Visible Bones

Jack Nisbet
author of
Sources of the River

Journeys Across Time in the Columbia River Country

"Nisbet makes the landscape come alive on many levels, historical, biological, and cultural." —*The Seattle Times*

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JACK NISBET

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Author's Note on Geography and Language:

In this book the Columbia Plateau refers to the part of the river's drainage that lies between t Rocky Mountains and the Cascade Range. The Columbia Basin denotes the arid central portion the Plateau. The Snake River is part of the larger Columbia drainage.

Ethnologists divide the native peoples of the Columbia drainage into three cultural groups. Plate tribes inhabited most of the interior and spoke Kootenai, Interior Salish, or Sahaptin language Great Basin peoples, all Shoshoean speakers, were concentrated in the Snake River country. T Coastal cultures along the lower Columbia spoke Chinookan and Coast Salish languages.

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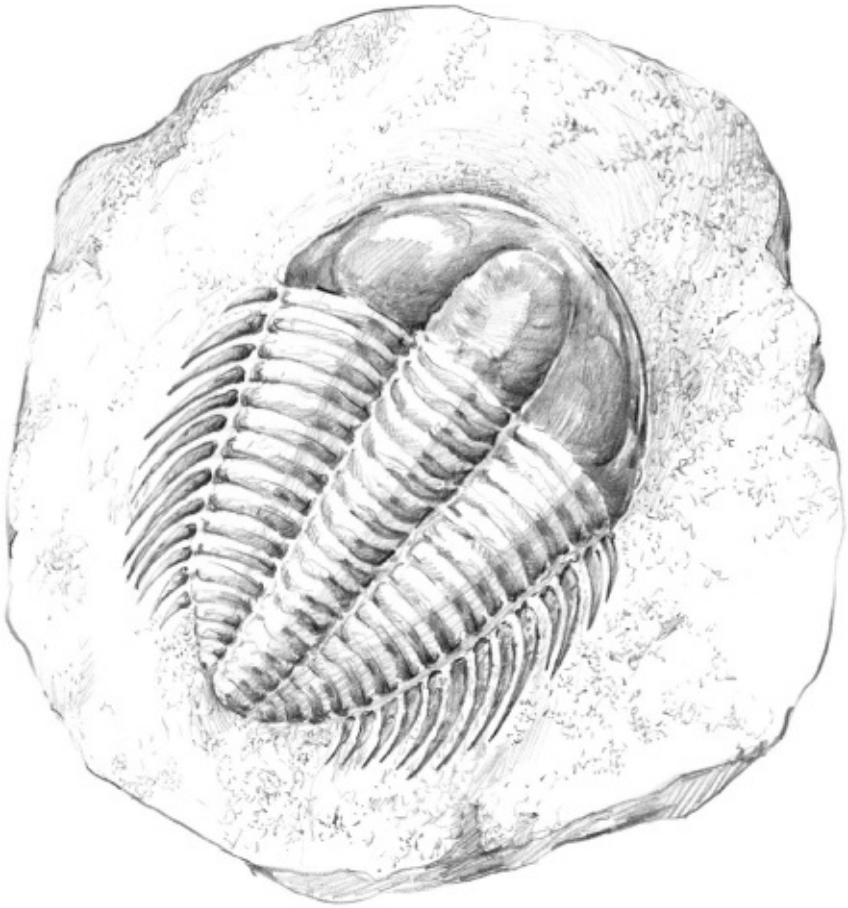
THE MOMENT THE REAR WHEEL BROKE through the crust, I knew I was really stuck. Muttering curses, switched off the engine and surveyed the situation. I had backed up too near a grove of birc trees that surrounded a seeping spring, and one wheel was buried to the hubcap. The slice blue clay that had enveloped my tire emitted a whiff of indigo perfume, and when I bent look I caught a glimpse of something long and smooth embedded in the mud. At first I took for the leg bone of an animal, and struggled to pry it free—I've always loved to pick up bon and try to figure out what animal they belonged to—but the fragment proved to be nothi more than a plank from a farmer's old spring box, warped to a pleasing arc by the preservi goo. Rubbing my fingers over the raised grain of the board, I figured that it must have bee only a century or so since the birch spring homesteader had set the board in place.

Now the rut that had dragged down my car was offering a small relic from those days fo my perusal. The spring where I was mired lay on an open bench, and I walked out to its edg and looked down on the Columbia River. From the site of my misfortune, the whole countr was laid out for me to see—open hillsides of ponderosa pine, new outcrops of colore dolomite, draws filled with darker Douglas firs and yellow-green tamarack. Time marche backward from the homestead spring, to the fur traders who had floated past, riding th initial wave of European contact, to the tribal memories buried beneath the waters. Th round peaks to the north still capped with snow in early June hinted at the glaciers that ha carved the bench where I stood.

The word *relic* conjures up a host of connotations, from human remains to a histor souvenir. It can denote a custom from the past, the remnants of an ancient language, or fragment of a whole. It can represent the last of a dying species, or an indefatigable survivo During the years I have lived in the Columbia country, I have come to see its vast natural an human archives as a reliquary of its former lives, a reservoir of clues that connect th moment to the distant past, this place to territories far away.

That is where this book begins, with the discovery of such relics. Some of them f comfortably in a pocket; some are far too large for transport. Certain ones have mesmerize generations of chroniclers and invited intense scientific scrutiny, while others have barel been noticed. Many take the tangible form of rock or bone; others are as ephemeral as th faint whiff of a bloom in spring or the laugh of an auntie poking fun. Some have faded t extinction; others can be found by any kid with a penchant for muddy feet. But whatev form they take, each evokes a facet of the region's past, reminding us that this place has n always been as we see it now. Their voices call across time, carrying snatches of the b river's long and larger song.



CHAPTER ONE

Little Stone House

Upper Cambrian trilobite *(Labiostria westropi)* from Tanglefoot Creek

Tanglefoot ~

"Look for cookies," Rolf had said, as he directed my attention to a tiny squiggle on a map southeastern British Columbia. "Little round treats in the streambed." He made it sound easy.

