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Ice Sheets

In The

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understanding
the formation of
life in the

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Astrobiology
offers an
introductory
text that
explores the
structure of
living things,
the formation of
the elements
required for

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life in the
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biological and
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history of the
Earth, and the
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other planets.

Written by a
noted expert on
the topic, the
book examines
many of the
major conceptual

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foundations in
astrobiology,
which cover a
diversity of
traditional
fields including
chemistry,
biology,
geosciences,
physics, and
astronomy. The
book explores
many profound
questions such

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as: How did life originate on Earth? How has life persisted on Earth for over three billion years? Is there life elsewhere in the Universe? What is the future of life on Earth? Astrobiology is centered on

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investigating
the past and
future of life

on Earth by
looking beyond
Earth to get the
answers.

Astrobiology
links the
diverse
scientific
fields needed to
understand life
on our own

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planet and,
potentially,
life beyond.

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a new chapter
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and how they got
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latest advances
in the field

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physics,
astronomy and
related
disciplines, the

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text that
includes recent
advances to this
dynamic field.*
Mars is a small
world with a big
reputation. This
mysterious,
singular
planet—with

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volcanoes that
dwarf Mount
Everest, a
canyon system
that would
stretch fully
across the
United States,
and curious
landscapes that
perhaps once
harbored
water—has
fascinated us

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for centuries.

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available of the
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follows our
longstanding
love affair with
this unique
celestial body,
from the musings
of humanity's

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first stargazers
to the
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writers, radio
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and filmmakers,
to the latest
images and
discoveries from
the Curiosity
rover. The book
also reviews
plans for

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piloted missions
to Mars—and what
it will take for
those missions
to succeed.

A major non-
technical
challenge of
space activities
is ensuring
productive
cooperation,
communication,
and

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understanding
between the
engineers who
design the
mission and the
space lawyers
who cover its
relevant legal
aspects. Though
both groups
usually attain
some level of
understanding,
it is only

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achieved after
many years of
experience in
the space
industry and
through repeated
contact with
topics relevant
to their
projects. A
basic
understanding of
the most
important legal

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and technical
aspects acquired
earlier in their
careers can
facilitate
better
cooperation and
more efficient
development of
space projects.
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topics and
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conducting
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activities. The book uses high-profile space missions as examples and highlights the major technical aspects of these missions and the legal issues applied to these missions. While highlighting topics such as

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planetary
settlements,
policy
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perspectives,
and suborbital
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engineers,
academicians,
students, and
professionals.

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This book
provides concise
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reviews in

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young and still
emerging multidisciplinary field
of science that
addresses the
fundamental
questions of how
life originated
and diversified

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on Earth,
whether life
exists beyond
Earth, and what
is the future
for life on
Earth. Readers
will find
coverage of the
latest
understanding of
a wide range of
fascinating
topics,

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including, for
example, solar
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formation, the
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the history of
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intelligence on
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implications of
genome data,

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and beyond the
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contains a brief

summary of the
current status

of the topic

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under
discussion,

sufficient

references to

enable more
detailed study,
and descriptions

of recent
findings and

forthcoming
missions or
anticipated

research.

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leading experts

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science,
geoscience,
chemistry,
biology, and
physics, this
insightful and t
hought-provoking
book will appeal
to all students
and scientists
who are

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Drilling:
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[abstracts of
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Conference, 27th
The Human Cosmos

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pieces of ice
the size of
continents
breaking off
of Antarctica,

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rapidly
melting
glaciers in
the Himalayas,
and ice sheets
in the Arctic
crumbling to
the sea, but
does it really
matter? Will
melting
glaciers

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change our
lives?

Absolutely.

Glaciers are
built and
destroyed
during ice
ages and
interglacial
periods. These
massive ice
bodies hold

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three quarters
of our
freshwater,
yet we don't
have laws to
protect them
from climate
change. When
they melt,
they increase
sea levels,
alter the

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Earth's
reflectivity,
wreak havoc
for ocean and
air currents,
destabilize
global
ecosystems,
warm our
climate, and
bring on
floods that

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swamp millions
of acres of
coastal land.

