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The Lying Stones Of Marrakech

Stephen Jay Gould

Stephen Jay Gould

THE LYING STONES
OF MARRAKECH

Penultimate Reflections
in Natural History


VINTAGE

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*For Jack Sepkoski (1948–1999),
who brought me one of the greatest possible joys
a teacher can ever earn or experience:
to be surpassed by his students.
Offspring should not predecease their parents,
and students should outlive their teachers.
The times may be out of joint,
but Jack was born to set the order of life's history right—
and he did!*

ALSO BY STEPHEN JAY GOULD

Ontogeny and Phylogeny

Ever Since Darwin

The Panda's Thumb

The Mismeasure of Man

Hen's Teeth and Horse's Toes

The Flamingo Smile

An Urchin in the Storm

Time's Arrow, Time's Cycle

Illuminations

(with R W Purcell)

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Eight Little Piggies

Dinosaur in a Haystack

Life's Grandeur

Questioning the Millennium

Leonardo's Mountain of Clams and the Diet of Worms

Wonderful Life

Bully for Brontosaurus

THE LYING STONES

OF MARRAKECH

Stephen Jay Gould is the Alexander Agassiz Professor of Zoology and Professor of Geology at Harvard University, and the Vincent Astor Visiting Professor of Biology at New York University. His publications include *Ever Since Darwin*, *Eight Little Piggies*, *Life's Grandeur*, *Questioning the Millennium*, *Leonardo's Mountain of Clams and the Diet of Worms*, *Bully for Brontosaurus* and *Wonderful Life*. *Wonderful Life* won the Science Book Prize for 1991.

PREFACE

In the fall of 1973, I received a call from Alan Ternes, editor of *Natural History* magazine. He asked me if I would like to write columns on a monthly basis, and he told me that folks actually get paid for such activities. (Until that day, I had published only in technical journals.) The idea intrigued me, and I said that I'd try three or four. Now, 290 monthly essays later (with never a deadline missed), I look only a little way forward to the last item of this extended series—to be written, as number 300 exactly, for the millennial issue of January 2001. One really should follow the honorable principle of quitting while still ahead, a rare form of dignity chosen by such admirable men as Michael Jordan and Joe DiMaggio, my personal hero and mentor from childhood. (Joe died, as I put this book together, full of years and in maximal style and grace, after setting one last record—for number of times in receiving last rites and then rallying.) Our millennial transition may represent an arbitrary imposition of human decisions upon nature's true cycles, but what grander symbol for calling a halt and moving on could possibly cross the path of a man's lifetime? This ninth volume of essays will therefore be the penultimate book in a series that shall close by honoring the same decimal preference lying behind our millennial transition.

If this series has finally found a distinctive voice, I have learned this mode of speech in the most gradual, accumulating, and largely unconscious manner—against my deepest personal beliefs in punctuational change and the uniquely directive power (despite an entirely accidental origin) of human reason in evolution. I suppose I had read a bit of Montaigne in English 101, and I surely could spell the word, but I had no inkling about the definitions and traditions of the essay as a literary genre when Alan Ternes called me cold on that fine autumn day.

I began the series with quite conventional notions about writing science for general consumption: I believed, as almost all scientists do (by passively imbibing a professional ethos, not by active thought or decision), that nature speaks directly to unprejudiced observers, and that accessible writing for nonscientists therefore required clarity, suppression of professional jargon, and an ability to convey the excitement of fascinating facts and interesting theories. If I supposed that I might bring something distinctive to previous efforts in this vein, I managed to formulate only two vague personal precepts: first, I would try to portray all subjects at the same conceptual depth that I would utilize in professional articles (that is, no dumbing down of ideas to accompany necessary clarification of language); second, I would use my humanistic and historical interests as a “user friendly” bridge to bring readers into the accessible world of science.

Over the years, however, this mere device (the humanistic “bridge”) became an explicit centrality, a feature that I permitted myself to accept (and regard as a source of comfort and pride rather than an idiosyncrasy to downplay or even to hide) only when I finally realized that I had been writing essays, not mere columns, all along—and that nearly five hundred years of tradition had established and validated (indeed, had explicitly defined) the essay as a genre dedicated to personal musing and experience, used as a gracious entrée, or at least an intriguing hook, for discussion of general and universal issues. (Scientists are subtly trained to define the personal as a maximally dangerous snare of subjectivity and therefore to eschew the first person singular in favor of the passive voice in all technical writing. Some scientific editors will automatically blue-pencil the dreaded *I* at every raising

of its ugly head. Therefore, “popular science writing” and “the literary essay” rank as an ultimate disparate, if not hostile, pairing of immiscible oil and water in our usual view—a convention that now dream about fracturing as a preeminent goal for my literary *and* scientific life.)

I have tried, as these essays developed over the years, to expand my humanistic “take” upon science from a simple practical device (my original intention, insofar as I had any initial plan at all) into a genuine emulsifier that might fuse the literary essay and the popular scientific article into something distinctive, something that might transcend our parochial disciplinary divisions for the benefit of both domains (science, because honorable personal expression by competent writers can never hurt; and composition, because the thrill of nature’s factuality should not be excluded from the realm of our literary efforts). At the very least, such an undertaking can augment the dimensionality of popular scientific articles—for we lose nothing of science’s factual beauty and meaning, while we add the complexity of how we come to know (or fail to learn) to conventional accounts of what we think we know.

