

Dawn of the Modern Garden

Eastern Washington's Fossil Forests Reveal a Familiar Flora

TEXT AND PHOTOS BY DANIEL MOUNT



One hardly thinks of 50 million years ago as “modern times.” There were no cell phones, no area code 206. There wasn’t even a Western Washington, as we know it. No Puget Sound. No Olympic Peninsula. No Cascades. The Arboretum was somewhere under the waves of the Pacific, as they crashed into a huge coastal plain, lush with subtropical forests of palms and dawn redwoods. Yet

paleontologists named this epoch, between 56 and 33.9 million years ago, the Eocene—literally “the dawn of the modern”—because it was during this time that the progenitors of the plants and animals we find in our forests and gardens today first appeared.

The world was a very different place then. The continents, as we know them today, were more or less discernible and moving towards

ABOVE: A nearly 50-million-year-old fossil leaf that the author dug up in Republic, a town in the Okanogan Highlands of Washington. The leaf probably belonged to a type of serviceberry (*Amelanchier*), a member of the rose family.

their current position, but sea levels were much higher. At the Eocene Optimum, about 49 million years ago, a subtropical climate reached all the way to the Arctic Circle, and there were no polar ice caps. Due to the frequency of volcanic eruptions, the atmosphere was also very different. Greenhouse gases filled the air, creating a stable and warm climate ideal for the evolution of plants.

Much of this is evidenced in the rich, forest-fossil deposits of Western Washington. Palms and cycads, as well as more temperate species like walnuts and oaks, are well represented in the fossil record from these subtropical lowlands—which experienced a similar temperature to modern-day Los Angeles, but a great deal more rainfall. Farther inland, something different was found in the Eocene fossil beds of the plateau-like Okanogan Highlands of Washington and British Columbia.

Treasure of the Okanogan Highlands

During the Eocene, this large upland area—7500 feet above the palm-lined shores of the Pacific—hosted a wide array of plants not closely related to the subtropical and temperate plants we find in the floras of Southeastern Asia or southeastern North America today. Among the highest landmasses on the planet at the time, this area (along with others like it around the globe) is thought to be one of the birthplaces of today’s Northern Hemisphere temperate forests.

From the middle of the Eocene onward, the climate became cooler and drier, and broad-leaved evergreens began to disappear, allowing broad-leaved deciduous plants to flourish. Maples and the rose family, which were minor players in the subtropical forests, had a major evolutionary burst in the highland forests—a burst that supplied the genetic diversity for



continuing evolution in these two major groups of modern plants.

These ancient floras were not really analogous to anything we see today, even in parts of the world that have many modern representatives of the genera found in fossils there. Oaks, beeches and rhododendrons are seldom found. And extinct genera with confounding names like *Macginitiea*, *Plafkeria* and *Barghoornia* were plentiful. Still, these floras represent a very early and crucial stage in the evolution of the modern temperate forest, according to Wesley Conrad Wehr.

Wes Wehr (1929–2004), a Seattle artist and musician, and “a foot soldier of paleobotany,” as

ABOVE: Amateur paleobotanists digging for fossils at the Boot Hill site, in Republic.



he described himself, was integral to the understanding of this flora. In 1977, Wehr—already an affiliate curator of paleobotany at the Burke Museum—set out with his teenage companion and driver, Kirk Johnson, for the Okanogan to dig fossils. Their destination was the town of Republic, Washington. The site of gold mining since 1896, the area had yielded fossils as early as 1910, cast-offs of the mining industry. In 1946, the Smithsonian had sent a group of paleobotanists to Republic, but after finding only 15 species, they decided there was nothing worthwhile there and left.

Familiar Fruits of an Ancient Eden

No palms have been found in Republic, yet cycads have, probably having existed in a microclimate situation. There is also an abundance of relict taxa from the Cretaceous period, like *Metasequoia*, *Cercidiphyllum* and *Ginkgo*, and members of the Betulaceae (birches), Ulmaceae (elms) and Fagaceae (oaks), which had diversified tens of millions of years earlier. Most significant are the numerous early members of the rose family.

