KAS BULLETIN

NEWSLETTER OF THE KANSAS ACADEMY OF SCIENCE

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156th ANNUAL MEETING OF THE KANSAS ACADEMY OF SCIENCE

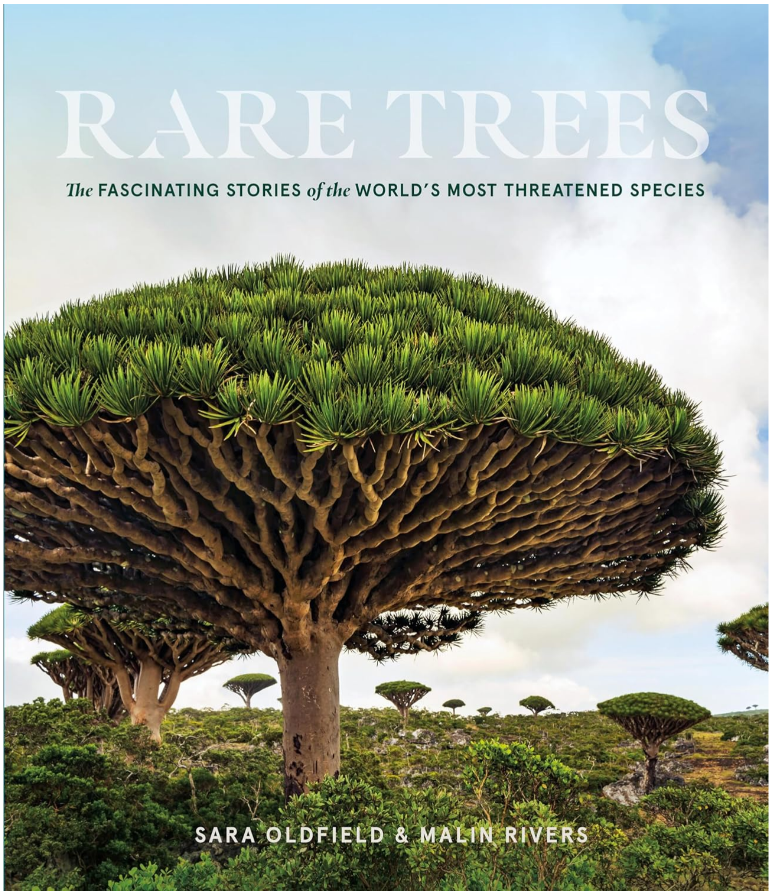
April 5th - 6th, 2024
Emporia State University
Emporia, Kansas

The 156th annual meeting of the Kansas Academy of Science will be held on April 5th and 6th, 2024. The keynote speaker for the Friday banquet is Dennis O'Rourke presenting, "Human Population History: Ancient DNA and the Power of Proxies. Kristne Baum, director of Monarch Watch will speak on "Translating Research into Conservation." There is a field trip to the Tallgrass Prairie National Preserve, leaving ESU at 2:30.

Please check the KAS website for more information regarding abstract submission and registration: www.KansasAcademyScience.org/meeting.html

Rare Trees

by Sara Oldfield and Malin Rivers, 2023,
Timber Press, Portland, Oregon. 400 p.
Book Review by Hank Guarisco, editor



After reading parts of this library book for a day or two, I decided I needed a copy in my personal library. This book is a very comprehensive, beautiful volume that depicts the world's most iconic, rare trees in their native habitats. From the rare *Torreya taxifolia*, a pleistocene relic of the Florida Panhandle, and *Franklinia alatamaha*, discovered by John and William Bartram in the mid-1700s along the Alatamaha River in southeastern Georgia, to the two species of dragon tree, one in the Canary Islands and the other in Socotra, the author tells of the discovery, history, distribution, uses, and current threats of these trees and many others.

Luckily, early explorers were very interested in the fauna and flora as they travelled the world, and often sent back plants and seeds to botanical gardens in Europe. Species of ancient Magnolia from Cuba, China, and Japan, and Rhododendrons from the Himalayas and mountains of the islands of southeastern Asia, have all been cultivated in botanical gardens. In fact, the dawn redwood, *Metasequoia glyptostroboides*, although almost extinct in its native habitat in central China, is the most common threatened conifer, and can be found in 316 collections around the world. However, the genetic diversity in these collections is low.