By the time I reached Tanglefoot Creek on the west slope of the Rockies, I was beginnin to wish I had waited until after spring runoff. Rising temperatures had loosened the snowpac from the nearby peaks, and the world seemed to be collapsing all around. A grinding porridg of mud and gravel sluiced bushes from steep rock faces. The creek, milky green in colo snapped like a racer snake, carrying chunks of my trail headlong toward the sea.

When I paused to check my progress, heavy drops of rain spanked down on my scrawle directions. I turned up a side rivulet that careened through a tight canyon, picking my wa across a fresh mudslide. Clumps of saxifrage flowers, white stars touched with maroon an lemon spots, surfed atop thin plates of brown shale. Outcrops of the same shale shot steep

upward on either side of the creek; this was country that had been bent and twisted on grand scale. Each step forward in space moved me backward in time.

The narrowing canyon finally forced me into the stream. I swapped boots for water sanda and plunged into the torrent. The water was so cold that I had to hop onto a boulder ever few minutes to let the sting go out of my feet. Grabbing at gooseberry bushes to steac myself, I cast my eyes left and right to match the pace of the torrid runoff, searching for th remains of a creature long extinct. The first round stone I picked up turned out to b completely smooth. So did the next several dozen. A thrush's song ascended leisurely over th creek's icy roar, and a succession of hard showers rode in one upon the next. The bird sar many times before an emerging ray of sunlight caught the raised edge of a biscuit-shaped roc on the nose of a gravel bar. I bent down and wrapped my hand around it, feeling for ridge Even before I lifted it free of the creek, my fingers told me I had found a trilobite.

I waded over to the bank and sat down to admire my prize. It proved to be a worn, warpe specimen not much bigger than an Oreo. The three lobes that had once defined a livir trilobite were squashed almost flat. The ribbed segments of its thorax showed only as blac shadows on the dark green rock, and the code of spiny detail had been reduced to fai cracks. Yet as I squeezed the patterned stone, my body flooded with warmth. Under the spe of the thrush's song, the ancient relic began to spin a tune all its own.

Trilobite Nation ~

It was a tale that began long ago, back in a time when life existed only in the sea. Beneath th surface of a placid ocean that lapped at the edge of our ancestral continent, the trilobi riffled through the mud. Quill-like spines curved backward along the sides of its squat bod Multiple pairs of jointed legs propelled it forward. As it moved, articulated hinges along i back flexed and rippled like slats on a rolltop desk, and feathered gills along its upper leg combed oxygen from the water. Supple antennae twisted above its head, sensing th surroundings through fine lateral hairs. A pair of prismatic eyes bulged from its rounde head, keen enough to catch movements through the murky depths. A host of images woul have flashed across those ancient eyeballs, for the trilobite's home teemed with life. Spir sponges and pedestaled brachiopods bloomed across the ocean floor, while exotic jellyfis floated in the water column, and segmented worms writhed through the mud. A medley o arthropods, with their jointed limbs and tough outer shells, scrabbled about. Other trilobite more than a dozen species of them, fanned out across the seafloor habitats like woo warblers through a hardwood forest.

My little trilobite would have begun life as a pin-sized larva drifting in this sea. The tir creature soon developed a hard calcite carapace that shielded its body. As the animal grev that protective shell became tighter and tighter, until wrinkled sutures atop its head softene then cracked open like a locust's shell. Plates around the eyes and cheeks broke free, and th trilobite began to lever its way through the opening. Once released, it was as vulnerable as soft-shelled crab until a new suit of armor came of age. Over the course of its life, th trilobite discarded many more shields, each slightly larger than the last. When death claime the animal, its carcass joined those molted shells on the ocean floor. Far beneath the reach o waves and wind, bacteria converged to consume its soft body parts. A gentle shower of si

soon covered the empty shell with a blanket of fine mud.

Time passed. Rivers continued to sluice sediments into the sea. Inch upon inch primordial goo sifted down atop the trilobite's shield, and myriad ones around it, until the were buried thousands of feet deep. The accumulating weight of all that sediment flattene the trilobite's skeleton and pressed the moisture from the layered silt. As mud wa transformed into rock, a peculiar chemical reaction took place between the calcium in th trilobite's exoskeleton and minerals in the surrounding mudstone. Crystals of calcite sproute around the carapace, forming a rounded nodule with the trilobite's shape perfectly replicate on its surface, as if embossed with the state seal of some ancient arthropodean republic.

Meanwhile, far above its crystalline sarcophagus, my trilobite's kin still crawled, and th remains of countless more generations collected on the seafloor. As the oceans grew colde near the close of the Cambrian period, half a billion years ago, many long-establishe varieties faded into extinction. New families came into prominence, along with familiar form of starfish, cuttlefish, bivalved clams, and corals. Jawless fish gave way to sharks, an primitive vegetation appeared on shore. Continents began drifting together to form Pangae sea levels rose and fell, climates warmed and cooled and warmed again. Insects took to th air, and amphibians established themselves on solid ground. In the sea, a different and le diverse suite of trilobites scuttled next to horseshoe crabs.

Then, around 250 million years ago, at the end of the Permian age, trilobites disappeare from the seas of our world. They had been part of the saltwater scene for over 350 millio years, and then they were gone. Some of their arthropod relatives survived, and their distan cousin the horseshoe crab is with us still, but the trilobite tribe left no direct descendant The entire evidence of their existence lay locked in vast stone cemeteries thousands of fe beneath the sea.

Tens of millions of years passed before Pangaea began to split apart, and the mechanics continental drift triggered a series of tectonic collisions off the western coast of Nort America. Secure within its crypt, my trilobite was slowly nudged ashore. Millimeter b millimeter, it traveled hundreds of miles eastward and thousands of feet upward as the o seabed became a new mountain range. Many more years of grinding ice and rushing wate exposed the seam of fossil-laden shale. At the twilight of the last great glacial epoch, th Kootenay and Columbia Rivers settled into the courses we see them run today, carrying th Tanglefoot's flow from the west slope of the Rockies to the Pacific. Birds migrated north an south along the ridgetops, and herding mammals wore pathways back and forth across th Continental Divide. In time, people followed.

