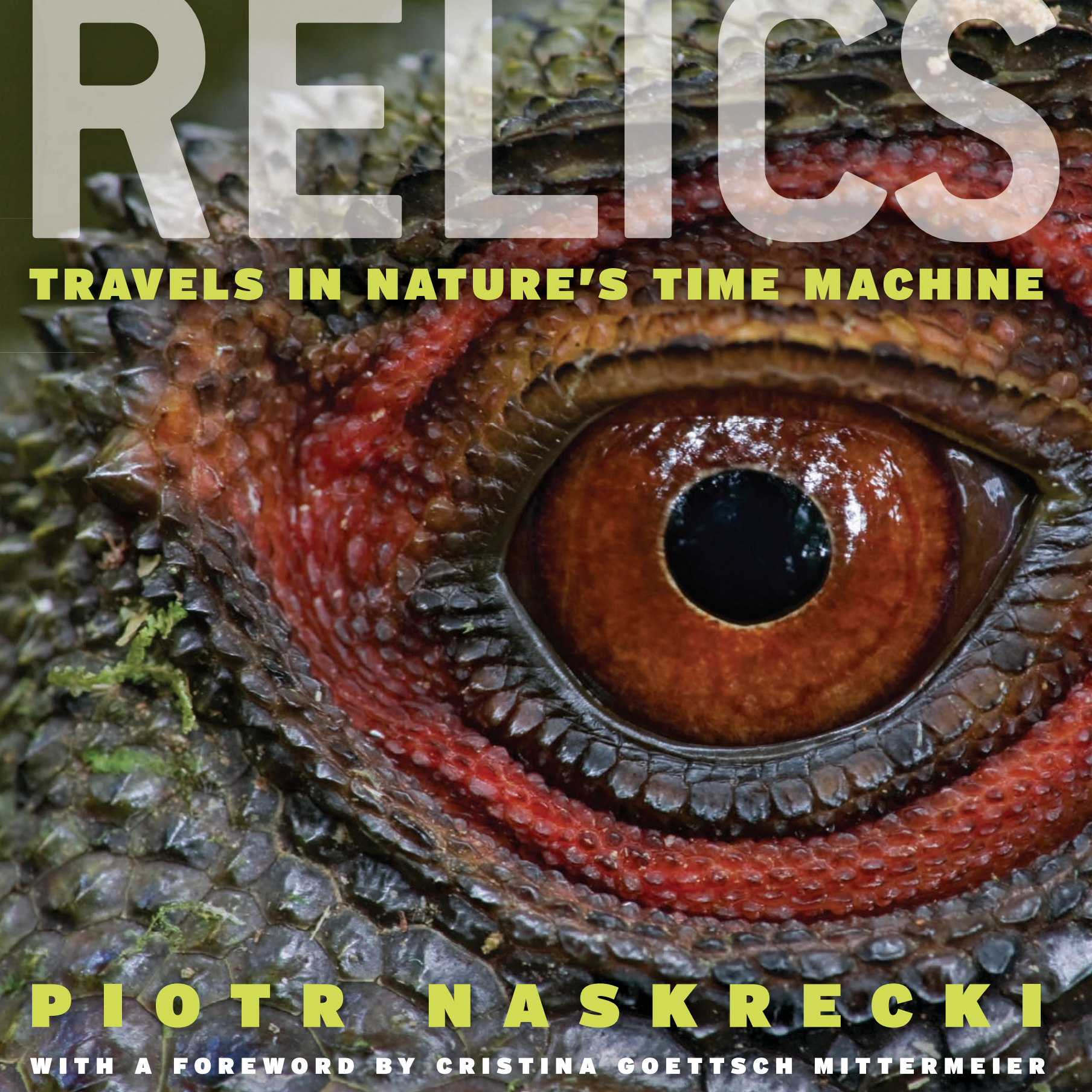
RELICS

TRAVELS IN NATURE'S TIME MACHINE



PIOTR NASKRECKI

WITH A FOREWORD BY CRISTINA GOETTSCH MITTERMEIER

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Few places are more humid than rainforests of New Guinea. Annual rainfall in some areas reaches seven thousand millimeters, or even a staggering twelve thousand millimeters (or nearly forty feet) per year! The atmosphere is saturated with moisture, and thick mats of mosses and lichens trap and store huge amounts of water. Yet at the same time many parts of the island are virtually devoid of streams, rivers, or any large bodies of standing water. This is due to the geological composition of its surface, which in many places consists of karst, a formation in which the underlying limestone layers have been dissolved, forming countless sinkholes and fissures. This prevents the accumulation of surface water, forcing organisms that rely on its presence for their reproduction and development to find other solutions.