As this series developed, I experimented with many styles for adding this humanistic component to tales about how we learned (or erred) to standard tales about what, in our best judgment, exists “out there” in the natural world—often only to demonstrate the indivisibility of these two accounts, and the necessary embeddedness of “objective” knowledge within worldviews shaped by social norms and psychological hopes. But so often, as both Dorothy and T.S. Eliot recognized in their different ways, traditional paths may work best and lead home (because they have truly withstood the test of time and have therefore been honed to our deep needs and best modes of learning, not because we fall under their sway for reasons of laziness or suppression).

Despite conscious efforts at avoidance, I find myself constantly drawn to biography—because absolutely nothing can match the richness and fascination of a person’s life, in its wondrous mixture of pure gossip, miniaturized and personalized social history, psychological dynamics, and the development of central ideas that motivate careers and eventually move mountains. And try as I may to ground biography in various central themes, nothing can really substitute for the sweep and storytelling power of chronology. (I regard the Picasso Museum in Paris and the Turner Wing of the Tate Gallery in London as my two favorite art museums because each displays the work of a great creator in the strict chronological order of his life. I can then devise whatever alternative arrangement strikes my own fancy and sense of utility—but the arrow of time cannot be replaced or set aside; even our claims for invariance must seek constant features of style or subject *through* time’s passage.)

So I have struggled, harder and more explicitly than for anything else in my life as a writer, to develop a distinctive and personal form of essay to treat great scientific issues in the context of biography—and to do so not by the factual chronology of a life’s sorrows and accomplishments (a noble task requiring the amplitude of a full book), but rather by the intellectual synergy between a person and the controlling idea of his life. In this manner, when the conceit works, I can capture the essence of a scientist’s greatest labor, including the major impediments and insights met and gathered along the way, while also laying bare (in the spare epitome demanded by strictures of the essay as a literary form of limited length) the heart of a key intellectual concept in the most interesting microcosm of a person’s formulation and defense.

The first three parts of this book apply this strategy to three different times, places, subjects, and worldviews—an extended test of my claim for a distinctive voice based on applying biographic perspectives to the illumination of key scientific concepts and their history (following the basic strategy, in each essay, of linking a person’s central operating idea, the focus of a professional life i

development, to an important concept in human understanding of the natural world—in other words, to summarize the range and power of a principle by exemplifying its role in the intellectual development of a particularly interesting scientist). Thus I have tried to encapsulate, in the unforgiving form of an essay, the essence of both a person (as expressed in the controlling idea of his scientific life) and a concept (through the quintessentially human device of displaying its development in an individual life).

Part I treats the most fascinating period in my own subject of paleontology, the premodern struggle (sixteenth to early eighteenth centuries) to understand the origin of fossils while nascent science struggled with the deepest of all questions about the nature of both causality and reality themselves. Are fossils the remains of ancient organisms on an old earth, or manifestations of a stable and universal order, symbolically expressed by correspondences among nature's three kingdoms of animal, vegetable, and mineral, with fossils arising entirely within the mineral kingdom as analogs of living forms in the other two realms? No subject could be more crucial, and no alternative view more eerily unfamiliar, than this particular battleground for the nature of reality. I present three variations upon this theme, each biographically expressed: the early-eighteenth-century tale of paleontology's most famous hoax, combined with a weirdly similar story from modern Morocco; the linkage of the unknown Stelluti to the preeminent Galileo through their friendship, and through a common error that unites the master's original view of Saturn with Stelluti's erroneous belief that petrified wood arose from the mineral kingdom; and finally, a "reversed" biography expressed in terms of an organism under study (the brachiopod fossils that were once called "vulva stones" for their resemblance to female genitalia) rather than a person pursuing the investigation.

Part II then discusses the greatest conjunction of a time, a subject, and a group of amazing people in the history of natural history: late-eighteenth- and early-nineteenth-century France, when a group including some of the most remarkable intellects of the millennium invented the scientific study of natural history in an age of revolution. Georges Buffon establishes a discipline, by the grandest route of virtually defining a new and historically based way of knowing, in the forty-four volumes of his eminently literary *Histoire naturelle*, and then loses public recognition, for interesting and understandable reasons, in the midst of his ubiquity. Antoine Lavoisier, the most stunningly incisive intellect I have ever encountered, literally adds a new dimension to our understanding of nature in the geometry of geological mapping, his one foray (amidst intentions cut short by the guillotine) into my profession. Jean-Baptiste Lamarck belies his own unfairly imposed reputation for error and inflexibility with a heartrending reassessment of the foundations of his own deepest belief—in an odyssey that begins with a handwritten comment and drawing, inked by Lamarck into his own copy of his first evolutionary treatise, and here discovered and presented for the first time.

Part III then illustrates the greatest British challenge to this continental preeminence: the remarkable, and wonderfully literate, leading lights of Victorian science in Darwin's age of turmoil and reassessment: the heart of Lyell's uniformitarianism as seen (literally) by visiting the site of his most famous visual image, the pillars of Pozzuoli, used as a frontispiece to all editions of his *Principles of Geology*; Darwin's own intellectual development from such an unpromising temperament and early training to an ultimately understandable role as the most gentle, yet thorough, revolutionary in the history of science; Richard Owen's invention of dinosaurs as an explicit device to subvert the evolutionary views of a generation before Darwin; and Alfred Russel Wallace on Victorian certainties and subsequent unpredictabilities.