The critical
ecological
role they play
to keep our
global climate
stable, and
the
environmental
functions they

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provide,
withier. And,
as climate
change warms

glacier cores,
collapsing
glacier ice
triggers
tsunamis that
send deadly
massive ice
blocks, rocks,

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earth, and billions of liters of water rushing down mountain valleys. It has happened before in the Himalayas, the Central Andes, the Rockies and Western

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Cascades, and
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the European
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Alps, and it
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will happen
again. In his
new book
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Taillant takes
readers deeper
into the
cryosphere,

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connecting the
dots between
climate
change,
glacier melt,
and the
impacts that
receding
glacier ice
brings to
livability on
Earth, to our

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environments,
Sheets In The
and to our
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communities.
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Taillant walks
us through the
little-known
realm of the
periglacial
environment, a
world of
invisible
subsurface

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rock glaciers
Sheets In The
that will
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outlive
Latitudes
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glaciers as
climate change
destroys
surface ice.

He also looks
at actions
that can help
stop climate

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change and
save glaciers,
exploring how
society,

politics, and
our leaders
have responded
to address the
global
COVID-19
pandemic and
yet largely

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continue to
fail to
address the
even
larger looming
and escalating
crisis of
climate
change. Our
climate is
deteriorating
at a drastic

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rate, and it's
happening
right in front
of us.

Meltdown is
about glaciers
and their
unfolding
demise during
one of the
most critical
moments of our

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planet's
geological
history. If we
can reconsider
glaciers in a
whole new
light and
understand the
critical role
they play in
our own sustain-
ability, we

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may be able to
save the
cryosphere.

This book is a
comprehensive
advancement
about the
understanding
of the
volcanology of
Mars in all
its aspects,

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from its
primary
formation to
its evolution
in time, from
the smaller
structures to
the bigger
structures. It
discusses the
implications
of volcanism

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in the general
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and geological
context of

Mars. The book
is validating
the Southern
Giant Impact
Hypothesis
explaining the
formation of
Mars in an int

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approach,
including
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geochemical,
volcanological
as well as geo-
morphological
information.

Implications
for future
explorations

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in terms of
resources are
provided. This

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undergraduate
and graduate
level to
foster new
basic research
in the field
of planetary

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volcanology
and is a new
guide for
future

missions
toward a
volcanic
world,
including new
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information
for the

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audience who
is always keen
to know more

about the
history of
Mars and its
large
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water
resources of
the planet.

Universe. When
it comes to
staying
current with
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discoveries,
clearing away

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contemporary
issues on the

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preservation
of the oceans
and sea life,
covering such
topics as
global
warming, water
pollution, and
declines in
fish
population and
diversity.

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Astrobiology

Mars

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Snow and ice environments support significant biological activity, yet the biological importance of some of these habitats, such as glaciers, has only recently gained appreciation.

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Subsurface Ice Sheets In The Northern Mid Latitudes

Collectively, these ecosystems form a significant part of the cryosphere, most of which is situated at high latitudes. These ice environments are important sentinels of climate change since the polar regions are presently undergoing the highest rates of climate warming, resulting in very marked changes in

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the extent of ice caps, glaciers, and the sea ice. Glacial systems are also regarded as an analogue for astrobiology, particularly for Mars and the moons of Jupiter (e.g. Europa), and one of the justifications for research in this area is its potential value in astrobiology. This timely and accessible volume draws together the

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current knowledge on life in snow and ice environments. It describes these often complex and often productive ecosystems, their physical and chemical conditions, and the nature and activity of the organisms that have colonised them. The cryosphere is the domain of extremophiles,

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organisms able to adapt to the physiological and biochemical challenges of harsh cold conditions where liquid water may only be present for relatively short periods each year. The majority of extremophiles in ice and snow are microorganisms. The Ecology of Snow and Ice Environments is intended for the non-

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specialist, enabling
environmental scientists
to understand the
biological functioning of
extreme cold
environments and for
biologists to gain
knowledge of the nature
of the cryosphere.

A diverse account of
how life exists in
extreme environments
and these systems'
susceptibility and

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resilience to climate
change. Sheets In The

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extensively

photographed by
cameras and
compositionally detected
by spectrometers
onboard orbiters on a
global scale, and
explored in-situ by
landers and rovers at
both local and outcrop
scales in different

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locations. The results have proved that the Martian surface is rich in Earth-like

geomorphologies, and the study of terrestrial analogs to Mars has been listed as one of the highest priorities of Martian science. With increasing new discoveries by in-situ explorations, Mars exploration has begun to

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enter the era of focusing on detailed analyses at regional to outcrop levels, rather than global mapping. Analog studies are playing a crucial role in this transition, making this book, which introduces the methodology and provides cases for readers, essentially important. Dozens of sites on Earth have been

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listed as analog targets for comparative study with the geomorphology, geology, geochemistry, environment and habitability of Mars. However, due to the diversity of landforms and forming mechanisms, and the long history of Mars, no single analog site on Earth can be fully compared to Mars.