The rising waters of formal science did not touch the eroding shale up the Tanglefoot unt the late 1950s, when a graduate student stumbled upon some fossils while doing fieldwork the area. He and subsequent geologists described a lagerstätten—a trove of beautifull preserved specimens spilling out in an abundance that echoed that of the primordial se Paleontologists working at the site have since collected thousands of trilobites belonging over a dozen different species, including two completely new to science.

Stone House ~

The graduate student, it seems, was not the first visitor to pick up a Tanglefoot trilobite. Sever

years ago, a retired schoolteacher from southwestern British Columbia donated a collection
artifacts to a local confederation of Coast Salish tribes. The items, gathered along the low
Fraser River, included projectile points, scrapers, and knives; the tribal archaeologist not
that several of the pieces were of a sort associated with traditional burial sites. Present in th
array was a biscuit-shaped stone that contained some kind of fossil. Rolf Ludvigsen,
paleontologist who directs a research institute in western B.C., was called in to have a look.

Ludvigsen instantly recognized a trilobite of a very unusual type. Furthermore, he kne
the species, with its distinctive method of preservation, was found in only one place-
Tanglefoot Creek, clear on the opposite side of the province, fully three hundred miles eas
But the Tanglefoot belongs to the Columbia drainage, and there is no natural force that cou
explain how the fossil crossed to the Fraser River system. It could only have been transporte
across the watersheds by human hands. Ludvigsen speculated that the trilobite might hav
been picked up by a native traveler who either carried it on a long journey or introduced
into a trading network that eventually led to the lower Fraser. As a student of trilobite lore
well as morphology, he knew that such an occurrence was not without precedent.

Trilobite fossils are found on every continent, and the annals of archaeology hold evidenc
that these stone images have been catching the eyes of humans since Paleolithic times. A
aboriginal tool uncovered in Australia had been chipped from a piece of chert containing
complete trilobite that retained enough distinguishing features to be identified as a ne
species.

At a rock shelter in central France now known as La Grotte du Trilobite, archaeologis
excavating a layer of debris occupied by humans around fifteen thousand years ago unearthe
an oblong facsimile of a beetle, carved from lignite coal. Near the beetle lay a worn trilobit
Both artifacts matched recognizable species of the Arthropod order, and both were perforate
by carefully placed holes, presumed to have carried a string so that the ornaments could har
in necklace fashion. There is no way to know what these objects meant to their ancie
crafters, but they must have been regarded as items of value. There must have been som
attraction of design or shape that led curious hands to pick them up and carry them along,
modify them for specific purposes, to touch them over and over.

Folklore from around the world offers insights into the motives of more recent collector
One small trilobite species found in a province in China has been used as a medicin
“swallowing stone” for centuries. Some Welsh people still carry the ribbed rear portion of a
Ordovician trilobite that is shaped like a pair of wings. These “petrified butterflies” have lon
been ascribed to an ancient spell of Merlin.

In the early 1900s a natural history buff named Frank Beckwith was digging in tradition
Pahvant Ute territitory in west-central Utah when he uncovered a human skeleton. Within th
rib cage lay a fossil trilobite. There was a hole drilled through the head of the trilobite, an
its position inside the chest cavity indicated that it must have been worn as a pendant.
nearby mountain range contained an abundant deposit of this particular type of trilobit
which a Pahvant Ute acquaintance called by a name that Beckwith translated as “little wate
bug like stone house in.” Upon inquiry, he learned that Ute elders used the fossils as cures fo
diptheria and sore throat, and wore them as amulets to afford protection in battle. A
Beckwith’s request, a young tribal member fashioned a necklace following a tradition
design. When complete, it contained thirteen trilobite fossils, each drilled through the hea

and strung on a rawhide thong between hand-formed clay beads and tassels of horse hair.

Back on the Tanglefoot, I turned over these stories along with the fossil in my palm, thinkin of everyone who had touched those traveling trilobites—the Australian toolmaker, th wearers of the amulets, the Chinese physicians, the traveler on the Tanglefoot, the trade along the path, the schoolteacher, the scientists. I wondered how many of them had looke for more.

After a while, pulled by the lure of the search, I waded back into the snowmelt. Th rushing water magnified the streambed into a swirling kaleidoscope. I plucked a rando pebble and flipped it over. A mayfly nymph clung to the underside, its segmented body an bristling limbs echoing the trilobite form. The thrush sang on as I tested other rocks, pushin up riffles until my shins turned blue. But no more stone water bugs appeared in my hand.

A fresh burst of hailstones finally convinced me to call it quits. Shivering, I wiped the gr from my eel-white feet and re-laced my boots. On the trek back to my car, the single trilobi in my pocket began to bother me with the way it knocked against my leg at every step, and stopped to draw it out. In the tired afternoon, the fossil had faded—its color dulling towar gray, the details of its anatomy sinking back into the stone. The word *relic* is rooted in th Latin *relinquere*, "to let go," and I thought about that as I tossed my prize beside the path an continued walking.

Ten steps out, a fading whisper of "once upon a time" reached my ear, and I turned aroun to retrieve my trilobite from beneath a tangle of budding serviceberry. The grooves and lobe were still there, however faint. I burnished the stone's bumpy surface with my thumb slipped it into a different pocket, and carried on.

CHAPTER TWO

Water Dogs

Adult blotched tiger salamander *(Abystoma tigrinum melanostictum)*, after a sketch by George Suckley, 1855

Robert's Cap ~

Robert had been right on the verge of trouble all week. A short sinewy boy, lined in the fac beyond any of the other seventh-graders, he possessed the kind of energy that kept hi wriggling in his desk all day long. I was a guest teacher at his rural school for a unit o natural history, and although Robert made no secret of his distaste for books, he was happ to talk about anything remotely connected with hunting or fishing. But whenever I cut hi off to present an assignment, he would pull his black baseball cap tight over his eyes an slide down in his seat for a sulk that generally lasted past the bell. That pattern held unt Friday morning, when we ventured outside for a field trip.

