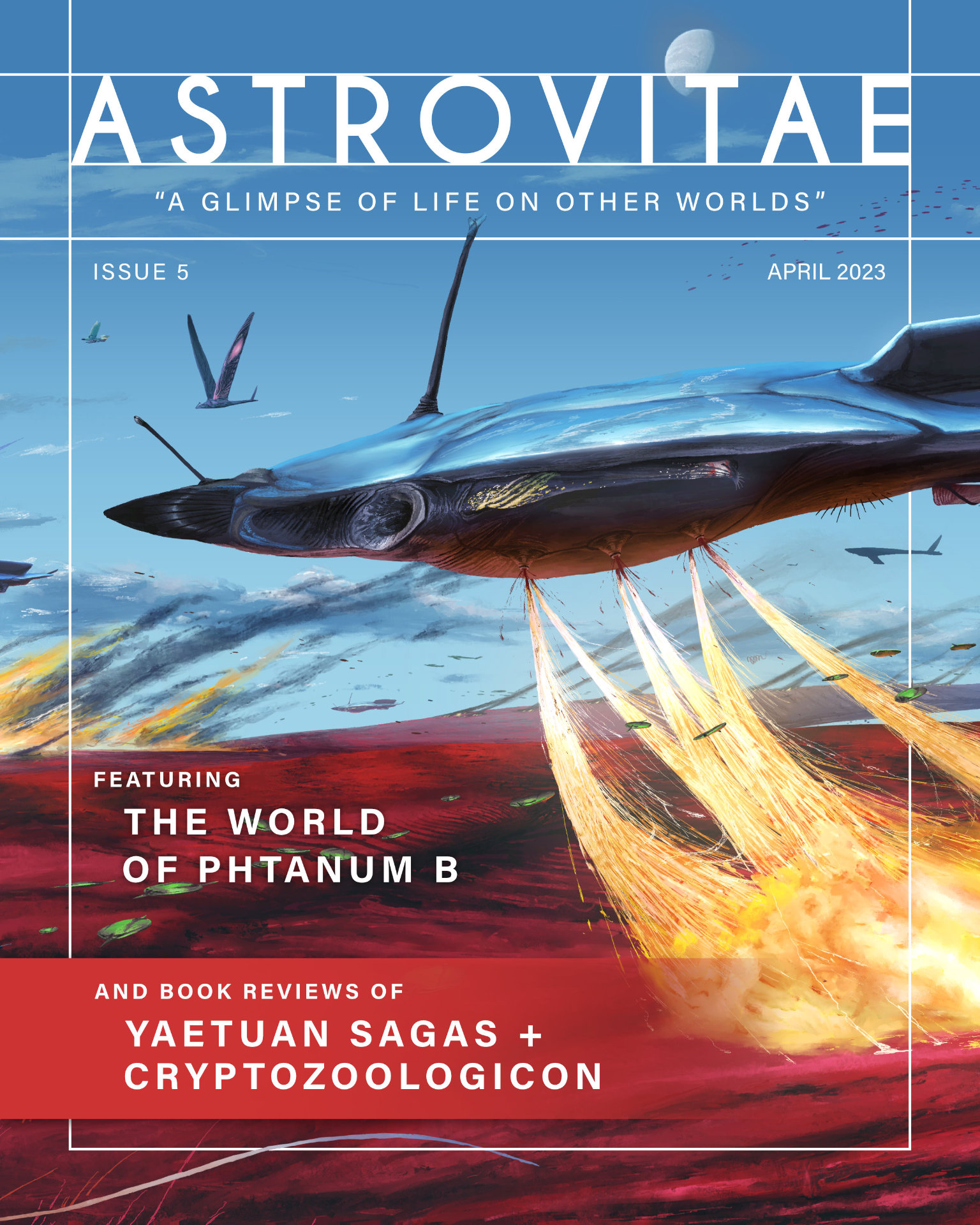
ASTROVITAE

"A GLIMPSE OF LIFE ON OTHER WORLDS"

ISSUE 5

APRIL 2023



FEATURING

THE WORLD OF PHTANUM B

AND BOOK REVIEWS OF

YAETUAN SAGAS + CRYPTOZOOLOGICON

ISSUE CONTENTS:

SECTION CATEGORIES:

Each article within the body of the magazine is tagged with an icon that best summarizes the type of content it contains. Listed below are all of the existing icons for readers to familiarize themselves with:

SOFT SPEC
Light research with an emphasis on conceptualization

ALIEN SPEC
Xenobiological anatomy, biology, and evolution

HARD SPEC
Heavy research or use of data in worldbuilding

PLANET SPEC
Focus on planets and their unique features or physics

EARTH SPEC
Involves Earth or organisms from present day

UNIVERSE SPEC
Unnatural or otherworldly physics and matter

PALEO SPEC
Involves organisms from Earth's past history

MYTH SPEC
Related to cryptids, fantasy, and mythology

MICRO SPEC
Focus on small organisms like mites, viruses, and cells

ENVIRO SPEC
Emphasis on environment, landscapes, or scenery

LETTER FROM THE EDITOR:

Dear Reader,

Thank you for your interest in *Astrovitae Magazine*! This first issue of 2023 marks the third year the magazine has been around, and we hope that the publication can continue into the future to support artists and creators within the community. With the release of *Avatar: The Way of Water* and the confirmation of the second season of *Prehistoric Planet*, it feels like creatures, prehistoric or imagined, are more real than ever. The artists featured in this issue and their projects express so much passion that it begins to rival these large budget media—a testament to the community's creativity and imagination!

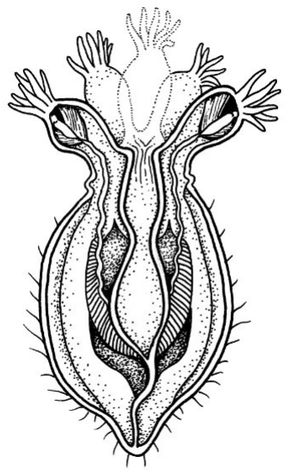
Not only does this issue cover a variety of speculative projects, but there are also two reviews of speculative biology-related books. Literature has always been an important backbone for the genre of speculative biology, and it is why *Astrovitae Magazine* will be looking toward printing formats or alternatives in the near future. There is nothing official to announce to the public quite yet, but let it be known that there might be plans to make the magazine more tangible for you!

Thank you for reading this issue's note from the Editor, and hopefully you'll enjoy another collection of amazing projects full of bizarre biomes, creatures, and worlds!

Sincerely,

Domenic Pennetta
Founder o*f Astrovitae* & Chief Editor

Although Astrovitae *is very much a labor of love, a small donation or two would really support the editor, the magazine, and its featured artists. If you would like to donate, please visit the link below:* ***www.ko-fi.com/astrovitae***.



Astrovitae Magazine is a biannual digital publication created by Domenic Pennetta.

Any written abstracts, articles, projects, pictures, book or movie reviews, and other media related to the genre of speculative biology may be submitted and considered for publication within the magazine. There is no responsibility assumed for statements made by its contributors. Submissions should be sent via email as a Microsoft Word document, PDF document, or linked as a Google Doc. Submitted digital images should be 300 dpi resolution, .PNG or .TIF files. Submit to astrovitaeofficial@gmail.com or visit www.astrovitae.com/submissions for more details.

SPEC NEWS:

Have some interesting news to share? *Anything special going on in the community that has sparked your interest?! It could be a blog post, a new YouTube video or book release, or even a video game! Whatever it is, Astrovitae Magazine is looking to feature more speculative biology news! If you'd like to help the Editor-in-Chief out, send a brief description and link to astrovitaeofficial@gmail.com, subject line "SPEC NEWS". The magazine would love to share whatever caught your interest! ~ Domenic Pennetta*

YOUTUBE VIDEO

NEW EPISODE OF PROJECT ISLA RELEASING SOON

May–June, 2023

Movement and migration are important facets of animal life and are behaviors exhibited by countless species. But how would we see such actions differ among fauna which have evolved on a planet far different from earth? On a planet without day and night cycles, or seasonal change, would migratory behaviors still evolve? How would organisms navigate such a planet?

In episode 5 of the Isla Project, all of these topics will be discussed, and we will see the biosphere of a tidally locked world expand significantly. New fascinating species will be explored, as well as their interactions with the broader ecosystems around them. We will look into the anatomy which enables movement on planet Isla, as well as group behaviors behind herds, and the packs of species which hunt them. Stay tuned for the next episode of the Isla Project!

2022 ASTROVITAE NEWS

SPECPOSIUM 2023

ASTROVITAE FOUNDER PRESENTING AT SPECPOSIUM 2023!

This year the founder of *Astrovitae Magazine* is planning to present in *Specposium 2023*—an informal virtual conference focused on the field of speculative biology. The lecture will explore the origins of the magazine, its current and future goals, and how to take information from your own spec project and turn it into a submission. For dates and event updates, follow Astrovitae's Instagram page!

SPEC PROJECT

PROJECT RHYNIA GETS A REBOOT

March 28, 2023

Project Rhynia began in August of 2022. The premise was this: crew from an interstellar shuttle travel to Proxima Centauri b to look for intelligent life. No life was found, but instead, a huge abandoned space station was discovered orbiting the planet's star. This station contained many bizarre forms of life all genetically related to prehistoric animals from Earth's past.

The project recently lost a pivotal member—a loss which will lead to many changes and essentially reboot the whole project. All the story and characters have to be rewritten, with many iconic animals such as the 'chimaeraflies' and 'hoppers', which will now be decanonized. In addition, the project's website will be receiving a new, fresh look in order to better represent these new changes.

"I think the project is going to be in a much better place," says Bobsicle, the co-creator of Project Rhynia. "The creative control is now entirely in my hands. But to be honest, we are still in the early stages of rebooting the project and it's difficult to conclusively say where things are going to go in detail."

This is an exciting time to begin watching the project grow, as there will be new characters and creatures to watch interact, adapt, and evolve. You can see the project yourself by visiting www.spacestationrhynia.blogspot.com.

THE CRYPTOZOOLOGICON

THE BIOLOGY, EVOLUTION, AND MYTHOLOGY OF HIDDEN ANIMALS

BY JOHN MESZAROS — *INSTAGRAM: @johnmeszaros*
WEBSITE: www.johnmeszarosart.com

As creatures that skirt the boundaries between folklore, mythology, and scientific plausibility, cryptids make excellent subjects for speculative biology. Although to give cryptids a good, realistic depiction that holds true to their descriptions from folklore, not only is it necessary to have a thorough knowledge of the cryptozooligcal folklore and literature, but one must also have a strong background in biology and natural history. Lucky for readers, authors/illustrators Conway, Kosemen, and Naish possess just such a suite of interests and expertise. Their book imagines what cryptids such as bigfoot and the chupacabra might be like as actual living creatures. They develop their cryptids with a hard scientific eye that incorporates each animal into its environment and provides a believable explanation for how each could have evolved.

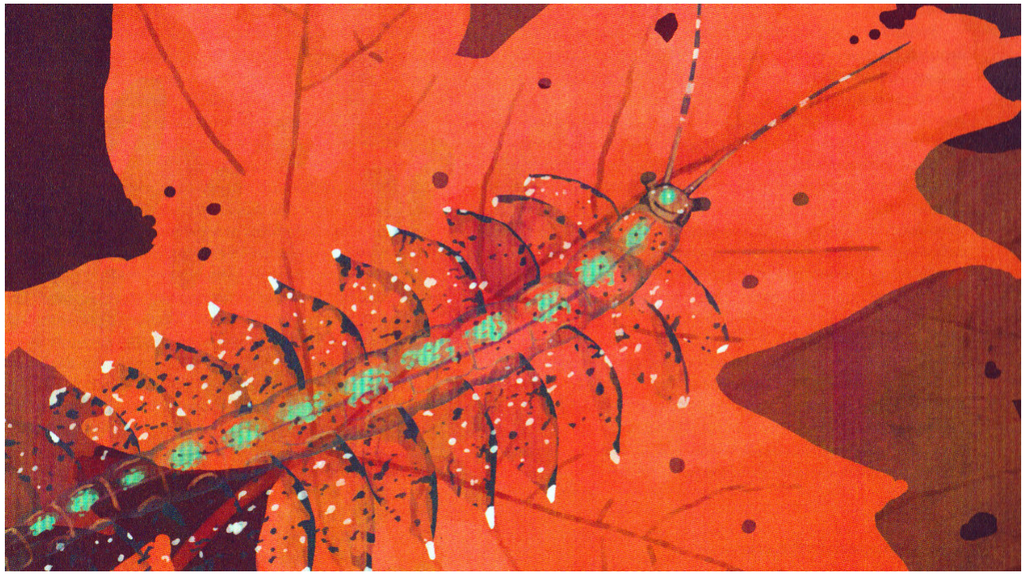
The book covers classic creatures like bigfoot, the Beast of Gévaudan, and the alleged "plesiosaur" carcass hauled up by the Japanese trawler Zuiyo-Maru, as well as more obscure animals like the Congolese mbielu-mbielu-mbielu, the con rit of Southeast Asia, and De Loy's Ape of Venezuela. There's even an entry for flying rods, tiny aerial creatures that allegedly move so fast they can only be seen in video cameras.

Each entry begins with a history of the cryptid's development in folklore along with famous sightings and the history of expeditions and investigations to find them. Next follows a skeptical explanation for the cryptid, often explaining them as misidentifications of a known animal or an elaboration of folklore. The last section of each entry is where the speculative biology comes in as Conway, Kosemen, and Naish recreate the cryptid as a real animal. The chupacabra, for example, is reimagined as a large, carnivorous possum-like marsupial—not too far-fetched since marsupials are common in South and Central America. This speculative design also fits well with some descriptions of the beast that describe it as having kangaroo-like legs (the more humanoid, and "blue hairless dog" versions of the chupacabra are discussed in the entry as well, with the former explained as pop culture folklore and the latter as unusual coyote-wolf hybrids).

Book Cover & Spread. *The book is a celebration of the myths, legends, evolution and biology of hidden animals reimagined!*

The illustrations in *Cryptozoologicon* are naturalistic, often showing animals partially obscured or in deep shadows to depict what a real-life encounter with one might look like. Particularly evocative is a scene of yetis strolling through a Himalayan mountain valley blooming with magenta flowers.

The entries often include satirical and hyperbolic remarks about how mainstream science just doesn't want to accept the truth of the authors' "findings"—a playful jab at crypto-



Flying Rod. *Flying rods are elongated visual artifacts appearing in photographic images and video recordings, but the book depicts them as if they are actual creatures.*

zoologists and other investigators of the mysterious who can be all too eager to gush over their own flimsy theories. While these jabs are playful, they can occasionally become a bit too mocking as the authors' frustrations with the credulity and defensiveness of some cryptozoology enthusiasts show through.

There is much cross-over in the speculative biology and cryptozoology communities, and fans of both will appreciate this imaginative and scientifically-rigorous book. Interested readers can get a copy of Cryptozoologicon at Irregular Books: https://irregularbooks.art/

Additional information about the authors is available on their websites:

C. M. Kosemen:
http://cmkosemen.com/

John Conway:
https://johnconway.art/

Darren Naish:
https://tetzoo.com/

THE YAETUAN SAGAS

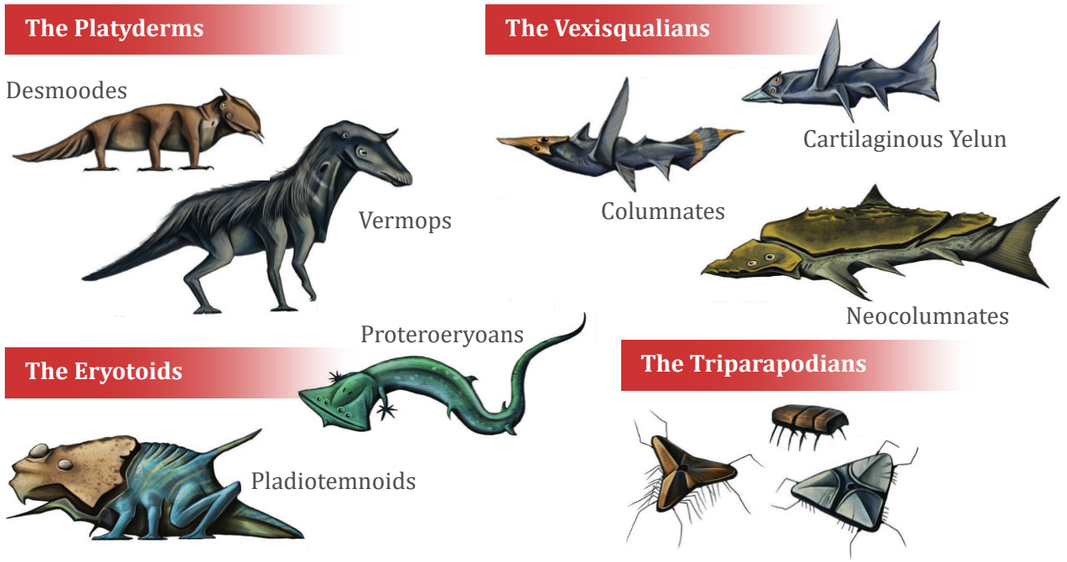
THE NEXT STEP IN A SPECULATIVE BIOLOGY PROJECT IS EXPLORING INTELLIGENT LIFE

BY DOMENIC PENNETTA

It is a great accomplishment to take the culmination of your speculative biology project and produce a book out of it, but it is another thing to do it twice! Author and artist, Christian Cline, recently released his newest title "*The Yaetuan Sagas: A Chronicle and Account of the Yaetuan Species*". On April 3rd, 2023, *The Yaetuan Sagas* was officially published on Amazon and is in some ways a direct sequel to Christian's first book, *The Teeming Universe*. Although *The Yaetuan Sagas* is a bit different—its predecessor was a classic exploration of alien planets and speculative lifeforms, but *The Yaetuan Sagas* goes one step further. It explores the evolution and development of one intelligent alien species, from its animalistic stages of life, to a race of civilized and technological spacefaring beings spanning across worlds.

The Yaetuan Sagas begins with an introduction to the possibility of life in the universe. Here concepts like the Great Filter and Fermi's Paradox are explained, and despite these arguments against finding life out there in the cosmos, we are shown many habitable worlds teeming with life forms. Instead of taking readers to explore these worlds like in *The Teeming Universe*, *The Yaetuan Sagas* instead focuses on the development and history of the Yaetil System, giving us a much narrower yet detailed view of alien life and evolution. Part 1 of the book explores the entirety of this star system composed of 7 planets, like the gas giant 'Tonuka', and another gas giant made of ice 'Yaelisa', and of course, the only habitable planet within the system called 'Yaetu' (which the majority of the book's setting is located). Yaetu is much heftier compared to Earth, around 80% more massive, composed of mostly silicates, and has two moons named 'Ael' and 'Yanta'. Since the planet is significantly further away from its host star, one Yaetuan year is roughly 466 Earth days, with an average day of 29 hours!

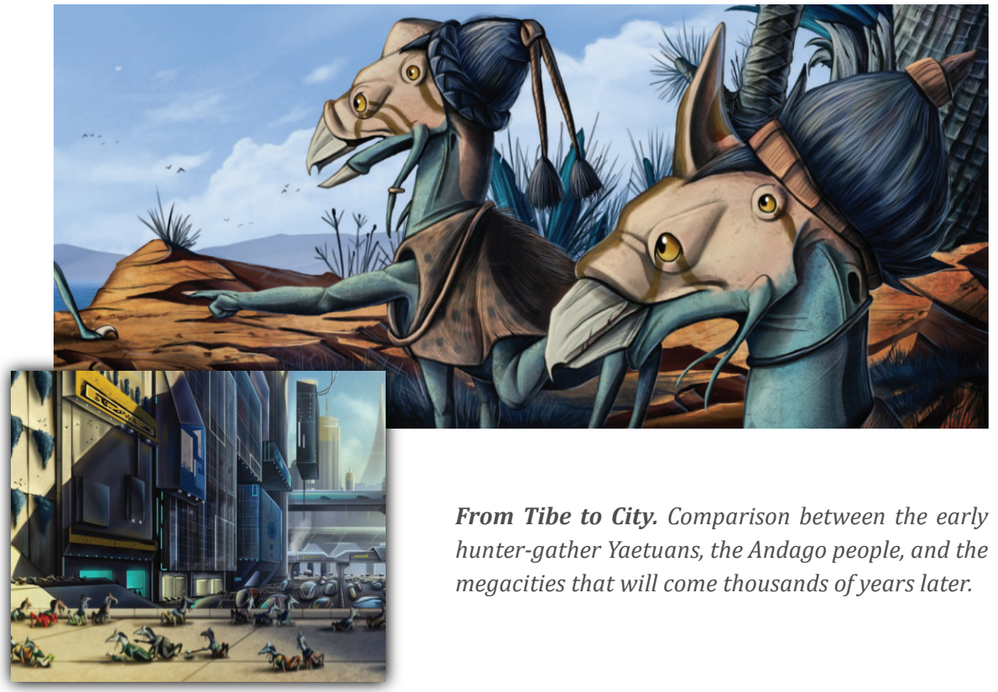
Kekatian Spirit. *Arecita, left, and her fellow dancers (or telangari) dance in poise and stead to welcome the beginning of the summer solstice; this dance is an ancient staple of Kekatian culture and identity.*



Native Animals of Yaetu. *A collection of animals from Part 1 of the book.*

Here on planet Yaetu is where we find an intimate look at the origins of a complex alien species, called the 'Yaetuans'. Like Earth, Yaetu has a long and complex evolutionary history. Invertebrates like 'Triparapodians', stubby tri-radial symmetric creatures which can walk in any direction, and vertebrates like the aquatic 'Vexisqualians', and amphibious 'Eryotoids' (which act like modern day earth amphibians), all evolved to fit into ecological niches in various biomes. Among all the life on Yaetu, the most peculiar are the 'Platyderms', terrestrial hexipodal animals which eventually speciate and evolve into the sapient race known as the *Yaettis sapiens* or 'Yaetuans'. This chapter marks the end of a focus on speculative biology, with the book more interested in exploring the development of culture and civilization of the Yaetuan species. Part 2 is clearly inspired by the disciplines of paleonanthropology and archaeology, following the exploits of early-Yaetuan peoples, from nomadic hunter-gatherer tribes, to the first agricultural villages.

Parts 3, 4 and 5 are the peak of the book, where we see the Yaetuans at their finest developing bustling industrial cities to interstellar technologies for exploring the universe. I shall not go into detail about these section, as I'd rather not spoil its details... That's what buying the book is for!



From Tibe to City. *Comparison between the early hunter-gather Yaetuans, the Andago people, and the megacities that will come thousands of years later.*

In conclusion, *The Yaetuan Sagas* is definitely a must read for anyone interested in the evolution of intelligent alien life in our universe. If you haven't read Christian's first book, *The Teeming Universe*, you may find a brief overview of the book and its contents in Issue 2 of *Astrovitae Magazine*. You are not expected to read the first book to follow along in *The Yaetuan Sagas*, but it is a great companion containing 300 pages jam-packed with speculative biology worlds, biomes, and creatures. If interested, you can pick up your own copy today from Amazon where it is listed for $40.00 USD (but perhaps this price is more or less taking into account Amazon deals and shipping costs). Astrovitae is proud to have Christian as a contributor, and we hope that our readers can support his art too!

CAPTIVATING WORLDS

By Paul Drenckhahn (SteveMobCannon)

THE RETURN OF PHTANUM B

BY PAUL DRENCKHAHN (STEVEMOBCANNON) — *INSTAGRAM: : @phtanum_b_official*
TWITTER: @stevemobcannon
ARTSTATION: stevemobcannon

In the last issue of Astrovitae, Phtanum B and its core features were introduced. The planet itself, deuvertebrate anatomy, geologic timetables and four select clades were presented. Now, Phtanum B returns once again for all to see!

