# Preface
# A Personal Note

When I was a 13-year-old kid nearly six decades ago, I discovered the heavens. That discovery changed everything. Finding my way around the night time sky was the first challenge. As I learned the celestial stick figures of Greek and Roman mythology placed there as monuments to ancient gods, they became stationary signposts that allowed me to wander from figure to figure, retracing my steps from celestial pole to celestial equator. I soon learned that hidden within these constellations were objects of great beauty and wonder—star clusters, nebulae, double stars, and galaxies. It wasn't long before I laid aside the simple star charts that I had carefully cut out from the Long Beach, California *Press-Telegram.* In their stead, I purchased a book by my namesake, *Norton's Star Atlas.* This marvelous book had sky charts showing many more stars than I had learned about from the newspaper maps, stars so faint that I could barely see them with the unaided eye. There were exceptionally bright stars also. Some of them moved among the starry background, usually moving east but occasionally changing direction and moving west for several weeks before stopping and resuming their easterly courses. I learned that these were the planets of the Solar System and the motions they displayed against the stars had perplexed ancient Greek astronomers for centuries.

It wasn't long before I recognized my physical limitations. If I wanted to continue this adventure, I would need a telescope. Back in those days most amateur astronomers made their own telescopes from mirror to mount. (Nowadays, if you have the dollars you can purchase telescopes that match some of the best found in professional observatories.) I made a 4-in. reflecting telescope out of plate glass and pipe fittings. This modest telescope would be my constant companion until I graduated from high school. With it, I could explore the mountains and craters on the Moon, the rings of Saturn, Jupiter and its Moons, the polar caps of Mars, and on and on. No longer this naked eye astronomy. With my telescope, I had reached out to bring the celestial sphere with all of its wonders a bit closer to me. Besides the obvious Solar System objects, there were more subtle things that were a challenge to find and observe. Asteroids! Through my telescope, I could only see the largest and brightest as a yellowish point of light moving among the stars between Mars and Jupiter. And then there was the occasional comet that seemed to defy all the rules, crossing the orbits of the inner planets with total disregard for their stately motions. Comets were fascinating because, unlike the constellations, they could be seen to change from night to night or even hour to hour, leaving

behind a diaphanous tail of gaseous matter and dust. There were some things in the sky that did move quickly—"falling stars." I remember lying on my back when I was 9 years old watching the Draconid meteor shower of October 9, 1946, and waiting for the stars to fall. I recall staring at a particularly bright star (probably Vega) and anticipating its final fall to Earth. Needless to say, it's still there among the summer stars. At that early age, I wasn't aware that falling stars (or shooting stars) were not stars at all, but dust specks from comets descending to Earth. Once I had learned this association several years later, I was primed to ask more pertinent questions. Could any of this comet dust survive passage through Earth's atmosphere? Might there be comet dust in my mother's vacuum cleaner? Comet dust particles, now more accurately called interplanetary dust particles (IDPs), have been collected in the stratosphere by sticky-winged high flying aircraft as we will see. Most of the dust particles are too small to produce visible meteors but annual meteor showers show us that larger particles, a millimeter or greater, do exist and do produce meteors, some very bright ones.

Can we go further? Is there a connection between IDPs and other objects of subplanetary mass, namely, the asteroids? Occasionally, brilliant fireballs are observed passing through Earth's atmosphere leaving a trail of gas and dust behind. These have been photographed in flight, and their orbital paths have been extrapolated backward terminating in the asteroid belt. This implies that there are still large chunks of rocky material out there that have left the asteroid belt and are on their way to Earth. Today our museums house thousands of rocky samples of asteroids that have come to us from space—free of charge. They are relics of the early Solar System. So we have moved from the fixed stars to celestial objects we can actually touch. Even rock samples collected on the Moon during the Apollo missions have their counterparts on Earth. About 50 stones of lunar origin have been found on Earth in the past decade. More discoveries will follow as meteorite hunters (scientists and amateurs) continue to comb the hot and cold deserts of the world to touch what was once beyond their reach.

It wasn't long before I began to realize that the study of the Solar System requires more than simply acquiring beautiful optical images of distant Solar System objects, as wonderful as they are. Over the years, I recognized the need to expand my knowledge of meteorites to include such diverse fields as petrology, optical mineralogy, petrography, and the study of minerals as they pertain to meteoritics, the science of meteorites. I invited Lawrence A. Chitwood, volcanologist and geologist for the Deschutes National Forest in central Oregon and an expert in igneous petrology and mineralogy, to write this book with me for he has much of the knowledge that is necessary to study meteoritics. (We met not as scientists, but as musicians. We both play the piano and have performed many classical duets together. Curiously, I learned that he also made a telescope when he was a kid and he too spent hours under the sky memorizing the constellations.)

The connection has now been made between those tiny specks of dust that flash across the night sky, their asteroidal precursors and meteorites. No longer must amateur astronomers be content with passively observing the heavens. Not only are meteorites fragments of asteroids but some also contain interstellar grains—and we can actually hold them in our hands. These space rocks have made it to Earth by the thousands, even though it took us centuries to come to terms with them, to realize their true nature. They are scattered all over Earth from pole to pole waiting to be discovered. A new world of exploration awaits the backyard scientist. Amateur astronomers, in particular, have surveyed the Solar System with their telescopes but their surveys remain incomplete. Now it is time to look down as well as up; to set aside your telescopes, and arm yourselves with metal detectors, magnets, magnifiers, and microscopes and prepare to explore the wonders of the Solar System locked inside these rocks from space for the last 4.56 billion years. Let this book be your guide to the smaller bodies of the Solar System.

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