The monkey puzzle tree, *Araucaria araucana*, is threatened in the temperate rainforests of southern Chile, its native habitat. It is an early colonist of rocky sites, and has been coping with volcanoes, landslides and other disturbances for the last 200 million years. In 1795, plants were brought back to Europe by the naval surgeon aboard Captain Cook's ship, the *Discovery*. Three seedlings survived and were given to Joseph Banks at Kew Gardens in England. Since then, the monkey puzzle has been used as an ornamental, and the edible seeds that taste like chestnuts are an important food source for the local Chilean population.

The Patagonian cypress, *Fitzroya cupressoides*, is another impressive Chilean tree that attains heights of 70 meters. One specimen is estimated to be 3,622 year old! The genus was named after Robert FitzRoy, captain of the famous HMS *Beagle* that carried Darwin on the voyage leading to his discovery of the theory of evolution through natural selection. This tree has been prized for its beautiful red grain and resistance to rot, and therefore, was overharvested for many years.

Some rare trees were only recently discovered and described. The Vietnamese golden cypress, *Cupressus vietnamensis*, was first noticed in 1999. During the last 20 years, very small populations have been found in China and two other locations in Vietnam. It occurs in inaccessible, highly eroded limestone ridges.

Many trees around the world that are not widely known in the US produce edible fruits with important nutritional and medicinal properties. One example is the baobab tree *Adansonia sp.*. There are eight species: one in Africa, one in Australia, and six endemic to the island of Madagascar. A local market exists for the harvesting and preparation of a dry powder from the fruit of the African species. It is full of vitamins and minerals and has a mild flavor akin to yogurt with a pleasant lemony overtone, according to fruit aficionados. There is great potential for a wider market for many tropical fruits and fruit products. This will benefit the local economy and help save forests in the process.

I was even more impressed with this book when I discovered that the bottle palm tree, *Hyophorbe lagenicaulis*, found only on Round Island off the coast of Mauritius, was discussed. Many years ago, as a trainee at the Jersey Wildlife Preservation Trust, Gerald Durrell's zoo for endangered species in the Channel Islands, I encountered two seedlings of this almost extinct tree on the desk Quentin Bloxam, the curator of herpetology. He had just returned from an expedition to Round Island where he surveyed the population of the island's endemic boa. At the time, only one tree was known, and it was threatened by goats and rabbits that had been introduced to the island during the whaling days. So, as I stood in his office, I realized that those two seedlings represented twice the known wild population!

This book is a well-written compendium of the rare trees of the world, and deserves an honored place in your library.

Notice of Change to KAS Bylaws

To ensure that members can vote by email as well as snail mail, the following change to the bylaws is being proposed:

Currently in the bylaws:

Article IV, Section 5:

"Officers shall be elected by plurality **mail vote** of the membership."

Proposed change:

"Officers shall be elected by plurality **vote** of the membership."

Taxonomy: The Game of Naming Nature, and Why It Matters

Editorial by Hank Guarisco, editor

Part 1: Scientific Names

From a very young age we learn to name the things around us. There are even two separate regions of the brain that enable us to name non-living and living things. This was discovered by examining individuals who had accidents that damaged specific parts of the brain. One person could identify living organisms but not inanimate objects, while another could not distinguish between his wife and a hat (Yoon 2009)! Of course, it is very useful, if not downright essential, to be able to identify everything around us at an early age. Even in the Bible's creation story, Adam is instructed by God to name all the animals.

Although it might have been easy enough for Europeans to tell a cat from a dog, and a bee from a beetle, exploration of new continents revealed a plethora of animals and plants that did not fit neatly into simple categories. Furthermore, there were often many different names for the same creature, which led to confusion. Since Latin was the universal language of Europe, especially among scientists, an organism's scientific name was often a string of ten, twenty, or more words that described its uniqueness. This cumbersome approach was brought to an end by the adoption of binomial nomenclature invented by Baron Charles Linne, aka Carolus Linnaeus.

Charles LINNÉ

Linnaeus was a gifted individual who used his unique ability to recognize the important features of plants and animals to order life on earth into categories presented in his famous work, "Systema Naturae," first published in 1735. Each organism was given only two names, a genus name followed by a species name. In some ways, this is similar to our own names, only our "genus" name follows our "species" name instead. For example, the name Thomas Brown indicates that the unique person, Thomas, belongs to a family of other individuals with the surname Brown. However, in the scientific name for a dog, *Canis familiaris*, the individual species, *familiaris*, resides within the genus, *Canis*, which has other members, such as the wolf, *Canis lupus*.