One big aspect of the project that has not been mentioned thus far is the layout of the Phtanum system. The Phtanum system is somewhat bigger than ours, harboring 11 rocky and giant planets instead of our 8. The innermost of these is Phtanum B itself, officially named Manzat after its discovery (although both names can be used interchangeably). Following Manzat is Dhara, a rocky world between the size of Mars and Earth with notable tectonic activity. Further out is the first gas giant of the system—Haneul. Haneul is slightly bigger than Jupiter. Enormous internal heating allows its surface to be warm enough to house water clouds, giving the planet its grey-blue color. After Haneul come Euterpan, Maricha and Teshub, all three cold rocky worlds with icy surfaces.

Progressing into the outer system, we encounter Yan Wang—another super-earth with a surface consisting largely of rock and ice and a thick, dusty atmosphere. Behind it lies our second gas giant, Seraphiel. Seraphiel is a roughly Saturn sized blue marble, not too indifferent to an oversized version of Uranus or Neptune. After it comes Mefismo—an atmosphere-less cratered ice husk of a world. Nearing the end we stumble upon our final gas giant, Asmodeus. Asmodeus is unique in that its atmosphere houses a complex phosphorus cycle, causing the planet to change color in a cyclical manner every earth year or so. From white, to yellow, to red, to purple and back again to white. On the outer edge of the Phtanum system rests Culsans—a frigid world with a surface covered in nitrogen ice.

Returning to Phtanum B, a few new imposing clades have emerged to see the light of day. A number of these are considered Aneucnemids—a deuvertebrate group that split off from the main branch before the latter became terrestrial. These animals independently took to land or to the sky, as the waterjet propulsion tunnels of early deuvertebrates turned into through-lungs once on land. Early aneucnemids eventually adapted their tunnels to pump the thick atmospheric air, turning them into flying fish of sorts. These partly aquatic aneucnemids independently evolved lungs on their own, opening the way for fully non-aquatic ones and independently evolving legs to land on solid ground.

Distal Messenger. *A lone deuvertebrate gazes out into the landscape.*

Nowadays, nearly 400 million years after the phylogenetic split, aneucnemids are more diverse than ever before, inhabiting heaps of niches in every imaginable environment. Many inhabit niches comparable to insects, living as tiny decomposers, hunters, and herbivores. Others fly in larger swarms to avoid predation, not too unlike some birds of Earth. And again, others are some of the single most intimidating organisms of the planet.

A scream cuts through the air. Like loud drums or a faulty diesel engine, something like a plane passes by at high speeds. Though, this is not a plane. Causing the noise in the air is nothing other than a ramjet dragon—this one, a Mirrorback, is an aerial apex predator reaching 12 meters long. Known as *Autostochus miradorsum* by its binomial

Phtanum System | Terrestrial Planets

name, these imposing hunters are only one of a number of large predatory aneucnemids that call the sky their own. Ramjet dragons are named after their propulsion tunnels are made of a chain of chambers that get smaller the further towards the end you go. This pushes the air together, speeding it up in the process. The dragons don't rely on igniting the air in their tunnels, the air pressure alone gives them by far enough speed. A feature that unites all of them is their ability to spray burning, napalm-like liquid from specialized pores on their underside, nicknamed burnfluid, con-nected to the digestive system. These "pores" are a feature that unites most modern aneucnemids, and they evolved to fill a lot of roles as species diverged.

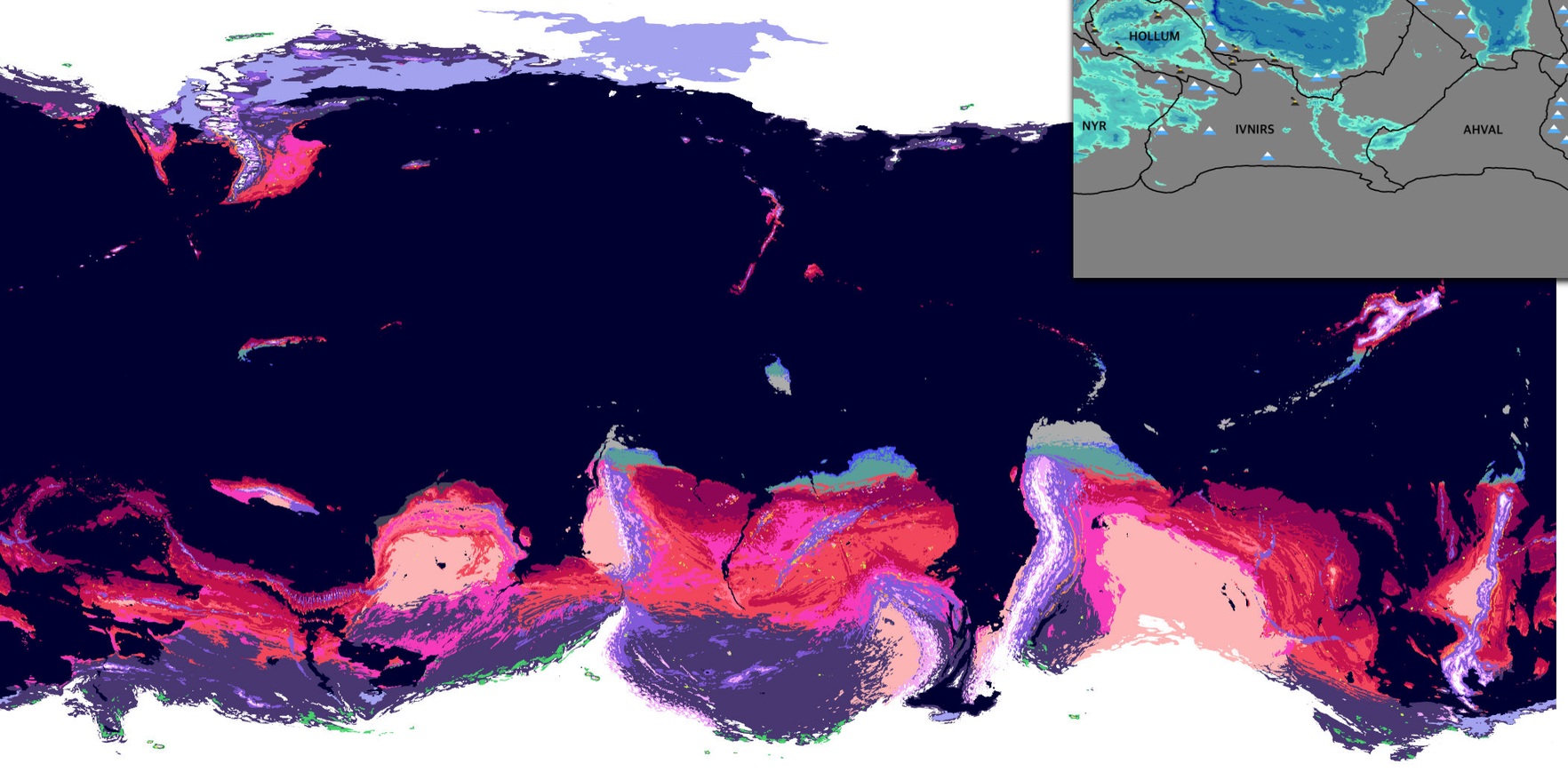
Smaller dragons usually go for smaller game, ejecting projectiles of semi-hardened burnfluid that splatter up on impact. Some, like the enormous firewall ramjet, release a wide "curtain" of burnfluid that is perfect for taking down swarms. And again others, like the Mirrorback, are hyperspecialized on taking down large game like deocardids by spraying the backs of their prey with burnfluid ejected from six individually moveable pore-turrets.

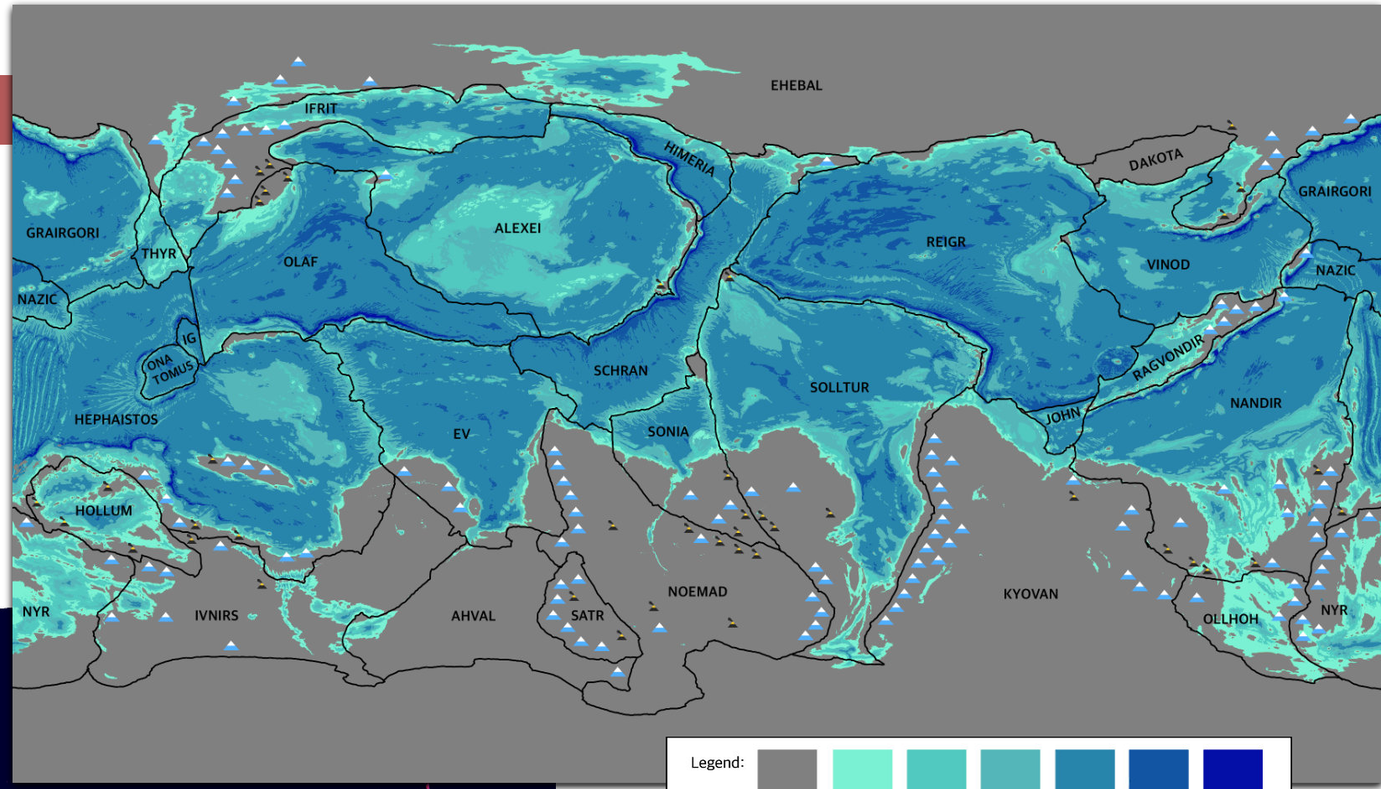
The prey of the latter is no less imposing. Deocardids are the largest deuvertebrates on Phtanum B by sheer scale. Their largest member, the red windwhale, reaches wingspans of just over 200 meters. The bulk of their body and especially their wings are filled with lungs and a complex air-chamber system however, reducing their density considerably and allowing them to grow to the maximum physically possible size limit. But being a flying mountain of meat has its drawbacks. Due to their size and low density, big deocardids must avoid storms by waiting out on the ground, tightly anchored to the ground via their tube feet that jam like stakes into the soil. Otherwise they risk being torn apart by the winds.

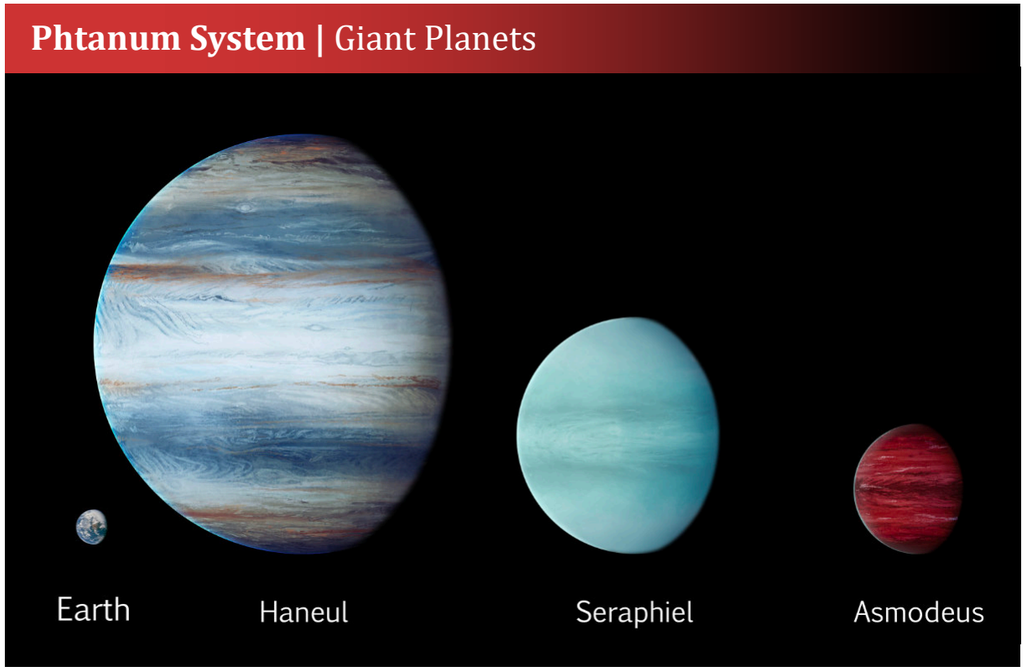
Avoiding predation is another matter. While many smaller deocardids can spend a good amount of time closer to ground or attempt to hide under the treeline, larger ones do not have it that easy. With the help of their retractable tube feet, they can "kitewalk" like their smaller relatives, but their sheer scale makes hiding impossible. This counts for the air as well, as their rumbling air pumps produce a lot of noise. Sub-sequently, many larger deocardids opted for threat displays instead of staying hidden, including but not limited to colorful, bright and vibrant patterns (known as 'aposematism').

Yet should a large deocardid be attacked anyway, a good number have multiple defense mechanisms. The first would be symbiotic flyers that follow the flying giants around like a living aircraft carrier. These feed on dead skin, waste material, use the whale as laying ground

Phtanum b Maps | Biome Map (left) and Plate Map (right)







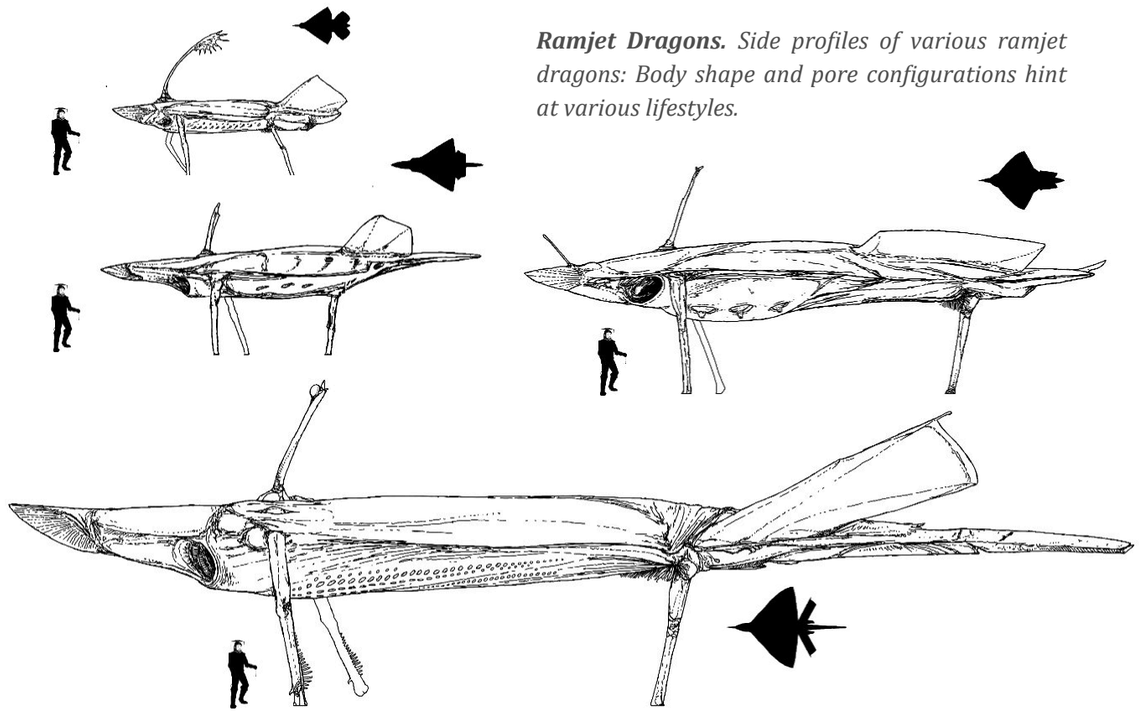
for their own polyps or co-feed on the occasional cloud of aerial junk that the whale feeds on. If the whale is under attack, these symbionts will work together in order to get rid of the unwanted guests. Emerald diskflies use their iridescent shimmer to confuse predators, or tumblecutters slash down attackers for example.

Should this line of defense fail, the whale will start to utilize its own resources in an attempt to defend itself. Covering its entire body are modified pore-turrets of two types, which eject clouds of foul-smelling black mist and hardened waste pellets respectably. While the former ones should blind attackers and cause them to turn back, the latter ones are used to snipe the predators out of the sky. Yet this whale in particular is weakened. With its own pores empty and with flesh already charred deep, it will no longer manage to hold itself in the air for much longer. Should this hunt be successful, the dragons will visit the crashed carcass over a period of multiple weeks, until it is eaten and eroded away. This marks an end to our tangent into a dramatic hunting scene.

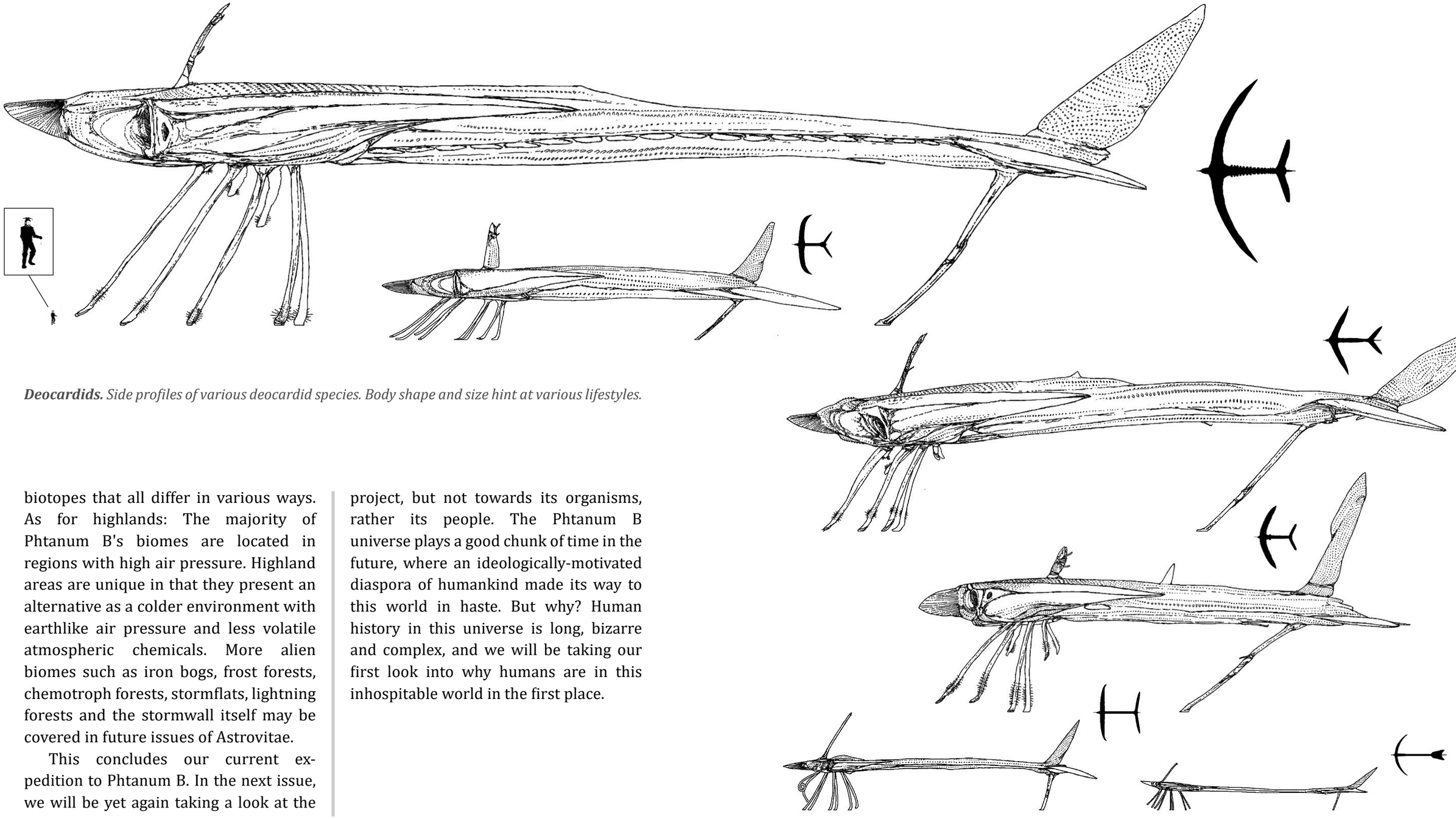
Phtanum B's geography is different from what we are used to here on Earth. Instead of split smaller continents that adorn the globe, Phtanum B has two supercontinents: Ehebalis in the north and Kyovanis in the south. These enormous landmasses are composed of many smaller continents that eventually merged together. This map shows the various biomes and habitats that exist on the planet. Many of these are self-explanatory, though there are a few terms here that may be confusing to the new phtanumbian citizen:

For one, a "biomat" in Phtanum B's context is an at least ten-centimeter thick carpet of decaying, organic material similar to peat, that forms the soil for organisms above it. These are fueled by a constant cycle of short-lived regrowing plants above, which eventually die and become part of the mat, then turning into resources for more plants and organisms that grow above and so on. This process has caused biomats to get ten meters tall in certain regions (biomat savannas) and dozens of meters tall in the most extreme cases (biomat jungles). This enormous amount of biomass is the result of phtanumbian life turning inorganic matter into organic one more efficiently at the cellular level. In tropical regions, biomats are prone to water-filled sinkholes.

"Dry Forest" is a term for pretty much any forest that does not grow on biomat ground. It is not a singular biome, but instead a group of vaguely related



Ramjet Dragons. *Side profiles of various ramjet dragons: Body shape and pore configurations hint at various lifestyles.*



Deocardids. *Side profiles of various deocardid species. Body shape and size hint at various lifestyles.*

biotopes that all differ in various ways. As for highlands: The majority of Phtanum B's biomes are located in regions with high air pressure. Highland areas are unique in that they present an alternative as a colder environment with earthlike air pressure and less volatile atmospheric chemicals. More alien biomes such as iron bogs, frost forests, chemotroph forests, stormflats, lightning forests and the stormwall itself may be covered in future issues of Astrovitae.