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Nonetheless, the
Qaidam Basin has been
listed as an unique Mars

analog site for studying

the red planet's

geomorphology,

geology, and

environmental changes,

particularly regarding

the evolution of

paleolakes on Mars. This

kind of setting has

always been listed as a

top priority for the

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search of life on

Sheets In The

Mars. This book contains
first-hand information

and on-site images

obtained by the work's

contributing authors, and

is an essential read for

anyone interested in

Martian geomorphology

and its evolution

processes and history.

Dynamic Mars: Recent

and Current Landscape

Evolution of the Red

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Planet presents the latest observations, interpretations, and explanations of geological change at the surface or near-surface of this terrestrial body. These changes raise questions about a decades-old paradigm, formed largely in the aftermath of very coarse Mariner-mission imagery in the 1960s,

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suggesting that much of the interesting geological activity on Mars occurred deep in its past, eons ago. The book includes discussions of (1) Mars' ever-changing atmosphere and the impact of this on the planet's surface and near-surface; (2) the possible involvement of water in relatively new, if not

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contemporary, gully-like flows and slope streaks (i.e. recurring slope lineae); and (3) the identification of a broad suite of agents and processes (i.e. glacial, periglacial, aeolian, meteorological, volcanic, and meteoric) that are actively revising surface and near-surface landscapes, landforms, and features on a local,

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regional, and
hemispheric scale.

Highly illustrated and
punctuated by data from
the most recent Mars
missions, *Dynamic Mars*
is a valuable resource
for all levels of research
in the geological history
of Mars, as well as of
the three other terrestrial
planets. Utilizes
observational and model-
based data as well as

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geological context to
frame the understanding
of the dynamic surface
and near-surface of
Mars Presents a broad
spectrum of highly
regarded experts and
themes to discuss and
evaluate the geological
history of late and
current Mars Includes
extensive and detailed
imagery to clearly
illustrate these themes,

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discussions, and
evaluations

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Understanding Life in
the Universe

Permafrost (perennially
Frozen Ground)

Mars On Earth: A Study
Of The Qaidam Basin

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From the Late Noachian
Epoch to the Present
Day
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*Advances in
Extraterrestrial
Drilling: Ground, Ice,
and Underwater
includes the latest
advances that have
been made in recent
years in developing
drilling and excavation
mechanisms for
extraterrestrial bodies.*

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The chapters cover drill types, drilling techniques and their advantages and associated issues, rock coring including acquisition, damage control, caching and transport, and data interpretation, as well as unconsolidated soil drilling and borehole stability. This book includes a description

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*of the basic science of
the drilling process,
associated processes of
breaking and
penetrating various
media, the required
hardware, and the
process of excavation
and analysis of the
sampled media. Covers
the most recent
advances in
extraterrestrial drilling.
Discusses drilling in*

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*the broadest range of
media including
ground, ice,
underwater, and
planetary surfaces from
shallow to very deep.*

*Provides a
comprehensive
description of key
drilling techniques and
the efforts to develop
unified approach to
assessing the required
tools for given drilling*

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requirements.

Discusses how the environment affects drilling and approaches to addressing the effects and current challenges of drilling and excavation on other planets. Examines novel drilling and excavation approaches.
Dr. Yoseph Bar-Cohen is the Supervisor of the Electroactive

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*Technologies Group (<http://ndea.jpl.nasa.gov/>
) and a Senior*

*Research Scientist at
the Jet Propulsion
Lab/Caltech, Pasadena,
CA. His research is
focused on electro-
mechanics including
planetary sample
handling mechanisms,
novel actuators that are
driven by materials
such as piezoelectric*

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and EAP (also known as artificial muscles), and biomimetics. Dr. Kris Zacny is a Senior Scientist and Vice President of Exploration Systems at Honeybee Robotics, Altadena, CA. His expertise includes space mining, sample handling, soil and rock mechanics, extraterrestrial drilling,

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Utilization (ISRU).*

This two-volume set includes the latest principles behind the processes of drilling and excavation on Earth and other planets. It covers the categories of drills, the history of drilling and excavation, various drilling techniques and associated issues, rock