Frogs are organisms whose early development requires an aquatic habitat, an inconvenient remnant of their early evolutionary history. In most species females lay their eggs in streams and ponds, and developing tadpoles use their gills to breathe under water. But on New Guinea, where surface water is scarce, many species have evolved strategies that allow them to bypass a free-living tadpole stage entirely. Rather than laying hundreds or thousands of small eggs and leaving them to their own devices in the water, they produce a handful of very large eggs and take care of them until they are ready to hatch. Each egg contains enough nutrients, in the form of a large yolk reserve, that allows the embryo inside to complete its development into a tiny, independent froglet. Unlike reptile or bird eggs, frog eggs lack a hard, water-impermeable shell, and risk they desiccation if not protected and moistened regularly. For this reason, one of the parents stays with the eggs and safeguards them throughout their development. In the large and heavy *Platymantis boulengeri* the female digs a small hole in the ground, and sits on the eggs, providing both physical protection and humidity. In the much smaller frogs of the genus *Oreophryne*, it is the male that guards the eggs suspended in a clutch underside a leaf. He leaves them during the day to go hunting for insects but comes back every evening to moisten them with water and shield them from harm. After a few weeks, young frogs are ready to become independent, and break the walls of their miniature aquatic cradles.

A lone quiver tree (*Aloe dichotoma*) stands on a hill against the very last rays of the setting sun, surrounded by low, succulent vegetation. Only now, after the air around it has cooled off and the risk of water loss is lower, will the plant open the stomata on its leaves to absorb the carbon dioxide that it needs to grow. This, and many other plants found in the Succulent Karoo, exhibits an interesting type of physiological adaptation to dry conditions, known as the crassulacean acid metabolism (CAM). Most plants around the world exhibit a different type of metabolism, known as the C_3 type, which absorbs carbon very efficiently, but at the same time requires intensive transpiration, leading to the loss of most of the water the plant absorbs from the soil. This works great in humid conditions where water is continually available, but in xeric habitats plants simply cannot afford to lose so much of the precious and scarce resource. CAM plants, such as quiver trees and most other succulents, are extremely good at retaining water, but pay for it by limiting the time during which they can absorb carbon, the main building block of their bodies. This is one of the reasons why plants of the Succulent Karoo grow very slowly. A quiver tree may take up to eighty years to reach its full size.

Turning their bodies into living cisterns, succulents of the Succulent Karoo display some of the strangest shapes found among plants. The red Pearson aloe (*Aloe pearsonii*) is an example of a leaf succulent, whereas hoodia (*Hoodia alstonii*) is a typical stem succulent. This unidentified succulent from Richtersveld Transfrontier National Park (top) appears to store water both in its thick leaves and branches.

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On any night in early June, if you stand on the right beaches of America's East Coast, you can travel back in time all the way to the Jurassic. For as you watch, thousands of horseshoe crabs will emerge from the foam and scuttle up the beach to their spawning grounds, as they've done, nearly unchanged, for more than 440 million years.

Horseshoe crabs are far from the only contemporary manifestation of Earth's distant past, and in *Relics*, world-renowned zoologist and photographer Piotr Naskrecki leads readers on an unbelievable journey through those lingering traces of a lost world. With camera in hand, he travels the globe to create a words-and-pictures portrait of our planet like no other, a time-lapse tour that renders Earth's colossal age comprehensible, visible in creatures and habitats that have persisted, nearly untouched, for hundreds of millions of years.

Naskrecki begins by defining the concept of a relic—a creature or habitat that, while acted upon by evolution, remains remarkably similar to its earliest manifestations in the fossil record. Then he pulls back the Cambrian curtain to reveal relic after eye-popping relic: katydids, ancient reptiles, horsetail ferns, majestic magnolias, and more, all depicted through stunning photographs and first-person accounts of Naskrecki's time studying them and watching their interactions in their natural habitats. Then he turns to the habitats themselves, traveling to such remote locations as the Atewa Plateau of Africa, the highlands of Papua New Guinea, and the lush fern forests of New Zealand—a group of relatively untrammeled ecosystems that are the current end point of staggeringly long, uninterrupted histories that have made them our best entryway to understanding what the pre-human world looked, felt, sounded, and even smelled like.

The stories and images of Earth's past assembled in *Relics* are beautiful, breathtaking, and unmooring, plunging the reader into the hitherto incomprehensible reaches of deep time. We emerge changed, astonished by the unbroken skein of life on Earth and attentive to the hidden heritage of our planet's past that surrounds us.

Piotr Naskrecki is an entomologist and a research associate with the Museum of Comparative Zoology at Harvard University. He is the author of *The Smaller Majority*.

"*Relics* is an exciting, adventure-filled, and scientifically important presentation by one of the world's best naturalists and photographers."
—E. O. Wilson

Praise for *The Smaller Majority*

"Imagine Gulliver just back from Lilliput. That is the entirely pleasurable feeling a reader will have after traveling through *The Smaller Majority*. Among the spineless wonders captured in macrophotos are giraffe weevils, tiger beetles, ant lions, shovel-snouted lizards and even a ghost-crab, dancing. . . . Small is beautiful—and powerful, too."—Patti Hagan, *Wall Street Journal*

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