This concludes our current expedition to Phtanum B. In the next issue, we will be yet again taking a look at the project, but not towards its organisms, rather its people. The Phtanum B universe plays a good chunk of time in the future, where an ideologically-motivated diaspora of humankind made its way to this world in haste. But why? Human history in this universe is long, bizarre and complex, and we will be taking our first look into why humans are in this inhospitable world in the first place.

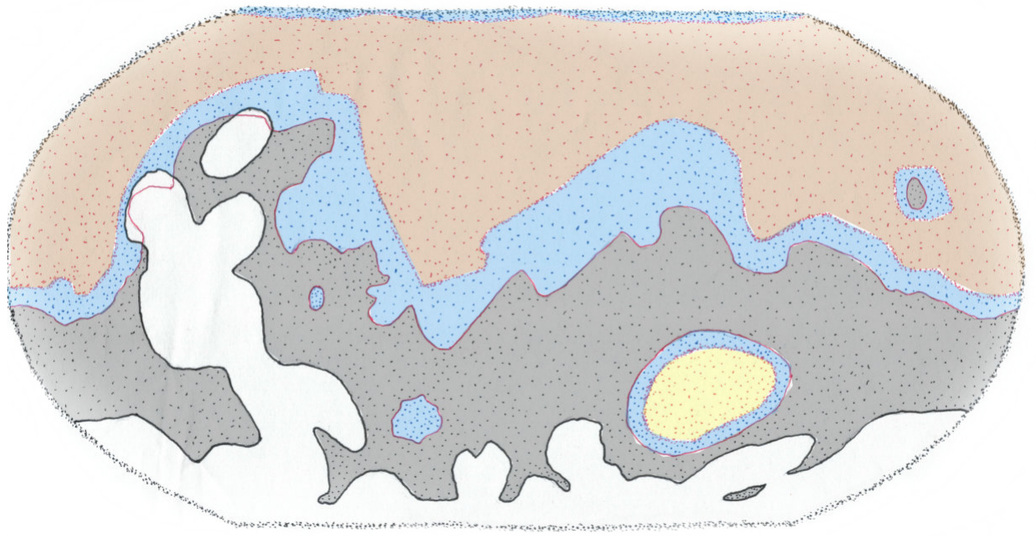
HAR DESHUR

VISIONS OF AN ALTERNATE & HABITABLE MARS

BY T.K. SIVGIN — *INSTAGRAM: @t.k.sivgin*
WEBSITE: www.hardeshur.blogspot.com

Mars has always been a fixture of the human imagination, ever since the first apes looked up into the night sky and saw a strange red star fly on even stranger courses. In our minds it has been home to many wonders and menaces, from near-human Christians in the first Renaissance era pieces of planetary fiction to Lowell's sophisticated canal-builders[1], and to the utterly inhuman cephalopods regarding Earth with envious eyes (which made H.G. Wells famous). Even as our telescopic and spectroscopic observations of Mars progressed, fantastic speculations did not die down, as Edgar Rice Burroughs simply put his Barsoom[2] on life support with the iconic atmosphere generator John Carter[3] had to rescue. By the 50s and 60s, however, even firm believers of life on Mars in the scientific community had to dial down their expectations.

Our observations by that point still left many things mysterious, but it became clear that Mars was too inhospitable of a place to become the home of any remaining civilization or large beasts. But the hope for extremophile plants and animals on the surface was still there. And why should there not have been? Telescopes clearly showed blue-green patches across the Martian surface changing with the seasons, a clear sign of vegetation, it was thought (for an amusing read on such speculations, check out the 1962 paper *Martian Biology* by Frank Salisbury in the journal *Science*). These observations influenced depictions such as Walt Disney's *Mars and Beyond* documentary and the movie *Robinson Crusoe on Mars*. Astronomer Carl Sagan was also a firm believer in Martian botany, even after the Mariner-4[4] mission showed us first close-up images of Mars' desolate wastes in 1964, for three years later he wrote a story for *National Geographic* featuring his illustrated vision of lowly plant and animal life he hoped still lived in the corners of Mars that were simply not yet photographed by the space probe. Any such hopes were inevitably lost with the Viking landers[5] and further missions, showing that Mars' surface has only 0.6% of Earth's air pressure, the dust and soil are laden with toxic chemicals, the radiation received from space is cancer-inducing at best and the average temperature is -60 degrees Celsius. The



Map of Mars. *This map shows the climate found on the surface of Mars. White areas encased by a solid black line mark regions of permanent ice. The blue area between the two isotherms is where the MAT rises above freezing, while the red dotted areas the MAT is above 10°.*

Footnotes:

[1]**Lowell's canal-builders** - Percival Lowell, an American astronomer, was a proponent in the erroneous belief that there were canals on Mars made by intelligent civilizations.

[2]**Barsoom** - A collection of stories presenting a fictional representation of Mars created by American pulp fiction author, Edgar Rice Burroughs.

[3]**John Carter** - John Carter of Mars is a fictional protagonist from the Barsoom stories.

Footnotes:

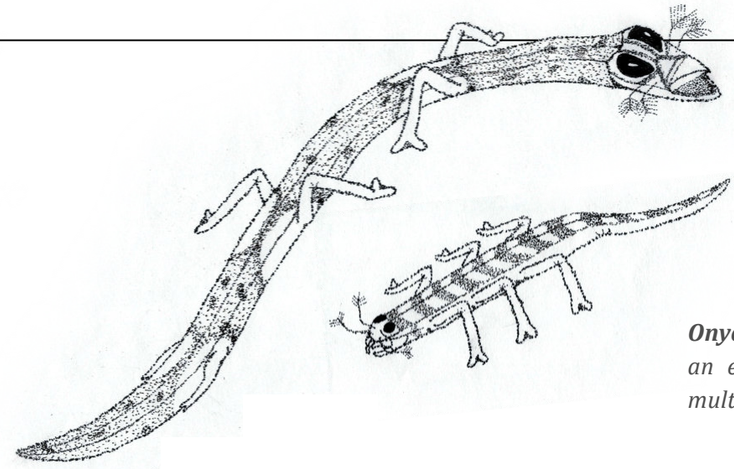
[4]**Mariner-4** - A spacecraft that conducted a flyby of Mars in 1965, offering the first closeup scientific photos and observations of the planet.

[5]**Viking Landers** - Pair of identical American space probes, Viking 1 and Viking 2, which landed on Mars in 1976.

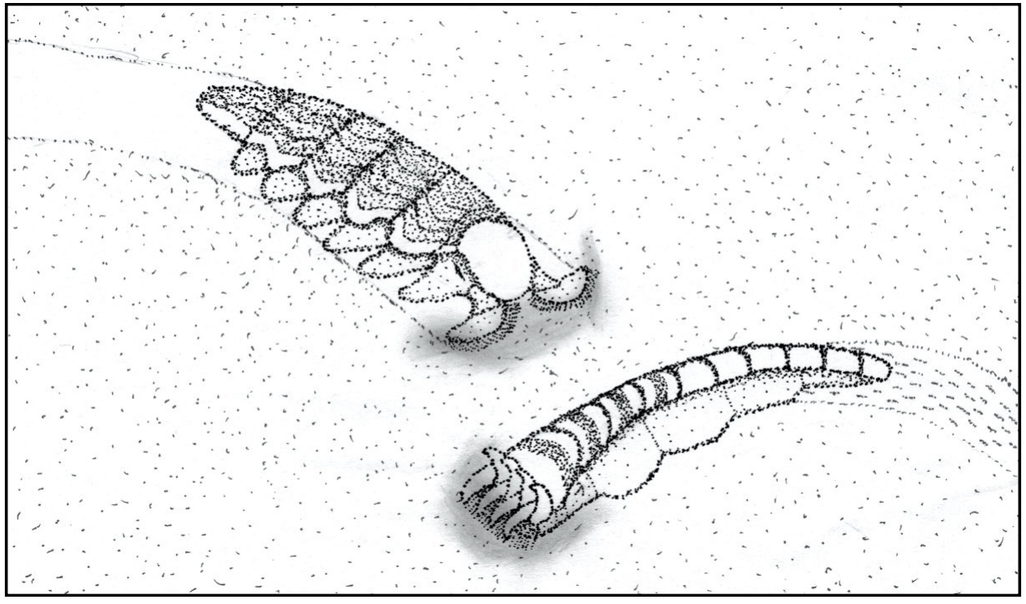
seasonally changing patches were simply dust storms and the infamous canals were an optical illusion. The surface of Mars is dead. If life still persists on the planet, it can now only be found deep in the geothermal underground and likely in a unicellular state.

But of course, it was not always like this. Mars has gone through many climatic changes throughout its history, with some current work indicating that in rather recent times of strong obliquity, the planet's poles likely thawed enough to allow for higher air pressures and liquid water on the surface and that this may happen again in the future. Maybe we just caught Mars at a bad time. What if Mars stayed just a little bit more habitable at the surface long enough for astronauts to pick up some space bugs? What if the vision of Sagan and others from the mid-20th century was the correct one? Har Deshur, named after Mars' designation in Egyptian mythology, explores this idea. Through the accounts of a future astronaut, we explore an alternate, slightly more habitable Mars (though one still grounded in modern data), its perilous geography and weather, its exotic lifeforms and the influences their discovery has had on humanity. A Mars that never was but very well could have been...

Brave New Mars. Mars is a harsh, desolate world. Average air pressure at the datum is only 0.5 bar, the same you would feel atop the Alps on Earth, and the average global temperature is just 2 degrees Celsius. Most of the water is trapped in the ice caps and permafrost and while it may snow sometimes, it almost never rains. But, due to the planet's varied landscape, these conditions are not uniform. Mars' Great Dichotomy, the significant difference in height between the low northern and tall southern hemisphere, is unique among the planets and generates distinctive temperature and climate zones (seen on Pg. 29). The completely white areas are regions such as the poles and the Tharsis Plateau, which stay covered in permanent ice the whole year. The darkened area of the highlands is where the mean annual temperature (MAT) stays below freezing and is dominated by an eternal tundra that thaws only for short periods during Martian summer. In blue are where the MAT is between 0 and 10 degrees Celsius and where seasonal meltwater from the icy regions allows for the growth of sparse shrublands. In red the MAT rises above 10 degrees, but the lack of precipitation makes this area so dry that we know it as the Great Dustbowl Desert. Unique is the deep Hellas Basin of the southern hemisphere. Its warming air pressure, combined with a high water table, allow a sort of alien savannah to persist here.



Onychognatha. *These animals possess an endoskeleton and descended from multi-limbed ancestors.*



The Dust Slugs. *Animals with segmented pseudopods for locomotion.*

Dust Slugs. One of the major phyla on Mars are the Spiriferia, a group of animals which move with segmented pseudopods and which are covered in a row of dorsal plates. Their mouthparts in some ways resemble an oversized version of the corona seen in rotifers (small microscopic plankton), and it is an efficient tool for sucking up particulate food like a vacuum. In the class Lobostomia, the corona consists of two arms beset with hundreds of setae, whereas in the Verticutia the upper "lip" has been modified into a toothed whirl that functions similarly to a garden scarifier[6]. "Dust Slugs" are a

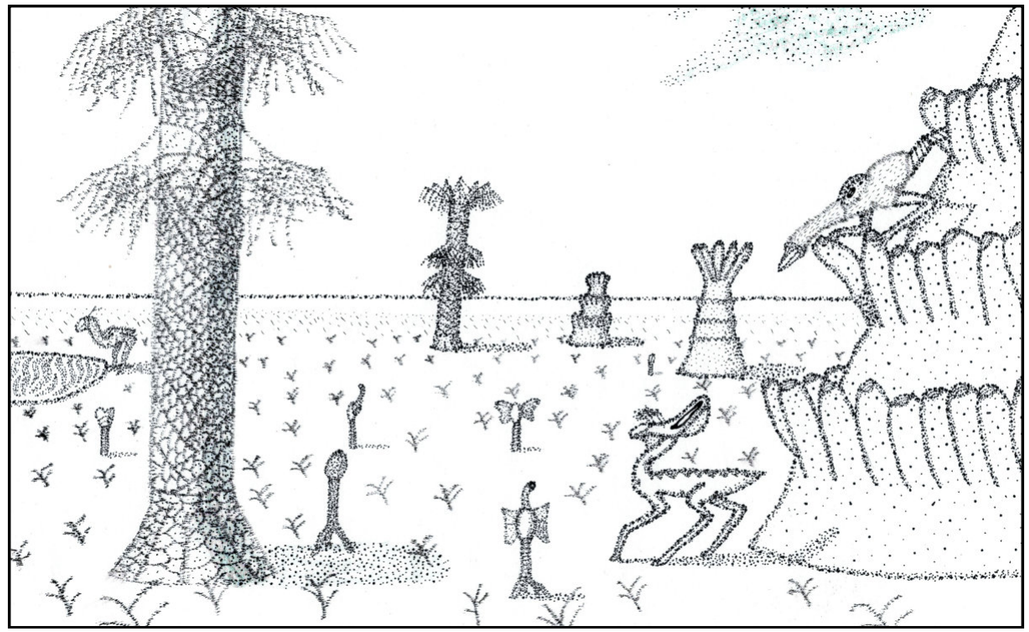
polyphyletic group of various spirifers living in the great northern desert which have convergently evolved symbiotic relationships with iron-reducing microbes in their gut. This lithotrophy[7] actually allows them to process the abundant dust on Mars into energy. As such metabolisms are inefficient, however, this is not the main diet of the dust slugs, who mainly feed on plant matter or smaller animals.

Onychognaths. Onychognatha are the closest analogue on Mars to vertebrates, as they possess an endoskeleton (albeit one that mixes apatitic with siliceous elements). They descend from multi-limbed ancestors which evoked arthropods in shape and largely evolved through thagmosis: four former limbs have fused with the cephalon to become antennae, while the jaws themselves derived from chelicerous pincers. Their eyes are also solid discs made of biosilicon[8], perhaps a protective measure against the frequent and abrasive dust storms on Mars. They breathe through orifices in front of every limb pair. Two grades are distinguished within the Onychognatha, the paraphyletic Archaeocephalia and the monophyletic Cuneocephali. The former are the ones who retain the ancestral mandibular jaws, while in the latter the mouthparts have further fused with the skull to form a sort of beak. Only the upper jaw is movable, sort of like a toilet seat.

Beneath the Ice Caps. (Not pictured) Another major phylum on Mars are the Antitremata (named after their U-shaped gut in which the mouth and cloaca are next to each other). Ancestrally, these were bivalvious, shelled, sessile animals very similar to Earth's brachiopods, but many forms have significantly modified this bauplan. The amstiel walk ontop the roof of a subglacial lake, evolving crustaceous legs out of its stalk. Another animal, the rhoson represents a different kind of development: its valves have fused into a turtle-like carapace, its cellulose stalk has become a swimming tail and former lophophores are now fins and a retractable proboscis, with tooth-like mouthparts reminiscent of a polychaete worm. Atop the carapace sits a cranium with mineral eyes derived from aesthetes.

Hellas Savannah. The Hellas Basin is the only region on Mars where ambient temperatures and high groundwater allow for the existence of a savannah analogue. Flora on Mars, excluding sessile planimals, is principally divided into four separate kinds: most primitive but also very common are the macroareonts (which are multicellular organisms composed of prokaryotic cells, similar to some myxo- or cyanobacteria, just macroscopic in size). Then come Arephyta, which structurally resemble Earth-plants the most, but are restricted to an archaic form of non-oxygenic photosynthesis, where hydrogen sulfide is turned into sulfur. Once dominant, they are now restricted in range and habitat, displaced by newer clades. One of them is the Spongisporia, filtering organisms which resemble a mix between fungus and sponge. Giant forms, the tube-trees, are common in the savannah, growing in clusters that form land reefs. The other group is the Fractaria, whose main characteristic is a glide symmetry. Through symbiosis they engage in true oxygenic photosynthesis and have become the most common flora across the planet. Most complex among them are the Polyfractaria, such as the scale-tree on the left, which are composed of multiple clonal individuals working together as one.

Tundra of Mars. Wide and desolate



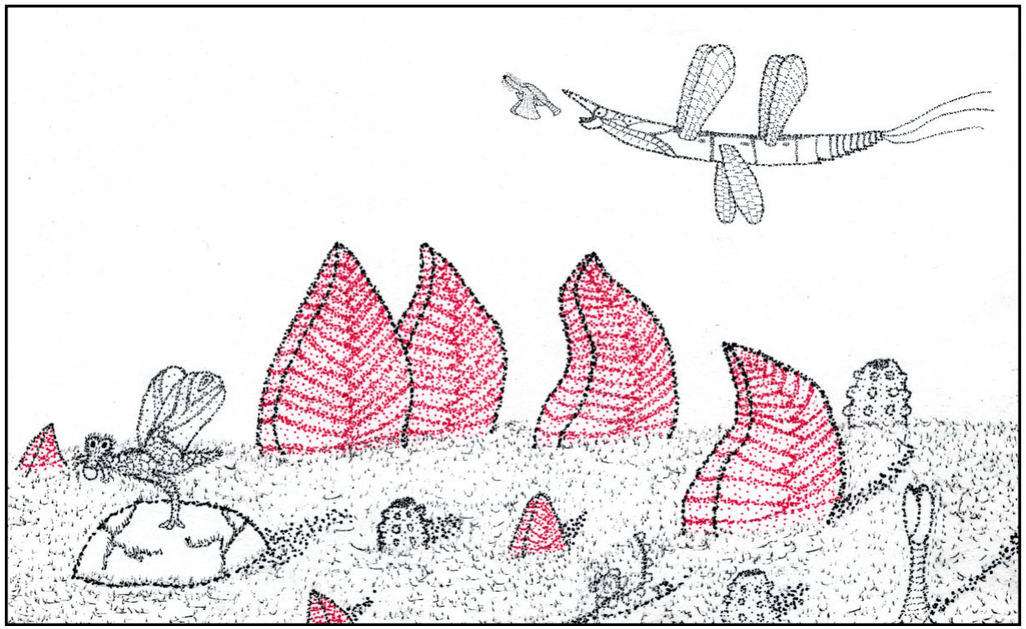
The Hellas Savannah. *Many martian planimals and wildlife inhabit these plains.*

Footnotes:

[6]**Garden scarifier** - Machine that removes layers of old grass stems and other debris from a lawn.

[7]**Lithotrophy** - The process in which organisms use inorganic substrates for respiration.

[8]**Biosilicon** - Also called Biogenic silica (bSi), biogenic opal, or amorphous opaline silica; one of the most widespread biogenic minerals.



Tundra of Mars. *Landscape with red fronds and flying animals overhead.*

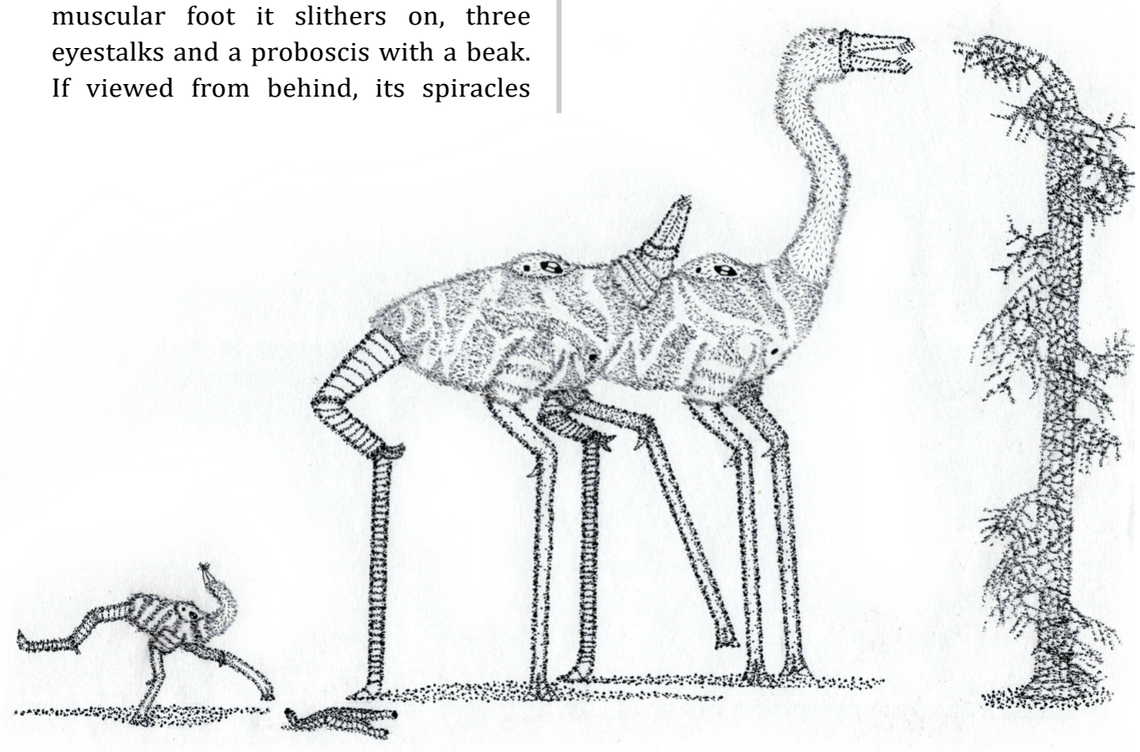
is Mars' giant alpine tundra, for most of the long year temperatures here are below freezing. But once summer comes, things spring to life. Red fronds, primitive fractarians, digest their biological antifreeze and become active again, as do the filulithophores and flechtoids, overgrown microbial scum that carpets the soil. Flying organisms, from microbial aeroplankton to arthropodous wadjets, migrate here to lay their eggs in the bogs that form atop the permafrost. They are followed by flying dyles, one-legged ballousaurs and various terrestrial animals trying to feed on the summer bloom.

Striped Hellasic Dyle. Periostraca is a diverse clade of antitrematans descended from forms similar to the rhoson. While some, like the bennus, have become bird-like bipeds, forms such as the dyles have developed their exoskeletal tail into a third leg and became tripods.

Great Ushabti. (Pictured on Pg. 102-103) Dyles are not the only tripods on Mars. Among the cuneocephalian onychognaths has evolved a group named Deltadactylia, who lost a whole limb segment while fusing another one into a single leg at the front of the body. How or why this awkward arrangement evolved remains a mystery. Fact is, multiple of these tripods have later shifted towards bipedalism and the most famous of Mars' featherless bipeds is the great ushabti of Hellas. Humanoid as it appears, it has fooled many early astronauts into thinking of it as a sapient being, but alas, it is about as smart as a deer. This has not stopped authors on Earth from writing inaccurate Mars fiction with intelligent ushabtis living in tribal societies.

Malacoda. (Pictured on Pg. 102-103) A clam-like organism, the last of its kind. Through its fused rostroconch shell it operates a muscular foot it slithers on, three eyestalks and a proboscis with a beak. If viewed from behind, its spiracles amusingly resemble a face.

Hortax and Yrp. (Pictured on Pg. 102-103)Trichordates like the hortax are starfish-like land creatures, whose endoskeleton looks like it was stitched together from three snake-tails. Using ocelli at the tips of its arms, it hunts for prey like the Yrp, a highly derived onychognath that has fused most of its limbs with the cephalon.



Striped Hellasic Dyle. *Dyles are bird-like creatures with tails that act as a third leg.*

FREELOADER PLANTS

THE WONDERFULLY WEIRD CAVE ECOSYSTEM OF THE OUREAN MOUNTAINS

BY ALEJANDRO MARTÍNEZ FLUXÁ — *INSTAGRAM: @artechocene_explorer*
TWITTER: @ArtechoExplorer

Thirty-nine million years into the future, during the Artechocene period, the uplifting of the Mediterranean sea has resulted not only in massive mountain chains, but also the formation of incredibly intricate cave systems deep in the limestone layer. Kilometers and kilometers of caverns snake through these mountains like burrows from massive worms! Although, most of these caverns are connected to the outside world, providing potential habitats to all who are able to survive in this environment.