The last three parts of this book do not invoke biography so explicitly, but they also use the same

device of embodying an abstraction within a particular that can be addressed in sufficient detail and immediate focus to fit within an essay. The interlude of part IV presents some experiments in the different literary form of short takes (op-ed pieces, obituary notices, and even, in one case, an introductory statement for Penguin CD's series of famous classical compositions). Here I include several attempts (the literal meaning of *essay*) to capture the most elusive and important subject of all: the nature and meaning of excellence, expressed as a general statement about substrates (chapter 1) followed by five iterations on the greatness of individuals and their central passions across a full range of human activity—for excellence must be construed as a goal for all varieties of deeds and seasons, not only for mental categories—from bodily grace and dignity within domains debased by the confusion of celebrity with stature; to distinctive individuality within corporate blandness; to the intellectual innovations more commonly cited by scholars to exemplify this most precious (and uncommon) of human attributes.

Part V, on scientific subjects with more obvious and explicit social consequences (and often unacknowledged social origins as well), also uses biography, but in a different way to link past stories with present realities—to convey the lesson that claims for objectivity based on pure discovery often replay episodes buried in history, and proving (upon exhumation and linkage) that our modern certainties flounder within the same complexities of social context and mental blockage: Spencer's social Darwinism, the Triangle Shirtwaist fire, and modern eugenics (chapter 17); contemporary boasts about the discovery of genes for specific behaviors, Davenport's heritability of wanderlust, and the old medical theory of humors (18); Dolly the cloned sheep, the nature of identical twins, and the decapitation of Louis XVI (19); J.B.S. Haldane on the "humaneness" of poison gas in warfare, and the role and status of unpredictability in science (20).

Finally, part VI abandons biography for another device of essayists: major themes (about evolution's different expression across scales of size and time) cast into the epitome of odd and intriguing particulars: fossil embryos nearly 600 million years old (21); three stories about measurable evolution in snails, lizards, and fishes (22), conventionally misinterpreted as moderate enough to prove the efficacy of Darwin's mechanism extended across the immensity of geologic time, but far too rapid and convulsive to convey any such meaning when properly read at this grand and unfamiliar scale; and avoidance in antipathy among several Christian groups (23) that "share Jerusalem's Church of the Holy Sepulchre (the traditional site of Christ's crucifixion).

At this equipoise, with one more foray into the breach yet to come, I can only thank readers who have joined me on this rocky journey. For only the conjunction of growing fellowship and increasing knowledge—a loop of ethical and intellectual, emotional and rational feedback that positively rings with the optimism of potential survival, maybe even transcendence, in this endlessly fascinating world of woe—can validate the accident of our existence by our free decision to make maximal use of the simple gifts that nature and evolution have granted us.

I
Episodes
in
the Birth
of
Paleontology

The Nature of Fossils
and the
History of the Earth

The Lying Stones of Marrakech

WE TEND TO THINK OF FAKERY AS AN ACTIVITY DEDICATED to minor moments of forgivable fun (from the whoopie cushion to the squirting lapel flower), or harmless embellishment (from my grandfather's vivid eyewitness tales of the Dempsey-Firpo fight he never attended, to the 250,000 people who swore they were there when Bobby Thomson hit his home run in a stadium with a maximal capacity of some fifty thousand).

But fakery can also become a serious and truly tragic business, warping (or even destroying) the lives of thousands, and misdirecting entire professions into sterility for generations. Scoundrels may find the matrix of temptation irresistible, for immediate gains in money and power can be so great while human gullibility grants the skillful forger an apparently limitless field of operation. The Van Gogh *Sunflowers*, bought in 1987 by a Japanese insurance company for nearly 25 million pounds sterling—then a record price for a painting—may well be a forged copy made around 1900 by the stockbroker and artist manqué Emile Schuffenecker. The phony Piltdown Man, artlessly concocted from the jaw of an orangutan and a modern human cranium, derailed the profession of paleoanthropology for forty years, until exposed as a fake in the early 1950s.

Earlier examples cast an even longer and broader net of disappointment. A large body of medieval and Renaissance scholarship depended upon the documents of Hermes Trismegistus (Thrice-Great Hermes), a body of work attributed to Thoth, the Egyptian god of wisdom, and once viewed as equal in insight (not to mention antiquity) to biblical and classical sources—until exposed as a set of forgeries compiled largely in the third century A.D. And how can we possibly measure the pain of so many thousands of pious Jews, who abandoned their possessions and towns to follow the false messiah Shabbetai Tzevi to Jerusalem in the apocalyptic year of 1666—only to learn that their leader, imprisoned by the sultan and threatened with torture, had converted to Islam, been renamed Mehmed Efendi, and made the sultan's personal doorkeeper.