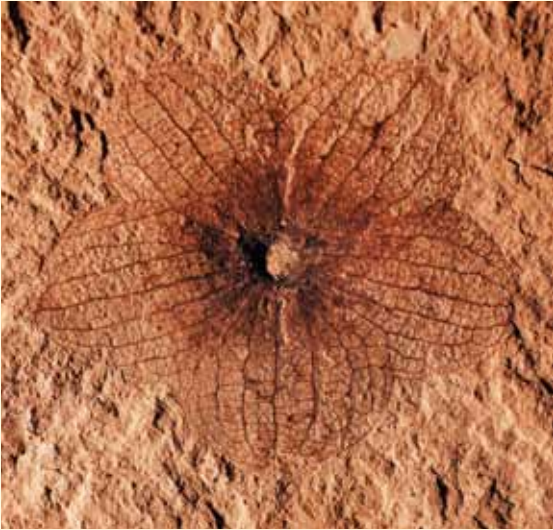
Wehr called the Eocene forests of the Okanogan Highlands “orchards” and “gardens”—and with good reason. They contain the

Yet Wehr and Johnson’s first visit offered plenty to get excited about. Johnson, who is now Director of the Smithsonian National Museum of Natural History, recalls, “We knew we were onto something big.” But it wasn’t until the mid-1980s that the most-productive outcrop, an ancient lake bed known as the Boot Hill site, was discovered. According to George Mustoe, a retired paleobotanist from Western Washington University, “Wehr quickly recognized the world-class importance of the site, and he began a highly successful effort to recruit paleontologists to conduct research at Republic.”

By the 1990s Johnson was declaring, “Republic is the richest known Eocene floral locality in western North America.” What makes this ancient flora so rich, according to Johnson, is that it represents a period when the planet was just beginning to cool after reaching a global thermal maximum. Also the mid-level elevation allowed for genera from both higher and lower elevations to be present.

ABOVE TOP: *Metasequoia occidentalis*, a now-extinct species of dawn redwood. Leaves of this redwood are among the most-common fossil types found at Republic, indicating that the species was abundant in the Eocene forest at Republic.

ABOVE BOTTOM: The extinct sycamore relative, *Macginitiea gracilis*.



TOP: *Florissantia quilchenensis*, the extinct “stone rose,” actually a member of the Malvaceae, or mallow family, and a close relative of cacao.

BOTTOM: *Ginkgo biloba* from Republic, circa 49 million years old.

world’s oldest fossil records of some of Washington’s economic staples: apple (*Malus*), cherry (*Prunus*) and raspberry (*Rubus*). Also the oldest-known fossil records of currants (*Ribes*), mulberries (*Morus*), elderberry (*Sambucus*) and serviceberries (*Amelanchier*) were found at these sites, supporting Wehr’s horticultural assessment of this Edenic flora.

It must have been a beautiful place.

The fossils themselves are beautiful. You can see how an artist like Wehr might have been attracted to them in the first place. The delicate and near-perfect condition of some of the fossils

believe the rough geologic and climatic processes that created them. They appear as though they had been laid by gentle hands between the pages of a sacred book.

How the Plant Fossils Formed

It took around 80,000 years for the 80-foot-deep fossil beds at Republic to form. This occurred during a relatively calm geological cycle, with few or no volcanic eruptions in the vicinity. A deep, nine-square-mile lake developed at the Republic site during the late-middle Eocene. It was part of a chain of lakes running north to south from present-day British Columbia into Washington. Seasonal rains washed fine-grained, ash-rich soils and plant debris—seeds, flowers, leaves and twigs—from the surrounding volcanic mountains into the lake. Even animals—insects, fish, and at least one bird—were trapped in the soils at the bottom of the lake.

Because the soils were anaerobic, decomposition could not take place, and the organisms were preserved. In later epochs, heavy volcanic activity formed a basalt layer over these soils, protecting and compressing the fossilized specimens in a shale-like mudstone. Later uplifting pushed them back to the surface again.

