on the selection of the landing site for the Tianwen-3 MSR mission.

Is There Life on Mars?

Earth is the only planet we know that harbours life. Research traces the origin of life on Earth dates back to approximately 3.8 billion years ago, around 700 million years after the formation of our solar system. Drawing on theoretical, experimental, and observational approaches, scientists believe that Earth's evolution during its first 700 million years made it a planet capable of producing life and being habitable. However, definitive evidence is still lacking as to whether life on Earth arose solely through indigenous evolution.

Like Earth, Mars lies within the habitable zone of our solar system. Research suggests that Mars once had a dense atmosphere and a warm, moist climate early in its history, making it suitable for the emergence and development of microbial life. From an astrobiological perspective, the early Martian environment was conducive to the survival of many of the so-called *extremophiles* found on Earth**.**

The Mission: Bringing Mars to Earth

The key to China's MSR mission lies in identifying Martian materials most likely to preserve evidence of past or present life. To achieve this, Chinese scientists must conduct extensive research before launching the rockets. This includes searching for regions on Mars where liquid water was likely present in the planet's early history, areas rich in essential metallic nutrients, and sites where traces of Martian microbial activity could potentially be preserved for billions of years. While this article outlines the fundamental framework for these studies, the search for promising sampling sites on Mars remains an ongoing and active endeavour.

The MSR mission, scheduled for launch in 2028, involves two separate rockets:

1. A lander, which will land on the Martian surface to collect samples.

2. An orbiter, which will wait in Mars' orbit to receive the samples and bring them back to Earth.

The lander will drill 2 metres underground—a critical depth because the surface of Mars is bombarded with radiation and corrosive chemicals that can destroy any signs of past or present life. Below this hostile surface layer, valuable organic materials may still be preserved. The samples will be transferred to the orbiter and then flown back to Earth for detailed analysis using sophisticated instruments not available on Mars.

Advancing Planetary Exploration Frontiers

The article further highlights that the greatest challenge in returning Mars samples to Earth lies not in the formidable technical or scientific obstacles, but in quarantining and monitoring required once these extraterrestrial materials arrive—a process known as planetary protection.

As China is poised to become the first country to return potentially biologically active planetary material, including potential life forms, from beyond Earth, the potential risk such substances might pose to terrestrial life, including humans, is a major concern. To address this, China plans to construct a specialised facility on the outskirts of Hefei, its renowned scientific hub, where Martian samples will undergo comprehensive biochemical and pathological testing under strict isolation from the Earth's environment. Only after it is conclusively determined that the samples contain no active biological agents or substances that could threaten the Earth's biosphere will they be released to designated laboratories for in-depth scientific analysis.

China's upcoming Mars sample return mission represents the next research goal following the successful deployment of the Zhurong rover on Mars in 2021. With this achievement, China became the second country—after the United States—to successfully land and operate a rover on the Martian surface. In 2020, several countries and entities announced ambitious goals for close-up and in-situ exploration of Mars by around 2030. Ultimately, only China's plan has made significant progress and been realised thus far.

The Team Behind Tianwen-3

The article was co-authored by leading experts at the forefront of China's planetary exploration efforts:

- Liu Jizhong – Chief Engineer of Tianwen-3, Deputy Director of the Science and Technology Committee for Large Space Projects, and Chief Designer of China's heavy-lift rocket programme.

• Hou Zengqian – Academician and Chief Scientist of Tianwen-3 and China's National Planetary Exploration Programme, former Vice President of the National Natural Science Foundation of China, and Scientist at the Chinese Academy of Geological Sciences.

• Wang Yuming – Deputy head of the Space Science and Ground Application Demonstration Group for the Tianwen-3 Mars Sample Return Mission. He is also the Deputy Director of the National Key Laboratory for Deep Space Exploration and Professor at the University of Science and Technology of China. He previously led the development of Mars magnetometers and comparative planetary science centres.

The perspective article in *Nature Astronomy* can be accessed via this link:

https://www.nature.com/articles/s41550-025-02572-0

For media enquiries, please contact HKU Faculty of Science (tel: 852-3917 4948/ 3917 5286; email: caseyto@hku.hk / email: cindycst@hku.hk).

