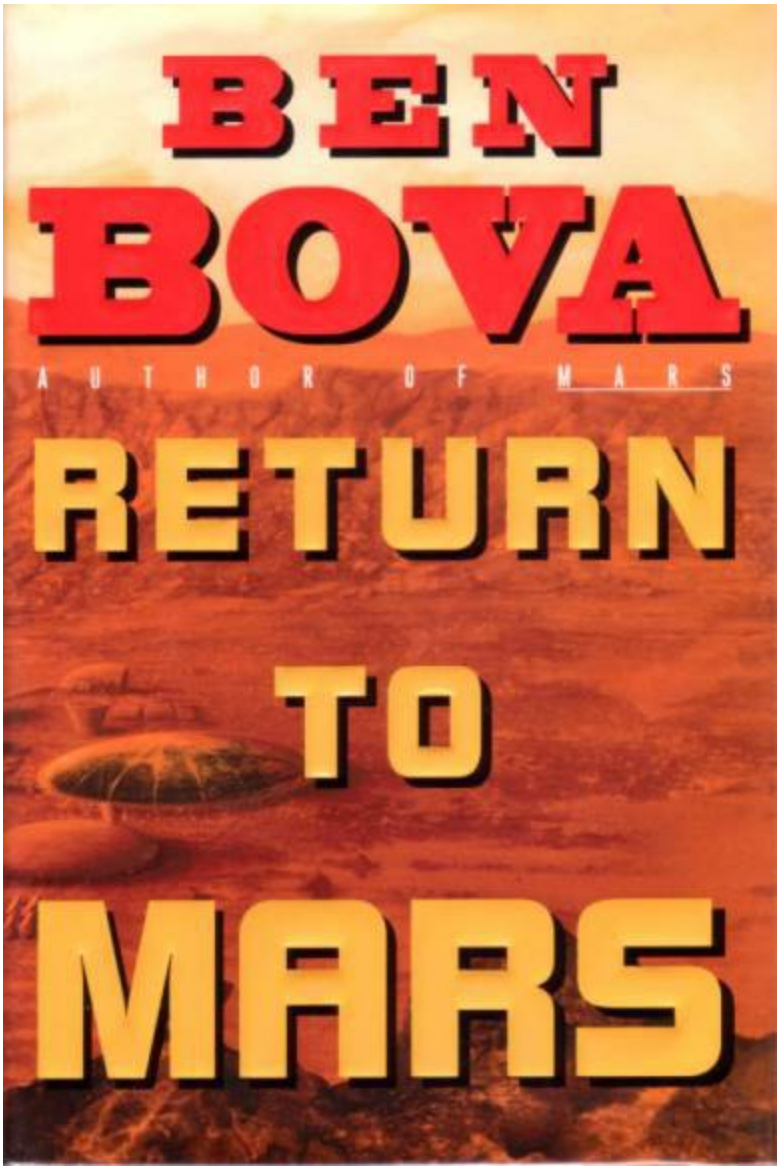
"Provocative and believable...Bova writes with sparkling clarity."
St. Petersburg Times

BEN BOVA

AUTHOR OF MARS

RETURN TO MARS



BEN BOVA

RETURN TO MARS

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To Barbara:

... constant as the northern star, of whose true-fixed and resting quality there is no fellow in the firmament.

ACKNOWLEDGMENTS

I owe an enormous debt of gratitude to Lynn Harper and her colleagues at the NASA Ames Research Center, who answered my myriad questions promptly and cheerfully and provided many of the technical details in this story (for example, making glass bricks from in situ materials on Mars). I have taken a novelist's liberties with their excellent information, of course, so

any faults with the techniques and technologies used y the characters in this tale are my own, not theirs.

The mission plan for the Second Mars Expedition was adapted from i he Mars Direct concept originated by Robert Zubrin, as detailed in his book, The Case for Mars. Again, I have deviated from the specifics of his concept, but the basic mission plan stems from his innovative and highly creative work.

