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Wind as a geological process
on Earth, Mars, Venus and Titan

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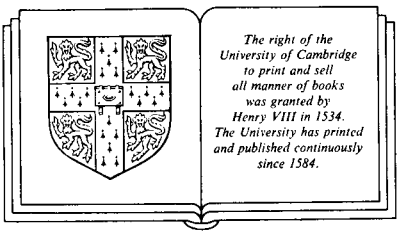

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To Cindy and Marge

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PREFACE

Ralph Bagnold – an engineer by training, a military man by profession, and in many ways a geologist at heart – melded his interests into an elegant study of aeolian processes that has spanned many decades. In 1941 Bagnold published the first edition of his book, *The Physics of Blown Sand and Desert Dunes*. Often referred to simply as 'Bagnold's classic book', it is indeed a classic in every sense of the word. The fact that nearly every subsequent paper dealing with aeolian processes refers to the Bagnold book bears testimony that the basic principles described by him are essentially correct and have withstood the test of time.

Our book deals with aeolian processes in the planetary context. It is not our intent to 'replace' Bagnold's book or the research it represents. We learned that was neither required nor possible early in our own research program! Instead, we have built upon the solid foundation laid by Bagnold, testing the relationships defined by him through different approaches, and extrapolating the results to other planetary environments by attempting to predict how aeolian processes operate on Mars, Venus and, perhaps, Titan, the largest of the saturnian satellites.

We begin with an introduction to aeolian processes and a general overview of aeolian activity on the planets. We then discuss, in Chapter 2, the requirements for aeolian activity – a dynamic planetary atmosphere and a supply of particles capable of being moved by the wind – and describe in Chapter 3 the physical processes involved in particle movement by the wind. In Chapters 4 and 5 we describe wind-eroded and wind-deposited features and landforms. Next we consider interaction between the wind and topography and then close with a chapter on windblown dust (fine-grained material carried aloft in suspension).

Insofar as is practical, we have integrated non-Earthly aspects of aeolian activity into the appropriate chapter sections. Typically, we begin a section with a discussion of Earth (our 'ground truth'), extend the discussion to Mars, and then close the section with speculations for Venus and Titan.

Our intention is that this book be used as reference and text for upper division or graduate courses in comparative planetology. Perhaps more than any other field, planetology requires a multidisciplinary approach to combine talents from the geological sciences, engineering, chemistry, and physics. One of the biggest difficulties in comparative planetology is communication among the various disciplines. Consequently, we have attempted to write this book in such a way that it can be understood by anyone with a science or engineering background. Our own somewhat disparate backgrounds, in geological sciences and in engineering, have often forced us to reevaluate our own and each other's viewpoints, and we hope those experiences have helped us achieve our objectives. Terms and commonly used jargon are defined where first used; an expanded glossary is also included for reference.

RG and JDI
1983

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