After this auspicious beginning, taxonomy has evolved over the years as new questions concerning the classification and naming of organisms have arisen. It was necessary to form an international commission on zoological nomenclature (ICZN) that was tasked with developing the International Code of Zoological Nomenclature (ICZN). The code contains all the rules regarding the proper designation of animals' scientific names.

One important aspect of the code involves using the correct scientific name in a standard format. The genus and species names are presented in that order, and both are in italics. The genus name is capitalized, while the species name is not. The name of the person who initially described the species, followed by the year in which it was described, follow the genus and species name. For example, the scientific name of the bold jumping spider is, *Phidippus audax* (Hentz 1845). Note that in this case, there is a pair of parentheses around the describer's name and year it was described.

This indicates that this species was originally described by Hentz in a different genus than the one in which it now resides. Hentz originally described it as *Attus audax*. As more research was done through the years, this genus was split into several other genera, and the bold jumping spider was moved into the new genus *Phidippus*. Therefore, if a species name is followed by the describer and date, and there are no parentheses around them, we can be sure it is still in the original genus, and has not been moved.

Phidippus audax male

Another important rule of the code is known as "priority." Sometimes taxonomists describe a new species but are not aware that it has already been described by someone else. In this case, if it can be clearly established that both names belong to the same organism, the name that was first published is given priority. This rule even extends to what is called, "page priority." If two names are given to a species in the same issue of a journal, the name that appears first in that issue of the journal is given priority.

Sometimes, a species possesses a scientific name that has been in use for many years, and then someone discovers that it actually was described earlier under a different name. By strictly applying the code, the commonly used scientific name must be replaced by the older one. However, this name change could cause a lot of problems in the literature. For example, there may be many ecological studies that use the commonly employed scientific name, and therefore changing it could cause confusion. In this case, a petition can be sent to the international commission on zoological nomenclature to suppress the older, relatively obscure name. Interested parties can submit evidence and their opinion to the commission who is considering the case.

Scientific names that have been suppressed, or have been given to the same species after it has already been described, are "synonyms," and are often included under the proper scientific name in species accounts. In this way, one can easily check older literature for these names and know to what species they refer. Looking at the account for the bold jumping spider in Edwards (2004), we find two pages of synonyms following the accepted scientific name. If we come across "*Phidippus variegatus* (Lucas 1833)," or any other name in the list, we know it refers to the bold jumping spider.

There can be a further wrinkle in the proper use of scientific names. Although it is common to use just the last name of the describer, this can cause problems in some instances. For example, two related individuals, L. Koch and C.L. Koch , both described new species of spiders. Another example involves the famous arachnologist, Octavius Pickard-Cambridge, who described many new species in England and Central America, and his nephew, Frederic O. Pickard-Cambridge, who also discovered new species. Therefore, in these two cases it is important to use their initials within the complete scientific name. Although some of these rules may seem a bit esoteric and boring, it is all part of the game of taxonomy. "One should always keep in mind that an important function of classifications is information retrieval" (ICZN 1999).

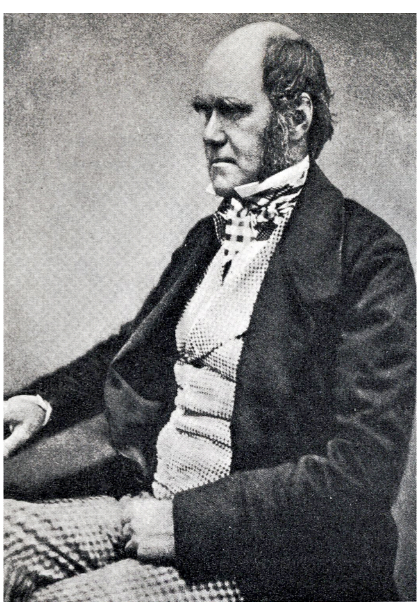
Part 2: What is a Species and How Can We Determine if a Species is New to Science

Naming nature is not just a simple matter of following the rules, although it is one important aspect. A scientific name is given to each unique species of life on earth. In the days of Linnaeus (1707-1778), every living organism was believed to have been created by God and was unique and unchanging. This belief spurred early naturalists, who were often ministers and preachers, to give glory to God by exploring and studying His creation. Early explorations of tropical jungles in both hemispheres led to the discovery of a dazzling array of new plants and animals.