A cool spring fog hung over the river as the class ambled downstream toward the mouth o a small creek where, two centuries before, a group of Canadian fur traders had met a encampment of local Salish people. It was a comfortable walk, following long skeins o

standing water bordered with many of the same berry bushes and wildflowers those earli denizens would have known. We passed blooming camas lilies, and one of the tribal gir described digging their roots with her grandmother. We stopped to watch a cormorant mak an underwater dive, and while the rest of us waited for it to resurface, Robert darted up an down the embankment, scratching through the grass like a buck rabbit. I was telling the cla how the early traders sometimes ate the fat black birds for dinner when Robert motored u behind me, driving a battered steering wheel he had pulled from the weeds. "Hey," h crowed, to the delight of his audience. "Think those mountain men left this behind?"

Beyond the trestle that spanned the creek mouth, we reached an expanse of floodplain. A their regular teacher and I herded the class through a gap in the fence, Robert veered off t peer into the opening of a large concrete culvert. "He'll catch up," his teacher assured m and we pressed on.

The rest of the students had fanned across the grassland before Robert reappeared, h hands cupped in front of his chest as if carrying something fragile. The magnetism o discovery quickly drew his classmates back from the arc of the floodplain. Robert held h ground as they pressed around him, opening his hands to offer teasing glimpses of wha appeared to be a dark-colored extra finger.

"It's a lizard," one boy announced.

"Don't touch it!" gasped another. "Those things squirt out poison from their skin!"

Robert did not say a word. He spread one palm flat so that everyone could see his priz then curled his mud-stained fingers as pickets against the small animal's probes for escape. H drew a blade of grass down a wavy olive-green line that traced its sinuous spine.

"Thump its tail," a tall girl commanded. "It'll fly right off and dance beside the body."

I was opening my mouth to counter this flow of misinformation when a smaller gi shouldered her way through the circle. "That's no lizard," she said calmly. "That's salamander."

She held out a fisted forearm, and Robert carefully placed the creature on her wrist. began to walk, slowly but steadily, toward the back of her hand.

"Look how smooth its skin is," she instructed. "Anybody knows lizards have scales."

The girl rotated her wrist so that Robert's find stepped naturally into the protection of h palm. With her free hand she teased gumming bites from its harmless mouth, prompting joke about a toothless grandparent.

"See, it won't hurt anything," she cooed. "I find these guys around our well house all th time."

One of the boys stepped forward for a closer look. "Hey, I saw one of those things pokin around in the snow up on the mountain." He reached a tentative finger toward its hea "They're supposed to be cold-blooded, right?" he said, gingerly touching the tiny snout. "Ho can they do that?"

Other students had encountered the creatures as well. A girl confessed that she and h brother had found a pair of salamanders in a window well and decided to keep them as pet they installed them in a glass casserole dish, only to have them both disappear the first nigh Months later they discovered one of them behind the sofa, perfectly mummified.

Several members of the class knew you couldn't beat salamanders when it came to fis bait. Water dogs, they called them. One kid described the proper way to hook them, tuggin

at his own lower lip. He had an uncle who kept a washtub full down in his basement. “H
are the kind with feathers on their neck,” he added proudly.

“Those are gills, stupid,” broke in the girl who held the salamander. “That’s because they’
just babies.”

From the corner of my eye, I had noticed Robert step back and fade from view during th
early stages of the discussion. He had been out of sight for only a few minutes when h
returned, clutching his baseball cap to his midsection. To his obvious satisfaction, the cla
quickly gathered back around him. This time he revealed a hat chock-full of writhin
salamanders, with all shades of green amoebic stripes. An excited voice asked where he ha
uncovered such a bonanza.

“Oh,” he replied, playing it cool. “Around.”

When I started in on the wisdom of putting the fragile creatures back where he had foun
them, Robert cradled cap to belly, his black eyes burning with the twin fires of possessio
and purpose.

“Take them back?” he asked, incredulous. “I’m the one who found them.” Robert hugge
his cap fondly, and a small smile of satisfaction creased his lips. “Besides,” he said, “me an
my little buddies here got some fishing to do this afternoon.”

I’m not much of a fisherman, but I do like salamanders. From their slender builds and th
green stripes down their backs, I had recognized Robert’s finds as long-toed salamanders,
species that I have uncovered everywhere from alpine lakes in Montana to rain forests on th
Oregon coast. Yet you seldom see one of these secretive creatures, much less a hatful. Lon
toeds belong to the aptly named family of mole salamanders (Ambystomatidae), who spen
most of their adult life in solitude, hidden in burrows and crannies. Late every winter, as th
ground begins to thaw, some unknown signal calls these hermits away from their catacomb
A few males begin to move toward the body of still water—anything from a puddle to a lak
—where they began their lives. In succeeding days and weeks, pulses of other males follow
Some take to the water, but most seek shelter beneath any available cover. With the patien
of hermits, they await the arrival of their female counterparts.

The writhing mass in Robert’s cap had told me that just such a spring congress must b
afoot. As soon as school was over for the day, I went back to the mouth of the creek. I kne
beside the dank culvert and began gently lifting rocks and rotting branches. Within minutes,
had uncovered a small selection of long-toed salamanders. I picked one up, wondering if th
might be the evening when the first females trickled onto the scene and drew the waitin
males into the water. These are creatures of the night, and their annual courtship rites ar
seldom seen by humans. Witnesses describe ponds roiled by the frenzied pummeling o
competing males, followed by the undulating courtship dances of mating couples.

I looked at the animal resting in my palm. It raised its head very slowly, as if surfacin
from underwater. White stars glistened from its moist, inky flanks. Its head waverе
momentarily, then bounced up and down. The salamander lifted a forelimb and spread fou
toes, each as fine as a stem of newly sprouted lettuce. The primitive wrist waved lightly
the air, its tiny digits reaching back toward the very beginnings of life on land.