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*coring (acquisition,
damage control,
caching and transport,
restoration of "in-situ"
conditions and data
interpretation), as well
as unconsolidated soil
drilling and borehole
stability. It describes
the drilling process
from basic science and
associated process of
breaking and
penetrating various*

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*media and the required
hardware and the
process of excavation
and analysis of the
sampled media.*

*A mission to send
humans to explore the
surface of Mars has
been the ultimate goal
of planetary
exploration since the
1950s, when von Braun
conjectured a flotilla of
10 interplanetary*

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vessels carrying a crew of at least 70 humans. Since then, more than 1,000 studies were carried out on human missions to Mars, but after 60 years of study, we remain in the early planning stages. The second edition of this book now includes an annotated history of Mars mission studies, with quantitative data

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wherever possible.

*Retained from the first
edition, Donald Rapp*

looks at human

missions to Mars from

an engineering

perspective. He divides

the mission into a

number of stages:

Earth's surface to low-

Earth orbit (LEO);

departing from LEO

toward Mars; Mars

orbit insertion and

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*entry, descent and
landing; ascent from
Mars; trans-Earth
injection from Mars
orbit and Earth return.
For each segment, he
analyzes requirements
for candidate
technologies. In this
connection, he
discusses the status and
potential of a wide
range of elements
critical to a human*

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*Mars mission,
including life support
consumables, radiation
effects and shielding,
microgravity effects,
abort options and
mission safety, possible
habitats on the Martian
surface and aero-
assisted orbit entry
descent and landing.
For any human mission
to the Red Planet the
possible utilization of*

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any resources

indigenous to Mars

would be of great value

and such possibilities,

*the use of indigenous
resources is discussed*

at length. He also

discusses the

relationship of lunar

exploratio n to Mars

exploration. Detailed

appendices describe the

availability of solar

energy on the Moon

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*Subsurface Ice
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*and Mars, and the
potential for utilizing
indigenous water on
Mars. The second
edition provides
extensive updating and
additions to the first
edition, including many
new figures and tables,
and more than 70 new
references, as of 2015.
Space exploration,
especially the recent
push for the*

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*commercialization and
militarization of space,
is attracting increased
attention not only from
the wider public and
the private sector but
also from scholars in a
wide range of
disciplines. At this
moment of uncertainty
about the future
direction of national
spaceflight programs,
The Value of Science in*

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*Space Exploration
defends the idea, often
overlooked, that the
scientific*

*understanding of the
Solar System is both
intrinsically and
instrumentally
valuable. Drawing on
research from the
physical sciences, social
sciences, and the
humanities, James S.J.
Schwartz argues*

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further that there is truly a compelling obligation to improve upon our scientific understanding-including our understanding of space environments-and that there exists a corresponding duty to engage in the scientific exploration of the Solar System. After outlining the underpinning epistemological

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*debates, Schwartz
tackles how this
obligation affects the
way we should
approach some of the
major questions of
contemporary space
science and policy: Is
there a need for
environmental
preservation in space?
Should humans try to
establish settlements on
the Moon, Mars, or*

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*elsewhere in the Solar
System, and if so, how?*

*In answering these
questions, Schwartz
parleys with recent
work in science policy
and social philosophy
of science to
characterize the
instrumental value of
scientific research,
identifying space
research as a
particularly effective*

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*generator of new
knowledge.*

*Additionally, whereas
planetary protection
policies are currently
employed to prevent
biological
contamination only of
sites of interest in the
search for
extraterrestrial life,
Schwartz contends that
all sites of interest to
space science ought to*

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be protected.

Meanwhile, both space resource exploitation, such as lunar or asteroid mining, and human space settlement would result in extensive disruption or destruction of pristine space environments. The overall ethical value of these environments in the production of new

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Latitudes*

*knowledge and
understanding is
greater than their value
as commercial or real
commodities, and thus
confirms that the
exploitation and
settlement of space
should be avoided until
the scientific
community develops an
adequate
understanding of these
environments. At a time*

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when it is particularly pertinent to consider the ways in which space exploration might help solve some of the world's ethical and resource-driven concerns, The Value of Science in Space Exploration is a thought-provoking and much-needed examination into the world of space.