The first task in describing a newly discovered species is to determine its closest relatives. For example, the New World jaguar and puma can be easily recognized as two different kinds of cats, members of the mammalian family Felidae. Are they more closely related to each other or to another member of the family? Detailed anatomical studies are required to make this decision. If a number of individuals of the new species are available, one typical example is chosen and the taxonomist provides a detailed description of pertinent characters that distinguish it from close relatives. This individual is designated as the "type specimen," or "holotype," and is stored in a museum collection. Other specimens of the new species collected at the same location and same time are called "paratypes."

Although detailed descriptions of new species, often accompanied by illustrations, published in peer reviewed, scientific publications are very helpful in identifying specimens, it is often necessary to actually examine the type material to be certain if one has discovered a new, undescribed species. Therefore, these invaluable, museum collections are literally the great libraries of life on earth.

Some libraries and museums have been destroyed during wars or natural catastrophies, resulting in the loss of priceless collections. If the holotype specimen has been destroyed, one of the paratypes can be designated as a new holotype to replace it. What happens if all of the type material is gone? A biologist can go to the type locality, where the original types were collected, and find new specimens of the species. One of them is selected as the new type specimen. It is called a "topotype."



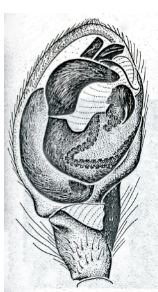
The question of just what is a species is especially important these days because the world is losing them at an unprecedented rate, mainly due to human activities. During the time of Linnaeus, species were believed to be unique, unchangeable, and not subject to extinction. Although variation among individuals of the same species was recognized, those that varied from the typical examples were considered to be degenerate – errors that had crept into the system. The detailed observations of Darwin (1809-1882), published in a book entitled, "On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life" in 1859 shook both contemporary scientific and religious establishments.

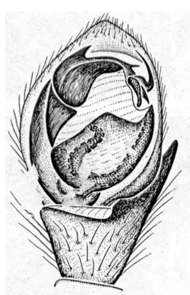
Darwin's evidence, based on the development of domestic breeds of various animals, as well as his extensive biological observations in the Galapagos Islands and elsewhere during his travels on the HMS *Beagle,* suggested that species were subject to evolutionary change brought about by natural selection, which weeded out those individuals less suited to their local environment. The survivors passed on their unique characteristics to the future generation. This also helped explain why fossil animals were no longer in existence. Later biologists, beginning with Mendel, uncovered the actual mechanism involved in this character transmission when chromosomes, genes, and DNA were discovered.

Now we are ready to provide a cogent definition of a species. The biological species concept defines a species as a population of freely interbreeding individuals that produce viable and fertile offspring in nature. It does not include a mule, which is the sterile hybrid between a donkey and a horse. It also does not extend to the young hybrids of animals, such as lions and tigers that do not interbreed in nature, which can breed in captivity.

What can prevent or significantly diminish the ability of animals to freely interbreed? One reason is some sort of physical barrier that prevents them from coming into contact with one another. This could be a river, glacier, mountain range, or ocean. Think of island populations. Given long enough time periods, even remote regions, such as the Hawaiian Islands, will become settled by species from distant continents. Over time, these small populations will be changed by natural selection, and eventually may become so genetically distinct from their parent populations that they could no longer interbreed, even if they were next to each other. In that case, the island population would have evolved into a new species (Stebbins 1966).

There are other factors that can prevent adequate gene flow by restricting populations from interbreeding. Slight differences in microhabitat choice, or chemical and behavioral cues involved in courtship and mating may also tend to inhibit the mixing of adjacent populations. In fact, chemical and behavior changes often occur before significant changes in morphology become evident.





Zelotes duplex Zelotes gertschi

Of course, biologists usually don't determine species by directly observing which populations are freely interbreeding with one another in the wild. Slight differences in the morphology of key structures, usually involved in the mating process, between populations of similarly-looking species are used as proxies to decide if they are indeed different species. For example, the ground spider genus *Zelotes* consists of a large number of species of quick, shiny, black spiders that resemble one another. Individuals can be positively identified to species by the unique conformation of their genital organs. The male palps of two species are shown here (images adapted from Platnick & Shadab 1983).