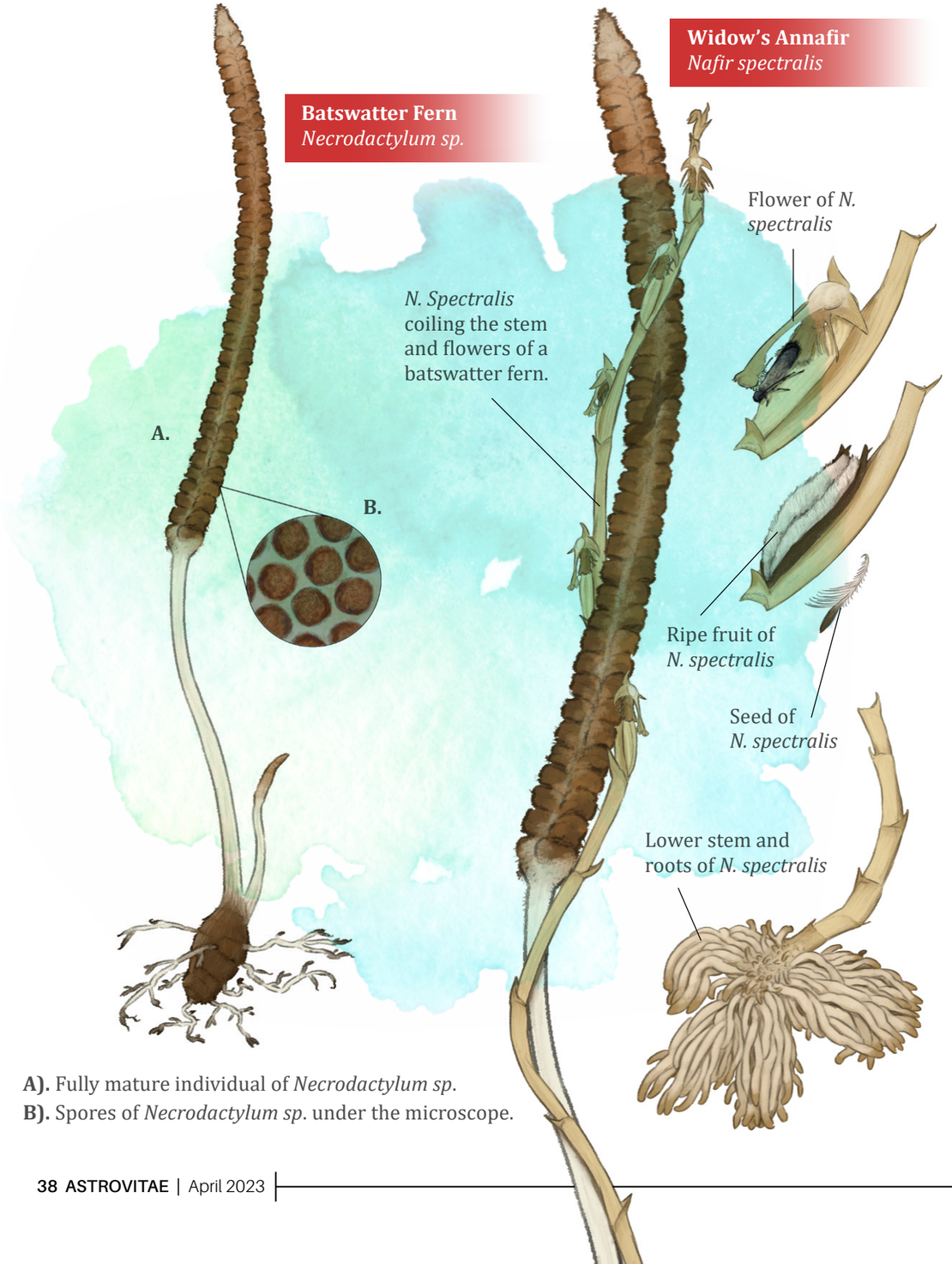
One of the animals that has benefited the most from the new abundance of caves are bats, which can create colonies that number in the tens of millions in the places near abundant food sources. And although they're not exclusively living inside of them their whole lives, they have become a vital component to the ecosystems within these caves, since they serve as a conveyor belt for nutrients to move into the cave in the form of guano. This guano accumulates over time below the colonies, forming soil that can be exploited by a whole plethora of organisms, which form the base of a strange yet fascinating ecosystem.

Fungi dominate these ecosystems, digesting the bat droppings and breaking them down into more available nutrients to incorporate into their biomass. The hyphae of these fungi behave like grass in this environment—acting as the main food source for dozens of species of insects and other invertebrates that call the cave home. Cockroaches, opiliones (harvestmen), and larvae of various insects like flies and moths feast on the innumerable white filaments embedded into the soil. Among these thoughts, some ditch the fungi and feed directly on the guano and other decomposing matter in the soil. These are the larvae of the Tartarus moths (*Tartaropogon sp.*), the most common insects that can be found inside of these cave systems.

Although dominant, they're not the only sessile organisms that call these caves home. As surprising as it may seem, several species of plants can be found in these pitch black caverns, such as the Batswatter Ferns (*Necrodactylum sp.*) and the Widow's Annafir (*Nafir spectralis*), the only cave plants in the world. Both employ the same strategy to survive with a complete absence of light, and unsurprisingly, the answer is fungi. They effectively "enslave" the fungi in the early stages of their development and make the fungi share nutrients with the plant, even though the plant doesn't share nutrients back like its photosynthetic surface relatives. With this relationship established, the plant can now develop its root system to connect to more individuals of that specific fungi species, unfairly sharing nutrients with them and accumulating nutrients in its roots during the winter (when bats are hibernating). At the beginning of the summer, the plant will use these stored nutrients to produce its specific reproductive structures. But this is the point where the life cycles of these two plants diverge. Batswatter Ferns are achlorophyllous Ophioglossid ferns found in caves all across Eurasia that do not produce flowers or seeds, but a long sporophyll whose sporangia open once it's matured. However, because there's minimal air currents, spores wouldn't be able to travel far, and when germinating the young plants would compete with the parent plant for resources. To combat this, batswatter ferns have developed a fascinating adaptation to disperse far and wide not only within a bat colony, but in between other colonies and caves.

Apart from being very long and thin (making it harder for it to be detected with echolocation) it has a very strange surface texture. The macro and micro-structures formed by the epidermis of the sporangia and the sporophyll has

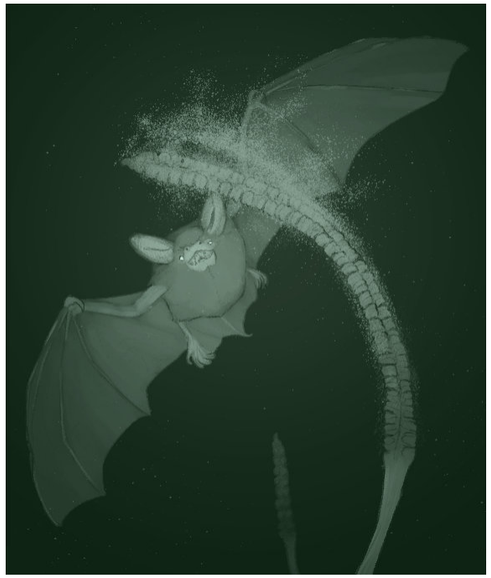
Pollination. *Tartaropogon fungus moths pollinate widow's annafir, allowing the growth of thousands of lightweight seed filaments.*



A). Fully mature individual of *Necrodactylum sp*.
B). Spores of *Necrodactylum sp*. under the microscope.

evolved to, when impacted by the frequencies used for echolocation, return an amplified sound that interferes with the rest of the bat's signals and interferes with them. This confuses the animal, and more often than not, causes the animal to hit the sporophyll, releasing millions of spores that stick to its hair and the hair of nearby bats. This disperses the spores to wherever the bat moves, or to neighboring bats who preen and clean themselves (a behavior which transfers spores to the neighbor).

The Widow's Annafir is an orchid in the Nafir genus, which contains a bunch of photosynthetic as well as non-photosynthetic species. All these species share one trait: being pollinated by fungus moths in the family Tineidae. In the case of this Annafir, it specialized in attracting Tartarus moths, adapting its smell to the pheromones of the local Tartaropogon species' females. Once pollinated, the ovary dries and opens up exposing thousands of tiny, lightweight seeds topped with a pinnated hardened filament. But that's not the only trick this plant uses in order to reproduce. Before flowering, the stem grows horizontally, searching for one specific thing: the stem of a batswatter fern. Once it reaches the stem, it starts coiling around the sporophyll of the fern and finally flowers more or less at the same height as the fern's sporangia are located. This way, when bats collide with the fern, not only do they get covered in spores, but some of the seeds of the orchid sticks to their fur, dispersing alongside the fern. This makes it so it's more likely for the orchid to grow near these ferns when it germinates.



Accidental Pollinators. *Bats knock into batswatter ferns and cause spores to eject into the air. Spores fall to the floor or are carried by the bat within its dense fur.*

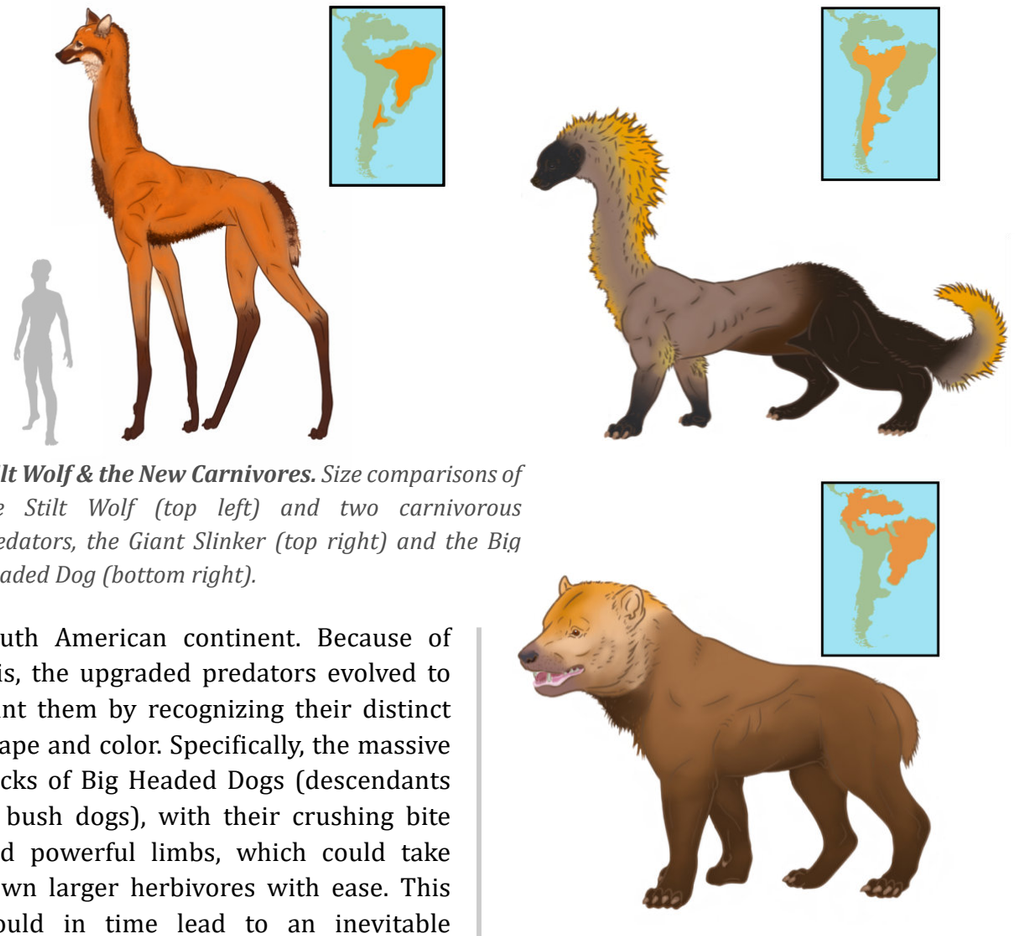
These tactics of deception and taking advantage of other organisms might seem cruel and unfair to an outside observer, but that judgment fails to take into account the complexity and beauty of these life cycles. All of them evolved thanks to trickery, but trickery allowed these plants to colonize places never before seen and deep within the mountains.

FUTURE FLOODED SOUTH AMERICA

BY HUNTERSETH (BIO SPECULO) — *INSTAGRAM: @bio_speculo*

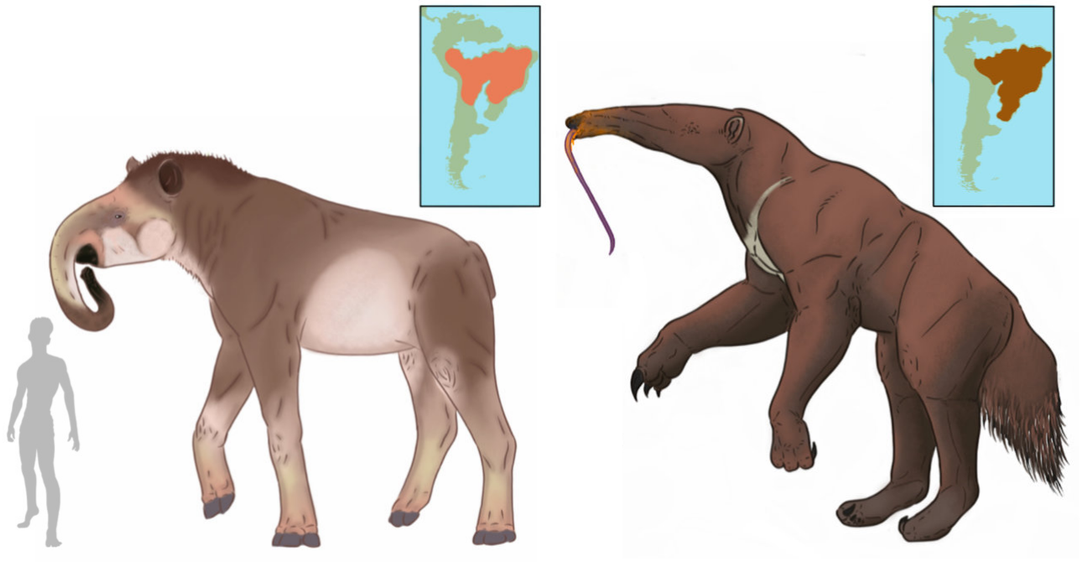
In the future, humanity has collapsed and the Earth has suffered through the subsequent consequences of our species. Among the most tragic of events caused by humanity was called the 'Great Releasing'—which was the melting of Antarctica. The cause of ancient humanity's collapse is as of yet unknown, and those few human populations that remain can only speculate. Those of which remain now inhabit a 'Flooded South America', a continent separated once again from its neighbor, and now inundated with water. With such drastic changes, the continent's available resources increased in abundance, inevitably driving the radiation and formation of several new species and genera. The continent was not without its fair share of extinction, however. Following the Great Releasing, non-native fauna ravaged the land over many generations, increasing in population and number. This massive increase in prey created the perfect conditions for an increase in predators, leading to the success of many endangered South American carnivores. Although most non-native populations would die off in time, the damage of their presence had already been done, and the strain was too great for the South American Cervids and Camelids (deer and camels), both lineages pushed to extinction. With these changes, many niches became open and many new creatures rose to fill them. This is the premise behind the Future Flooded South America.

Hunter Turned Prey. With the native camelids gone and cervid population beginning to decline, the populations of carnivores that were made massive by the increase of non-native fauna from long ago, set their sights and tastes on their own cousins. These newly upgraded canines could not distinguish their long-legged deer-like relatives from the cervids they were so adapted to hunt. The only cervids that were then still extant, were the Marsh Deer (*Blastoceros dichotomus*) for they had in previous generations thrived on the Flooding



Stilt Wolf & the New Carnivores. *Size comparisons of the Stilt Wolf (top left) and two carnivorous predators, the Giant Slinker (top right) and the Big Headed Dog (bottom right).*

South American continent. Because of this, the upgraded predators evolved to hunt them by recognizing their distinct shape and color. Specifically, the massive packs of Big Headed Dogs (descendants of bush dogs), with their crushing bite and powerful limbs, which could take down larger herbivores with ease. This would in time lead to an inevitable conflict with their native canine cousins. Due to their resemblance in color and shape to that of deer, the Maned Wolves (*Chrysocyon brachyurus*) of this Future South America would continually find themselves being targeted by their pack hunting kin. After many generations of running away in fear and being mistaken for deer, these Maned Wolves would eventually succumb to this unusual and unnatural pressure brought upon them by nature. Thus, with the camelids gone and the cervids slowly vanishing, and with the ever impending hunger of their brothers at their heels, the genus Acteocyon soon emerged. Named after the Greek myth of hunter turned prey, the earliest members of the genus Acteocyon would rise to take the place of the now open camelid niches. In time, they would



The Megafauna. *Size comparison of the large Tapir Titan (left) and the Snouted Sloth (right).*

become the Stilt Wolves, the tallest organisms to now inhabit South America.

Stilt Wolf. The largest member of the genus Acteocyon, the Stilt Wolf (*A. draskelykos*) is a descendant of the maned wolf (*Chrysocyon brachyurus*) with few natural predators. Early ancestors of the genus were continuously hunted by their canine relatives due to their superficial resemblance to camelids and cervids.

Upgraded Carnivores. The Giant Slinker (*Chimeira vorsipellis*) is a giant mustelid relative that predominantly preys upon Cavykeys and Alpecari. It is a pursuit predator that takes down prey by means of wrapping its long neck around the prey item before suffocating it. The Big Headed Dog (*Speothos orthrus*) is a pack hunting canine descended from bush dogs (*Speothos venaticus*). Named after the brother monster to Cerberus in Greek mythology, Big Headed Dogs are an efficient predator capable of taking down prey much larger than themselves.

The New Megafauna. The Stilt Wolf, although the tallest, is not the largest species to now inhabit South America. Instead, South America would see the radiation of two distinct lineages; one obvious, the other surprising. Following the collapse of humanity and the subsequent Great Releasing, sea levels began to rise along the eastern side of South America. This abundance of water at first generated massive deforestation, especially in the Amazonian region. But, as the years went by this somewhat newly stabilizing cycle would feed the growth of newly emerging plant species which would then in turn fuel entirely new habitats and ecosystems as well as make certain biomes more prevalent. With these changes in place, and with the ever increasing availability of resources, the continent would see the radiation and appearance of new megafauna.

Among those that would rise to fill these new and open niches, the tapirs were among the first to radiate into a variety of forms. The largest of these forms would become the Tapir Titans (*Tapir-titanae gigaterrestris*). These massive herbivores like to spend most of their time in and around water. Since they primarily exist on a diet of aquatic vegetation, any large and prominent tusks therefore appear to be absent. Although monstrous in size, there is at least one other species that could rival the titan status of these giants. The Snouted Sloth (*Magnurostra mapinguari*) is also among the new megafauna to emerge. Named after a monster in Brazilian folklore, this massive descendant of an anteater is the end result of a surprising radiation. As the continent's climate was continually altered by massive amounts of water thus favoring the formation of larger flowering plants, the insects that fed on those plants also grew larger. This appears to be the primary pressure that pushed these anteaters into such an odd niche. After ages of eating ants, now these monstrosities feed on flower nectar and flightless hymenopterans (ants, bees, and wasps) primarily, but also supplement their diet with honey and bone marrow.

Tapir Titan. The largest member of the genus Tapirtitanae, the Tapir Titan (*T. gigaterrestris*) is just one evolutionary end of the tapir radiation in South America. Somewhat convergent with ancient elephants, this titan occupies a niche somewhere between that of hippos and elephants, mostly feeding on aquatic vegetation, but occasionally on other plant life.

Snouted Sloth. Named after a monster in Brazilian folklore, the Snouted Sloth (*Magnurostra mapinguari*) surely lives up to its name. As a massive anteater descendant that primarily exists on a diet of nectar from giant banana flowers, the species obtains its other dietary requirements by sucking on bones for their nutrients and also feeding on massive insects.

Examples of Coevolution. The two most arguably iconic species that now inhabit this Future South America happen to be two species that are clear examples of coevolution. While the hunter was turning to prey, the fruiting plant its ancestors most commonly fed upon was in the process of reaching for new heights. The result was a lineage branching from the Wolf Apple (*Solanum lycocarpum*) that increased in size to become a new species of tree, the False

Acacia, also known as the Stilt Wolf Tree (*Solanum psuedocacia*). As the ancestors of the Stilt Wolf continued their journey increasingly becoming more herbivorous due to competition and conflict with their relatives, the plant they commonly fed on was slowly becoming larger. Now, the small fruit from the False Acacia constitutes 90% of the Stilt Wolf's diet. The Stilt Wolf is well adapted to eating this fruit and so possesses a long neck and long stilt-like legs (for which it gets its name).

The other example of clear coevolution is that between the Snouted Sloth and the Giant Banana Tree (*Musa mutarae*). After the collapse of humanity, the banana plantations in South America spread across the continent, mutating in the process. As the flowers of these fruiting trees became larger, so did the insects that fed on their nectar (as mentioned above). This inevitably aided in the emergence of the Snouted Sloth as a species, which has, as a result, evolved to feed on the Giant Banana flowers' nectar.

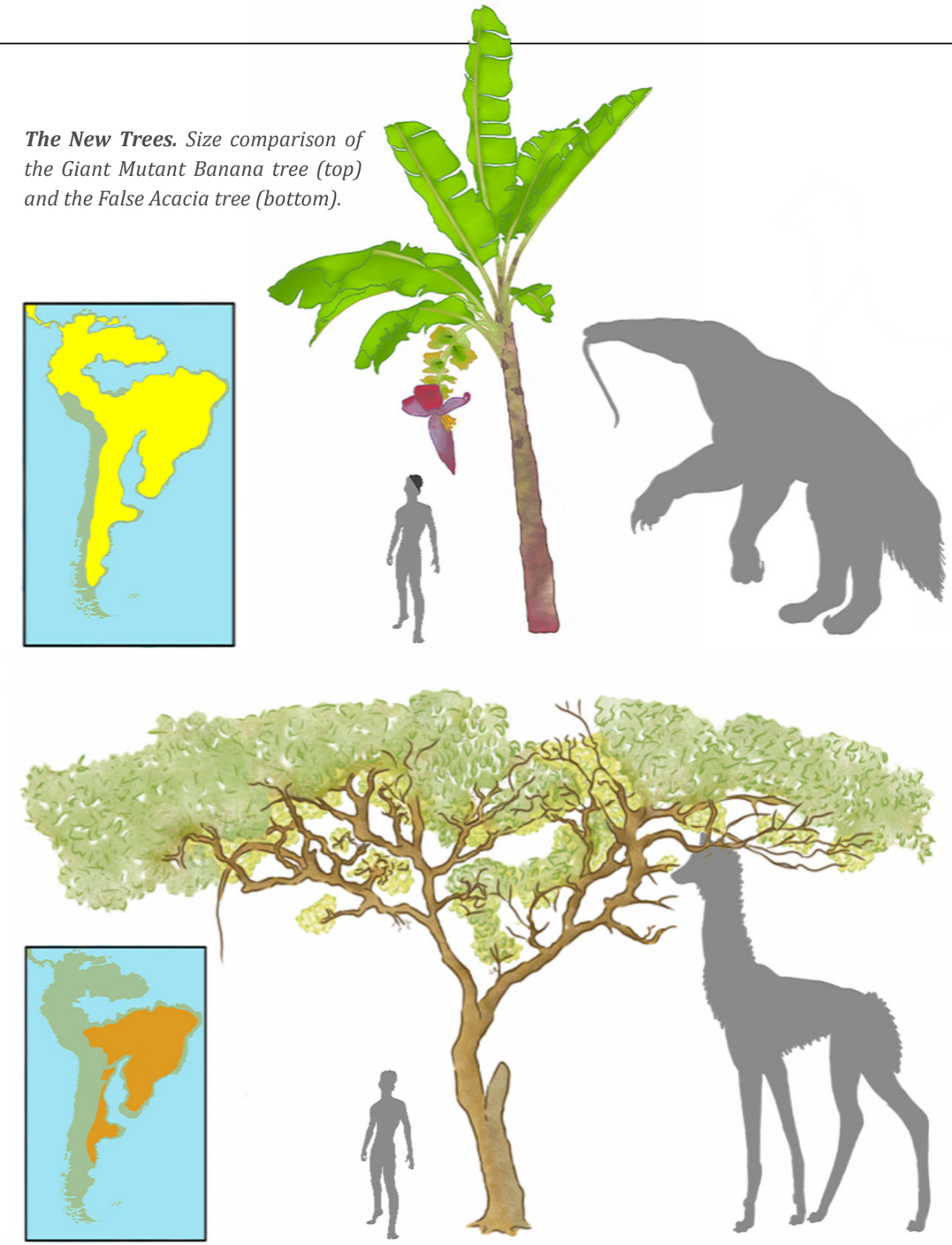
False Acacia. The False Acacia (*Solanum pseudocacia*), also known as the Stilt Wolf Tree, is a large tree resembling the acacia trees of Africa. It is descended from the Wolf Apple *(Solanum lycocarpum*) and its speciation is partially responsible for the emergence of Acteocyon as a genus, and therefore is a prime example of coevolution.

