

# Lonely Planet

## **FIVE BILLION YEARS OF SOLITUDE**

### **The Search for Life Among the Stars**

By Lee Billings

294 pp. Current. \$27.95.

By DENNIS OVERBYE

Published: November 8, 2013

For all the vaunted progress of science, it's only rarely that we get to check off the existential-sounding questions that really matter: Did the universe have a beginning? Yes. Will it ever end? Dunno. Are we alone here in the stars? Dunno.

But hold on to that last thought. If you believe the newspaper headlines, this is in fact one of those golden moments in history. Astronomers are on the verge of finding a world beyond our own solar system that might support life, Earth 2.0, in the vernacular.

What we do when we find it is the trillion-dollar science-fiction question. Do we send an interstellar probe to visit? Can we dream of living there? Do we build giant orbiting telescopes that can inspect them for signs of life? Just the discovery of microbes on a distant planet would be "like putting Copernicus and Darwin into the same bottle and giving it a good shake," says Matt Mountain, director of NASA's Space Telescope Science Institute.

But the stakes in the planet-hunting game are more than just intellectual, as Lee Billings, a freelance journalist, points out in "Five Billion Years of Solitude," his graceful new book on the history, meaning and personalities behind the search for life among the stars. "Life on this planet has an expiration date," he writes, "if for no other reason than that someday the Sun will cease to shine."

So we, or our successors, may need somewhere to go.

In the last 20 years, the field of exoplanets — the planets outside our solar system — has become the fastest growing branch of astronomy. NASA's Kepler spacecraft alone has identified some 3,500 potential planets in a small patch of the Milky Way, and astronomers have concluded that there are roughly as many planets in the galaxy as stars, that is to say, billions. Some of them, presumably, must be like home. Happy hunting.

The field is hotly competitive and "Goldilocks" planets that might or might not be habitable — or even exist at all — have danced in and out of the news in recent years. Our putative twin remains missing.

Billings sketches this history ably, though he is light on the exploits of Kepler, which has driven the news of late. His main interest is less in chasing Goldilocks planets than in exploring the deeper issues involved, including just how hard it will be to learn anything about these planets once we find them.

Earth, for example, is 4.6 billion years old, but animal life has been around for only half a billion years, and oxygen has only been abundant in the atmosphere for two billion years or so and, of course, intelligent life only a sliver of that time. If we found an analogue of Earth circa three billion years ago, would we even recognize it as a promising place?

The book's title, Billings says, is a reference to the expected longevity of life on Earth, but his account is less about exoplanets than about the people who make the search for them their lives' cause — "creatures that, before their sun went dim, might somehow touch the stars."

We meet luminaries like Frank Drake, a professor emeritus at the University of California, Santa Cruz, who pioneered the search for radio signals from extraterrestrials more than 50 years ago. Drake is now worried that Earth's own detectability in this regard has declined with the advent of digital television, a worrisome omen if this is the trend of advanced civilizations.

Reading this book is like peering over Billings's shoulder. He doesn't just interview astronomers and geophysicists; he and his subjects ponder the history of the universe over margaritas and one-dollar tacos. They tromp through redwood forests, talking, talking, talking.

Sometimes they even do some science, or at least try. During a trip to Lick Observatory in Northern California to watch Venus crossing the Sun, the computer controlling one astronomer's telescope goes berserk and he misses the crucial moment when sunlight shining past the edge of Venus can delineate the planet's atmosphere, a feat astronomers want to accomplish with exoplanets. Venus won't be transiting again until 2117.

The story may meander at times, but this is the best book I have read about exoplanets, and one of the few whose language approaches the grandeur of a quest that is practically as old as our genes. Billings's description of the history of the Marcellus shale, the subject of a national debate about fracking, is worth the price of the book by itself.

The 4.5 billion years of "deep time" revealed by Earth's geological record inspires Billings to pull out all the rhetorical stops. About the geologists who have uncovered it, he writes, "The sight of a fossilized form, perhaps the outline of a trilobite, a leaf or a saurian footfall can still send a shiver through their bones, or excavate a

trembling hollow in the chest that breath cannot fill.”

He goes on: “A planet becomes a vast machine, or an organism, pursuing some impenetrable purpose through its continental collisions and volcanic outpourings. A man becomes a protein-sheathed splash of ocean raised from rock to breathe the sky, an eater of sun whose atoms were forged on an anvil of stars.”

There is both good and bad news here. The good news, Billings reports, is that even if we burn up all the fossil fuel, we are unlikely to tip Earth into “a runaway-greenhouse world” as one scientist described Venus.

The bad news is the planet is going to become uninhabitable anyway. Long before the Sun burns out, Earth’s core will cool off and volcanoes, which restore the atmosphere, will cease. The amount of carbon dioxide will fall to levels too low to support photosynthesis in half a billion years or so.

Complex life arose here only half a billion years ago, notes James Kasting, a geosciences professor at Penn State, who concludes glumly that intelligence might exist for only one-tenth of Earth’s history, cutting the odds of its being detected elsewhere.

But the discovery of Earth 2.0 will mark only the beginning of the real work. Figuring out whether its atmosphere is conducive to life — or perhaps even indicative of life — could take years and billions of dollars, and the immediate prospects are discouraging.

Plans for an ambitious NASA project known as the Terrestrial Planet Finder, which has the power to inspect distant planets, have collapsed, partly because astronomers could not agree on which of several challenging technologies to adopt.

At the end of the book, Billings introduces us to Sara Seager, a rising young M.I.T. planetary astronomer, who organized a small exoplanet conference in 2011 to discuss where the field is headed and to announce to her colleagues that she was going to be working in the “commercial spaceflight industry.”

Billings describes in much detail Seager’s canoe trip to Canada’s Northwest Territories, the so-called Barren Lands, the summer before graduate school. She made the journey with her friend Mike Wevrick. Together, “they portaged over the roots of tall mountains transformed to gentle nubs by four billion years of weathering.” By the end of the trip, “she realized she had not only fallen in love with remote desolation; she had fallen in love with Wevrick, too.” This is only the beginning of a heartbreaking story I won’t spoil by telling here.

What, you might wonder, does this journey have to do with exoplanets?

It has nothing to do with exoplanets. But it has everything to do with the passion and determination and resourcefulness of scientists like Sara Seager, those creatures who would touch the stars.

*Dennis Overbye, a science correspondent for The Times, is the author of "Einstein in Love."*

Link to this article:

<http://www.nytimes.com/2013/11/10/books/review/five-billion-years-of-solitude-by-lee-billings.html?pagewanted=2&r=0&ref=dennisoverbye>