Ed Carlson, South Florida Area Manager for the National Audubon society, kindly provided the background information about the Living Machine, an organic technique for using solar energy, bacteria, and green plants to produce potable water from waste water. This served as the basis for my Martian explorers' garden, which provides them not only with the hulk of their food but recycles their water. Living Machines, designed and built by Ocean Arks International, are at work in South Burlington, Vermont; Sonoma, California; Henderson, Nevada; the Corkscrew Swamp Sanctuary in Collier County, Florida; and elsewhere.

Dr. Janet Jeppson Asimov kindly granted permission to quote the late Isaac Asimov's "classic" limerick.

My good friend Philip Brennan patiently detailed the methods used by modern geologists to date rocks.

Alexander Besher graciously answered my questions about the Russian language.

The term bytelock was coined by another good friend, Jan Howard hinder, who defines it thusly: "When the Information Superhighway slows to a crawl or stops, you are experiencing BYTELOCK!"

The quotation from Freeman J. Dyson is from "Warm-Blooded plants and Freeze-Dried Fish," by Freeman J. Dyson, The Atlantic Monthly, Vol. 280, No. 5, November 1997, p. 69.

The quotation from Malcolm Smith originally appeared in "Facing Mars Rationally," by Malcolm Smith, in Spaceflight magazine, Vol. 40, No. 2, February 1998, p. 45.

We should not be surprised if we find that life, wherever it originated, spread rapidly from one planet to another. Whatever creatures we may find on Mars will probably be either our ancestors or our cousins.

FREEMAN J. DYSON

Certain topics in science are deemed "unsuitable." A form of scientific censorship arises to prevent these ideas getting out into wider circulation and challenging the current orthodoxy's accepted status quo. Yet the history of science is littered with ideas, which were initially frowned upon, only to be accepted later, sometimes long after the death of their proponents.

MALCOLM SMITH

Listen to the wisdom of the Old Ones. The red world and the blue world are brothers, born together out of the same cold darkness, nourished by the same Father Sun. Separated at birth, for uncountable ages they remained apart. But now, like true brothers, they are linked once more.

PROLOGUE: THE SKY DANCERS

THE RENTAL MINIVAN JOLTED AND LURCHED ALONG THE RUTS OF THE Unpaved road as Jamie Waterman squinted briefly at the dying red sun touching the ragged skyline of the mountains. Jamie was driving too fast mill he knew it. But he wanted to get there before his grandfather died.

Soon it would be dark and he'd have to slow down. The unmarked road twisting through the desert hills would be unlit except for his headlamps—and the stars. Might as well be driving the rover on Mars, he said to himself.

As the sun disappeared behind the distant mountains and the shadows reached across the desert to overtake him, Jamie knew he would have to stop again to ask directions. He had passed a hogan several miles back, but it had looked dark and empty.

Now he saw a mobile home, rusted metal sides and a slanted awning over the screen door. Lights inside. A pair of battered pickup trucks in 11 "lit. As he pulled to a stop, spraying dust and pebbles, a dog yapped from out of the shadows.

The screen door banged open and a young man appeared in the doorway;

jeans, tee shirt, can of beer clutched in one hand, long braided hair.

Jamie slid the driver's side window down and called, "I'm looking tin Al Waterman."

With the light from inside the mobile home behind him, the young man's face was impossible to see. Jamie knew what it looked like, just the same: stolid, dark eyes, broad cheeks, emotions hidden behind an impassive mask. Much like his own.

"Who?"

"Al Waterman."

The young Navaho shook his head. "He don't live here."

"I know. He's in a hogan up along this road, I think. That's what they told me down at the post."

"Not here," the young man repeated.

Jamie understood his reticence. "He's my grandfather. He's dying."

The young Navaho stepped down to the dusty ground and slowly walked over to Jamie's minivan, boots crunching on the gritty soil.

He looked closely at Jamie. "You the guy who went to Mars?"

"Right. Al's my grandfather. I want to see him before he dies."

"Al Waterman. The old guy from Santa Fe."

Jamie nodded.

"I'll take you there. You can follow me." Without waiting for a reply he loped to the nearer of the two pickups.

"Don't drive too fast," Jamie called. He had driven across the badlands of Mars, but he didn't want to have to chase a pair of dim taillights at breakneck speed across the dark New Mexico desert.