The earliest known fossils that can be linked to salamanders appear in Asia, in rocks fro
the Triassic period around two hundred million years ago. When a volcano erupted

northern China fifty million years later, at the height of what we think of as the dinosaur er a flow of lava overran a body of water not much larger than Robert's puddle. Just as Mou Vesuvius captured the breadth of daily life in Pompei and Herculaneum, the Chinese eruptic exquisitely preserved a cross section of aquatic life in one small pond. Within this microcos lay bodies of about five hundred amphibians of all ages, from larvae to adults, whose skull limb proportions, soft tissue imprints, and unique fused wrists are remarkably similar to th skeletons of modern salamanders.

From these Asian beginnings, salamanders radiated onto every continent, specializing they plodded across space and time. Icthyosaurs and pteranodons came and went, b salamanders crawled on. The mole salamander family apparently arose in North Ameri around thirty million years ago; from a locus in the valley of Mexico, they have populate almost every available habitat across our continent. Geologic upheaval and climatic chan have isolated populations, and a bewildering variety of species has emerged, but the chang are relatively subtle: Basic salamander design has remained pretty much the same since th volcanic eruption in China long ago. The creature in my hand was a living relic of th primordial past.

Windmill Pond ~

The decrepit windmill stood alone in the scablands of eastern Washington, surrounded b overgrazed rangeland. Its stubby tower rose only about twenty feet above the ground, and i direction vane hung limp behind a spokeless differential. Near the base of its ruined sucke pump, a slim ellipse of cattails indicated the presence of a viable spring, which had bee scooped out to make a small pond. The Bureau of Land Management had recently built fence around the waterhole to keep out livestock, and biologist Todd Thompson wa interested in what creatures might be making use of it. Considering the spread of barre ground around the pond, it looked like a most unpromising place for amphibians. Tod looked around at the battered landscape and shook his head. "You never know till you take look, though," he said.

A curlew called from the open prairie as we slid down the short embankment in our che waders and began to work our way through the suctioning silt, sloshing cold water near th tops of our bibs. A tree frog sang from the cattails, drawing an interested nod from Tod April winds had blanketed the pond's surface with a tangle of tumble mustard, and we bega examining woody skeletons soaked green with algal scum. After several minutes I raised stalk lined with individual opaque globes, spaced along the stick like small peeled grape Each globe held a round black yoke rimmed with white. With a quick glance, Todd confirme that we were looking at the spawn of a tiger salamander, another member of the mo salamander family. Tigers range over much of temperate North America, but in the enti Northwest there is only one variety, the blotched tiger salamander, which occurs along th mid-Columbia and some of its drier tributaries.

Circling the pond, we found more egg-bearing branches than seemed possible for such small area. "That's one thing about salamanders," Todd said. "They're always going surprise you." He reached down and scooped up a tiny red shrimp. Todd has visited hundre of pothole ponds in search of salamanders, beginning with a field trip when he was in fif

grade, and he remains eager to talk about their mysteries. “People’ve tried to correlate the to rainfall, pH, dissolved oxygen, and fish, but it’s hard to say what makes the differenc There are places where I find them thick as this one year, and when I go back the next spri —nothing. You just never know what you’re going to find.”

As we approached the cattails at the shallow end of the pond, we found an entire different sort of jelly mass attached to the flotsam. These egg packets were smooth and limp like stockings hung on a clothesline, with noticeably smaller eggs scattered throughout. Whe Todd held a branch up to the light, we could see that each ball enclosed an elongated creatu with a wobbly line down its back and a tiny nub protruding from each side of its neck. Thes eggs belonged to a long-toed salamander. “See what I mean?” Todd exclaimed. “You’ll read books that tigers are found in the sagebrush country, while long-toeds belong in wette cooler places.” But here they were, sharing the same scabland pond. Todd said he saw every now and then, especially around the edges of the Columbia Basin. He was curious see what would happen in the little pond beneath the windmill as summer wore on.

When I returned to the windmill pond two weeks later, its surface had changed drastically The algae had retreated to the edges, and all the tumble mustard seemed to have sunk to th bottom. After several passes in my waders, I couldn’t find a single egg mass, nor were the any signs of swimming larvae. It was a situation that called for a dip net.

The first swirl of the net dragged up a big glop of pure mud that rolled off the black an white patterns of many backswimmers, leaving them to rattle around the edges of the mes After a few moments, other creatures began to separate themselves from the muck: sma crustaceans, purple worms, and leeches that twisted like sensuous leaves. It took a while see the salamander larvae, lying perfectly still, like small-caliber bullets embedded in th slime. Lots of them.

The first two hatchlings that I plucked from the mud sported tails that were little mo than transparent fins. Small bushy gills sprouted from the sides of their necks, and developi organs were visible inside their clear swollen bellies. I thought, tentatively, that they mig be little tigers. The next one I pulled out seemed smaller, with knobbed appendages in fro of its gill slits that looked like the balancing poles used by tightrope walkers. According Todd, the balancers were a sure indicator that this was a long-toed salamander. Trapped the net, both kinds of larvae looked like creatures still in the process of being born; release back to the water, they proved swimmingly alive.

In mid-May I took my kids out and impressed them by netting several larvae with eve muddy sweep. Both kinds of salamanders still looked very fishlike, except for obvious le budding off the front quarters of their smooth bodies. Both had golden eyes always on th glare. The tigers had put on appreciable weight, and some of their heads had grown so broa that they resembled bullhead catfish. At dusk we watched several of the larger ones hangi in the water column, their luxuriant gills waving like palm fronds in a tropical breeze.

The life of a salamander larva is fraught with danger; the creatures that feast on the range from great blue herons to fish. But if there are no fish present—and many Columb Basin ponds are either too small or too alkaline to support them—it is often the tiger larva that represent the most voracious predators in the pond. Carnivorous tigers have been know to gobble up other amphibian eggs, larvae, and even adults of their long-toed cousins. A

yet in potholes where both species occur, the two moles seem to break the rules of logic ecology by breeding at just about the same time and growing in the water togethe Somehow, the smaller, less aggressive long-toed salamanders must avoid being eaten, becaus they remain common. One key adaptation appears to be their rate of change from larvae adult.