The most famous story of fraud in my own field of paleontology may not qualify for this first rank in the genre, but has surely won both general fame and staying power by persistence for more than 250 years. Like all great legends, this story has a canonical form, replete with conventional moral messages, and told without any variation in content across the centuries. Moreover, this standard form bears little relationship to the actual course of events as best reconstructed from available evidence. Finally, to cite the third common property of such legends, a correction of the conventional tale will add and general value in teaching us important lessons about how we use and abuse our own history. Thus, the old story merits yet another retelling—which I first provide in the canonical (and false) version known to so many generations of students (and no doubt remembered by many readers from

their college courses in natural science).

In 1726, Dr. Johann Bartholomew Adam Beringer, an insufferably pompous and dilettantish professor and physician from the town of Würzburg, published a volume, the *Lithographia Wirceburgensis* (Würzburg lithography), documenting in copious words and twenty-one plates a remarkable series of fossils that he had found on a mountain adjacent to the city. These fossils portrayed a large array of objects, all neatly exposed in three-dimensional relief on the surface of flattened stones. The great majority depicted organisms, nearly all complete, including remarkable features of behavior and soft anatomy that had never been noted in conventional fossils—lizards with their skin, birds complete with beaks and eyes, spiders with their webs, bees feeding on flowers, snakes next to their eggs, and frogs copulating. But others showed heavenly objects—comets with tails, the crescent moon with rays, and the sun all effulgent with a glowing central face of human form. Still others depicted Hebrew letters, nearly all spelling out the tetragrammaton, the ineffable name of God—YHVH, usually transliterated by Christian Europe as “Jehovah.”

Beringer did recognize the difference between his stones and conventional fossils, and he did not state a dogmatic opinion about their nature. But he didn't doubt their authenticity either, and he did not dismiss claims that they had been carved by human hands, either recently in an attempt to defraud, or long ago for pagan purposes. Alas, after publishing his book and trumpeting the contents, Beringer realized that he had indeed been duped, presumably by his students playing a prank. (Some sources say that he finally acknowledged the trickery when he found his own name written in Hebrew letters on one stone.) According to legend, the brokenhearted Beringer then impoverished himself by attempting to buy back all copies of his book—and died dispirited just a few years later. Beringer's false fossils have been known ever since as *Lügensteine*, or “lying stones.”

To illustrate the pedigree of the canonical tale, I cite the version given in the most famous paleontological treatise of the early nineteenth century, Dr. James Parkinson's *Organic Remains of the Former World* (volume 1, 1804). Parkinson, a physician by training and a fine paleontologist by avocation, identified and gave his name to the degenerative disease that continues to puzzle and trouble us today. He wrote of his colleague Beringer:

One work, published in 1726, deserves to be particularly noticed; since it plainly demonstrates, that learning may not be sufficient to prevent an unsuspecting man, from becoming the dupe of excessive credulity. It is worthy of being mentioned on another account: the quantity of censure and ridicule, to which its author was exposed, served, not only to render his cotemporaries [*sic*] less liable to imposition; but also more cautious in indulging in unsupported hypotheses.... We are here presented with the representation of stones said to bear petrifications of birds; some with spread, others with closed, wings: bees and wasps, both resting in their curiously constructed cells, and in the act of sipping honey from expanded flowers ... and, to complete the absurdity, petrifications representing the sun, moon, stars, and comets: with many others too monstrous and ridiculous to deserve even mention. These stones, artfully prepared, had been intentionally deposited in a mountain, which he was in the habit of exploring, purposely to dupe the enthusiastic collector. Unfortunately, the silly and cruel trick, succeeded in so far, as to occasion to him, who was the subject of it, so great a degree of mortification, as, it is said, shortened his days.

All components of the standard story line, complete with moral messages, have already fallen in

place—the absurdity of the fossils, the gullibility of the professor, the personal tragedy of his undoing and the two attendant lessons for aspiring young scientists: do not engage in speculation beyond available evidence, and do not stray from the empirical method of direct observation.

In this century's earlier and standard work on the history of geology (*The Birth and Development of the Geological Sciences*, published in 1934), Frank Dawson Adams provides some embellishments that had accumulated over the years, including the unforgettable story, for which not a shred of evidence has ever existed, that Beringer capitulated when he found his own name in Hebrew letters on one of his stones. Adams's verbatim "borrowing" of Parkinson's last line also illustrates another reason for invariance of the canonical tale: later retellings copy their material from earlier sources:

Some sons of Belial among his students prepared a number of artificial fossils by moulding forms of various living or imaginary things in clay which was then baked hard and scattered in fragments about on the hillsides where Beringer was wont to search for fossils.... The distressing climax was reached, however, when later he one day found a fragment bearing his own name upon it. So great was his chagrin and mortification in discovering that he had been made the subject of a cruel and silly hoax, that he endeavored to buy up the whole edition of his work. In doing so he impoverished himself and it is said shortened his days.

Modern textbooks tend to present a caricatured "triumphalist" account in their "obligatory" introductory pages on the history of their discipline—the view that science marches inexorably forward from dark superstition toward the refining light of truth. Thus, Beringer's story tends to acquire the additional moral that his undoing at least had the good effect of destroying old nonsense about the inorganic or mysterious origin of fossils—as in this text for first-year students, published in 1961:

The idea that fossils were merely sports of nature was finally killed by ridicule in the early part of the eighteenth century. Johann Beringer, a professor at the University of Würzburg, enthusiastically argued against the organic nature of fossils. In 1726, he published a paleontological work ... which included drawings of many true fossils but also of objects that represented the sun, the moon, stars, and Hebraic letters. It was not till later, when Beringer found a "fossil" with his own name on it, that he realized that his students, tired of his teachings, had planted these "fossils" and carefully led him to discover them for himself.

