PREFACE

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The search for extraterrestrial life is one of the most important endeavors of modern science, and Mars is the best candidate for fulfilling it, both in terms of the intrinsic probability that life could have once existed there, and in terms of the availability of information. The NASA rovers Spirit, Opportunity, and more recently Curiosity and Perseverance travelled, taking on the task of geologists, and analyzing former lakes and sea deposits where life may have existed. They have provided many thousands of images and interesting clues as to the possibility of past Martian life.

In Chapter 2, which makes up the central part of this volume, we present a large selection of sedimentary structures recorded by the NASA rovers (before March 2023, the starting date of this book's preparation), through their progressive, reasoned and weighed evaluation, in order to show their congruence with the world of microbialites. Even more pioneering, we aim to show their congruity with some recurrent millimeter shapes, having complex and inexplicable structure, and traits of terrestrial forms of life which resemble microfossils.

The initial suggestion for the title of this book was "Evidence of past life on Mars: microbialites and microfossils". A title that was, and remains, in our opinion, most in line with the content of the book. The difference to the current title is not significant, but merely clarifies the limitations of the terminology. The current version responds to the suggestions of an eminent geologist and NASA collaborator, who was consulted for his input. Although appreciative of the remarkable work done, and the scientific interest of the analyzed structures, he wanted to make clear that such interesting structures cannot be considered proof of life, *as great caution is needed on this topic*, due to the social and religious implications.

Consequently, the question emerges of, What the difference is between the two titles, and What does "evidence" mean? Evidence is the magic link which connects the mind to an object and its context through its vision. Furthermore, it represents the subjective reply to the question: "What is it?" and what it is for us, it may not be for others. To better emphasize the

subjectivity of the term "evidence" we added the term "compelling" to the type of evidence.

Despite its subjectivity, 'evidence' can assume a very different relevance (and scientific consensus) when the evaluation process is supported by multiple convergent elements, and when the latter lead to only one possible conclusion. In this case the evidence becomes "compelling evidence" (as suggested by several authors, as shown elsewhere in the volume) and the term 'putative' indicates a useful proposition, valid for further characterization and in-depth investigations.

At the center of this evaluation there are sciences such as "Sedimentology and Paleontology" which, in our terrestrial environment, are much more varied and dynamic than the Martian one. These sciences give us a broad palette of methods of approach and environment-related products that can be employed to exclude mimic cases and to support the evidence.

The hardest thing to see is what is in front of your eyes.
—Johann Wolfgang von Goethe.