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*Recent and Current
Landscape Evolution of
the Red Planet*

*Proceedings of the
Polar Processes on
Mars Workshop
Cold Regions Science
and Engineering
Atmospheric Evolution
on Inhabited and
Lifeless Worlds
Lunar and Planetary
Science*

Life in Extreme

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Environments

***Granite is
exposed over
more than 15%
of the
continents,
implying that its
significance to
the Earth's
surface is
comparable to
that of the***

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carbonates.

***Landforms and
Geology of***

Granite Terrains

is devoted to

this

phenomenon

and provides a

comprehensive

explanation of

the landforms

and landscapes

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*Subsurface Ice
Sheets in The
Martian Mid
Latitudes*
**developed on
granitic rocks
and forms.**

**Whereas
existing
literature in the
field
predominantly
deals with karst
landscapes, this
book is
specifically**

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Subsurface Ice
Sheets In The
Martian Mid
Latitudes
***focussed on
granitic
terrains.***

***Landforms and
Geology of
Granite Terrains
provides
detailed
considerations
of the forms,
major and
minor, well-***

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*known and not
so familiar
granitic
terrains,
developed over
large areas of
the continents.
It comprises
interpretations
which are of
general
significance in*

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Latitudes*

***the analysis and
understanding
of the landscape
and includes
many theories in
the context of
granite
landforms. The
importance of
structure,
including crystal
stresses, and***

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***the value of
etching of
subsurface
initiation, multi-
stages or two-
stages
development,
neotectonic
forms, solution
forms is
emphasized as
well as the***

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***antiquity of
some forms and
surfaces
(inherited
forms).***

***Morphogenetic
forms are placed
in perspective
and comparison
is made with
similar forms in
other rock***

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types. This work is intended for geologists, geomorphologists, geographers and mining engineers and can serve both as a practical guide for professionals and as a

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*textbook for
university
courses. Author,
location and
subject indices
are included.*

*This book covers
in detail the
mechanisms for
how energy is
managed in the
human body.*

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Latitudes

The basic principles that elucidate the reactivity and physical interactions of matter are addressed and quantified with simple approaches. Three-dimensional

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**representations
of molecules are
presented
throughout the
book so
molecules can
be viewed as
unique entities
in their shape
and function.
The book is
focused on the**

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***molecular
mechanisms of
cellular
processes in the
context of
human
physiological
situations such
as fasting,
feeding and
physical
exercise, in***

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**which metabolic
regulation is
highlighted.**

**Furthermore the
book uses key
historical
experiments
that opened up
new concepts in
biochemistry to
further
illustrate how**

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*the human body
functions at
molecular level,
helping students
to appreciate
how scientific
knowledge
emerges. New to
this edition: - 30
challenging
practical case
studies (2-3 at*

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*the end of each
chapter) based
on movies,
novels,
biographies,
documentaries,
paintings, and
other cultural
and artistic
creations far
beyond canonic
academic*

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***exercises. - A set
of challenging
questions and
problems in the
end of each case
study to further
engage students
with the
applications of
medical
biochemistry -
Insights into the***

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*answers to the
challenging
questions to
help steer teachi
ng/learning
interactions key
to productive
lectures, PBL
(problem-based
learning) or
traditional
tutorials, or e-*

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learning
approaches.

Advance praise
for the second
edition: "The
Challenging
Cases are
compelling both
from a scientific
viewpoint and
for the
perspective they

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***provide on the
history of
medicine.”***

***David M.
Jameson,
University of
Hawaii “Using
case studies to
reinforce the
biochemistry
lessons is
extremely***

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***effective - as
well as
entertaining!”***

Joseph P.

Albanesi, UT

Southwestern

Medical Center

Advance Praise

for the first

edition: “This

textbook

provides a

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***modern and
integrative
perspective of
human***

***biochemistry
and will be a
faithful
companion to
health science
students
following
curricula in***

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**which this
discipline is
addressed. This
textbook will be
a most useful
tool for the
teaching
community.”**

**Joan Guinovart
Former director
of the Institute
for Research in**

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***Biomedicine,
Barcelona,
Spain, and
former***

***president of the
International
Union of
Biochemistry
and Molecular
Biology, IUBMB
This report
presents***

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***engineering
guidance for the
design and
construction of
foundations in
areas of deep
seasonal frost
and permafrost
as developed up
to the early
1970's.
Attention is***

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**given to basic
considerations
affecting
foundation
design, site
investigations,
survey datum
points,
construction
consideration,
and monitoring
performance.**

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*Included in the
main text are 17
tables, 141
figures, and 213
selected*