When you split the soft mudstone and reveal a fossil, it is not a print of a leaf but a carbon shadow of a leaf nearly 50 million years old. Like a charcoal sketch, the leaf rests on the surface of the stone, fragile in the first light it has seen for eons. During the process of carbonization (a process similar to the formation of coal), venation and leaf margins, papery insect wings and fish scales are preserved. This makes these fossils not only beautiful to behold, but incredibly detailed specimens for study.

According to Wehr, by 1996 nearly 450 fossil taxa of plants had been recorded from the Okanogan Highlands sites in Washington and British Columbia. About 250 of those have been identified; the remaining 200 are likely to represent new genera. Many can be seen at the Burke Museum, the Princeton Museum in British Columbia, and the Stonerose Interpretive Center in Republic.

Dig for Fossils at Stonerose!

The Stonerose Center, which opened in 1989, was Wehr's brainchild. Wehr wanted to make the excitement of fossil digging available to all. So the Boot Hill site remains open to the public under the auspices of the Center. The dig site is within city limits—the City of Republic actually sits above the ancient lake—just blocks from the Stonerose Center.

Housed since 1996 in a historic home, the Center is part museum/part research facility and maintains a well-archived research collection. It is also the starting point for visitors coming to try their luck at fossil digging. Travis Wellman, Operations Manager at the Center, estimates between five and 10 thousand visitors come each year. Most, he says, are families with small children. But many paleobotanists arrive yearly, too—from the Burke, as well as Yale, Arizona State, and the Denver Museum of Natural History. And even as far afield as Russia!

Stonerose still reserves the right to withhold any rare specimens that visitors dig, but these specimens are labeled with the collector's name, and often these names are used in the naming

of new-found species. Wellman estimates that he retains two to five samples each week that visitors have dug. And each year they are adding one or two new species of plants or animals to the archive.

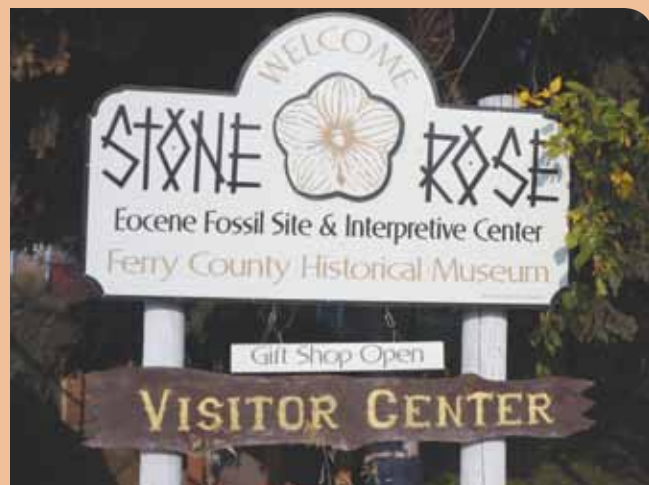
The landscape around Republic has a lovely old beauty, soft like the Ozarks. The conifer-covered knolls and dales and little lakes and rivers seem so gentle when compared to the geologic history of the place. It has sunk, over time, to only 2500 feet in elevation, and the climate is decidedly colder and drier than in the Eocene. There are no dawn redwoods, katsuras or ginkgos anymore.

But there are wild hawthorns and serviceberries, firs and pines in those hills. And in the town gardens there are roses and birches, apples and maples: all part of a very modern flora that started 50 million years ago. ☺

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Interpreting the Stonerose Logo

The Stonerose Interpretive Center was named for the numerous unique early members of the rose family found at the fossil site in Republic, Washington. The beautiful plant that inspired the Stonerose



logo, however, is not a rose at all or even in the rose family. It is an extinct species, *Florissantia quilchenensis*, a member of the Malvaceae, related to cocoa. The best-preserved specimens of *Florissantia* are found at the Republic site.

The Stonerose Interpretive Center is open from May through October. For a small fee, you can find your own fossils, maybe even a new species of plant or animal. Visit www.stonerosefossil.org for more information.