THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

SCIENCE
SCHOOL OF ENVIRONMENT

Horizon Europe

Group and Personnel Profile

Group Focus

Building digital realities in extraterrestrial domains: Using gaming to explore the surface of Mars

Concept: We aim to create a digital world on the surface of Mars, using a conceptual Mars sample return mission (LifeSpringsMars) as a basis for new research and educational tool centred in Gusev Crater, Columbia Hills, Mars. By combining realistic geologic, physical, and engineering constraints in a video game environment, players will simulate the challenges faced during space exploration, with the goal of successfully collecting unique geologic materials in the search for ancient extraterrestrial life. From initial decisions around a sample recovery vehicle (e.g. helicopter or rover), to successfully collecting targeted, small, irregularly shaped samples with varied physical properties, players will face increasing levels of difficulty and can learn through experimentation while aided by tutorials and demonstrations using real Mars data and Earth analogues.

Game design is intended to include real physical constraints to 1) provide simulation data that can feed back to researchers developing surface exploration strategies; 2) create a mechanism for public engagement through digital citizen science; and 3) educate the next generation of STEM scientists through a fun and engaging digital platform.

Group Competencies

This concept combines scientific knowledge from University of Auckland Earth science researchers with Geo AR gaming.

Melanie Langlotz is CEO of GeoAR, a seasoned professional with over 35 years of experience in the ever-evolving landscape of trending technology. specialising in translating complex scientific research into interactive simulations. Her expertise lies in aligning gameplay mechanics with real physical and engineering constraints to create scientifically credible, engaging digital environments for education and research. With her diverse expertise and deep understanding of the tech industry, Melanie is dedicated to driving innovation and taking scientific research to masses.
Divya D. is a analyst and partnerships lead at Geo AR, with an academic and industry background in engineering and business. She specialises in building interdisciplinary research collaborations and positioning serious games and simulations as credible research, and science-communication tools.

The science team at the University of Auckland, led by Professor Kathleen Campbell and Associate Professor Michael Rowe, are world leaders in hot springs research and its application to investigations of early life. Campbell is an astrobiologist/geologist with an extensive research background in understanding rock textures created by microbial life. Rowe is a geochemist whose specialization in analytical techniques provides a broad background for utilising novel approaches for geologic problem solving. Rowe and Campbell are both members of the steering committee for the LifeSpringsMars mission ideation.

Geo AR is a New Zealand based creative-technology studio specialising in transforming complex scientific research into interactive simulations and serious games for education, sustainability, and societal impact. Geo AR collaborates with universities, research institutes, and public-sector organisations to co-design digital tools that enhance science communication, public engagement, and evidence-based decision-making. The multidisciplinary team includes a senior e-learning designer with deep expertise in pedagogical frameworks, and a Digital Cultural Advisor who ensures that Indigenous perspectives, particularly Te Ao Māori, are authentically incorporated. This combination enables us to translate sophisticated data, models, and research outputs into intuitive, accessible gameplay experiences that support learning and behavioural change.

With our combined skill sets, we would like to contribute to:
HORIZON-CL4-2027-SPACE-03-12: Digital solutions for autonomy for space transportation systems, design and simulation tools
HORIZON-CL4-2026-04-DIGITAL-EMERGING-09: Advanced Local Digital Twins using AI for Early Warning and Preparedness (IA)
HORIZON-CL4-2027-02-DIGITAL-EMERGING-52: New approaches for Human/AI collaboration for the workforce of the future

Relevant Publications, Products, Services or other Related Achievements

Our science research team members have numerous relevant scientific publications related to silica deposits and their applications for the search for ancient life. Recent key examples include:

Rowe, M.C., et al. 2025. Life and death of a sinter archive: Evolution of siliceous hot-spring deposits (Holocene) on the dynamic Paeroa Fault at Te Kopia, Taupo Volcanic Zone, New Zealand. Journal of Volcanology and Geothermal Research, 465, https://doi.org/10.1016/j.jvolgeores.2025.108380
Nersezova, E.E., **et al** 2024. Trace metal and organic biosignatures in digitate stromatolites from terrestrial siliceous hot spring deposits: Implications for the exploration of martian life. Chemical Geology, 661, https://doi.org/10.1016/j.chemgeo.2024.122194
Nersezova, E.E., et al. 2023. Exploring the internal textures and physical properties of digitate sinter in hot springs: Implications for remote sampling on Mars. Planetary and Space Science, 238, doi.org/10.1016/j.pss.2023.105786
Ruff, S.W., Campbell, K.A., Van Kranendonk, M.J., Rice, M.S. and Farmer, J.D., 2020. The case for ancient hot springs in Gusev crater, Mars. Astrobiology, 20(4), pp.475-499.

Relevant Previous Projects/Activities

Rowe and Campbell were awarded seed funding from the New Zealand Royal Society Catalyst fund on "Remote sampling strategies for hot spring deposits on Mars" (2021-2023). This project was designed to build international collaborations for promoting a Mars sample return mission.

Rowe and Campbell have also recently (2025) been awarded a NZ Marsden Fund award for **"**Gallium as a new indicator of biogenic processes in geologic materials" which serves as scientific underpinning for the LifeSpringsMars sample return mission.

Key Infrastructure and Resources

The scientific underpinning of this concept draws on the unique natural setting of New Zealand's hot spring environments, from which Campbell and Rowe have extensive research experience. The University of Auckland also houses an extensive collection of hot springs silica deposits as analogue environments to potential hot spring deposits on Mars.

Biosketch of Key Personnel

Assoc. Prof. Michael Rowe – Geochemistry, petrology, volcanology, analytical, https://profiles.auckland.ac.nz/michael-rowe/about

Professor Kathleen Campbell – paleoecology, extreme paleoenvironments, hot springs, astrobiology, https://profiles.auckland.ac.nz/ka-campbell

Melanie Langlotz- CEO, GeoAR
Melanie Langlotz | LinkedIn

Divya Dihuliya- Relationship management, impact delivery and analysis
Divya D. | LinkedIn

Miranda Verswijvelven- Interactive narrative design for social impact and learning games
Miranda Verswijvelen. PhD | LinkedIn