Sure enough, the youngster took off in a roaring cloud of dust. Jamie shifted into four-wheel drive and followed him grimly, sweating as he wrestled the wheel of the jouncing minivan with both clenched hands.

Al Waterman had been a shopkeeper in Santa Fe all his adult life, with a condo in town and a ski lodge up in the mountains, but now that he was dying he had returned to the reservation where he had been born.

Everyone seemed to know about Al and his famous grandson, the man who had traveled to the red planet. Wherever Jamie stopped to ask directions, they knew exactly where Al's hogan was. Trouble was, Jamie thought as the minivan jolted through the darkness, there aren't any direction signs along these old roads. Nothing but darkness and the clear desert sky. Thousands of

stars but not one sign to point his way.

At last the pickup skidded to a stop near the low hump of a hogan. Jamie pulled up beside him, but the young man was already backing his truck, heading home.

"Thanks!" Jamie yelled out his window.

" 'Kay," he heard from the truck as it spit gravel and roared off into the night.

Frightened of death, Jamie thought. The Navaho would not stay in a place where a death had occurred, whether out of respect or fear of evil spirits, Jamie did not know. They would abandon this hogan after Al died. I wonder what they do with mobile homes? Jamie asked himself as he got out of the minivan.

The hogan seemed little more than a rounded hump of dried mud on the desert floor with a single light shining through a curtained window. The night was chilly but still; the dark sky so clear that the sparkling stars seemed close enough almost to touch.

It was even colder, somehow, inside the hogan. Jamie kept his sky-blue windbreaker zippered; the pitiful little blaze in the fireplace cast flickering light, but no heat. An old woman sat on the floor in a corner near the fire, wrapped in a colorful blanket. She nodded once to Jamie but said nothing, silent and sturdy as a rock.

Al was curled fetally on the bed in the far corner, nothing but a shell of the man he had been; a husk whose insides had been devoured by cancers. Yet he opened his eyes and smiled when Jamie bent over him.

"Ya'aa'tcy," he whispered. His breath smelled of decay and sun baked earth.

"Ya'aa'tey," Jamie replied. It is good. That was a lie, in this place at this time, but it was the ancient greeting.

"That's what you said when you got to Mars," Al said, his voice already as faint as a ghost's. "Remember?"

They were the words Jamie spoke to the television camera when the first expedition landed.

"I'm going back there," Jamie said, bending low so his grandfather could hear him.

"Back to Mars? You're going?"

Nodding tightly, Jamie said, "It's official. I'll be mission director."

"Good," breathed Al, with a wan smile. "Mars is your destiny, son. Your path leads to the red world."

"I guess it does."

"Go in beauty, son. Now I can die happy."

Jamie wanted to say no, you're not going to die, Grandfather. You're going to live for many years more. But the words would not come to his lips.

Al heaved a sigh that racked his frail body. "The sky dancers are coming soon. They'll take me with them."

"Sky dancers?"

"You'll see. Wait with me. It won't be long now."

Jamie pulled up the hogan's only chair and sat by his grandfather's bed. His parents had been killed in an auto crash two years earlier. Al was the only close relative he had left. After him there would be nothing, no one. The old man closed his eyes. Jamie could not tell if he were breathing or not. The only sound in the chill little room was the crackling of the fire as the silent woman fed sticks to it.

The wooden chair was hard and stiff, its woven rope seat as unyielding as rock, yet Jamie dozed off despite himself. He stepped off a high cliff, naked in the hot sun, and began to fall, slowly, as in a dream, falling down the face of the blood-red mesa.

He awoke with a start. Al was clutching at his knee.

"The sky dancers!" Al croaked in his feeble voice. "They've come!"

He's delirious, Jamie thought. He turned to the woman, still sitting silently near the fire. She looked up at him with dark, calm eyes but said nothing.

"Look!" Al pointed a quavering finger toward the curtained window. "Go outside and look!"

Confused, Jamie pried himself out of the chair and went to the door. He hesitated, turned back toward his grandfather.

"Go on!" Al urged, excited, trying to lift himself up on one emaciated arm. "You'll see!"

Jamie opened the door and stepped out into the cold dark desert night. His breath frosted in the air. He looked up at the stars.