A recent trip to Morocco turned my thoughts to Beringer. For several years, I have watched, with increasing fascination and puzzlement, the virtual "takeover" of rock shops throughout the world by striking fossils from Morocco—primarily straight-shelled nautiloids (much older relatives of the coiled and modern chambered nautilus) preserved in black marbles and limestones, and usually so large, beautifully polished slabs intended for table or dresser tops. I wondered where these rocks occurred in such fantastic abundance; had the High Atlas Mountains been quarried away to sea level? I wanted to make sure that Morocco itself still existed as a discrete entity and not only as disaggregated fragments, fashioning the world's coffee tables.

I discovered that most of these fossils come from quarries in the rocky deserts, well and due east of Marrakech, and not from the intervening mountains. I also learned something else that alleviated

my fears about imminent dispersal of an entire patrimony. Moroccan rock salesmen dot the landscape in limitless variety—from young boys hawking a specimen or two at every hairpin turn on the mountain roads, to impromptu stands at every lookout point, to large and formal shops in the cities and towns. The aggregate volume of rock must be immense, but the majority of items offered for sale are either entirely phony or at least strongly “enhanced.” My focus of interest shifted dramatically from worrying about sources and limits to studying the ranges and differential expertises of a major industry dedicated to the manufacture of fake fossils.

I must judge some “enhancements” as quite clever—as when the strong ribs on the shell of a genuine ammonite are extended by carving into the smallest and innermost whorls and the “improved” in regular expression on the outer coil. But other “ammonites” have simply been carved from scratch on a smoothed rock surface, or even cast in clay and then glued into a prepared hole in the rock. Other fakes can only be deemed absurd—as in my favorite example of a wormlike “thing” with circles on its back, grooves on both sides, eyes on a head shield, and a double projection, like a snake’s forked tongue, extending out in front. (In this case the forger, too clever by half, at least recognized the correct principle of parts and counterparts—for the “complete” specimen includes two pieces that fit together, the projecting “fossil” on one slab, and the negative impression on the other where the animal supposedly cast its form into the surrounding sediment. The forger even carved negative circles and grooves into the counterpart image, although these impressions do not match the projecting, and supposedly corresponding, embellishments on the “fossil” itself.)

But one style of fakery emerges as a kind of “industry standard,” as defined by constant repetition and presence in all shops. (Whatever the unique and personal items offered for sale in any shop, the *vin ordinaire* of the genre always appears in abundance.) These “standards” feature small (up to four or six inches in length) flattened stones with a prominent creature spread out in three dimensions on the surface. The fossils span a full range from plausible “trilobites,” to arthropods (crabs, lobsters, and scorpions, for example) with external hard parts that might conceivably fossilize (though never with such complete exactitude), to small vertebrates (mostly frogs and lizards) with a soft exterior including such delicate features as fingers and eyes that cannot be preserved in the geological record.

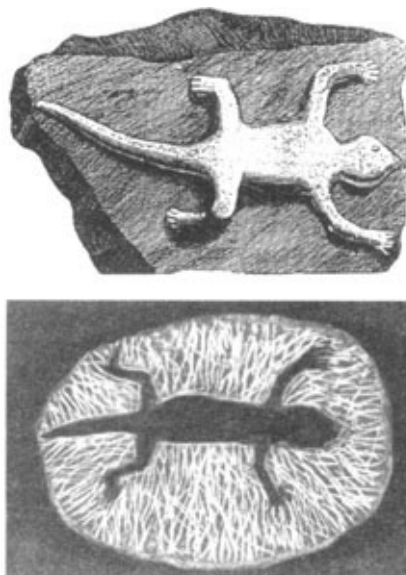
After much scrutiny, I finally worked out the usual mode of manufacture. The fossil fakes are plaster casts, often remarkably well done. (The lizard that I bought, as seen in the accompanying photograph, must have been cast from life, for a magnifying glass reveals the individual pores and scales of the skin.) The forger cuts a flat surface on a real rock and then cements the plaster cast to this substrate. (If you look carefully from the side, you can always make out the junction of rock and plaster.) Some fakes have been crudely confected, but the best examples match the color and form of the rock to overlying plaster so cleverly that distinctions become nearly invisible.



A fake fossil reptile from a Moroccan rock shop. Done in plaster from a live cast and then glued to the rock.

rock.

