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An International Network of Planetary Field Analogues for Astrobiology: Advancing Biosignature Science for ESA's ExoMars Rosalind Franklin Mission

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Over more than a decade, the Astrobiology and Geomicrobiology Laboratory of the University of Bologna has developed an international network of collaborations dedicated to planetary field analogues and biosignature research. This collaborative framework has progressively evolved into a network of complementary analogue sites, analytical facilities, and multidisciplinary expertise to address one of the central challenges of planetary exploration: the reliable detection and interpretation of biosignatures.

Planetary Field Analogues (PFAs) constitute the core of this collaborative framework, providing unique natural laboratories for investigating geological processes, habitability, and biosignature formation and preservation under environmental conditions relevant to Mars and other rocky planetary bodies. Rather than relying on individual analogue environments, the network exploits the complementarity of multiple field sites to investigate how geological, geochemical, and biological processes control the formation, preservation, and detectability of biosignatures.

The network includes hydrothermal, fumarolic systems and cold seep systems across Africa, South and North America and Europe, alkaline volcanic lakes from the Afar Depression to South America, evaporitic environments, and hyper-arid regions in Botswana, Morocco, and Algeria, collectively reproducing the diversity of geological and environmental processes considered relevant to Mars.

Beyond providing analogue sites, the network demonstrates that scientific collaboration is itself an enabling technology for planetary exploration. The preparation of missions such as ESA's ExoMars Rosalind Franklin rover requires the integration of complementary geological settings, analytical methodologies, and multidisciplinary expertise that no single institution can provide alone. This international framework illustrates how collaborative research accelerates the development of robust biosignature detection strategies and maximizes the scientific return of future life-detection missions.

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