By summer's solstice, long-toed salamanders seemed to be a thing of the past—it was tiger's pond now. Three swipes of the net produced five slurping larvae the size and color gherkin pickles. Since no more than a small fraction of these larvae could possibly survive th journey to adulthood, it didn't seem like any great disturbance to borrow one of them for while. We chose the biggest and most active pickle from the bunch and placed it in the buck we had brought along, plucked a wapato plant that was sprouting nearby for shade, an headed home. Our captive was still very much alive when we transferred it to the miniatu habitat we had prepared in a terrarium on the back patio. Its color was now a pure jade gree infused with calligraphic lines. Recognizable digits crowned each limb—four on the front leg five on the rear. Its silken gills, three to a side, were fringed with black lace and flowed lik samurai decorations. Milky lips defined an outlandishly large mouth. We tucked the succule wapato tuber into a patch of gravel in one corner of the tank and added a big scoop of mu from the pond to hold it down.

By the next morning the arrowhead leaves of the wapato had uncurled in glistening gree and a couple of its three-petaled flowers had burst into bloom. Below them mosquit wrigglers, a water scorpion, several striders, and multiple backswimmers were all carrying o as if they had never left the pond. The salamander, however, did not look so good. It seeme to be in shock, lolling and tilting in the water. Its belly was alarmingly distended. In the fac of sudden movement, it would flail its roly-poly self down and out of harm's way, then bo awkwardly back to the surface. We peered helplessly into the tank until I remembered woman who had told me about helping her dad catch salamanders for bait when she was little girl. She said he always made her ride in the back of the pickup on the way hom keeping the pail that held the day's catch upright as they bounced toward town on rough di roads. Knowing that the larvae could gulp the sloshing water and choke to death, he taug her how to pick up any that appeared to be in trouble and use her fingers to massage the bloated bellies. She became an expert at burping them, laughing every time one expelled mix of air and water with an audible bark—real water dogs.

Thinking of those swollen white bellies, I ladled our sick larva out of the tank an massaged its underside with my forefinger. Sure enough, a sharp burble escaped from i mouth. When I lowered the patient back into the water, it swam smoothly into the wapat leaves. We shooed the cat away and sat down in front of the glass to watch what mig happen next.

Nosh'-Nosh ~

Mole salamanders, secretive though they may be, do occasionally appear among the oral an written records of the Columbia Basin. In the early 1900s, a Yakama elder told a story abo Coyote journeying up the Teanaway River on the east slope of the Cascades. When Coyo came to a certain lake, he saw that the water was bad, and he decreed: "No salmon will com

to this lake. Only *nosh'-nosh* will be here." Coyote returned downstream and built a waterfa to stop the fish, and from that day on, only nosh'-nosh, the water dog, lived in the lak There he grew to great size. The elder explained that these water dogs belonged to th salamander family, and added that they were never used as food by his people.

Tribes around the rim of the basin, including Cayuse, Walla Walla, Nez Perce, Spokan Kalispel, Flathead, and Kootenai, all have words for salamander. Like the Yakama, thes tribes never utilized the water dogs for food, but several do associate salamanders with th idea of bad or dangerous medicine. This could be attributed to the animal's mysterious habi and confounding life changes, and such ideas are by no means confined to Native American In European lore, salamanders spontaneously generate themselves from the flames of household hearth, and their parts often figure in recipes for witch's brew. In Japan, the wor *ryuu* means both "salamander" and "dragon."

The reaction of the Scottish botanist David Douglas was similarly ambiguous in th midsummer of 1826, when he followed a tribal trail that wound between scabland coule and the Palouse Hills of eastern Washington, through "an undulating woodless country good soil, but not well watered." Douglas enjoyed the day's ride with his usual fervor for ne places, but his enthusiasm was somewhat dampened at suppertime: "We were obliged to coo from stagnant pools full of lizards, frogs, water snakes." Many people, past and present, ca any small four-legged animal of a certain shape a lizard. But since true lizards don't swim salamander larvae are the only creatures that really fit Douglas's description.

Thirty years later, naturalist George Suckley made a beautiful drawing of a tig salamander while surveying a railroad route along the Columbia, but apparently no scienti probed their larger range until U.S. Army surgeon Basil Norris paid a visit to the norther edge of the Palouse in early June 1886. During an investigation of the purported alkali healing properties of Medical Lake just outside Spokane, Dr. Norris captured a couple peculiar "reptiles, the species of which has caused so much controversy in a local way fo years." Seeking an authoritative opinion, he shipped the swimmers east to the Smithsonia and a few weeks later he received a reply from its esteemed director, Spencer F. Baird.

> Dear Doctor,
> The specimen referred to in your letter of June 12th was duly received, and, on an examination, proves to be the larva, or immature stage of the salamander. It is one of the so-called water lizards, found in wet places, under logs and stones. We are very glad to get the specimen as it is considerably out of any range known to us. We should like to have more of these creatures as they are probably quite abundant in your neighborhood.

James Slater, a Tacoma college professor and salamander buff, paid a visit to the source this early specimen in September 1930. In the town of Medical Lake he spent an afternoo searching for the local water lizards in vain. Looking for inside information, Slater spoke wi a young man at the swimming beach, who promised that he and his friends could supp plenty of the "dog-fish" (meaning "fish with legs") after dark. Sure enough, a little after eig a few local men gathered and kindled a bonfire before stepping into the lake to drag a sein net. To Slater's delight, their pass captured a dozen larval salamanders.

As soon as that crew left, another group appeared. Slater learned that since July these me

had been driving from Spokane and catching salamanders to sell as fish bait. “I suppose w should call them salamandermen instead of fishermen,” he wrote. While the profess pondered whether the creatures might be attracted by the light of the bonfire, the seine brought fifty-five good-sized larvae ashore. The catch included two adults with the distin dark and light pattern of the blotched tiger salamander. Slater made sure he got that pair f himself, and accepted a few of the larvae as well.