Giant Mutant Bananas. Descended from introduced bananas, the Giant Banana Tree (*Musa mutarae*) is now widespread across Future South America. The tree produces massive flowers that attract both *M. mapingauri* as well as a number of flightless hymenopterans. It is another example of coevolution in that the Snouted Sloth has specifically adapted to feed on its nectar as well as the ginormous insects it attracts.

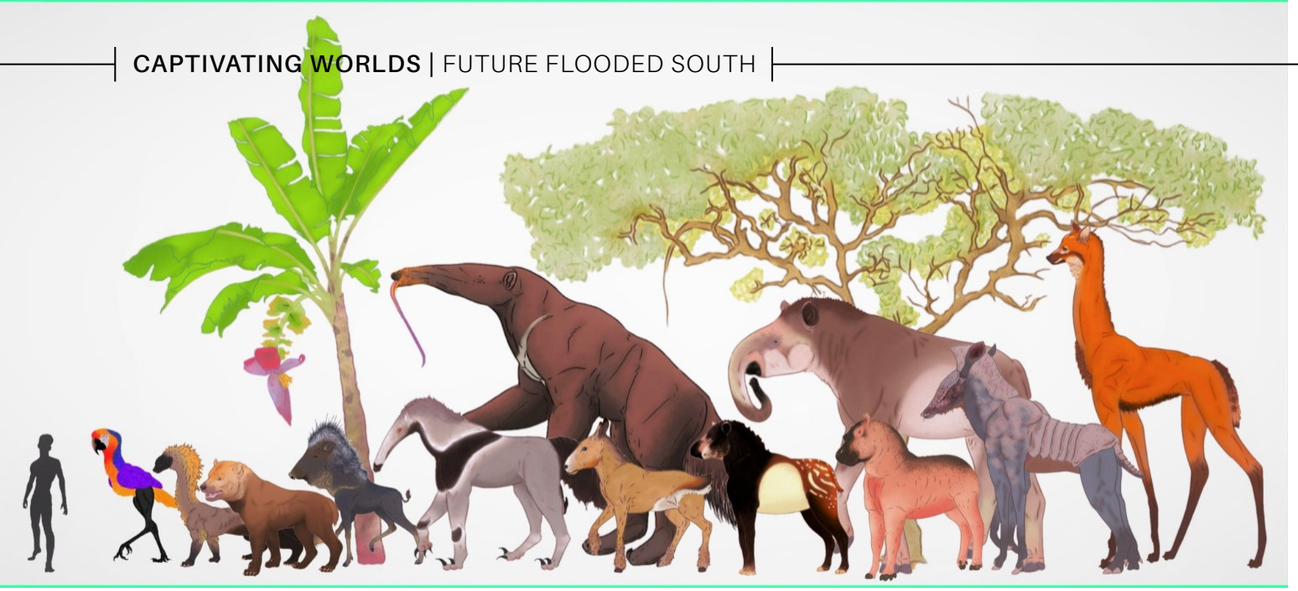
Other Examples and Oddities. The species above are only a few of the most shocking examples that display how the Flooded South America has changed in the future. Although there are likely many new species yet to be discovered across the continent, below are a few other examples of oddities beginning to arise:

The Macawalk (Terrara purpura) is a giant flightless parrot with a somewhat convoluted history. It is unclear whether these terrestrial parrots descended from different populations of flying parrots or if a single population of ancestral flying parrots turned flightless thus forming all Macawalk species. Whatever the case, one thing is clear, all species enjoy feeding on large melon-like ground fruits.

The Alpecari (Alpecari alitis) is perhaps one of, if not the, most peculiar creatures to now inhabit South America (see Species Chart). Often referred to as the "doink '' the Alpecari is a pig relative that has served as a replacement for deer. After the unfortunate extinction of cervids on the continent, peccary radiated to fill the niche, with the result being an odd tall pig-deer creature that



The New Trees. *Size comparison of the Giant Mutant Banana tree (top) and the False Acacia tree (bottom).*



Size Comparison. *The two species of tree, the animals featured in the article, plus a few additional species lined up to compare sizes.*

loves to frolic through the rainforests and grasslands.

South America is also now home to many equinoids (see Species Chart). This is possible because the flooding has divided the landmass into three geographic regions, each with its own equinoid, and each species does not share the same diet. They are the Slowpoke (Tardiungula mavrozoni) an anteater, the Cavykey (Roderequus rhindolichos) a rodent, the Neohorse (Novequus maculosus) a tapir, and the Kelpie (Hippoproteus kelpie) a hippo.

Last on this list is the Hexdilliorse (Dactylopodi panopliippos), a bizarre xenarthran. Descended from armadillos, it is speculated that this new genus had an arboreal ancestor. This would imply that at some point armadillos became arboreal. As of yet, this is not yet known. Another thought is that its odd assemblage of digit-legs might be related to the cause of humanity's collapse. Whatever is the reason, its four front legs are actually elongated fingers not unlike a horse's, only more specialized. Although unique in appearance, the Hexdilliorse occupies a niche between that of its distant cousins the Slowpoke and Snouted Sloth.

As an isolated landmass, the south american continent has produced many new and bizarre specimens yet again.

WELCOME TO GALARIUS

BY PEDRO MANOEL MODANEZI MARTINS — *INSTAGRAM: @pedro_m_specbio*

The human race was at the peak of our technological knowledge and development while beginning their search for a habitable planet. Many star systems with planets were observed and casted aside, but after much research and struggle, a perfectly habitable planet was found. Orbiting around an A-type-star, Galarius is a low gravity planet, with its diameter being ¼ times smaller than Earth's. It is roughly the same size as Mars in comparison, and its atmosphere is thinner and less dense due to more radiation blowing across the planet by its sequence star. Despite life's struggle to evolve on Galarius, life still found a way to survive and thrive among these harsh conditions.

The Rocky Plains. Since the mothership landed on Galarius, probes were released with the mission of reconnaissance. One of the first biomes ever discovered were the Rocky Plains, a desert of stone with little rain and astonishingly hot days and cold nights. This rocky formation reaches to the far extremities of the planet's poles—with its lightly colored rocks responsible for reflecting 10-15% of the star's radiation. Surprisingly there is life living in this arid biome. The *Aetariusicarius rubrarpon*, meaning "lonely bronze being with a red harpoon", is about the size of a *T. Rex* when not on all fours. It's a liquivore-carnivore which hunts alone; a distant cousin from Rupons (a species that inhabits the Wine Desert). When it finds a suitable mating partner, a monogamous relationship is formed with the female giving birth to 3 individuals. The species has two sexes and little to no sexual dimorphism (they rely on pheromones to differentiate one of another). The purple-ish fungal organism attached to a larger rock (seen on the left) is an organism that generates energy through heating—in this case it's using the heat provided by the rock (as consequence of the sun heat) that it's annexed into. The taller ones are dark green in color for absorbing as much light as possible; using its large leaves for the same purpose. This species are

The Rocky Plains. *An arid plain environment populated by rocks. The creature on the right is known as the* A. Rubrarpon*, a liquivore-carnivore which roams these plains.*

just like cactuses from Earth—accumulating as much water as possible to survive with defensive mechanisms like long, sharp spikes. The small dark ones are funguses; if any creature gets perforated by any of its spikes, the spikes break apart and the organism continues its life inside of the attacker, growing perpetually until the animal's organs ruptures and dies.

The Wine Desert. It's ironic that after the rainy season the desert grounds become the driest substrate on the entire planet. These expansive deserts are called the "Wine Desert" for a reason—it is made up of sand that is mostly purple in color due to the shells of a certain species of bacteria. During average months, the sand does not adopt this coloration as the bacteria are inactive when in dry substrates. But when contact is made with water, the sand takes on its vibrant tonality.

Plants in the Wine Desert are tall but are little in quantity. Like plants found on Earth, seeds are produced in multitude to spread across the barren land via wind or water.

Dionysus una, a name meaning "single Dionysus", is the first ever animal cataloged. Peculiarly, the team hasn't found any other species related to it genetically. The coloration of the skin on this species isn't derived from the bacterium within the desert sands and likely comes from another source. With uncovered skin and any kind of scales or wrinkles, perhaps this species is adapted for dealing with high temperature environments caused by solar heat? There is a thick fat layer on its back where it stores water which the species finds in oases. Its antennae are used to maintain its orientation and navigational senses; using the planet's magnetic field along with their heightened sense of hearing and smell. They have been observed to be quite social creatures, communicating among themselves through whistles and grunts in complex patterns.

The Vertebra Walls. Another biome found on Galarius is a bizarre one. It has an interesting discovery which was recorded by a team of human explorers as they experienced the Vertebra Walls for the first time:

CATALOGING DESERTIC PLANTS #1:

"My team and I have discovered plant-like life beyond the canyon's formation. They average around 1.80 meters tall... one of ours tried to gently push the plant from its actual site, but it was in vain. The plant hasn't budged a centimeter! Perhaps this is due to unusually deep roots..."

The Wine Desert. *Three* D. Una *traverse the desert plains as day becomes night.*

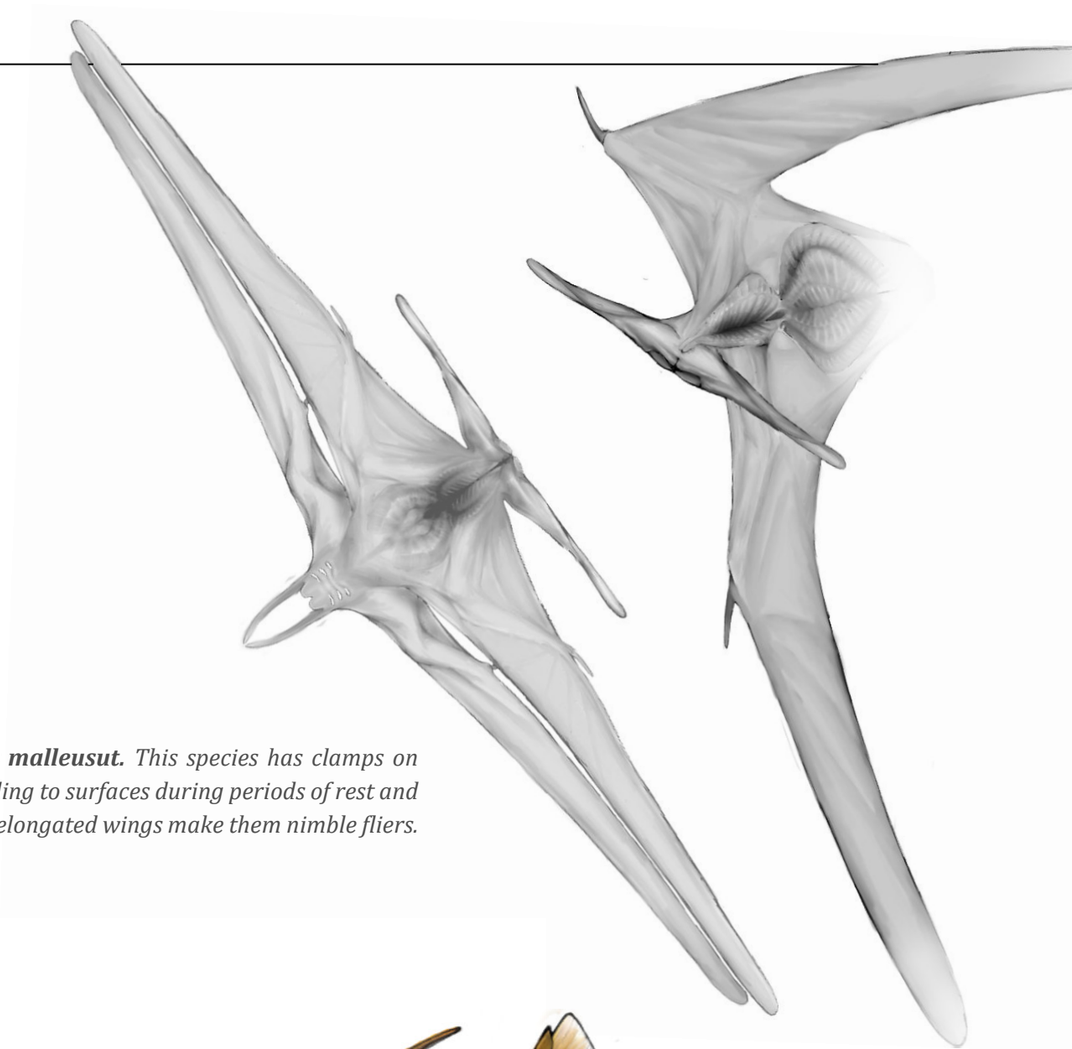
The Vertebra Walls. *Large roots from native plants found on Galarius harshly drop downward stretching sometimes hundreds of kilometers.*

CATALOGING DESERTIC PLANTS #2:

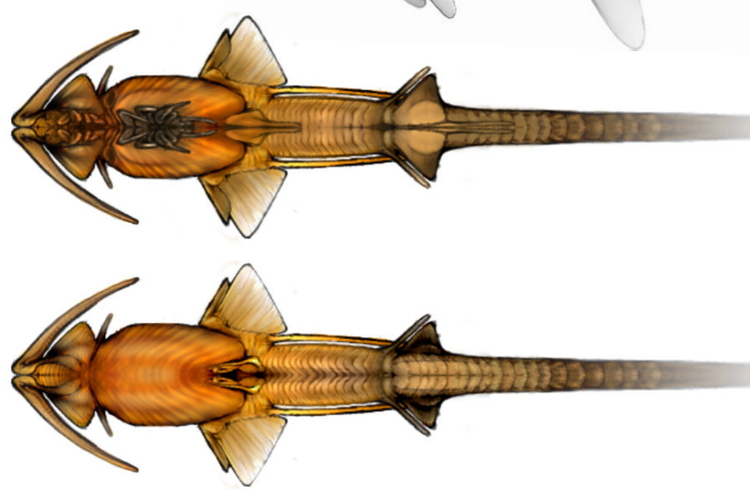
"There are roots that extend far away from the main body of the plant. After completing our observations, we decided on following the direction of one of these tall plants and its roots for about half an hour. The team and I were amazed by what was found! We seemed to have stumbled into an entirely new biome, formed by the roots of these bizarre plants!

CATALOGING DESERTIC PLANTS #3:

"It goes down the entire canyon formation until reaching an aqueous solution [water]. New roots structures are grown down here... It looks that the main plant is totally dependent on this biome, and perhaps all other plants are interlinked. If one individual collapses, then so will another, and another... Also, we've found an unknown group of creatures flying there..!"



Planuganis malleusut. *This species has clamps on its head to cling to surfaces during periods of rest and sleep. Their elongated wings make them nimble fliers.*

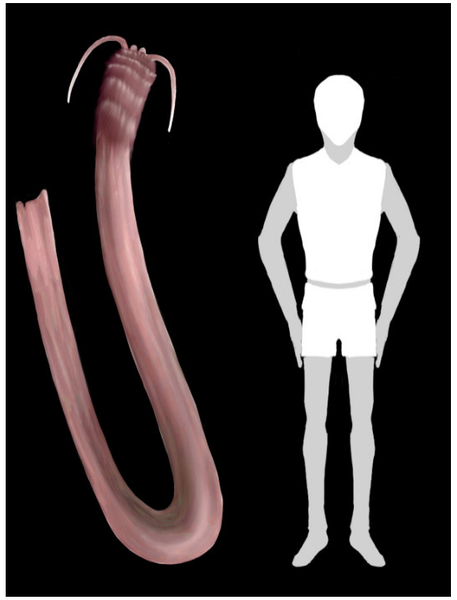


Planuganis malleusut. *This is the first aquatic creature found on Galarius. It has a flexible body and can squeeze through tight spaces (similar to that of octopuses on Earth).*

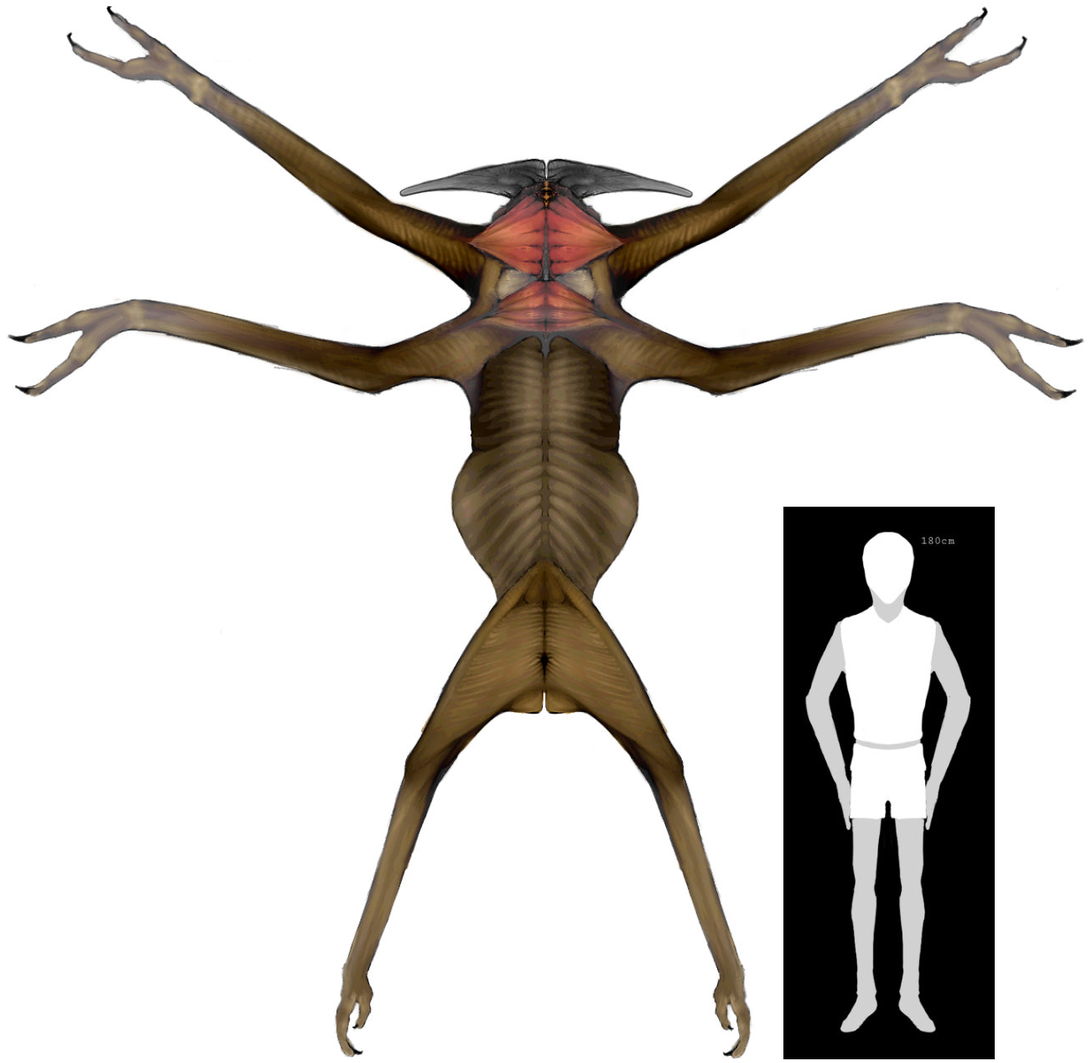
The Planuganis malleusut. This creature is a distant cousin of the 'strangles', but their reproduction is similar to the aforementioned species. *P. malleusut* occupy different niches and is a carnivorous being. Just like the difference between modern butterflies and prehistoric ones, liquivores and carnivores both have mandibles, respectively. They always hunt in schools of about 25 individuals. They have an unusual clamp found atop their heads which is used during periods of rest or sleep, similar to bats on Earth and how they use hang on surfaces during periods of rest.

The *Amalgascinsectum partilantis*. This is the first aquatic creature found on Galarius. It has a flexible body. This flexibility is used for navigating through tight spaces (similar to that of octopuses on Earth). When threatened, the animal rapidly swims up the water column and then breaches the water's surface. Its long antennas are used to search for food as well as for vision. The reproductive system is found on the specimen's back for females and on the other side for males; so both sexes can keep on swimming in a stable way while keeping an eye open for any possible obstacles or predators.

Animal Senses. The team is still researching how exactly Galarusians can see the world. One of the best hypotheses is that these creatures use some kind of hyper sensitive compass upon their head apparatus, similar to how cows, penguins, and many other animals back on Earth know how to find their way back home. Perhaps there are electromagnetic sensors that help enhance or assist in navigation?



Capilovermis gigas. *A worm-like creature that feeds on debris and smaller organisms it can get a hold of.*



Sexarmalaput batable. *This species inhabits dense forests and can reach 2.6 meters tall.*

EXTRATERRESTRIAL ROCKS

EXPLORATIONS OF SPECULATIVE MINERALOGY

BY MAJA OREŠKOVIĆ IGRIĆ — *INSTAGRAM: @songsforotherearths*
WEBSITE: www.extraterrestrialrocks.wordpress.com

Astrovitae Magazine and Artificial Intelligence: *The extraterrestrial rocks pictured in this article were created with artificial intelligence (AI), specifically with Nightcafe Studio, using only terms from mineralogy and photography for prompts. There is much controversy surrounding the use of AI in the online art community, and although I personally have an anti-AI stance myself, I felt that the contents of this article were significant enough to warrant publication. Many speculative biology projects neglect geobiological interactions—and by sharing speculative minerals, I hope to open the eyes of many artists and inspire them to create similar interactions within their own imagined worlds. ~ Domenic Pennetta*

> **"We see this intertwined co-evolution of the geosphere and biosphere. Life begets rock, rocks beget life.**
>
> — *DR. ROBERT HAZEN, SCIENTIST RESEARCHING THE ROLE OF MINERALS IN LIFE'S ORIGINS.*

Extraterrestrial Rocks is a project concerned with the discovery of minerals that have been formed by various imagined life forms around the Milky Way galaxy. I imagine visiting these different exoplanets that have already been discovered but yet to be observed—visualizing the native life and, more importantly, its interaction with available matter. This project removes the focus from biological life forms and instead puts emphasis on geological forms. Biological processes are often a vital part of geological processes, so I try to imagine how these interactions may play out to produce colorful and exciting new minerals. These imagined minerals are chemically realistic because they are heavily based on minerals that already exist here on Earth, even though I often hypothesize about their biological origins on other planets.