Sometimes, we may encounter a "species complex." This involves a number of species that have virtually identical genital structures, but which do not interbreed because of differences in courtship behavior. One example is the wolf spider *Schizocosa ocreata* species complex. In this case, individuals of suspected different species within the complex were brought into the laboratory to explore potential differences in courtship behavior. Besides *Schizocosa ocreata* (Hentz 1844), there are three more species in this complex that were not originally recognized as distinct species: *Schizocosa rovneri* Uetz and Dondale 1979, *Schizocosa stridulans* Stratton 1991, and *Schizocosa uetzi* Stratton 1997. They were all considered to be *S. ocreata* until behavioral studies and differences in leg ornamentation, a secondary sexual character, proved they were separate species (Stratton 1991, 1997; Uetz and Denterlein 1979; Uetz and Dondale 1979).

Part 3. Taxonomy and Biodiversity

Most members of the public, as well as many scientists, believe that almost all of the species on earth had been described hundreds of years ago, and therefore that learning taxonomy is no longer necessary. The discovery of thousands of new species across the globe every year proves this assumption is wrong. Unfortunately, the prevailing attitude has led to vastly reduced funding for basic taxonomic work. Because of this situation, few students are inclined to become taxonomists, and many of the experts are old or have gone to their graves. This leaves great gaps in our ability to identify many forms of life, especially invertebrates. It takes years or even decades to become proficient in indentifying arachnids and most insect orders.

Those organisms that are medically or agriculturally important have received the most attention, while others have been neglected. As a result, many ecological field studies don't even attempt to identify what they have collected, but instead, use terms like: ecospecies 1, 2, 3, and 4. This practice may speed up the process, but greatly reduces the value of the study, and often leads to errors due to the presence of unrecognized cryptic species.

We are currently living in an era called the Anthropocene, an age of another great species die-off. Unlike like past extinctions, this one is caused, directly or indirectly, by human activities that have resulted in habitat loss, poisons and other pollutants in the air and water, and disruption of normal biogeographic cycles. As a result, entire groups of species are dying at such an accelerated rate that many have not even been formally described, much less understood in terms of their ecological roles (Wilson1992).

The alarming loss of biodiversity, especially among pollinators, has become more apparent in recent years, and has spurred efforts to limit harmful insecticides and to plant pollinator gardens. Countries in the tropics and elsewhere are choosing to protect natural areas by designating new national parks. How are such areas selected? Some are chosen to protect one or two threatened, charismatic animals, such as jaguars or elephants, for example. By protecting habitat for these wide-ranging species that have gained public affection, entire ecosystems composed of numerous forms of life, many unknown to science, are also saved from destruction.

Another way of choosing the most desirable area to protect is to pick the one with the highest biodiversity. Since it is virtually impossible to inventory all of the plant and animal life within the several areas under consideration, one or more key groups that are speciose and occupy a wide variety of habitats and niches can be intensively surveyed and used as a proxy for assessing overall biodiversity. Birds and spiders are two such target organisms (Coddington et al. 1990). Therefore, it is important to have biologists with sufficient expertise in identifying them.

Conclusions

What we don't know **can** hurt us. Two great extinction events are currently happening at the same time: the increasing rate of species extinction and of the taxonomists who can identify them.

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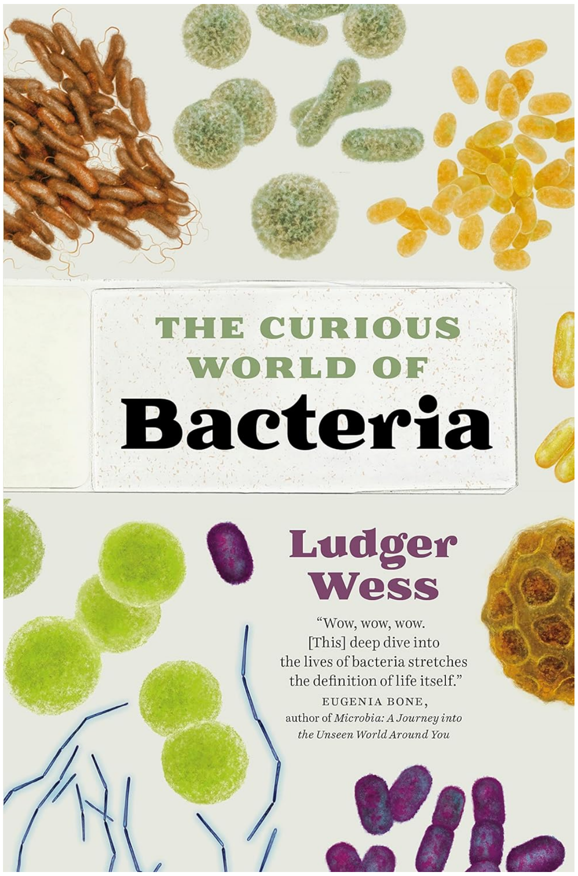
The Curious World of Bacteria

by Ludger Wess. 2022. Greystone Books, Vancouver, Berkeley, London. 224 p.
Book Review by Hank Guarisco, editor