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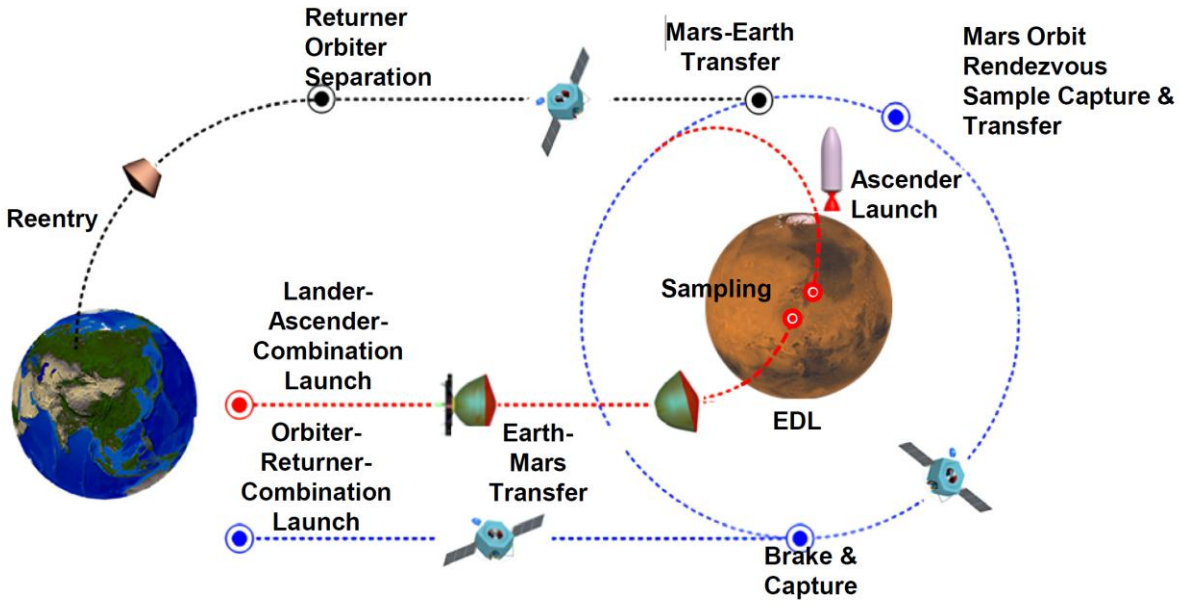

Figure 2. *The roadmap of the Chinese Mars Sample Return mission, which will be launched in 2028.*

Figure 3. *Professor Yiliang Li and his collaborator were conducting fieldwork to identify and recommend potential landing sites for the upcoming Chinese Mars Sample Return mission.*

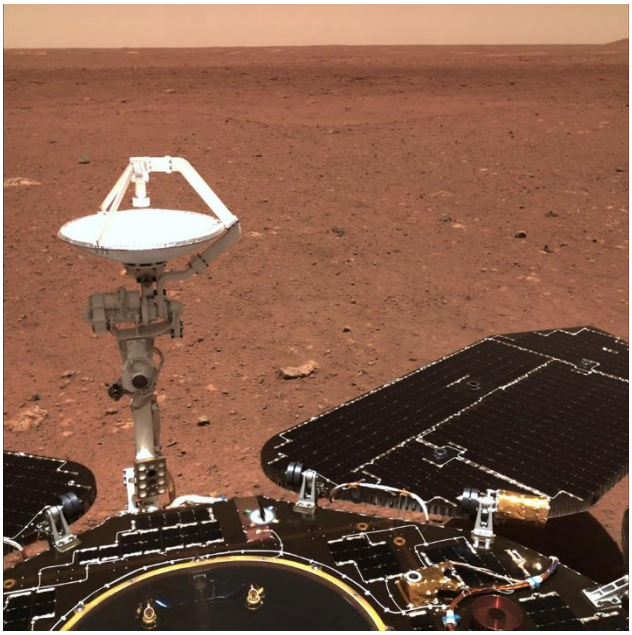

Figure 4. *The Tianwen mission is China's national effort to explore Mars through interplanetary space missions. The rover Zhurong, depicted in the image, became China's first rover to successfully land on the Martian surface in 2021.*