If life evolved on other planets, then these planets will certainly have minerals evolving alongside organisms. Exotic life forms may produce diverse mineral formations, and vice versa. I am personally interested in this area of exploration because it allows us to think about life from a different perspective—observing new possibilities and constraints all based on different geological formations that may display bizarre interactions. It allows us to think about the holistic effects life can have on the evolution of a planet as a whole. A discovery of a planet with alien life also means a discovery of alien minerals, and this is a whole new landscape that invites us to explore!

We have yet to discover alien life, and while it is exciting to think about what aliens might look like morphologically or behaviorally, we know that they must be immersed in their planet's geochemistry—they need to find ways to manipulate available geological materials into their private biochemistry; which opens a door to all the potential possibilities that may arise. It excites me to think about life not as something that simply grows on planets, but as a force that creates planets—a force that creates its own environment on a small or large scale, and therefore actively participates in planetary evolution.

Libraetite. Libraetite is a mineral found on an exomoon that orbits a Jovian exoplanet 23 Librae b that orbits the star 23 Librae, 85 light-years away from the Earth. Libraetite is a hydrated sulfate mineral with copper and aluminum. In the picture we see it as small, tabular blue crystals that follow the growth of the microscopic life forms—with the whole formation being just 3 cm tall.

Libraetite's composition can vary in water content and therefore varies in blue coloration as well. It appears that life forms use the mineral as a shell for protection and as water storage in periods of intense drought. When life forms decay, libraetite is deposited in layers of rock that can give the landscape a gentle blue shine that can even be seen from space.

Samhan. Samhan is a mineral found on an exomoon that orbits an exoplanet called Upsilon Andromedae c. The Upsilon Andromedae star is located 44 light-years away from the Earth. Samhan is a soft rock of various hardness due to the variability of its water content. Microscopic life forms use samhan as a medium to live within, and they are able to actively manipulate the rock. The

rocks are high in water content, and as they grow in a hyperbolic[1] manner, microorganisms direct the shape of the rock by releasing more water into it, making the rock soft and sometimes even gelatinous (this whole process is visible inside the rock). This process is how Samhan-inhabiting life forms change their environment, and because Samhan is a widespread silicate rock, it is how life is directly involved in shaping the exomoon's surface.

Doradoa. Doradoa is an oxide rock found on an Earth-sized exoplanet, TOI-700 d, which orbits within the habitable zone of a star 101 light-years away from the Earth. Doradoa is an old rock, several hundred million years old. It is a remnant of ancient bioprocesses that depended on organotin[2] compounds which ancient microscopic life forms used in their metabolism. When colonies of life forms decayed, and organotin compounds decomposed, tin was leached and it crystallized into oxides that can be found in pockets near the places where life forms lived.

Wisite. Wisite is a rock found on Gliese 514 b, an exoplanet 25 light-years away from the Earth. Wisite was formed around biological activity of miniature life forms whose metabolism depended on changing oxidation states of organocopper[3] compounds. Part of the copper is deposited outside of life forms where it forms blue and green minerals. Colors depend on the amount of copper; with blue rocks containing more copper. The color is also affected by the acidity of the immediate environment, with carbonated water from biological, acidic waste products making the rock look greener. The wisites pictured on page 44-45 are just 1 cm wide, the picture (a) is showing the early stage of growth whereas the (b) is showing the advanced stage. It is estimated that it takes about 1000 Earth years to proceed to the advanced stage. The life forms are quite long living. Sometimes large areas of planetary surface are covered in blue green pebbles from both living and decayed life forms.

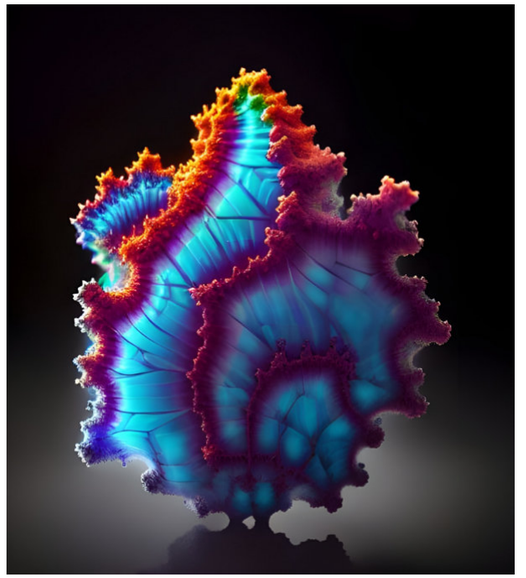
Rossy. Rossy is sulfosalt found on Ross 128 b, an Earth-sized exoplanet that orbits a star 11 light-years away from the Earth. Rossy consists of silver and it was deposited by biological

Footnotes:

[1]**Hyperbolic** - A hyperbola, which is a type of smooth curve or line lying in a plane.

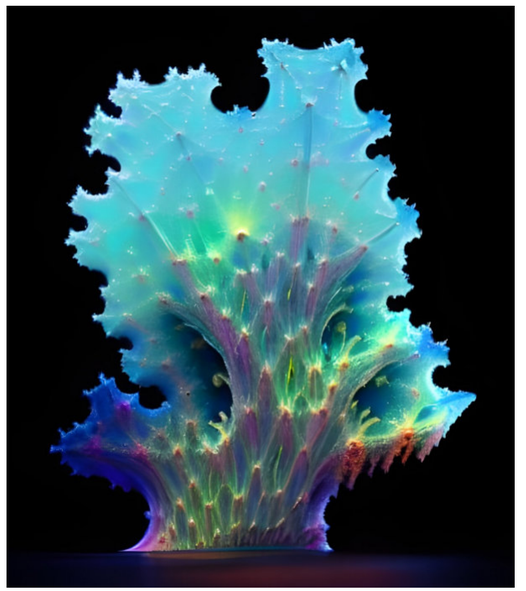
[2]**Organotin** - Compounds with at least one covalent bonds between tin and carbon.

[3]**Organocopper** - Compounds containing a carbon to copper chemical bond.



Libreatite

Group: *hydrated sulfates*
Crystal system: *orthorhombic*
Composition: *Cu, Al, S, O, H2O*
Color: *blue*
Habit: *crusts, tabular crystals*
Hardness: *1.5*
Cleavage: *none*
Fracture: *uneven*
Luster: *silky*
Streak: *blue*
Specific gravity: *2.5*
Transparency: *translucent*



Samhan

Group: *silicate*
Crystal system: *amorphous*
Composition: *Si, O, H2O*
Color: *cyan, light blue, yellow, red, white*
Habit: *massive*
Hardness: *1-6*
Cleavage: *none*
Fracture: *conchoidal*
Luster: *vitreous*
Streak: *white*
Specific gravity: *2*
Transparency: *translucent*

Doradoa

Group: *oxide*
Crystal system: *tetragonal*
Composition: *Sn, O, impurities*
Color: *brown, black, purple*
Habit: *prismatic*
Hardness: *6-7*
Cleavage: *indistinct*
Fracture: *uneven*
Luster: *adamantine*
Streak: *white*
Specific gravity: *7*
Transparency: *transparent to opaque*

Wisite *(Early Growth Stage)*

Group: *carbonate*
Crystal system: *monoclinic*
Composition: *Cu, C, O, H, impurities*
Color: *green, black, blue*
Habit: *massive, botryoidal*
Hardness: *3-4*
Cleavage: *perfect*
Fracture: *brittle*
Lustre: *adamantine to silky*
Streak: *green, blue*
Specific *gravity: 4*
Transparency: *translucent*

processes in the distant past hundreds of millions years ago, where microscopic life forms used silver's high electrical conductivity for their metabolism. Rossy itself is not conductive unless it interacts with electrolytes and then it displays ionic conductivity along sulfur-silver bonds. It is believed that ancient life forms mediated conductivity by such interactions because similar bioelectrical processes still exist on the exoplanet.

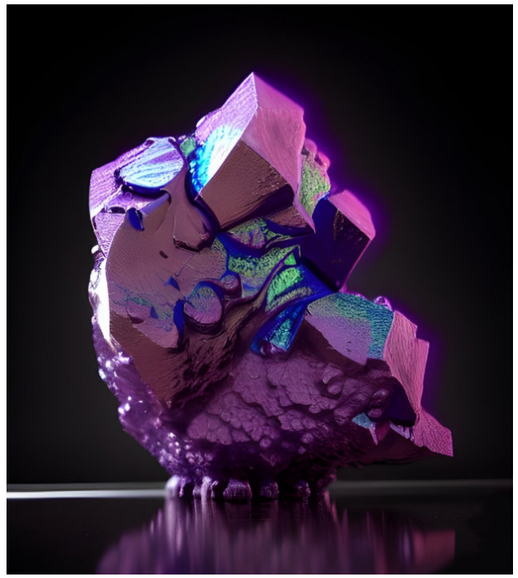
Spitzerite. Spitzerite is a sulfate rock found on TRAPPIST-1e, an exoplanet that orbits within the habitable zone of TRAPPIST-1. Spitzerite is normally an iron rock but due to the biological activity of microscopic life forms whose metabolism is tied to copper, it becomes blue if exposed to copper containing decaying biological matter.

Trap. Trap is a mineral found on TRAPPIST-1d, an exoplanet in the same system as the previous one. Trap from iron rock formed in hydrothermal veins by iron deposition by iron metabolizing life forms (yellow layers). In the picture green layers are also visible, these are richer in copper. (Purple parts are microcrystalline silicates.)

Pictorite. The last mineral, pictorite, is found on an exoplanet HD 40307d, 42 light-years away from the Earth. In the picture it is visible as tiny blue and purple masses on the surface of a miniature life form (4 cm in size). These life forms are one of many that grow on volcanic material and they use these mineral masses to remove extra copper from their systems. Tiny blue and purple masses fall off the life forms and create localized blue surfaces, a beautiful scenery on the exoplanet.

Wisite *(Advanced Growth Stage)*

Group: *carbonate*
Crystal system: *monoclinic*
Composition: *Cu, C, O, H, impurities*
Color: *green, black, blue*
Habit: *massive, botryoidal*
Hardness: *3-4*
Cleavage: *perfect*
Fracture: *brittle*
Lustre: *adamantine to silky*
Streak: *green, blue*
Specific *gravity: 4*
Transparency: *translucent*



Rossy

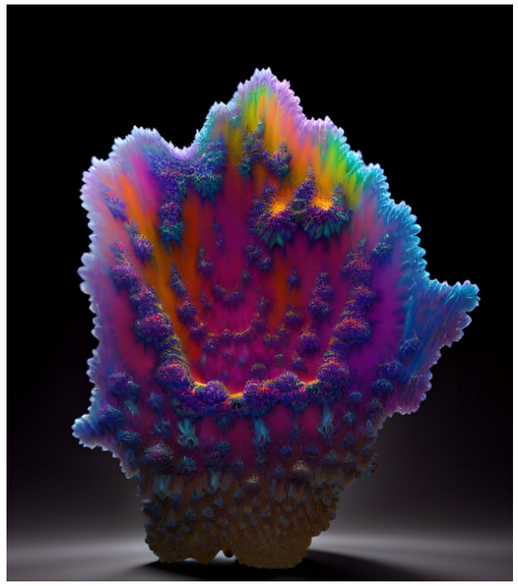
Group: *sulfosalt*
Crystal system: *trigonal*
Composition: *Ag, Sb, S, impurities*
Color: *violet, red, black*
Habit: *massive, prismatic*
Hardness: *2*
Cleavage: *distinct*
Fracture: *uneven*
Luster: *adamantine*
Streak: *purple*
Specific gravity: *6*
Transparency: *translucent*

Trap

Group: *carbonate*
Crystal system: *trigonal*
Composition: *Fe, C, O, Cu, impurities*
Color: *yellow, red, brown, green*
Habit: *massive, botryoidal*
Hardness: *3-4*
Cleavage: *perfect*
Fracture: *uneven*
Luster: *vitreous, pearly*
Streak: *white*
Specific gravity: *4*
Transparency: *translucent*

Spitzerite

Group: *sulfate*
Crystal system: *monoclinic*
Composition: *Cu, Fe, O, S, impurities*
Color: *white, blue, green*
Habit: *stalactitic*
Hardness: *2*
Cleavage:
Fracture: *brittle, conchoidal*
Luster: *vitreous*
Streak: *white*
Specific gravity: *2*
Transparency: *translucent*



Pictorite

Group: *sulfide*
Crystal system: *hexagonal*
Composition: *Cu, S*
Color: *blue, purple*
Habit: *foliated*
Hardness: *1.5*
Cleavage: *perfect*
Fracture: *uneven*
Luster: *resinous*
Streak: *gray*
Specific gravity: *4.5*
Transparency: *opaque*

BATRACHITERRA

AN AMPHIBIOUS WORLD SEEDED BY FROGS

BY J.F. — *WEBSITE: www.sites.google.com/view/batrachiterra*
DEVIANTART: joaovitor45556

Batrachiterra is a seed world project incorporating many species of frog. The frog species which were seeded were: *Rhinella marina* (the cane toad), *Incilius alvarius* (the Colorado river toad), *Phyllomedusa bicolor* (the giant leaf frog), *Bufo bufo* (the common toad) and *Dendrobates spp.* (poison dart frogs).

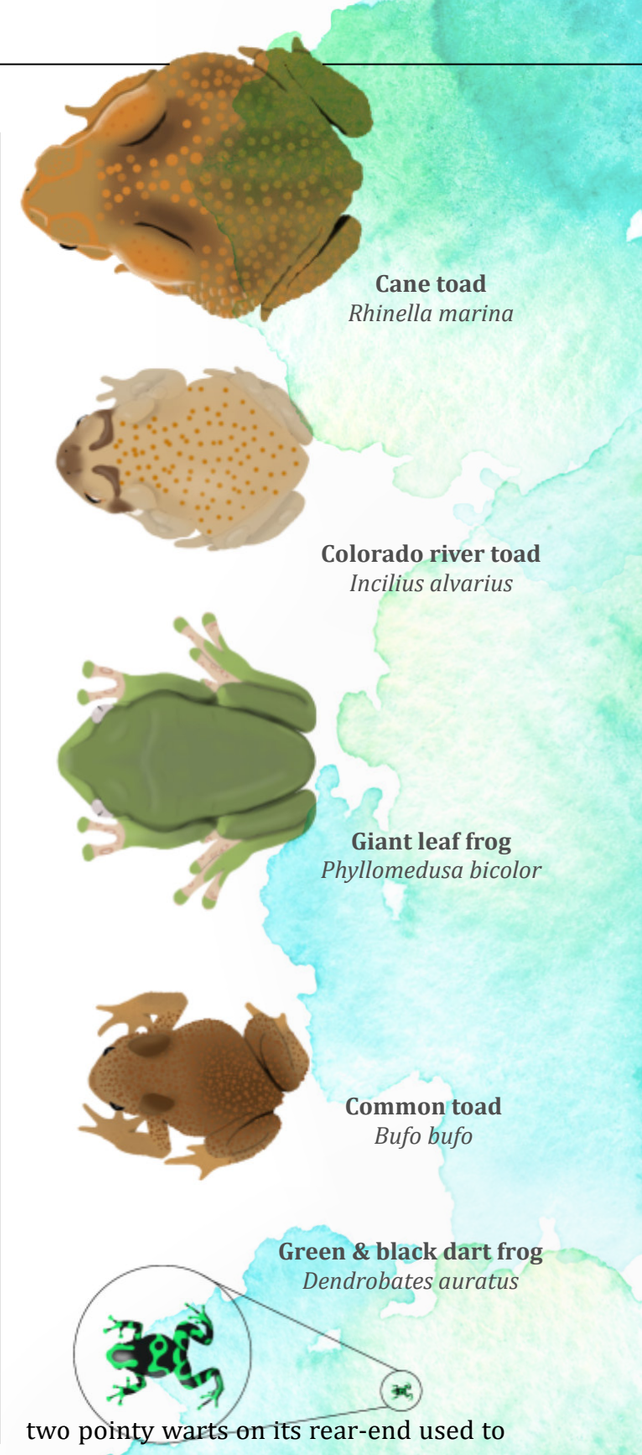
Other Seeded Species. Along with the species of frogs aforementioned, numerous invertebrates including myriapods like millipedes and centipedes, dipterans such as mosquitoes and assassin flies, hymenopterans such as carpenter bees and fire ants, and marine invertebrates like tunicates and barnacles, were all incorporated into this seeded world. The project is on the early stage of evolution taking place on the planet Heqet, which had been abandoned by humans after they terraformed it into a hospitable world and used it to study batrachotoxin of the yet-to-be "seeded" frogs. The species brought to the planet were not intended to live outside laboratories, nor evolve freely.

The first millions of years will be significant for evolution on Heqet, as the introduced animals and plants now present on the world will fill vacant niches—niches which would have been filled by other organisms back on Earth. This will lead to new exciting evolutionary forms as there will be little competition to speciate across these niches.

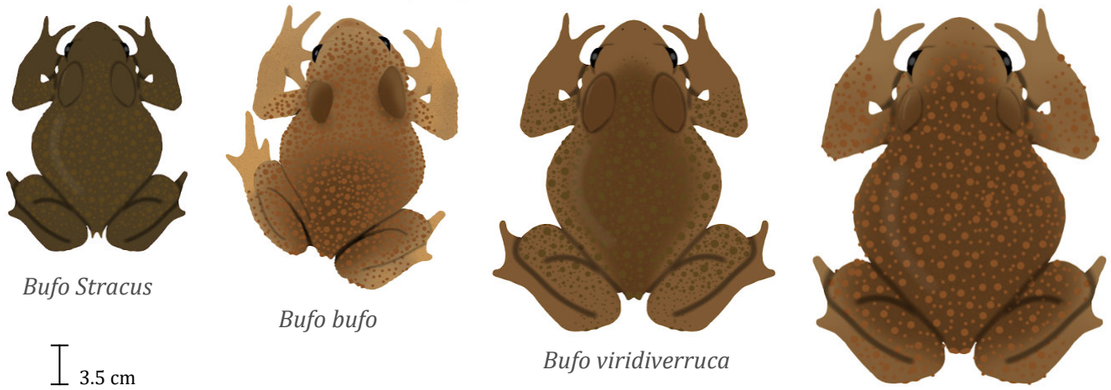
Heqet During the First Millenia. The planet Heqet has three major land masses. First there is Bufia, the smallest continent (see the map) which is seeded solely with common toads and alderflies. Second is Batrachia, pictured in the middle which was seeded with giant leaf frogs and the poison dart frogs. And the last continent, Incilia, is seeded with the cane toads and the Colorado river toads.

While exploring the newly evolved life on the continent of Bufia, here the sole endemic toad species is the common toad. Without competition from other frog species, the common toads specialized to learn different behaviors and habitats, and adapt to new diets. *Bufo gigas*, the giant toad, is a species that evolved to predate upon everything that fits in their mouth, and thus, evolved a larger size in order to hunt a wider variety of prey like other toads and invertebrates. They are resistant to the bufotoxin of other toad species and have actually started to lose their own paratoid glands, glands which are used to secrete the bufotoxin used in defense against predators (which the giant toad now no longer has in the wild).

The other two species, *B. viridiverruca* and *B. stracus* are respectively adapted to a semi-aquatic lifestyle and a burrowing one. *B. viridiverruca*, the green-warted toad, is undoubtedly the most water-dependent toad species as it spends most of its life underwater hunting for aquatic prey such as insect larvae, isopods, and tadpoles of other species and sometimes even their own. Due to increased cannibalism by their own species *B. viridiverruca* learned parental behaviors, such as the male toad protecting a clutch of eggs until they hatch, and later, defending the tadpoles who entirely rely on their father for safety. *B. stracus*, the spiky-butted toad, is a burrowing toad with dark skin used for camouflage in dark environments and also possesses two pointy warts on its rear-end used to



The Uncommon Toads



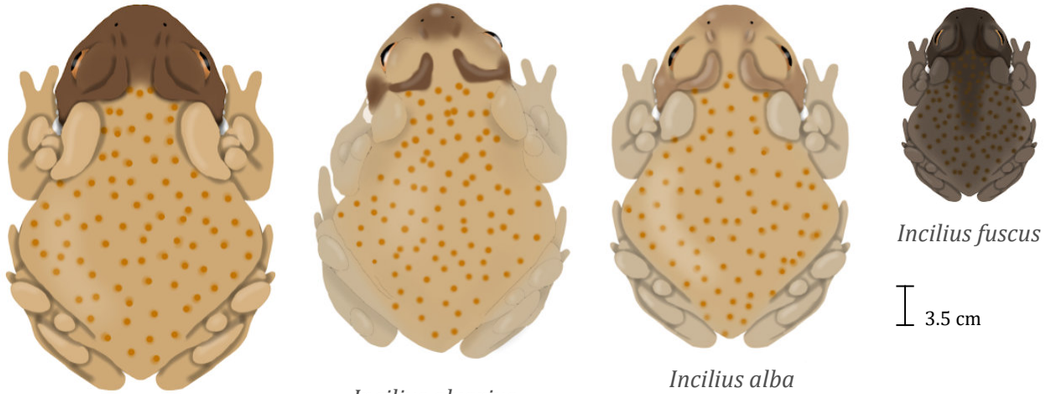
Bufo Stracus

Bufo bufo

Bufo viridiverruca

Bufo gigas

The Desert Dwellers



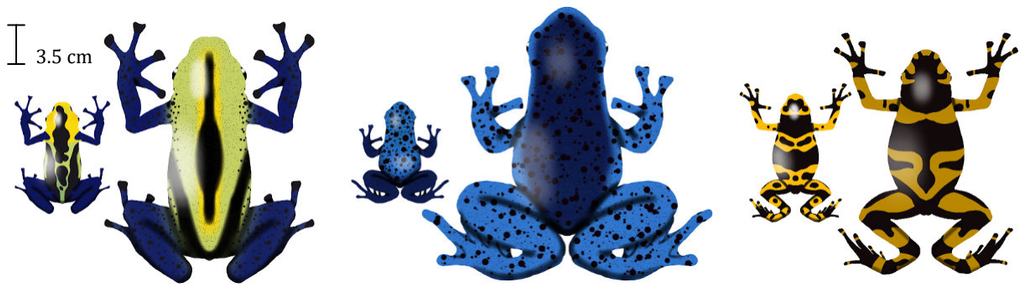
Incilius fscucephalus

Incilius alvarius

Incilius alba

Incilius fuscus

The New Dendrobates



Ancestral *D. Tinctorius* (left) compared to *D. Vulgaris* (right)

D. azureus (left) compared to *D. Hydrica* (right)

Ancestral *D. Tinctorius* (left) compared to *D. Vulgaris* (right)

defend its burrow from predators. They also have short but strong limbs used to push dirt around and create their burrows.

There are two genera of frogs on Batrachia, the *Dendrobates spp.* and the *Phyllomedusa bicolor,* two frogs which do not compete directly due to a great difference in size; leading to niche partitioning without much competition.

The poison dart frogs experienced many changes in size, with a few species growing twice the size of their ancestors on Earth. They also started to adopt less conspicuous coloration that once was used to warn predators of their high toxicity. After 1 million of years of a severe lack of predation, these tiny frogs started to grow hungry for new diets and lifestyles besides feeding entirely on small prey such as ants.