I am very pleased to have come across this small, hard-back volume in the local public library. The author, a very good story-teller, begins with the discovery and evolving exploration of bacteria and archaea. He explains why bacteria are important: " Bacteria didn't only have a profound effect on the planet's atmosphere; they also provided the prerequisites for plant and animal life and thus for the development of the human species." Understanding how bacterial immune systems have dealt with viral infections led to the development of the powerful genetic tool known as the CRISPER/CAS system.

In 1977, a whole new domain of life was discovered in addition to prokaryotes, single-celled bacteria which lack a nucleus, and eukaryotes, all other life forms which possess a nucleus. The latter group includes a host of unicellular creatures like amoebae and paramecia, fungi, plants, and animals. Growing around the extremely hot waters of hot sulfur springs in Yellowstone National Park were pink mats that were presumed to be composed of a new heat-tolerant bacterium, named



Thermus aquaticus. This species was able to live at the extreme temperature of 185°F. "…the organism's enzymes, stable in extreme heat, launched the field of biotechnology, because they facilitated replication of genetic material in the lab through a technique called polymerase chain reaction (PCR). " Further exploration uncovered the existence of other species living under extreme conditions. However, subsequent study of their cell walls revealed that this group of organisms was so fundamentally different from bacteria and other life forms as to constitute a new domain of life, known as the Archaea.

The rest of the volume features 50 species of newly discovered, fascinating bacteria and archaea. Each species account starts with a simple black and white drawing of the species under consideration, followed by amazing aspects of its discovery and life history. This is basically a field guide to some of the most extreme life forms on earth. I will recount a few of these interesting species below.

Lysinibacillus sphaericus uncomfortably conjures up the main premise of the movie Jurassic Park. Spores of his little rod-like bacterium were extracted from the gut of a bee that had been encased in amber for the past 25 to 40 million years. These spores germinated in culture media and successfully reproduced!

An archaean named *Picrophilus torridus* was found in extremely strong acidic conditions near hot springs in Japan. It can grow in a pH of 0, the pH value of sulfuric acid, and can also tolerate negative pH values! It survives on the remains of organisms that died in the hot springs. "*P. torridus* releases acid-resistant enzymes that predigest carbonic nutrients outside the cell. Numerous specialized transport proteins then deliver the individual products into the cell."

Janibacter hoylei was discovered in 2009, in the stratosphere 134,000 feet above the earth where it is able to thrive and multiply. This observation lends credibility to the presence of bacterial and archaeal life forms on distant planets. Some species can live under extreme pressure, vacuums, acidic and alkaline environments, extreme temperatures, and even in harsh radiation conditions.

Many more interesting species are discussed in this volume. I really enjoy the presentation of each species as a separate organism in field guide format, rather than just lumping all bacteria in a nebulose category.

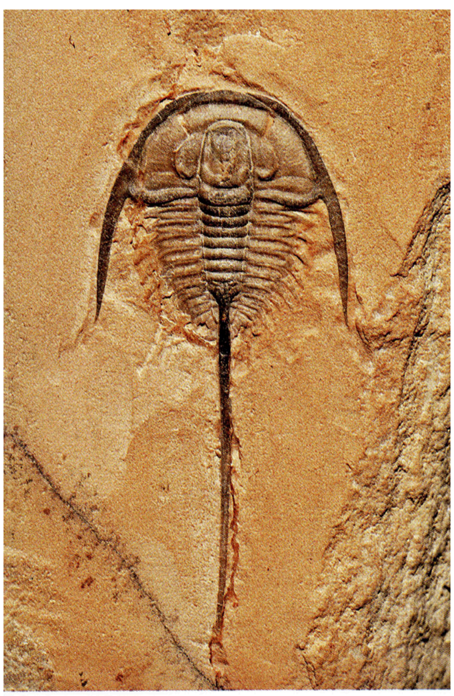
Travels with Trilobites

by Andy Secher. 2022. Columbia University Press, NY. 376 p.
Book Review by Hank Guarisco, editor