When I first set eyes on these fakes, I experienced the weirdest sense of déjà vu, an odd juxtaposition of old and new that sent shivers of fascination and discomfort up and down my spine—feeling greatly enhanced by a day just spent in the medina of Fez, the ancient walled town that has scarcely been altered by a millennium of surrounding change, where only mules and donkeys carry the goods of commerce, and where high walls, labyrinthine streets, tiny open shops, and calls to prayer enhanced during the fast of Ramadan, mark a world seemingly untouched by time, and conjuring up every stereotype held by an uninformed West about a “mysterious East.” I looked at these standard fakes, and I saw Beringer’s *Lügensteine* of 1726. The two styles are so uncannily similar that I wondered, at first, if the modern forgers had explicitly copied the plates of the *Lithographische Wirceburgensis*—a silly idea that I dropped as soon as I returned and consulted my copy of Beringer’s original. But the similarities remain overwhelming. I purchased two examples—a scorpion of some kind and a lizard—as virtual dead ringers for Beringer’s *Lügensteine*, and I present a visual comparison of the two sets of fakes, separated by 250 years and a different process of manufacture (carved in Germany, cast in Morocco). I only wonder if the proprietor believed my assurances, rendered in my best commercial French, that I was a professional paleontologist, and that his wares were *faux mais absolument et sans doute*—or if he thought that I had just devised a bargaining tactic more clever than most.



*The striking similarity between the most famous fake in the history of paleontology (Beringer’s *Lügensteine*, or “lying stones,” of 1726) and a modern Moroccan fabrication.*

But an odd similarity across disparate cultures and centuries doesn’t provide a rich enough theme for an essay. I extracted sufficient generality only when I realized that this maximal likeness in appearance correlates with a difference in meaning that couldn’t be more profound. A primary strategy of the experimental method in science works by a principle known since Roman times as *ceteris paribus* (“all other things being equal”)—that is, if you wish to understand a controlling difference between two systems, keep all other features constant, for the difference may then be attributed to the only factor that you have allowed to vary. If, for example, you wish to test the effect

of a new diet pill, try to establish two matched groups—folks of the same age, sex, weight, nutrition, health, habits, ethnicity, and so on. Then give the pill to one group and a placebo to the other (without telling the subjects what they have received, for such knowledge would, in itself, establish inequality based on differing psychological expectations). The technique, needless to say, does not work perfectly (for true *ceteris paribus* can never be obtained), but if the pill group loses a lot of weight, and the placebo group remains as obese as before, you may conclude that the pill probably works as hoped.

Ceteris paribus represents a far more distant pipe dream in trying to understand two different contexts in the developing history of a profession—for we cannot now manipulate a situation of our own design, but must study past circumstances in complex cultures not subject to regulation by our experimental ideals at all. But any constancy between the two contexts increases our hope of illustrating and understanding their variations in the following special way: if we examine the different treatment of the same object in two cultures, worlds apart, then at least we can attribute the observed variation to cultural distinctions, for the objects treated do not vary.

The effectively identical *Lügensteine* of early-eighteenth-century Würzburg and modern Marrakech embody such an interesting difference in proposed meaning and effective treatment by two cultures—and I am not sure that we should be happy about the contrast of then and now. But we must first correct the legend of Beringer and the original *Lügensteine* if we wish to grasp the essential difference.

As so often happens when canonical legends arise to impart moral lessons to later generations, the standard tale distorts nearly every important detail of Beringer's sad story. (I obtained my information primarily from an excellent book published in 1963 by Melvin E. Jahn and Daniel J. Woolf, *The Lying Stones of Dr. Beringer*, University of California Press. Jahn and Woolf provide a complete translation of Beringer's volume, along with extensive commentary about the paleontology of Beringer's time. I used original sources from my own library for all quotations not from Beringer in this essay.)



Note the exuberance and (by modern standards) whimsical nature of Beringer's fake fossils from 1726.

First of all, on personal issues not directly relevant to the theme of this essay, Beringer was not tricked by a harmless student prank but rather purposely defrauded by two colleagues who hated his dismissive pomposity and wished to bring him down. These colleagues—J. Ignatz Roderick, professor of geography and algebra at the University of Würzburg, and Georg von Eckhart, librarian to the court

and the university—“commissioned” the fake fossils (or, in Roderick’s case, probably did much of the carving himself), and then hired a seventeen-year-old boy, Christian Zänger (who may also have helped with the carving), to plant them on the mountain. Zänger, a double agent of sorts, was then hired by Beringer (along with two other boys, both apparently innocent of the fraud) to excavate and collect the stones.

This information for revising the canonical tale lay hidden for two hundred years in the incomplete and somewhat contradictory records of hearings held in April 1726 before the Würzburg cathedral chapter and the city hall of Eivelstadt (the site of Beringer’s mountain just outside Würzburg). The German scholar Heinrich Kirchner discovered these documents in 1934 in the town archives of Würzburg. These hearings focus on testimony of the three boys. Zänger, the “double agent,” states that Roderick had devised the scheme because he “wished to accuse Dr. Beringer ... because Beringer was so arrogant and despised them all.” I was also impressed by the testimony of the two brothers hired by Beringer. Their innocence seems clear in the wonderfully ingenuous statement of Nicklaus Hahn that if he and his brother “could make such stones, they wouldn’t be mere diggers.”

The canonical tale may require Beringer’s ruin to convey a desired moral, but the facts argue differently. I do not doubt that the doctor was painfully embarrassed, even mortified, by his exposure to gullibility; but he evidently recovered, kept his job and titles, lived for another fourteen years, and published several more books (including, though probably not by his design or will, a posthumous second edition of his *Würzburg Lithography!*). Eckhart and Roderick, on the other hand, fell into well-earned disgrace. Eckhart died soon thereafter, and Roderick, having left Würzburg (voluntarily or not, we do not know), then wrote a humbling letter to the prince-bishop begging permission to return—which his grace allowed after due rebuke for Roderick’s past deeds—and to regain access to the library and archives so that he could write a proper obituary for his deceased friend Eckhart.