*references. A
bibliography
presents 45
additional
references.*

*An introduction
for courses that*

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*involve some
knowledge of
glacial geology
and sediments
of formerly
glaciated
terrains. The
early chapters
describe
depositional
processes at
modern glacier*

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***and ice-sheet
margins relating
sediments and
landforms in
recurring
"landsystems".
Later chapters
portray the
distribution of
these
landsystems in
Pleistocene***

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Subsurface Ice

***glaciated
terrains of the
mid-latitudes,
focussing on
commonly
encountered
problems in
various fields
from
stratigraphic
and
sedimentologica***

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***I investigations
to construction
problems
relating to roads
and dams. The
resulting text is
a summation of
a large body of
literature
previously
accessible only
to specialists. A***

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*substantial
reference list is
complemented
by cross-
references
throughout.*

*An Introduction
for Engineers
and Earth
Scientists
Landforms and
Geology of*

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**Granite Terrains
Universe: The
Solar System
Antarctic**

**Journal of the
United States
Enabling
Technologies for
Exploring the
Red Planet
Origins**

Our appreciation of

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*glaciological
processes in
Antarctica suffers
from a lack of
observations in
regions where
numerical models
indicate the ice
sheet to be
susceptible to
ocean and/or
atmospheric*

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warming. The solution lies in the use and development of glacier geophysics. In this volume we present a series of papers that demonstrate how geophysics can be deployed in Antarctica to

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*comprehend: (1)
boundary
conditions that
influence ice flow
such as subglacial
topography, the
distribution of
basal water and
ice-sheet rheology;
(2) phenomena
that might affect
ice-flow processes,*

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*such as complex
internal ice-sheet
structures and the
proposition of large
stores of hitherto
unappreciated
groundwater; and
(3) how glacial
sediments and
formerly glaciated
terrain on, and
surrounding, the*

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*continent can
inform us about
past ice-sheet
dynamics. The
volume also takes
a historical view on
developments
leading to current
knowledge,
examines active
ice-sheet
processes, and*

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*points the way
forward on how
geophysics can
advance*

*quantitative
understanding of
Antarctic ice-sheet
behaviour.*

*Mars Geological
Enigmas From the
Late Noachian
Epoch to the*

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In 2016, scientist

Rosalyn Lopes and

artist Michael

Carroll teamed up

as fellows of the

National Science

Foundation to

travel to Mount

Erebus, the world's

southernmost

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*active volcano in
Antarctica. The
logistics of getting
there and complex
operations of
Antarctica's
McMurdo Station
echo the kinds of
strategies that
future explorers will
undertake as they
set up settlements*

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on Mars and
Sheets In The
beyond. This
Martian Mid
exciting popular-
Latitudes

level book
explores the
arduous
environment of
Antarctica and how
it is similar to other
icy worlds in the
Solar System. The
bulk of this story

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*delves into
Antarctica's
infrastructure,
exploration, and
remote camps,
culminating on the
summit of Erebus.
There, the authors
explored the caves
and ice towers on
the volcano's
flanks, taking*

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Latitudes*
photographs and
generating original
art depicting
scenes in

*Antarctica and
terrestrial analogs
on other planets
and moons.*

*Readers will see
an intimate side of
Mount Erebus and
Antarctica while*

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*surveying the
region's history,
exploration,
geology, and
volcanology, which
includes research
funded by the
National Science
Foundation's
United States
Antarctic
Programs. Richly*

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*Subsurface Ice
Sheets In The
Martian Mid
Latitudes*
*illustrated with
photographs and
stunning paintings
showcasing the
beauty of the harsh
continent, the book
captures the spirit
and splendor of the
authors' journey to
Erebus.*

*In spring 2011 the
National*

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*Academies of
Sciences,
Engineering, and
Medicine produced
a report outlining
the next decade in
planetary sciences.
That report, titled
Vision and
Voyages for
Planetary Science
in the Decade*

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*2013-2022, and
popularly referred
to as the "decadal
survey," has
provided high-level
prioritization and
guidance for
NASA's Planetary
Science Division.
Other
considerations,
such as budget*

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realities,
congressional
language in
authorization and

appropriations
bills, administration
requirements, and
cross-division and
cross-directorate
requirements
(notably in retiring
risk or providing

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*needed information
for the human
program) are also
necessary inputs
to how NASA
develops its
planetary science
program. In 2016
NASA asked the
National
Academies to
undertake a study*