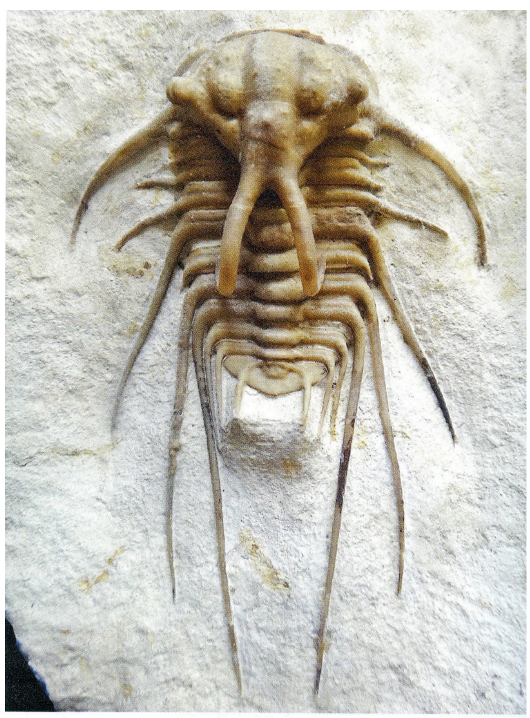
This large, hardback volume at first gives one the impression of a coffee table book – one that provides a collection of beautiful images and general statements, but nothing comprehensive or very informative. However, the book is a pictorial compendium of trilobites from their early beginnings during the Cambrian, approximately 521 million years ago, to their extinction in the Permian, about 300 million years later. The author, an avid collector of trilobites from around the world, also provides detailed information concerning the history of hundreds of species in his personal collection and their geological contexts.

Although there is usually some conflict between professional paleontologists and amateur collectors, the author is well respected by curators at both the Smithsonian and the American Museum of Natural History (AMNH). He has one of the largest collections of trilobites in the world, and "his generosity has been prodigious in providing the AMNH with important scientific and display specimens." Andy Secher has forged a partnership with the AMNH to create a trilobite website. This has led to the current volume. Most museums lack the money to procure specimens or pay staff to meticulously clean and prepare them.

The main strength of this book is the color images that are truly amazing. One final thought presented in the book, gives us a sense of how long ago trilobites first came upon the scene. It would take a person more than 16 years, counting at a rate of one number per second, to count from zero to 521 million.



CEDARINA SCHACHTI **(ADRAIN, PETERS, AND WESTROP, 2009)**
Middle Cambrian; Weeks Formation; Millard County, Utah, United States; 6.1 cm



DICRANURUS HAMATUS ELEGANTUS **(CAMPBELL, 1977)**
Lower Devonian; Haragan Formation; Coal County, Oklahoma, United States; 10.1 cm

MEGISTASPIS (EKERASPIS) HAMMONDI **CORBACHO AND VELA, 2010**
Lower Ordovician, Arenig Series; Upper Fezouata Formation; Drâa Valley, Zagora area, Morocco; 28.2 cm

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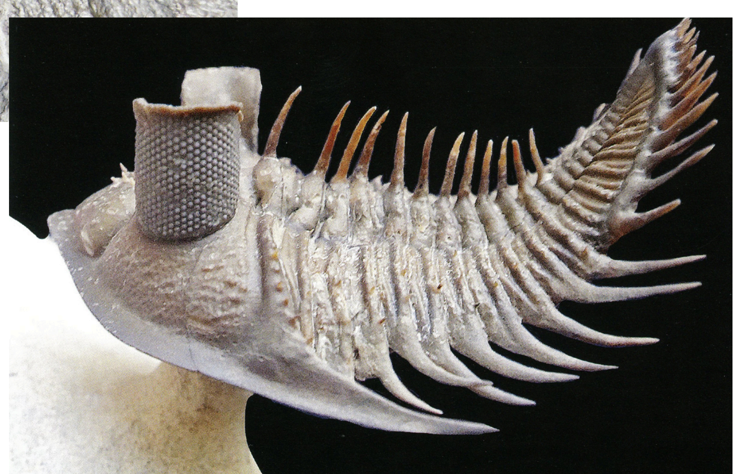

Images from *Travels with Trilobites* by Andy Secher