The leader of the Spokane seiners told Slater that year after year, colored animals starte coming up in the net around August 10 and continued to appear until the season ende around mid-September. His personal record for salamanders taken was 159 in a single pass the net, and 209 dozen in an evening. The creatures caught that night varied in length fro three to seven inches, which he deemed about average. The salamanderman could tell that h quarry’s abundance was tapering off, and he figured this would be his last trip of the yea Before departing, he confided to Slater that the going price for water dogs at Spokane ba shops was fifty cents a dozen—not a bad take in the midst of the Great Depression.

Sea Change ~

As we drifted through the dog days of summer, change was afoot in our terrarium. The wapat shed its white petals one after another, and the sepals formed round green seed pods. Ou salamander larva took to lying on the surface of the water at dawn and dusk. It would ride the level of the tangled weeds, then sink a bit, pushing away with soles and palms turne outward as if the water were a supportive wall. Sometimes it would stretch out all eightee of its toes, with one digit on each side breaking the surface. Its eyes began to bulge from i head, growing from flattened inset disks into round buttons. Odd swellings appeared alon both sides of its neck, and its gills began to shrink from the feather boas of their prime. I body developed distinct dark patches that dripped into parallel bars, but the belly remaine clear white, bordered by a beautiful pattern of black stipples. Sometimes it would make snap that might have been feeding. Occasionally it would burp out an air bubble with th sound of an old man spouting a good stream of tobacco juice, as if it might be learning ho to breathe. But most of the time it hung still, showing grave indifference to the activity tha whirled around it.

Then came a day when we found our captive lying on the surface, completely motionles supported only by plant fibers. At first the kids were sure it was dead, but they misted it wi a spray bottle over and over until, with excruciating slowness, the patient swam to the fa end of the tank and rested its head and shoulders on a flat rock just clear of the water. To ou astonishment, we could see that its entire front end had assumed the eerie, varnished shee of an Andean mummy. For the next several hours, it did not move one iota. In the cool of th evening, the larva slowly lifted its head. It was then we realized that we could no longer se its gills. The muscles along the sides of its neck flexed, and the gill slits pulsated visibly, bu those outrageous feathers, for so long our larva’s most visible feature, had disappeared. I ha read about amphibians resorbing their gills during metamorphosis, but nothing had prepare me for the fact that an appendage half as long as the animal’s body would disappear into i neck.

The salamander hung in limbo between infancy and adulthood, between life and deat

between the worlds of water and land. Now nascent lungs had to inflate with small gulps o
oxygen not just occasionally, but with a continuous rhythm. The membrane of skin had
make the switch from water to air. Limbs accustomed to swimming had to assume th
posture of a tetrapod; a body made for floating had to comprehend gravity. The creature wa
undergoing a metamorphosis that defined its whole existence, a monumental event th
reprised not only the life history of its species, but that of all amphibians, and of Earth itself

The salamander still lay in a light coma when night fell, and the next morning it wa
nowhere to be seen. We searched for many anxious moments before spotting the tip of a ta
peeking out from under a spruce bough in the dry part of the tank. When we lifted th
branch, we found ourselves looking at a completely transformed creature. Its head, broa
smooth, and smiling, seemed to have expanded, while its body had shrunk as if tightly woun
in plastic wrap. The phoenix rocked its big head forward and back. Its neck throbbed wi
slow but steady breaths. Fore and hind legs moved once, then again, very slowly.

Every morning for the next several days we found it in a different place, squeezed into
rock crevice or tucked beneath a slice of bark. Sometimes it flopped into its little pool an
swam turtle style, matching strokes with arms and legs of opposite sides. In the light its sk
glowed like the oiled parchment of an antique map, with sharply defined islands of mustar
and ebony. Its tail assumed an elegant taper, and fleshy doughnuts surrounded thos
periscope eyes. My ten-year-old brought an earthworm from the garden and waved it in fro
of the salamander's nose. Its head ratcheted up one cog, then another, then lunged forwar
and seized the prey. Taking a ritual bow, the salamander dropped its head and shook th
victim with a single violent snap. It took several minutes for the two dangling ends
earthworm to disappear, with periodic gulps, into the soft crescent mouth.

At the end of August, after eight bone-dry weeks, a morning thundershower rolled acro
the scene, and raindrops pelted our desiccated world. Within moments the salamander ha
ascended to the highest tip of the spruce bough that decorated the terrarium. Its hea
wobbled back and forth with every new drop from the sky. One eye blinked. It was feelin
air and moisture together, an animal made for rain. As succeeding nights grew cooler, I kep
imagining all those larvae back in the windmill pond, now transformed into adults an
preparing to leave the water to find a secure burrow or crevice for the winter. We decided
was time to return our captive to the wild.

Dust enveloped the car as we pulled up to the ragged windmill, leaving us to wonder one
again how a creature that required moisture could survive in such a dry place. The pond ha
shrunk to a fraction of its summer size, and across its reduced surface, brown wapato leave
were covered with black dots of insect frass. Green tree frogs were still hopping all over th
plants, but scoop after scoop of mud failed to bring up any salamanders. Then on one of th
last sweeps, a familiar shape snaked through the net. It proved to be a beefy tiger larva
least six inches long and very broad in the head. Its gills were huge, and its legs were stron
and flailing, but the eyes still lay flat, which lent it a mean, threatening look. It was
neotene.

The hormones that trigger metamorphosis do not always flow at the same time for all th
salamanders in a pond, and some larvae may not transform for a year or even more.
certain cases, such creatures can reach sexual maturity without ever leaving the water, a sta

of retarded development known as neoteny. These morphs, which can grow to outlandis size, often act like monsters in the pond, preying on their own kind. It is sneaker-size neotenes, flailing in the mud of disappearing ponds, that leave sageland farmers sputterin with cries of “walking catfish!”