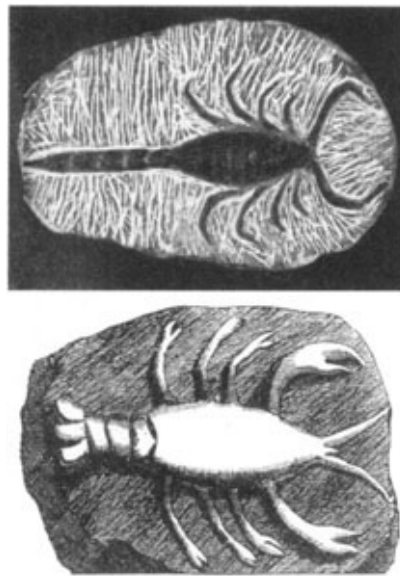
But on the far more important intellectual theme of Beringer’s significance in the history of paleontology, a different kind of correction inverts the conventional story in a particularly meaningful way. The usual cardboard tale of progressive science triumphant over past ignorance requires that the benighted “bad guys,” who upheld the old ways of theological superstition against objective evidence of observational science, be branded as both foolish and stubbornly unwilling to face nature’s factuality. Since Beringer falls into this category of old and bad, we want to see him as hopelessly duped by preposterous fakes that any good observer should have recognized—hence the emphasis, in the canonical story, on Beringer’s mortification and on the ridiculous character of the *Lügensteine* themselves.

The Würzburg carvings are, of course, absurd by modern definitions and understanding of fossils. We know that spiders’ webs and lizards’ eyes—not to mention solar rays and the Hebrew name of God—cannot fossilize, so the *Lügensteine* can only be human carvings. We laugh at Beringer for not making an identification that seems so obvious to us. But in so doing, we commit the greatest of all historical errors: arrogantly judging our forebears in the light of modern knowledge performed unavailable to them. Of course the *Lügensteine* are preposterous, once we recognize fossils as preserved remains of ancient organisms. By this criterion, letters and solar emanations cannot be real fossils, and anyone who unites such objects with plausible images of organisms can only be a fool.

But when we enter Beringer’s early-eighteenth-century world of geological understanding, his interpretations no longer seem so absurd. First of all, Beringer was puzzled by the unique character of his *Lügensteine*, and he adopted no dogmatic position about their meaning. He did regard them as natural and not carved (a portentous error, of course), but he demurred on further judgment and

repeatedly stated that he had chosen to publish in order to provide information so that others might better debate the nature of fossils—a tactic that scientists supposedly value. We may regard the closing words of his penultimate chapter as a tad grandiose and self-serving, but shall we not praise the sentiment of openness?

I have willingly submitted my plates to the scrutiny of wise men, desiring to learn their verdict, rather than to proclaim my own in this totally new and much mooted question. I address myself to scholars, hoping to be instructed by their most learned responses.... It is my fervent expectation that illustrious lithographers will shed light upon this dispute which is as obscure as it is unusual. I shall add thereto my own humble torch, nor shall I spare any effort to reveal and declare whatever future yields may rise from the Würzburg field under the continuous labors of my workers, and whatever opinion my mind may embrace.



Another comparison between German fake fossils of 1726 and modern Moroccan fabrications.

More importantly, Beringer's hoaxers had not crafted preposterous objects but had cleverly contrived—for their purposes, remember, were venomous, not humorous—a fraud that might fool a man of decent will and reasonable intelligence by standards of interpretation then current. Beringer wrote his treatise at the tail end of a debate that had engulfed seventeenth-century science and had not yet been fully resolved: what did fossils represent, and what did they teach us about the age of the earth, the nature of our planet's history, and the meaning and definition of life?

Beringer regarded the *Lügensteine* as "natural" but not necessarily as organic in origin. In the great debate that he knew and documented so well, many scientists viewed fossils as inorganic products of the mineral realm that somehow mimicked the forms of organisms but might also take the shapes of other objects, including planets and letters. Therefore, in Beringer's world, the *Lügensteine* could not be dismissed as preposterous *prima facie*. This debate could not have engaged broader or more crucial issues for the developing sciences of geology and biology—for if fossils represent the remains of organisms, then the earth must be ancient, life must enjoy a long history of consistent change, and rocks must form from the deposition and hardening of sediments. But if fossils can originate

inorganic results of a “plastic power” in the mineral kingdom (that can fashion other interesting shapes like crystals, stalactites, and banded agates in different circumstances), then the earth may be young and virtually unchanged (except for the ravages of Noah’s flood), while rocks, with the enclosed fossils, may be products of the original creation, not historical results of altered sediments.

If pictures of planets and Hebrew letters could be “fossils” made in the same way as appeared organisms, then the inorganic theory gains strong support—for a fossilized aleph or moonbeam could not be construed as a natural object deposited in a streambed and then fossilized when the surrounding sediment became buried and petrified. The inorganic theory had been fading rapidly in Beringer’s time, while the organic alternative gained continually in support. But the inorganic view remained plausible, and the *Lügensteine* therefore become clever and diabolical, not preposterous and comical.

