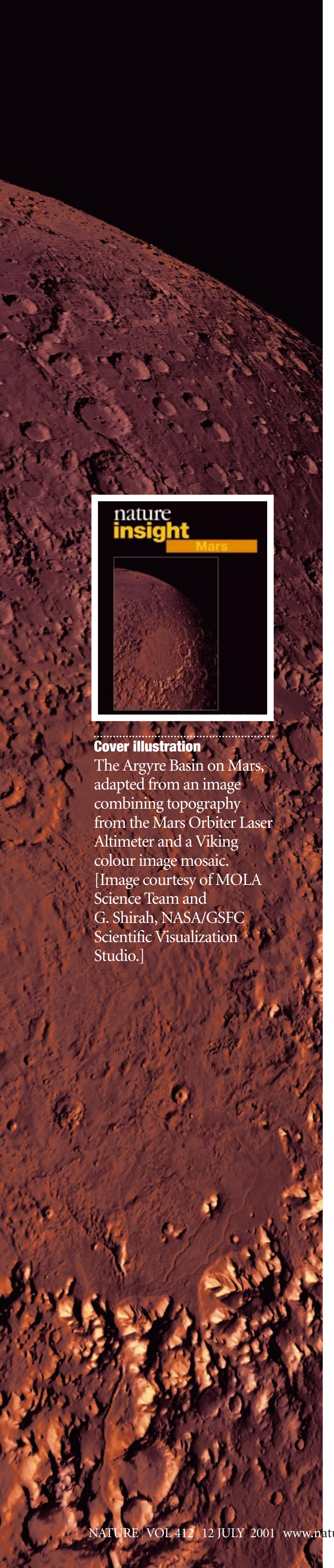
nature

insight

Mars



Cover illustration
The Argyre Basin on Mars, adapted from an image combining topography from the Mars Orbiter Laser Altimeter and a Viking colour image mosaic. [Image courtesy of MOLA Science Team and G. Shirah, NASA/GSFC Scientific Visualization Studio.]

This summer, Mars appears larger and brighter to us than it has for over a decade. We are reminded that each time we take a closer look at the red planet, the new observations seem only to increase our sense of wonder at how many mysteries remain unresolved regarding this most Earth-like of the other planets in our Solar System. At the heart of our fascination with Mars, at least over the past century, has been the possibility that liquid water exists at or near the martian surface and therefore that life might have taken hold elsewhere in our Solar System — or even exist there today.

And so, on the heels of some dramatic successes (and failures) in our attempts to deploy probes to study the martian surface, the time is appropriate to take stock of our understanding of present-day Mars as well as the geological and environmental evolution that has taken place since its formation, some four billion years ago. Most of our information on the interior of Mars comes to us from remote sensing of the martian surface and subsequent inferences on how the surface has evolved over geological timescales in response to both geodynamic processes in the martian interior and erosional processes at its surface. At the heart of this Nature Insight, a series of interrelated Review Articles describes this evolution, from the differentiation and solidification of the martian core to the dynamics of its atmosphere.

But first, on page 209, Kevin Zahnle provides a historical introduction of how both the public and scientific view of Mars has evolved since the latter part of the nineteenth century and how these ideas continue to propel our interest in Mars to this day. The core of Mars and scenarios for how the martian dynamo evolved are described by David Stevenson on page 214 — with consequences as far reaching as the preservation of the early atmosphere of Mars. Maria Zuber, on page 220, then reviews insights that have been gained into the evolution of the mantle and core of Mars, much of which have arisen from data obtained by the spectacular Mars Global Surveyor mission. The martian surface is thought to have evolved in response to surface processes, primarily through the action of water, ice and wind, as Victor Baker describes on page 228. Bruce Jakosky and Roger Phillips next discuss (on page 237) what such observations can tell us about the martian hydrological cycle and what constraints can be put on the possibility of liquid water having existed on Mars for significant periods of time. Atmospheric dynamics and weather on Mars differ from that of the Earth, as Conway Leovy explains on page 245. And, in a final commentary on page 250, Michael Carr and James Garvin describe the plethora of future missions planned for Mars.

At the next opposition of Mars in 2003, while a new set of landers and rovers will be hurling towards Mars, we will be able to gaze upon the brightest and biggest Mars in the night sky than at any time in the past 1,000 years as we ponder what new surprises await us from the martian surface.

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