The first known written mention of mole salamander neotenes came from the Aztec capit of Tenochtitlan, where sixteenth-century Franciscan monks traced stone carvings depicting god named Xolotl. This deity bristled with extra body parts, especially odd numbers fingers and toes, and it appeared to sprout layers of feathers from the back of its neck. Whe the Franciscans inquired into the meaning of the name Xolotl, native responses include water slave, water servant, water sprite, water monstrosity, water twin, or, most familiarl water dog. Brother Bernardino de Sahagun, assigned to teach a group of Aztec youths, learne from his students that Xolotl was closely associated with the *ajolote*, an aquatic form salamander that thrived in the necklace of canals and lakes that embraced Tenochtitlan. “Lik the lizard, it has legs,” the boys told Bernardino. “It has a tail, a wide tail. It is larg mouthed, bearded.”

The students showed their teacher the strange gilled creatures, some up to a foot long, an explained that they provided an important food source in waters that supported few fish. “ is glistening, well-fleshed, heavily fleshed, meaty. It is boneless—not very bony; good, fin edible, savory: it is what one deserves.” When, after forty years of labor, Brother Sahagu published his landmark account of Aztec culture and natural history known as the Florentin Codex, he included an entry with the title “Axolotl.” The accompanying illustration depicted creature with four legs and flowing gills, accurately representing a creature exactly like th neotene in my net.

I let the big pond monster slither away, then returned to the car and fetched the buck that held our much smaller, newly metamorphosed adult salamander. We walked around th pond to size up the situation. An area of cracked mud was crisscrossed with the tracks coyote and badger, skunk and raccoon, and the three-toed prints of ravens, gulls, and heron Any salamander that ventured out on this hardpan would be dancing at a predator’s ba Across the way we spotted a badger burrow, and around from that a bank so steep w couldn’t imagine any salamander making the climb. But down on the cattail end, a nice pi of drain rock rested in a damp seep. The rocks were of different sizes, with plenty of gap and crannies where a little animal could hide. That was the place we felt our little tig salamander deserved; that was where we tipped the bucket and let our captive go.

CHAPTER THREE

White Shield

Sagebrush sheepmoth *(Hemileuca hera)*

Flight ~

With no breeze to stir the air and no sign of rain for weeks, the August morning was heating u fast. As open bunchgrass began to crackle under the sun, the whole landscape seemed to slid into the protective arms of the nearest plant. One little sagebrush lizard, colored like i namesake's leaves and flowers, positioned itself on an outside branch to catch some rays. thrasher sailed in to touch a crown of rabbitbush, then departed without a sound. Beneath th crinkled leaves of a balsamroot, the bright red underwings of a captured grasshopper shon through the open curtain of an orb spider's web.

Walking a fallen fenceline, I spied what appeared to be a small white shield shimmering and out of focus near the top of an ancient sage. From a distance, I took it to be a picked vo carcass or a cricket shell—the remains of a meal pinned aloft by some efficient shrike. But a I drew closer I saw that it was a motionless insect. Black eyespots blinked from the center each wing, and black half-diamonds along their margins pointed straight at the open orbs.

was a female sagebrush sheepmoth, newly emerged from her pupa beneath the ground. Life liquid had inflated her wings, and she had scrambled up the branches to assume her positio on the very top sprig of the bush.

I stepped cautiously forward, but she did not fly. Fine golden-orange veins threaded acro her black and white wings, precious metal and fruit combined. The eyespots of her forewing came into focus as calligraphic black Cs, while those on the hindwings dripped into the shap of fancy sixes and nines. The moth's lower body, patterned with alternating bands of gold an black, could have belonged to a fecund bumblebee, and she accentuated the similarity b slowly curling the tip of her abdomen like a bee intent on stinging. I brought my face neare until I could see how her shoulders were wrapped in a luxurious stole woven from furr scales of foxy sorrel. Rich auburn tones topped her pate and swept to the tips of her wir antennae. Short combs grew off each antenna segment, and a few on the outside of the le one looked bent or damaged.

A puff of wind sprang up, and the moth adjusted her legs for a better grip on the sagebrus No matter how closely I approached, she did not budge. She pulsed her abdomen again, and guessed she was releasing a plume of pheromone to ride the breeze. Somewhere in the acre of sagebrush that surrounded her, flying males were waving their own leafy antenna equipped with elaborately combed receptors sensitive enough to pick up a female's perfum from miles away. Like flicking darts, they were careening across the top of the sagebrush wild zigzags, neither slowing to rest nor dipping for nectar. A male will quarter the wind unt he intersects a scent plume, then row against the current of the breeze as he gauges th pheromone's concentration against the lay of the land. The closer he approaches to th source, the more directly into the wind he flies, homing in on the sole purpose of his adu life. He has only a few days to fulfill his mission, for adult sheepmoths have no mouth par for eating, no way to refuel. The perched female usually accepts the first male that finds he soon after her eggs are fertilized, she flies off in search of a suitable host plant. For the rest her brief life, she circles the lower branches of a succession of sage bushes, laying rings pearly sage-colored eggs.

Early last September, on a gray morning with a cold wind bearing down, I came upon on such female. She was lying stock still on the ground near the central trunk of a spreadin sage, hemmed in by the forest of branches around her. Her powdery scales had flaked awa so that she looked more like a piece of littered newspaper than a fine white shield. Shar twigs or a pecking bird had tattered both hindwings, and her antennae were folde horizontally across her beady eyes. The spot high on her shoulders where burnished chestn scales once flashed was now rubbed bare.

And yet the gold filigree veins trailing through her wings still glowed with life. As watched, she began to move her forewings very slowly up and down. After some minutes th hindwings also began to quiver; the shivering spread at an almost imperceptible pace unt her entire body shook like some early aircraft warming its engine for liftoff. Both antenna stretched out, buffeted by the wind, and the moth began to crawl. Her legs clutched a lo branch and hoisted her body off the sand. She fell back, scrabbled to gain the branch agai then teetered out to its end. There she hopped clear of the entangling twigs and lifted of Within seconds she was up and away, flying the same crazy zigzag as the males, seekin