In Beringer’s day, many scientists believed that simple organisms arose continually by spontaneous generation. If a polyp can originate by the influence of sunshine upon waters, or a maggot by heat upon decaying flesh, why not conjecture that simple images of objects might form upon rocks by natural interactions of light or heat upon the inherent “lapidifying forces” of the mineral kingdom? Consider, moreover, how puzzling the image of a fish *inside* a rock must have appeared to people who viewed these rocks as products of an original creation, not as historical outcomes of sedimentation. How could an organism get inside; and how could fossils be organisms if they frequently occur petrified, or made of the same stone as their surroundings? We now have simple and “obvious” answers to these questions, but Beringer and his colleagues still struggled—and any sympathetic understanding of early-eighteenth-century contexts should help us to grasp the centrality and excitement of these debates and to understand the *Lügensteine* as legitimately puzzling.

I do not, however, wish to absolve Beringer of all blame under an indefensibly pluralistic doctrine that all plausible explanations of past times may claim the same weight of judicious argument. The *Lügensteine* may not have been absurd, but Beringer had also encountered enough clues to uncover the hoax and avoid embarrassment. However, for several reasons involving flaws in character and a passable intelligence short of true brilliance, Beringer forged on, finally trumping his judgment by his desire to be recognized and honored for a great discovery that had consumed so much of his time and expense. How could he relinquish the fame he could almost taste in writing:

Behold these tablets, which I was inspired to edit, not only by my tireless zeal for public service, and by your wishes and those of my many friends, and by my strong filial love for Franconia, to which, from these figured fruits of this previously obscure mountain, no less glory will accrue than from the delicious wines of its vine-covered hills.

I am no fan of Dr. Beringer. He strikes me, first of all, as an insufferable pedant—so I can understand his colleagues’ frustration, while not condoning their solutions. (I pride myself on always quoting from original sources, and I do own a copy of Beringer’s treatise. I am no Latin scholar, but I can read and translate most works in this universal scientific language of Beringer’s time. But I cannot make head or tail of the convoluted phrasings, the invented words, the absurdly twisted sentences of Beringer’s prose, and I have had to rely on Jahn and Woolf’s translation previously cited.)

Moreover, Beringer saw and reported more than enough evidence to uncover the hoax, had he been inclined to greater judiciousness. He noted that his *Lügensteine* bore no relationship to any other objects known to the burgeoning science of paleontology, not even to the numerous “real” fossils also found on his mountain. But instead of alerting him to possible fraud, these differences only fueled

Beringer's hopes for fame. He made many observations that should have clued him in (even by the standards of his own time) to the artificial carving of his fossils: why were they nearly always complete, and not usually fragmentary like most other finds; why did each object seem to fit so snugly and firmly on the enclosing rock; why did only the top sides protrude, while the lower parts merged with the underlying rock; why had letters and sunbeams not been found before; why did nearly all fossils appear in the same orientation, splayed out and viewed from the top, never from the side or bottom? Beringer's own words almost shout out the obvious and correct conclusion that he could not abide or even discern: "The figures expressed on these stones, especially those of insects, are exactly fitted to the dimensions of the stones, that one would swear that they are the work of a very meticulous sculptor."

Beringer's arrogance brought him down in a much more direct manner as well. When Eckhart and Roderick learned that Beringer planned to publish his work, they realized that they had gone too far and became frightened. They tried to warn Beringer, by hints at first but later quite directly as the anxiety increased. Roderick even delivered some stones to Beringer and later showed his rival how they had been carved—hoping that Beringer would then draw an obvious inference about the rest of his identical collection.

Beringer, however, was now committed and would not be derailed. He replied with the argument of all true believers, the unshakable faith that resists all reason and evidence: yes, you have proved that *these* psychics are frauds, but *my* psychics are the real McCoy, and I must defend them even more strongly now that you have heaped unfair calumnies upon the entire enterprise. Beringer never mentions Eckhart and Roderick by name (so their unveiling awaited the 1934 discovery in the Würzburg town archives), but he had been forewarned of their activities. Beringer wrote in chapter 1 of his book:

Then, when I had all but completed my work, I caught the rumor circulating throughout the city ... that every one of these stones ... was recently sculpted by hand, made to look as though at different periods they had been resurrected from a very old burial, and sold to me as to one indifferent to fraud and caught up in the blind greed of curiosity.

Beringer then tells the tale of Roderick's warning but excoriates his rival as an oafish moderate caricature of Praxiteles (the preeminent Greek sculptor), out to discredit a great discovery by artificial mimicry:

Our Praxiteles has issued, in an arrogant letter, a declaration of war. He has threatened to write a small treatise exposing my stones as supposititious [*sic*]—I should say, his stones, fashioned and fraudulently made by his hand. Thus does this man, virtually unknown among men of letters, still but a novice in the sciences, make a bid for the dawn of his fame in a shameful calumny and imposture.

If only Beringer had realized how truly and comprehensively he had spoken about "a shameful calumny and imposture." But Roderick succeeded because he had made his carvings sufficiently plausible to inspire belief by early-eighteenth-century standards. The undoing of all protagonists then followed because Beringer, in his overweening and stubborn arrogance, simply could not quench his

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