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Latitudes*
*assessing NASA's
progress at
meeting the
objectives of the
decadal survey.*

*After the study was
underway,
Congress passed
the National
Aeronautics and
Space
Administration*

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Transition

Sheets In The
Authorization Act
of 2017 which

Martian Mid
Latitudes
called for NASA to
engage the

National

Academies in a
review of NASA's

Mars Exploration
Program. NASA

and the Academies
agreed to

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*incorporate that
review into the
midterm study.*

*That study has
produced this
report, which
serves as a
midterm*

*assessment and
provides guidance
on achieving the
goals in the*

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Latitudes

*remaining years
covered by the
decadal survey as
well as preparing
for the next
decadal survey,
currently
scheduled to begin
in 2020.*

*The Value of
Science in Space
Exploration*

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Latitudes

*Abstracts of
Papers Submitted
to the Twenty-
seventh Lunar and
Planetary Science
Conference, March
18-22, 1996
Antarctica: Earth's
Own Ice World
Human Missions to
Mars
Civilization and the*

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Stars
Sheets In The

Martian Mid
Latitudes
*"Planetary
Astrobiology provides*

*an accessible,
interdisciplinary
gateway to the frontiers
of knowledge in
astrobiology via results
from the exploration of
our own solar system
and exoplanetary
systems'--*

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This book provides an intriguing look at how life can adapt to many different extreme environments. It addresses the limits for life development and examines different strategies used by organisms to adapt to different extreme environments.

*Mars Geological
Enigmas: From the Late*

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Noachian Epoch to the Present Day presents outstanding questions on the geology of Mars and divergent viewpoints based on varying interpretations and analyses. The result is a robust and comprehensive discussion that provides opportunities for planetary scientists to develop their own

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Martian Mid
Latitudes*

*opinions and ways
forward. Each theme
opens with an
introduction that
includes background on
the topic and lays out
questions to be
addressed. Alternate
perspectives are covered
for each topic,
including methods,
observations, analyses,
and in-depth discussion
of the conclusions.*

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*Chapters within each
theme reference each
other to facilitate
comparison and deeper
understanding of
divergent opinions.*

*Offers a
transchronological view
of the geological history
of Mars, addressing
thematic questions from
a broad temporal
perspective Discusses
outstanding questions*

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Latitudes*
*on Mars from diverging
perspectives Includes
key questions and
answers, as well as a
look ahead to which
puzzles remain to be
solved*

*Melt takes place where
the surface of glaciers
or ice sheets interacts
with the atmosphere.*

*While the processes
governing surface melt
are fairly well*

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Mid

Latitudes

understood, the

pathways of the

meltwater, from its

origin to the moment it

leaves a glacier system,

remain enigmatic. It is

not even guaranteed

that meltwater leaves a

glacier or ice sheet. On

Greenland, for

example, only slightly

more than 50% of the

meltwater runs off. The

remainder mostly

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refreezes within the so-called firn cover of the ice sheet. This eBook contains 11 studies which tackle the challenge of understanding meltwater retention in snow and firn from various angles. The studies focus both on mountain glaciers and on the Greenland ice sheet and address

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*challenges such as
measuring firn
properties, quantifying
their influence on
meltwater retention,
modelling firn
processes and meltwater
refreezing as well as
unravelling the
mechanisms within the
recently discovered
Greenland firn
aquifers.*

Cumulative

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of Oil and Gas*

*Activities on Alaska's
North Slope*

Planetary Astrobiology

*The Ecology of Snow
and Ice Environments*

*Promoting Productive
Cooperation Between*

*Space Lawyers and
Engineers*

*The Earth Without
Glaciers*

Dynamic Mars

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Astrobiology is the study of the origin, evolution, distribution, and future of life in the universe. It is an inherently interdisciplinary field that encompasses astronomy, biology, geology, heliophysics, and planetary science, including complementary laboratory activities

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and field studies
conducted in a wide
range of terrestrial
environments.

Combining inherent
scientific interest and
public appeal, the
search for life in the
solar system and
beyond provides a
scientific rationale for
many current and
future activities
carried out by the

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Administration

(NASA) and other national and international agencies and organizations.

Requested by NASA, this study offers a science strategy for astrobiology that outlines key scientific questions, identifies the most promising

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Martian Mid
Mission

research in the field,
and indicates the
extent to which the
mission priorities in
existing decadal
surveys address the
search for life's origin,
evolution, distribution,
and future in the
universe. This report
makes
recommendations for
advancing the
research, obtaining

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the measurements,
and realizing NASA's
goal to search for
signs of life in the
universe.