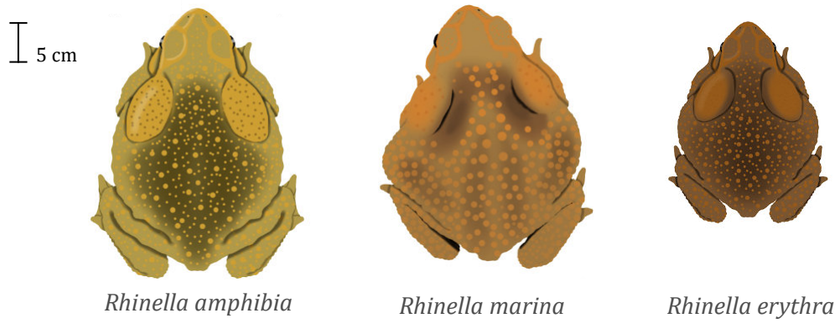
D. saltatorius is the smallest species; they have more inconspicuous coloration to better blend in with the surrounding leaves of trees and other plants they climb. As the most scansorial of all the dendrobates, *D. saltatorius* evolved stronger hind limbs compared to their ancestors.

D. terrestris is, as its name implies, very terrestrial. Its coloration supposedly mimics the dead leaves of the forest floor where they reside in groups of 6-10 frogs—all fiercely fighting for territory. These frogs enter a state similar to hibernation called 'aestivation', where they sleep through the driest season in a burrow to wake up in the autumn when it is more damp. *D. vulgaris* is the most common of the new dendrobatids even though their range is smaller than the range of *D. terrestris*.

D. hydrica is the most divergent of the dendrobatids, they are semi aquatic and have turned their blue aposematic coloration into a countershading coloration, with the darkest area being located in their backs and the belly being lighter in comparison. Their tadpoles can tolerate brackish water, a trait possessed by the ancestral *D. tinctorius*, and they use this trait as an advantage since no other frogs can tolerate as much salt in the water as they do. The larvae of *D. hydrica* tend to stay in brackish water in order to avoid predation.

The largest amphibians on the continent are the leaf frogs. These frogs are highly arboreal and may spend their entire adult lives on the forest canopy where they have an accentuated sexual dimorphism where the females are more or less the double of the males s-v length (snout to vent length). The females fold

The Gluttons



Rhinella amphibia *Rhinella marina* *Rhinella erythra*

leaves and lay their eggs inside the folded leaves so that the eggs hatch and drop directly to the water below.

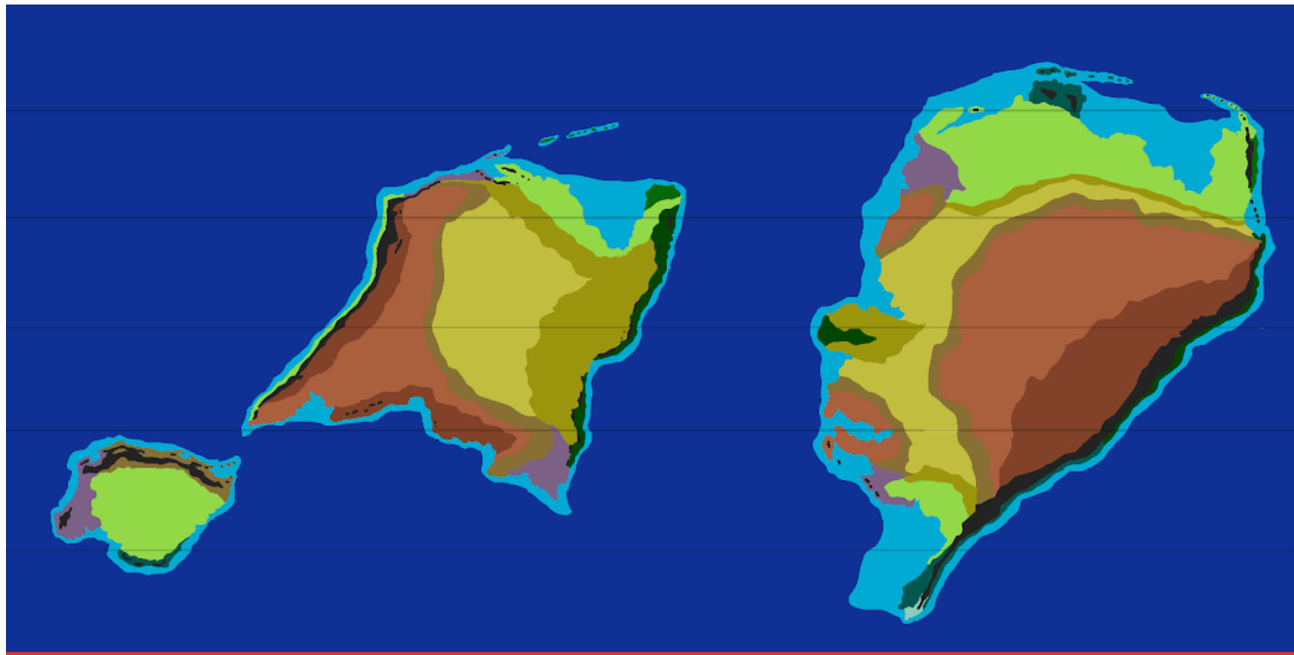
P. gigas is not that different from the ancestral leaf frog, except that as their name suggests, they are usually larger than their ancestors (even the males). This is likely due to their tendency to hunt much smaller frogs.

P. hidricus is the largest frog with a truly semi-aquatic lifestyle on the continent, possessing webbed hind feet. *P. gradus* has a completely different lifestyle to that of the other leaf frogs; they are primarily terrestrial, walking slowly through the forest floor and also on the savanna feeding on centipedes, millipedes and other frogs if the opportunity arises. The final continent is Incilia, where two species of true toads were seeded: the voracious cane toad and the hallucinogenic Colorado river toad.

As in other continents the amphibians here followed the trend of either becoming fossorial or aquatic, with *R. erythra* being the smallest cane toad seeking out invertebrate prey instead of vertebrates (even though the frog won't hesitate to feed on another toad). And the toad *R. amphibia* returned to a more water dependent lifestyle different from that of the highly terrestrial ancestral cane toad. With the desert dwelling *Incilius alvarius*, to avoid competition with the fierce competitors that cane toads are, this toad has adapted to pretty different behaviors.

The Brown river toad *I. fuscus* is the smallest amphibian in the continent; they are quite adaptive and habitat generalists, hunting underground, on the surface, or underwater, even though they are considered fossorial. *I. fuscucephalus* is large and competes directly with the cane toads.

The last frog we will see is the White toad *I. alba* which live in the most arid regions and tend to hunt crepuscularly, that is, during sunset or sunrise in order to avoid competition with toads who also hunt at night.



Map of Heqet

FLIGHT OF THE WYVERNS

BY ALDRICH HEZEKIAH — *INSTAGRAM: @kiabugboy*

This project is an exercise in taking one familiar animal from our world with a slight modification and imagining how evolution might take them on a path that morphs them into something resembling legends. Garden lizards have always been a permanent fixture where I live. Nimble tree climbers that seem to default to jumping straight down at the slightest hint of danger. A perfect animal to perhaps gain a stretched membrane over elongated fingers that slows their descent. Unlike the *Draco volans*[1] with their expanded ribs, these wyvern agamids[2] would stretch out their two last pair of fingers and have better control over their gliding direction as their arms can adjust the angle of the wings. Instead of leathery wings like bats, theirs are still covered in large overlapping scales, looking much like the dewlap of an iguana.

The first wyvern agamid discovered lived in remote isles somewhere in the fuzzy borders of Sulawesi and the Philippines; where it resembled the common green garden lizards that's widespread throughout South East Asia and most likely shared a common ancestry with *Bronchocela celebensis*[3] that diverged around the same time humans began spreading out of Africa. The strong island breeze, abundance of palm trees, and small rocky outcrops in the coasts made gliding beneficial for the territorial lizards.

Footnotes:

[1]***Draco volans*** - Also called the common flying dragon, this lizard can glide using its ribs that form a winglike structure.

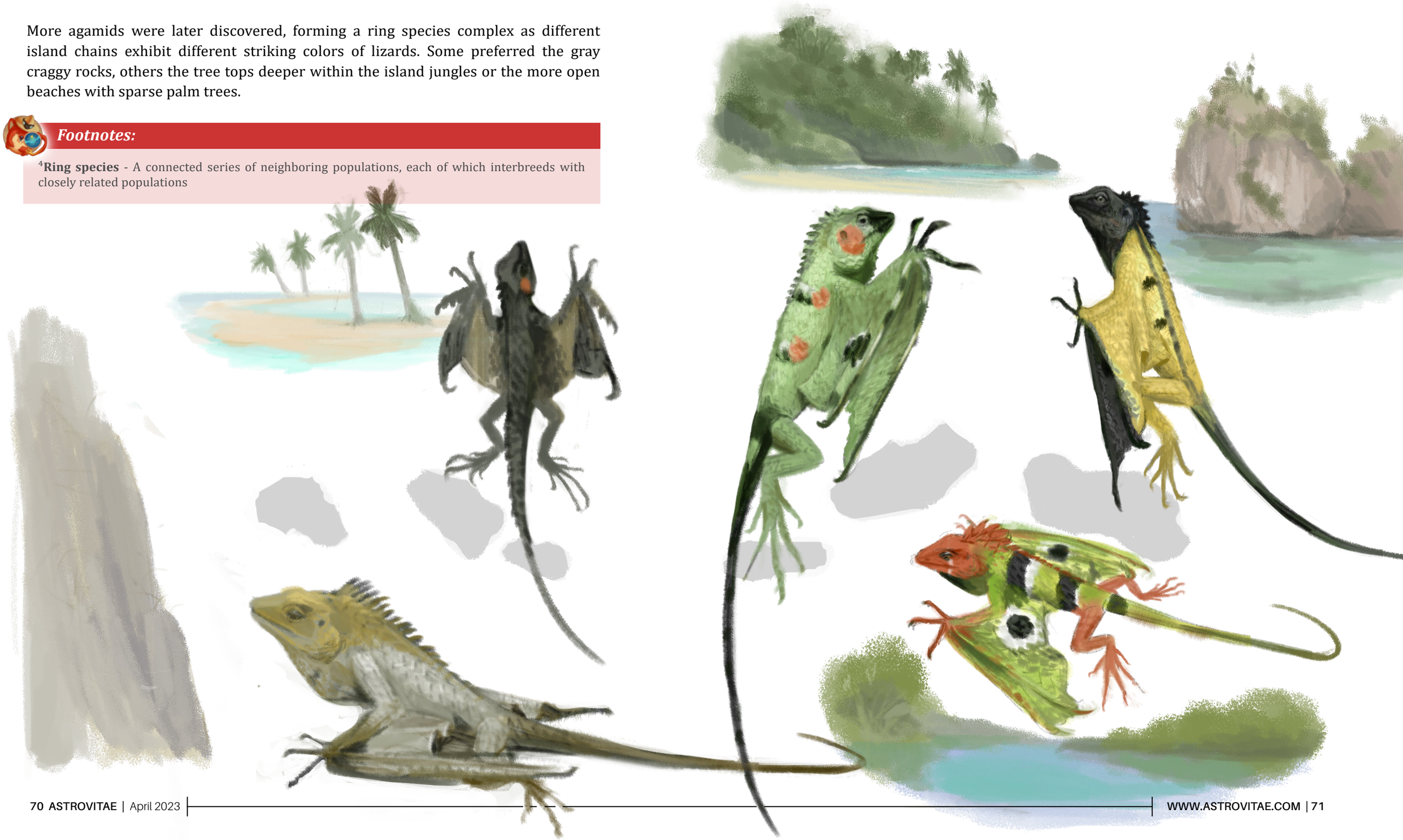
[2]**Agamids** - Iguanian lizards indigenous to Africa, Asia, Australia, Southern Europe; many species are commonly called 'dragons' or 'dragon lizards'.

[3]***Bronchocela celebensis*** - Species of lizard endemic to Indonesia.

More agamids were later discovered, forming a ring species complex as different island chains exhibit different striking colors of lizards. Some preferred the gray craggy rocks, others the tree tops deeper within the island jungles or the more open beaches with sparse palm trees.

Footnotes:

[4]**Ring species** - A connected series of neighboring populations, each of which interbreeds with closely related populations

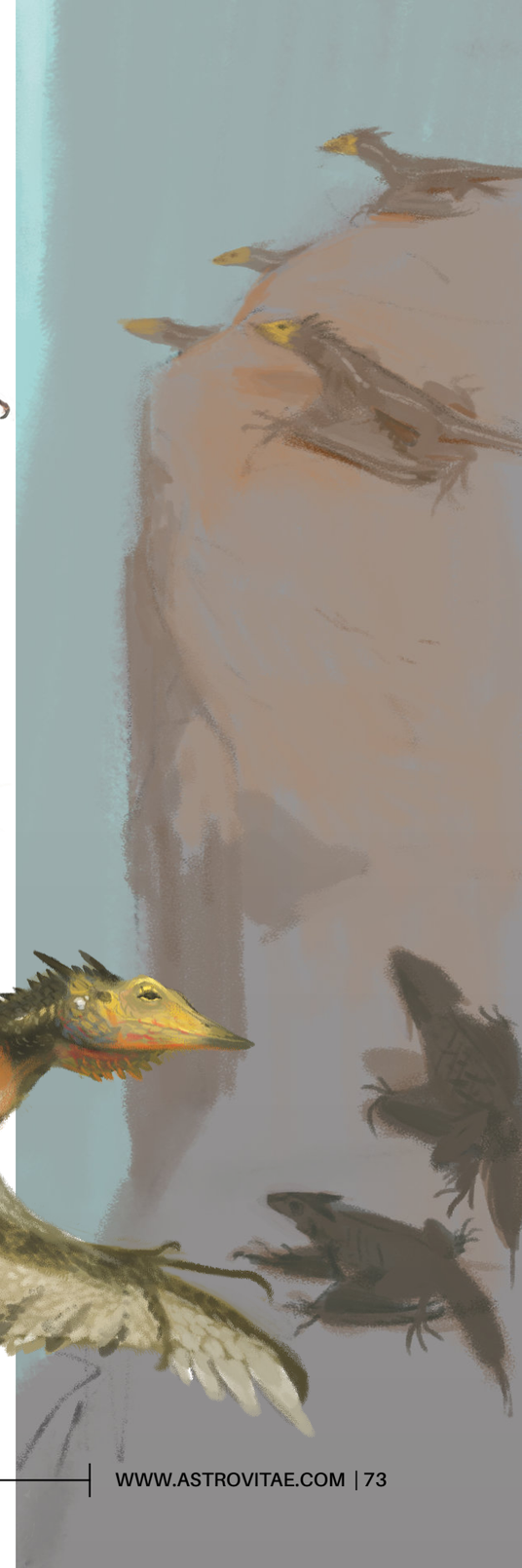


Wyverns in Sarawak. *Sarawak is now in a severely depopulated state following many famines and dustbowls.* Strong winds and decline of human activity hasallowed the lizards to thrive.

Calotes wyverns in Sarawak, now a severely depopulated state following famines and dust bowls. The strong winds and decline of human activity has allowed these lizards to thrive. As we move past the age of man, the anthropocene has stripped the world bare of its previous biodiversity, however the wyverns persevered. Some of the early agamids have made it into the pet trade and established themselves in the urban environment, escaping their home isle's watery grave just as the last remnants of human society begin to dwindle.

Now, what was once a genus has flourished into a family. Gone are the days of the bright colorful tropical agamids, the wyvernidae lizards find themselves living in wind-swept ruins and tall limestone mountains once covered in cloud forests (but now a mere rocky skeleton of itself). In this harsher environment, natural selection favored the lethal. The agamids have always had a certain level of toxicity in their saliva, it is only a matter of time before the wyverns began to develop more potent venom.

The very first spitters needed their ability as self defense, from larger wyverns and other predators. The scales covering the wings also began to be more specialized in the same way bird feathers were.



Further into the future, the Earth is recovering and in a similar state to the early Triassic period. Animals begin to radiate out to fill empty niches, weird organisms that would have died out to fierce competition in the past now roam the warming Earth. Any possible sapient lifeforms trying to inherit the planet must now face the wrath of a fire-starting animal—the wyverns have leapt out of the imagination of man long after humanity perished.

Although the wyverns make clumsy crawlers on land, the environment suits their way of hunting. Multiple wyverns would congregate in a feeding circle around one of the many bushes sparsely dotted throughout the plateau, as the phosphorus rich cliffs provide them ample resources for their matchstick snouts which create sparks. They would get themselves covered in the phosphorus dust and, using the same head-bobbing motion that was once a territorial display for their ancestor, they'd spark fire on twigs, rocks, and dried leaves.

Feeding circle. *Some animals, those who are too fast for the wyvern to catch or ferocious enough to intimidate (like corvids and varanids) have taken advantage of these feeding circles to catch the fleeing prey on their own.*

Fire breath. *Their coarse and phosphorous tipped snouts act like a matchstick, while their saliva glands spray out an oily substance that help spread the initial fire.*

ARTIST SPOTLIGHT

By Maryana Simpson

GLIMPSE OF PLANET KAHLANEA

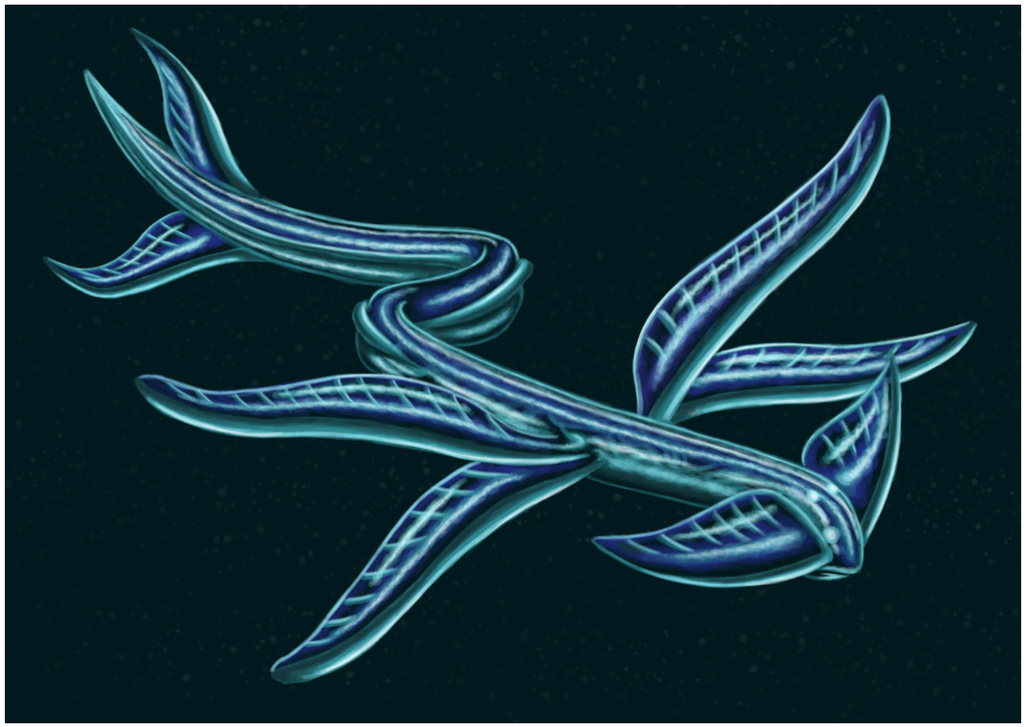
BY MARYANA SIMPSON — *INSTAGRAM: @arapaima_illustrations*
ARTSTATION: maryanasimpson1

Nearly 2 years ago, I stumbled across the first spec bio project that would pique my interest. One soon became many, and before I knew it, I was sucked into the world of speculative biology. These sagas of distant futures and far-away planets, along with the strange new life that dwelled within them, reawakened in me a nostalgic wonder and fascination with the universe that I'd had earlier in my life. Before long, I decided to take the plunge and switch the main focus of my art to speculative biology.

I've learnt and grown a lot as an artist since then, and I'm so grateful for this wonderful community and all the support and interest I've received for my creations. I'm Maryana Simpson, or "Arapaima Illustrations" on Instagram, and I'm a game design student and illustrator from Malta. My spec bio worldbuilding project, Planet Kahlanea, has been in the works for over a year now, and I'd love to properly introduce it!

The World of Planet Kahlanea. My project is set within an Earth-like world and is similar to our own regarding its atmosphere, climate, and geography. Much of the planet's surface is covered by vast, deep oceans which are home to an array of creatures. A common sight in the oceans of Kahlanea are various cnidarian-like species, ranging from simple filter-feeding lifeforms to large, complex animals possessing membranes stretching across their soft bodies. These membranes can contract and release, allowing for more deliberate movements and enabling these animals to fill the niches of more active predators.

Cephalopod-like animals, serpentine creatures, and mammalians equipped with tendrils used to grapple prey are among the other species that dwell within the Kahlanean oceans (the latter of which have some land-dwelling relatives). The volcanic islands located near the planet's equator are home to a few of these species, including semi-aquatic predators that use venom to subdue their prey, and an avian relative that uses the iridescence of its skin to disorient predators with an undulating dance. Iridescence as a means of self-defense is not an uncommon trait among the species of this archipelago, with the giant molluscs often sighted in the rockpools exhibiting a similar means of self-defense.



Lurking in the Deep. *A gargantuan, deep sea cnidarian-like animal inhabiting Kahlanea.*

Another trait often found among the species of Kahlanea is keratinous armor. Armored species have been noted occupying various niches within the ecosystems of this planet, aiding prey animals to avoid deadly wounds and protecting predators from defensive attacks. Over the course of my project, I'll explore various regions within the planet and go into detail about the different environments and lifeforms found within them. You'll see locations ranging from an arid desert, to the depths of the ocean, to a frozen continent—along with the various creatures that call these places their home. Exploration of the planet is currently focused on its Southern hemisphere, with the North remaining a mystery for now—yet I have some exciting plans for what shall be found there.

The Frabora. *A pair of Tropical Frabora, creatures from the planet Kahlanea I have yet to explore in the project.*

Cryptid Influences. One of my main sources of inspiration for this project are Earth's cryptids. A good cryptid story invokes that same air of mystery and want for exploration that makes speculative media so beloved to me, and often, I find myself gravitating towards various legends from around the world when searching for inspiration. Moreover, using life that might exist on our own planet as a starting point in my process suits the Earth-like theme of my project quite well. Other sources of inspiration come from life on Earth itself—both living species, and prehistoric ones. Much of what can be found on Earth is sometimes already surreal and alien looking—take life in the deep sea, or fossilized finds such as Opabinia (an arthropod from theCambrian with a segmented trunk and fan-shaped tail). Taking inspiration from Earth's strangest life forms and giving it an extra-terrestrial twist is another way I come up with creatures for Kahlanea.

The E-Book. As my project grows, I've been working on compiling it into an e-book. Rather than writing a bestiary-style book, I've chosen to instead style the e-book as the journal of an explorer traveling the planet and seeing its various locations and creatures first-hand. I'm hoping that introducing the world of Planet Kahlanea through an explorer's journal will make for a fun, more light-hearted read!

The E-book will feature more in-depth descriptions and observations of the planet's different locations and creatures, some snippets about the expedition itself, and of course, plenty of illustrations. I'm also working on the aesthetic of the book to have it express my chosen style, adding old photograph-style illustrations, aged paper backgrounds, and possibly a handwritten font to really capture the "explorer's notebook" style.

I've recently slowed down my progress on Planet Kahlanea to allow myself some time to create artworks based on different themes and avoid burnout, although I shall certainly continue to work on bringing this project to life. I cannot wait to share my completed creations with you, and I hope there will be more to come in future and that I'll continue to be a part of this growing Community!

