Whenever surprises occur, there is always a review to see if anyone had predicted what had been found. In this case, craters had apparently been seen on Mars by E. Barnard in 1892 using the Lick 36" refractor, and by J. Mellish in 1917 using the Yerkes 40" refractor. Their existence had been predicted by D. L. Cyr in 1944, C. Tombaugh, E. Opik and, most recently, F. Whipple of the Smithsonian Astrophysical Observatory. Nevertheless, the discovery of craters on Mars was a major surprise to the astronomical community as a whole..."

I can happily recommend this hefty book (paperback, 469 pages) to anyone interested in the history of astronomy. I enjoyed it very much, although I admit that I tended to read it one chapter at a time. *New Cosmic Horizons* is more of a reference source than a story that unfolds with each chapter. In fact, I found that each chapter stands alone quite nicely, and each is absorbing and informative.

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Chronology and Evolution of Mars edited by R. Kallenbach, J. Geiss and W. K. Hartmann. Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001, 458 pp., $165.00 hardcover (ISBN 0-7923-7051-1).

This well-written, impressive publication is the outcome of a series of planetary science workshops held at the International Space Science Institute, Bern, Switzerland, between 1999 and 2000. The book has very broad themes, and comprises 18 multi-authored chapters, including an introduction and an epilogue. The book aims to summarize recent developments and significant advances which have been made in constraining timescales and geological processes in the evolution of Mars, and furthermore, outlines future directions regarding martian research.

The first five chapters consider well-dated cratered lunar surfaces to establish a chronology of cratered geological units on Mars. Stöffler and Ryder present a revised lunar impact flux curve using isotope ages of lunar samples and new considerations of lunar stratigraphy. Such calibration curves are extremely important and serve as a reference for inner solar system bodies such as Mars. The authors cite several problems with ages used earlier for determining the lunar flux curves. Furthermore, for the Eratosthenian and Copernican periods (about 3–1 Ga), the authors point out that reliable absolute ages are needed to better constrain the lunar flux curve for this time. Neukem and colleagues use size-frequency distributions for lunar craters to provide estimates of the size-frequency distribution for projectiles which formed craters on terrestrial planets and on asteroids, and this lunar production function is later used by Ivanov to estimate the frequency of impacts for a particular size of a formed crater on Mars.

The mineralogical, geochemical characteristics, and crystallisation ages of 16 SNC martian meteorites (*i.e.*, shergottites, nakhlites, Chassigny and the orthopyroxenite Allan Hills 84001) are discussed by Nyquist and colleagues in the following chapter. The crystallisation ages suggest that martian volcanism occurred over most of its geological history, and that volcanic activity probably continues till the present day. The ages of martian surfaces are determined by Hartmann and Neukum using crater counts and the results of Neukum and colleagues, and that of Ivanov. This chronology indicates that volcanic and fluvial activity was more intense in the first third of martian history, and that such activity has persisted until even as late as 3 Ma ago.

Part II of the book discusses the petrological evolutionary history of Mars. First, Halliday and colleagues discuss the present understanding of how Mars accreted and the early development of Mars. From Tungsten, Ba/W and Re/Os isotope ratios in martian meteorites, they propose that Mars has undergone rapid accretion, and that it differentiated in the first 20 Ma of solar history. Next, geophysical constraints on martian evolution are presented by Spohn and others using data from Mars Global Surveyor (MGS) and Mars Pathfinder missions, thermal history modelling, and chemistry of martian meteorites. The authors also discuss the MGS discovery of strong magnetization in the oldest parts of the martian crust, suggesting that the strength of the planet's surface magnetic field might have been comparable to that on Earth at some time. Head and colleagues present an overview on the reconstruction of the geological history of Mars using stratigraphical relationships and geological mapping using imaging data. They draw attention to the lack of direct and compelling evidence for an early warm and wet Mars. Furthermore, they recommend that absolute ages be determined for several broad, homogeneous martian surface units for an improved understanding of the rates and timing of geological processes on Mars. In the concluding chapters of Part II, Bibring and Erard summarize present efforts to investigate the surface composition of Mars, whereas Wänke and colleagues discuss a petrogenetic model which presumes that Mars possesses 50% basaltic and 50% andesitic igneous rocks.