Glorious panoramic
photography by the
author, a specialist in
interpretive
landscape, reveals
the physical legacy of
the Earth's distant
past. This exceptional
book celebrates the

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Latitude

inevitability of global
change and highlights
our need as human
beings to recognize
and adjust to it. Color
and b&w illustrations.
A Best Book of 2020
(NPR) A Best Book of
2020 (The Economist)
A Top Ten Best
Science Book of 2020
(Smithsonian) A Best
Science and
Technology Book of

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2020 (Library Journal)
A Must-Read Book to
Escape the Chaos of
2020 (Newsweek)

Starred review
(Booklist) Starred
review (Publishers
Weekly) A historically
unprecedented
disconnect between
humanity and the
heavens has opened.
Jo Marchant's book
can begin to heal it.

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For at least 20,000 years, we have led not just an earthly existence but a cosmic one. Celestial cycles drove every aspect of our daily lives. Our innate relationship with the stars shaped who we are—our art, religious beliefs, social status, scientific advances, and even our biology.

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But over the last few centuries we have separated ourselves from the universe that surrounds us. It's a disconnect with a dire cost. Our relationship to the stars and planets has moved from one of awe, wonder and superstition to one where technology is king—the cosmos is

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now explored through data on our screens, not by the naked eye observing the natural world. Indeed, in most countries, modern light pollution obscures much of the night sky from view.

Jo Marchant's spellbinding parade of the ways different cultures celebrated the majesty and

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mysteries of the night sky is a journey to the most awe-inspiring view you can ever see: looking up on a clear dark night. That experience and the thoughts it has engendered have radically shaped human civilization across millennia. The cosmos is the source of our greatest

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creativity in art, in
science, in life. To
show us how, Jo

Marchant takes us to
the Hall of the Bulls in
the caves at Lascaux
in France, and to the
summer solstice at a
5,000-year-old tomb
at Newgrange,
Ireland. We discover
Chumash cosmology
and visit medieval
monks grappling with

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the nature of time and
Tahitian sailors
navigating by the
stars. We discover
how light reveals the
chemical composition
of the sun, and we are
with Einstein as he
works out that space
and time are one and
the same. A four-
billion-year-old meteor
inspires a search for
extraterrestrial life.

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The cosmically liberating, summary revelation is that star-gazing made us human.

The monograph summarizes information on permafrost for engineering construction in cold regions. The distribution and origin of permafrost is

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discussed and
information on
structure, thickness,
and thermal regime is
summarized.

Patterned ground and
vegetation in the cold
regions are discussed
and the engineering
significance of
permafrost is
reviewed. (Author).

The Atmosphere and
Climate of Mars

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on the Oceans

Lunar and Planetary
Science XXVII

A Midterm Review

An Astrobiology

Strategy for the

Search for Life in the
Universe

Visions into Voyages
for Planetary Science
in the Decade

2013-2022

This book identifies

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accumulated
environmental, social
and economic effects
of oil and gas leasing,
exploration, and
production on Alaska's
North Slope. Economic
benefits to the region
have been
accompanied by
effects of the roads,
infrastructure and
activities of oil and gas
production on the

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Latitude

**terrain, plants,
animals and peoples of
the North Slope. While
attempts by the oil
industry and
regulatory agencies
have reduced many of
the environmental
effects, they have not
been eliminated. The
book makes
recommendations for
further environmental
research related to**

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environmental effects.

As the search for

Earth-like exoplanets

gathers pace, in order

to understand them,

we need

comprehensive

theories for how

planetary atmospheres

form and evolve.

Written by two well-

known planetary

scientists, this text

explains the physical

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Latitude
**and chemical
principles of
atmospheric evolution
and planetary
atmospheres, in the
context of how
atmospheric
composition and
climate determine a
planet's habitability.
The authors survey
our current
understanding of the
atmospheric evolution**

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on other rocky planets
within our Solar
System, and on planets
far beyond.**

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the concepts and
equations governing a
range of topics,
including atmospheric
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thermodynamics,**

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atmospheric dynamics,
and provide an**

**integrated view of
planetary atmospheres
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text is an invaluable
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graduate-level
students and
researchers working
across the fields of
atmospheric science,**

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