And saw shimmering curtains of delicate pinkish red, pale green, flickering white, pulsating across the sky, dancing silently, glittering, rippling, covering the sky with their ghostly glow.

The northern lights, Jamie knew. The sun must have erupted a monster

flare. Then the Navaho side of his mind said, The sky dancers. They've come for Al.

Jamie stood transfixed, watching the delicate, awesome display in the night sky. He remembered that you could see auroras almost every night on Mars, even through the tinted visor of your spacesuit helmet. But here on Earth the sky dancers were rare. Yet so beautiful that they made even death seem less frightful.

At last he ducked back inside the hogan. His grandfather lay still, a final smile frozen on his face. The woman had come over to his bed and was smoothing Al's blanket over him.

"Good-bye, Grandfather," Jamie said. He felt he should cry, but he had no tears.

He went outside again, walking slowly toward his rental minivan. There's no one left, Jamie said to himself. No one and nothing left to keep me here.

Low on the rugged horizon the unblinking red eye of Mars stared at him, glowing, beckoning. Two weeks later he lifted off from Kennedy Space Center on a Clippership rocket, the first leg of his journey back to Mars.

DATA BANK

THE FIRST MARS EXPEDITION CONFIRMED MUCH OF WHAT EARLIER ROBOT spacecraft had discovered about the red planet.

Mars is a cold world. It orbits roughly one and a half times farther from the Sun than the Earth does. Its atmosphere is far too thin to retain solar heat. On a clear midsummer day along the Martian equator the afternoon ground temperature might climb to seventy degrees Fahrenheit; that same night, however, it will plunge to a hundred below /cm or lower.

The atmosphere of Mars is too thin to breathe, even if it were pure oxygen, which it is not. More than ninety-five percent of the Martian air is carbon dioxide; nearly three percent nitrogen. There is a tiny amount of tree oxygen and even less water vapor. The rest of the atmosphere consists of inert gases such as argon, neon and such, a whiff of carbon monoxide, and a trace of ozone.

The First Mars Expedition discovered, however, something that all the

mechanical landers and orbiters had failed to find: life.

Tucked down at the floor of the mammoth Valles Marineris—the Grand Canyon that stretches some three thousand kilometers across the ruddy face of the planet—sparse colonies of lichenlike organisms eke out a perilous existence, hiding a few millimeters below the surface of the rocks. They soak up sunlight by day and absorb the water they need from the vanishingly tiny trace of water vapor in the air. At night they become dormant, waiting for the sun's warmth to touch them once again. Their cells are bathed in an alcohol-rich liquid that keeps them from freezing even when the temperature falls to a hundred degrees below zero or more.

Fourth planet out from the Sun, Mars never gets closer to the Earth than fifty-six million kilometers, more than a hundred times farther than the Moon. Mars is a small world, roughly half the size of the Earth, with a surface gravity just a bit more than a third of Earth's. A hundred kilograms on Earth weighs only thirty-eight kilos on Mars.

Mars is known as the red planet because its surface is mainly a bone-dry desert of sandy iron oxides: rusty iron dust.

Yet there is water on Mars. The planet has bright polar caps composed at least partially of frozen water—covered over most of the year by frozen carbon dioxide, dry ice. The First Mars Expedition confirmed that vast areas of the planet are underlain by permafrost: an ocean of frozen water lies beneath the red sands.

Mars is the most Earthlike of any world in the solar system. There are seasons on Mars—spring, summer, autumn and winter. Because its orbit is farther from the Sun, the Martian year is nearly twice as long as Earth's (a few minutes short of 689 Earth days) and its seasons are consequently much longer than Earth's. Mars rotates about its axis in almost the same time that Earth does. A day on Earth is 23 hours, 56 minutes, and 4.09 seconds long. A day on Mars is only slightly longer: 24 hours, 37 minutes, and 22.7 seconds.

To prevent confusion between Earth time and Martian, space explorers refer to the Martian day as a sol. In one Martian year there are 669 sols, plus an untidy fourteen hours, forty-six minutes and twelve seconds.

The discovery of the rock-dwelling Martian lichen raised new questions among the scientists: Are the lichen the only life form on the planet? Or is there an ecological web of various organisms? If so, why have none been found except the lichen?