The final part of this book examines the volatile evolutionary history of Mars. Masson and colleagues discuss various geomorphological landforms which suggest that liquid water might have flowed on the martian surface at some time. They emphasize the need for high-resolution stereoscopic imaging data with wider areal coverage to resolve ongoing debates regarding the origin of the valleys networks and outflow channels. Bridges and colleagues discuss various models which explain the formation of the SNC secondary phases, and discuss evidence for near-surface liquid water conditions during early martian times. The fundamentals of aeolian processes, effects of wind erosion on impact craters, and consequences for understanding martian chronology are presented by Greeley and colleagues. They recommend that rates of erosion, burial and exhumation by aeolian processes be quantified for large landforms. The next chapter by Hartmann suggests that gullies observed on martian hillsides formed as a consequence of recent melting of permafrost ice by episodic, geothermal activity. The present status of the martian atmosphere and its history is then discussed by Encrenaz using ground and space based remote sensing data, and Viking *in situ* mass spectrometry measurements. Additionally, measurements of argon, krypton, xenon and other volatiles in martian meteorites indicate the composition of the martian atmosphere (Bogard and colleagues). The concluding chapter by Hartmann and colleagues presents an important summary of the current status of martian research and provides crucial research directions for the future.

In summary, this is a very useful and eminently readable book, which reflects the interdisciplinary nature of martian research. It also brings forth new knowledge since the last major Mars conference volume was published by Kieffer and colleagues in 1992. The book is an invaluable starting point and will serve as standard reference material for future Mars research work.

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Higher than Everest: An Adventurer's Guide to the Solar System by Paul Hodge. Cambridge University Press, Cambridge, United Kingdom, 2001, 244 pp., $28.00 hardcover (ISBN 0-521-65133-6).

Imagine for a moment what Sir Edmund Hillary and Tenzing Norgay must have experienced on May 29, 1953 as they climbed to the summit of Mt. Everest. The surrounding terrain was bleak, the temperature frigid, and the air thin. At 29 000 feet, Mt. Everest must have seemed somewhat alien to the two adventurers; Hillary and Norgay probably felt as if they were the first to reach a new world in addition to being the first humans to climb Earth's tallest mountain. But in the twenty-first century, all of the tallest peaks and "new" worlds on Earth have been or are being explored, and there are very few "firsts" remaining. What is the intrepid adventurer of the future to do? Perhaps he/she should organize an expedition to the caldera of Olympus Mons or to the ice cliffs of Miranda. In *Higher than Everest*, Paul Hodge describes these and other potential first-time expeditions to the solar system's most fascinating locales, many of which, as the book's title implies, are higher than Mt. Everest.

Higher than Everest is organized into 20 chapters, each describing a particular adventure to a special feature on a planet or satellite. Most of the expeditions deal with climbing mountains, cliffs, or volcanoes, but a few explore other realms such as canyons, impact craters, and subsurface oceans. The first 11 chapters are devoted to exploring the special features of the inner solar system, such as the Cliffs of Discovery on Mercury, Olympus Mons on Mars, Mt. Tepev on Venus, and Copernicus crater on the Moon. The next eight chapters outline potential adventures to the outer solar system's most enigmatic features, such as Jupiter's upper atmosphere, the ice cliffs of Miranda, and the volcanoes of Io. The last chapter, "All Nine", represents a grand finale to this whirlwind tour of exotic places. Here Hodge lists the highest planetary features on all nine planets for those adventurers who want to "bag" the highest "peaks" in the solar system.

In addition to the "adventurer's guide," each chapter of Hodge's work also contains a brief description of the planetary body in question. He explains what is currently known about the object as well as some possible theories on how it may have formed. He often includes a historical perspective to help the reader place the planetary object and its special feature in the proper context, and depicts each expedition as fact-gathering as opposed to exploration solely for the sake of adventure. Hodge supports the text with diagrams and images, many of which are based on data from NASA spacecraft missions. He also uses comparative pictures of Earth features to explain some of the mechanisms believed to have led to the formation of similar landforms on the extraterrestrial bodies described.

Because it is written for a more general audience, serious scholars would probably not find *Higher than Everest* particularly useful. As a general text, this work is adequate. Its main strength is that it provides a unique, enjoyable approach for teaching planetary science in introductory courses or public forums. It is probably not detailed enough to be used as a textbook, but portions of it may be useful for supplementing lectures on specific features within our solar system.

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