Lumbering Behemoth. *A Kahlanean Titanoid, inspired by legends of unknown beasts from the Mojave Desert on Earth.*

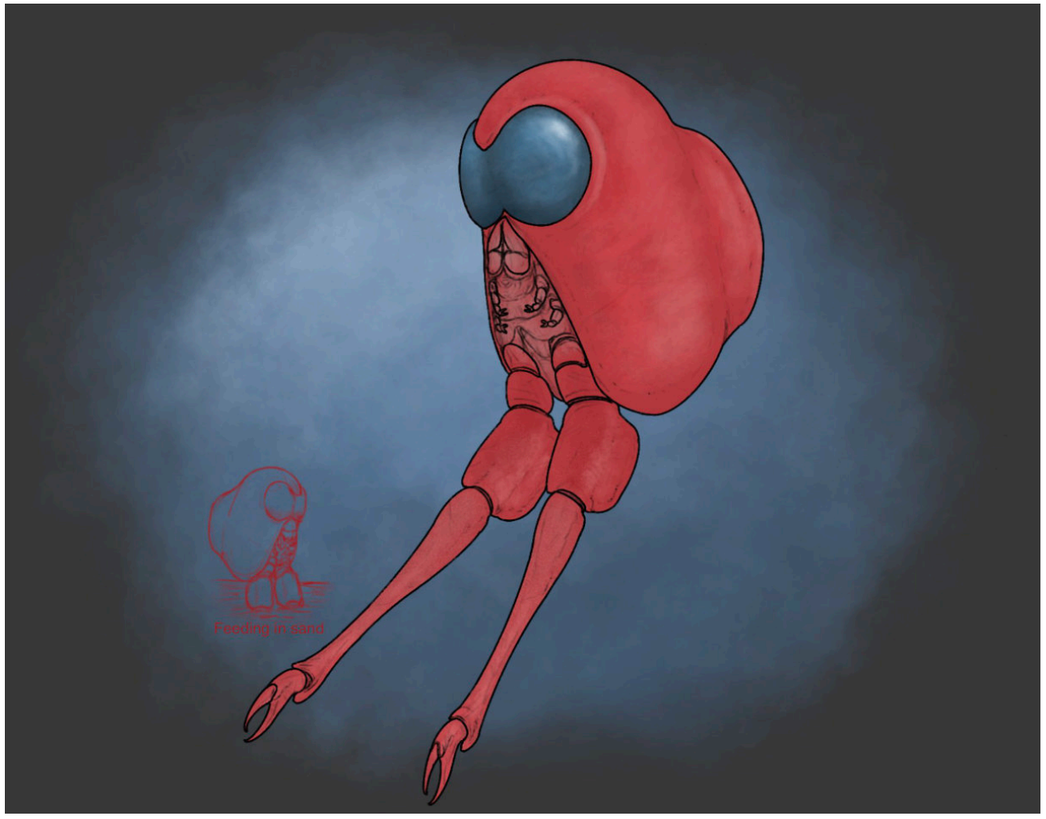
SUSPECTING SUSSOCARIS

BY DOMENIC PENNETTA

This *Artist Spotlight* entry is a bit different. Instead of choosing to focus on my own speculative biology art and experience, I'd rather share a story about another artist I know online. This artist found himself in an interesting predicament—he drew a fictional creature as a joke, and through miscommunication and deliberate online tomfoolery, people believed that it was real. Several larger content creators have beaten me to this story, but I personally know this artist myself from my circle of art friends online, and have a first hand experience of the phenomenon. Here, I want to chronicle the events as they take place and explore how some people online came to believe in a fake animal.

The Origins of Sussocaris. On Wednesday, February 15, 2023, the Twitter user and speculative biology artist by the name of Hop (also known as Qoralinius) posted an illustration based on an old drawing in his new and improved artistic style. This illustration depicted a thylacocephalan—an extinct, bizarre-looking group of arthropods, which lived in the Ordovician until the Late Cretaceous. However, Hop's thylacocephalan was different. This illustration depicted a peculiar species, an individual with two eyes seemingly merged together (jutting out from the carapace instead of beneath it like other thylacocephalans), ridiculously long raptorial appendages, a shortened cylindrical carapice, and a severe lack of any pleopod appendages.

Thylacocephalans already look quite weird, but Hop's thylacocephalan was especially weird. The description accompanying his post read, "Paleoart of the recently discovered thylacocephalan sussocaris, thought to use its long claws to dig up worms." Having known Hop myself, I read this post in his usual sarcastic tone—a tone which later proved imperceptible to many online. Clearly this was a speculative creature; one inspired off of the videogame Among Us and the memes that surround the game which, unfortunately to this day, still live rent free in our heads.



Sussocaris saliti. *The illustration above was created by Hop. Originally it was an old creature design he redrew in his new and improved artistic style.*

A Joke Gone Too Far? The next day on February 16, other artists noticed Hop's peculiar illustration and went on to make their own depictions of sussocaris. Two speculative biology artists, Sava (@DeadAlienFish) and Christian Cline (@ChrCline) created illustrations of the animal, which then appeared in other people's feeds. Eventually, other speculative biology artists began illustrating their own versions of the creature, even getting some paleoartists on Twitter involved as well. This blitz of online art spiraled in popularity, engrossing more and more artists while leaving people looking at their Twitter feeds bewildered. Inevitably questions began to arise, the main one being, "Is sussocaris real?" Whenever the validity of sussocaris was questioned in comments, a plethora of users would eagerly insist that the

creature was actually a recent paleontological finiding. As a spectator looking in, this was an obvious ploy to make fools out of gullible people, but there were several factors that helped influence people to believe sussocaris was in fact real.

What supposedly made this phenomenon spread so fast and fool so many people is its seemingly goofy, yet uncanny air of plausibility. Paleontologists have named extinct animals after pop-culture icons before, like the trilobite *han solo* (2005) and the theropod *Thanos simonattoi* (2020), which immediately come to mind. So naming a species inspired by Among Us, which had grown massively popular in recent years, felt somewhat believable. It surely does not help that most thylacocephalans already vaguely resemble the playable characters in Among Us already! Another notable factor in this phenomenon is Hop's choice of location. Sussex is located in the United Kingdom, and it is a site home to many aquatic invertebrate fossils from the Cretaceous, such as echinoids, brachiopods, gastropods and bryozoans. Thylacocephalans, which lived at the same time period as many of these extinct aquatic species, would not be a far-fetched discovery.

The combination of a semi-plausible name, location, and new art being published every hour perplexed and fooled many online. But the peak of this phenomenon occurred on Thursday, February 16, where Hop retweeted a post by another user who fabricated an image of sussocaris as a fossil. This fabricated image was created with artificial intelligence and then edited with Adobe Photoshop, a process which prevented people from reverse image searching the fake fossil, finding it nowhere else online.

The day after, on February 17, Hop retweeted the fossil again, but this time, with a fabricated screenshot of a scientific paper titled "The Description of a New Deep Sea Thylacocephalan from the Albian of South-Western England, Sussocaris saliti". Another Twitter user created this screenshot by using an actual scientific paper about thylacocephalans, which some commentators even pointed out. Nevertheless, many people still believed that sussocaris was real. As Hop's posts grew in popularity, the official Among Us Twitter account commented on Hop's original post, "Thank you, I hate it." This seemed to further validate the existence of this fictitious animal for some. However later that same day, Hop made a post explaining that sussocaris was in fact a fake animal, saying "To clear the air, sussocaris was a joke creature that got out of hand. I'm deeply sorry for anyone that thought it was real." And the two users who fabricated the fossil and scientific paper followed suit.

Perhaps this is where the phenomenon crossed some lines into

Fake Scientific Paper & Fossil. *Other artists fabricated a false scientific paper and a fake fossil which aided in fooling those on Twitter.*

'paleontological hoax' territory, as fabricated images were deliberately made in order to validate something unreal. However unlike past paleontological hoaxes, sussocaris had no ulterior motive other than fooling people on Twitter into believing that this silly creature was somehow real. Some paleontologists even found sussocaris amusing, while others bemoaned, claiming that this ordeal hurt the public's trust in science. On Saturday, February 18, an article about sussocaris appeared on the creationist website, BioLogos, and briefly circulated on Twitter during the aftermath. The article used sussocaris to argue against the practice of paleontology and other scientific disciplines, however, this article was later discovered as a hoax to capitalize on the popularity of the sussocaris phenomenon.

Hoaxes Aren't New. Sussocaris has brought us full circle—it shares its fictional place of origin in Sussex, England, the home of the first fraud in all of paleoanthropology—the Piltdown Man. Perhaps Hop chose this

Diving with Sussocaris. *Perhaps one of the silliest art inspired by the creature is this illustration by the digital artist 'Release The Hodari' (@HodariNundu). Divers are sometimes depicted in paleoart to compare a human figure to a marine animal... the image is literally a paleomeme within a paleomeme!*

intentionally, but in the early 20th century, Sussex was at the center of a great hoax. Bone fragments said to have been collected in 1912 were presented as the fossilized remains of a previously unknown early human, referred to as 'Piltdown Man'. In 1953 these bone fragments were exposed as a forgery. In 1999, National Geographic published an article on a fossilized chimera called 'Archaeoraptor', which was believed to be the missing link between dinosaurs and birds. Scientific investigations found that the fossil was actually a combination of rearranged pieces of real fossils to look like an undiscovered dinosaur. Sussocaris is nowhere near comparable to these hoaxes in severity, but mentioning the Piltdown Man and Archaeoraptor illustrates the fact that hoaxes have been perpetuated for a long time in paleontology and is something we should always be aware of.

In recent years, a similar online phenomenon to sussocaris occurred over social media (which coincidentally also began as a joke). A new species of spinosaurus named *Montanaspinous inexpectatus* was 'discovered' in Hell Creek Montana, the same environment once inhabited by *Tyrannosaurus rex*. Developers of the videogame, Saurian, were asked by fans to add Spinosaurus as a playable character in the game. Saurian's goal was to create an actual depiction of Hell Creek for players to explore, so there was one problem with adding Spinosaurus—the species did not occur in the Hell Creek formation. Developers joked over their live streams about the abundance of fans hounding them to add Spinosaurus. Eventually the developers referred to a spinosaurid found in the Hell Creek as "*Montanaspinus inexpectus*", an obvious jab at the fact that it would be entirely unexpected and even miraculous to find a spinosaurid there. Some fans were inspired by this fictitious name and went on to create depictions of the spinosaurid. Like sussocaris, these images circulated rapidly online, fooling many into thinking this dinosaur was a recent discovery.

What Have We Learned? Despite all the misinformation, perhaps there is some good to be found in the whole sussocaris ordeal? It's interesting to note that sussocaris is probably the most illustrated thylacocephalan, which is silly to think about when we have discovered and already know about many species of these animals. Invertebrates are often sparingly illustrated in paleoart, so in some way, this phenomenon introduced many people to these animals and allowed them to search and find real paleontological findings out of curiosity. The biggest lesson, I hope, is that we are now aware of how fast misinformation can spread over social media. All of us should think twice before believing if something is real without any hard or clear evidence, and should be wary of sharing news that may be falsified. Sussocaris may have fooled some of us, but now we are all more likely to look at claims made online and say 'that's sus man'.

References:

- *www.youtube.com/watch?v=i8WcAbMDyBw&ab_channel=HenrythePaleoGuy*
- *www.nmpdn.blogspot.com/2016/06/just-say-no-to-montanaspinus.html*
- *www.youtube.com/watch?v=43qnyWZdlqc&ab_channel=AZFK*
- *https://en.wikipedia.org/wiki/Archaeoraptor*

More Information on the History of Hoaxes in Paleontology:

- *www.youtube.com/watch?v=xSzwnwaC_d4&ab_channel=GSOCGeologicalSocietyoftheOregonCountry*
- *www.youtube.com/watch?v=j5bpTnwHbNo&ab_channel=DinoDiego*

VEKIA'S FIRST FIVE BIOMES

BY VEKNOR — *INSTAGRAM: @species_of_vekia*
DEVIANTART: species-of-vekia
YOUTUBE: www.youtube.com/@francistheriault5288

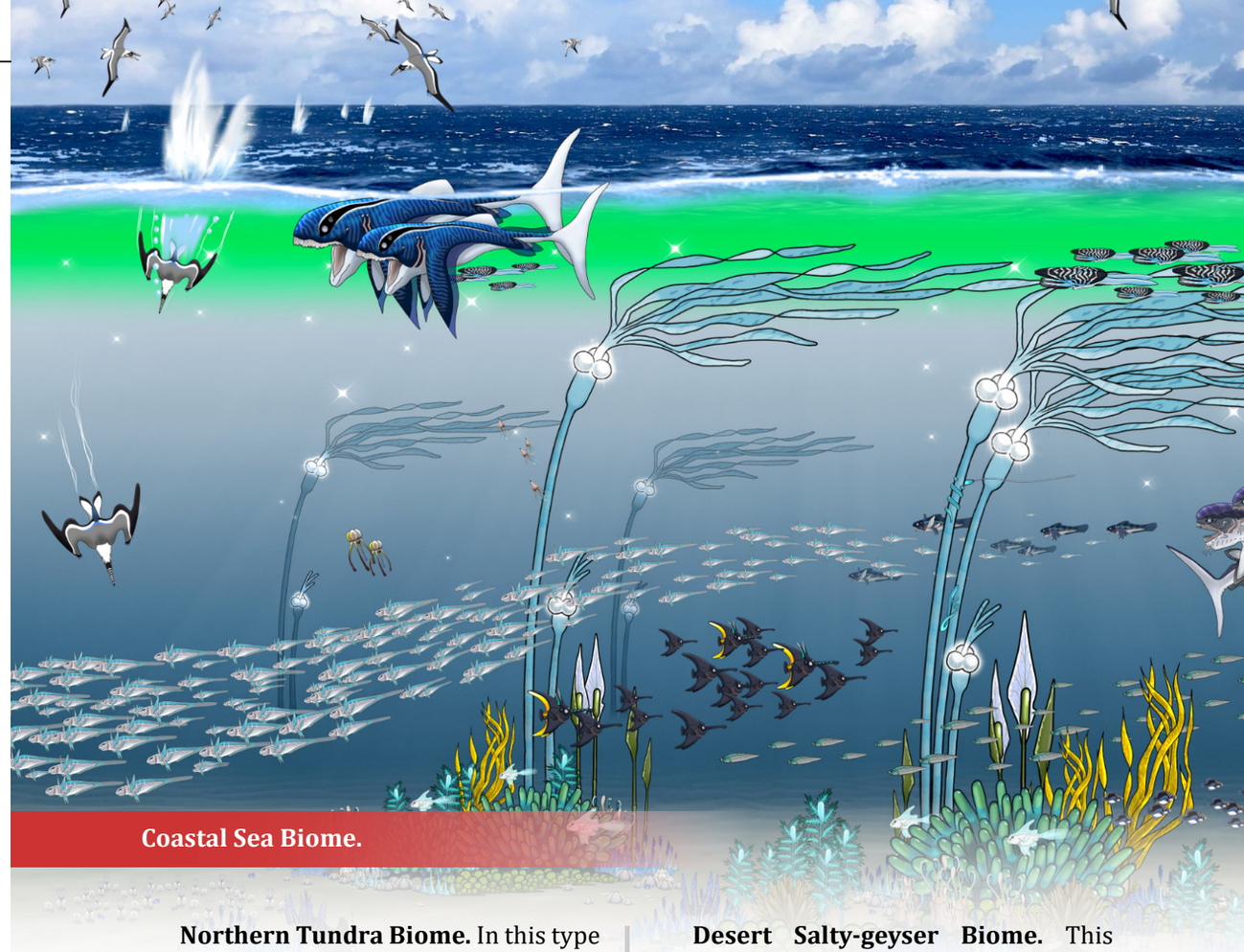
For the fourth issue of Astrovitae, I'd like to present several scenes from my ongoing speculative evolution project that I've finished so far. Instead of offering a summary for those of you who are unfamiliar with my work, I humbly invite you to go view the project's introduction video. The complete scenes are also available in high quality on DeviantArt, and new biomes will inevitably be added because this project is still in progress.

Coastal Sea Biome. I began working on this biome first, and since then, I feel as though my art has progressed significantly. This first subcategory depicts a marine environment that can be found in temperate regions of the moon, with water no deeper than 100 m. Although the coastal sea biome is home to a wide diversity of marine life, it is best known for the bioluminescent plankton film that covers the moon's surface.

Twilight Zone Biome. The twilight zone biome is located just outside the range of sunlight, between 200 and 1 000 m beneath the ocean's surface. It is a cold and dark place teeming with life.

To design the abyssal organisms of this habitat, I experimented with texture, bioluminescence, and trans-parency. Deep sea gigantism, which affects many of the vekian deep sea species, is the propensity for deep-sea creatures, particularly invertebrates, to grow to much larger sizes than their counterparts in shallow water. No vegetation can be found down there.

Forest Wetland Biome. The forest wetland biome is a mist-shrouded, swampy area that is primarily covered in mosses and bogs with countless shallow lakes and lagoons scattered throughout. Violet vines can be found in this biome, they have sharp blades and grow leaning against the massive light-emitting trees. A towering and dense canopy of vegetation covers this biome. This biome is teeming with life and breathtaking sounds are emitted by countless living creatures of all sizes.



Coastal Sea Biome.

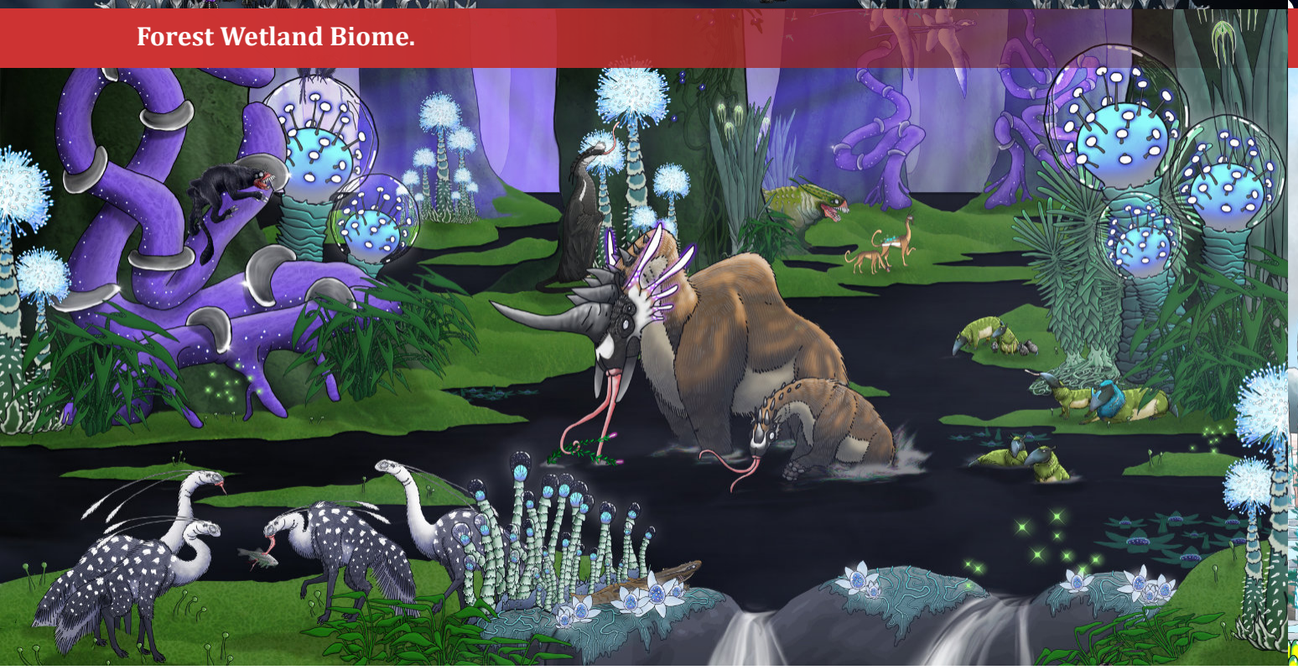
Northern Tundra Biome. In this type of ecosystem, short growing seasons and freezing temperatures make it difficult for trees to thrive. The vegetation of the tundra is made mostly of small shrubs and grasses.The soil contains a sizable amount of degraded biomass stored as methane and carbon dioxide in the permafrost. In this frozen landscape, you may observe herds of large grazing fury animals pursued by the predators that hunt them. During the colder months, many animals migrate or hibernate.

Desert Salty-geyser Biome. This biome's numerous salty geysers have allowed life to flourish despite it being a sweltering desert. Salt builds up at the base of the geyser chimneys as a result of the constant water vapor emissions from the geysers. The plant and animal species have adapted to the salty environment, and they don't seem to suffer too much from it. There aren't many other predators since the elusive sandworms, which ambush anyone crossing the desert, fill the predator niche.

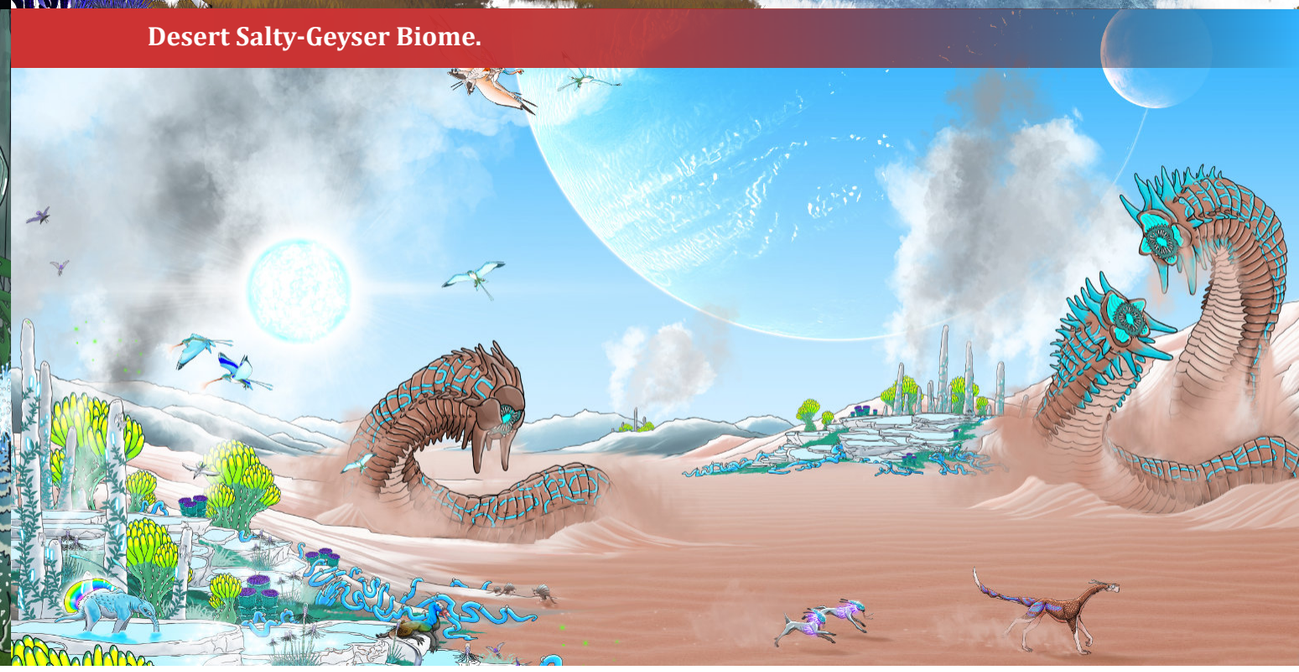
Twilight Zone Biome.

Northern Tundra Biome.

Forest Wetland Biome.

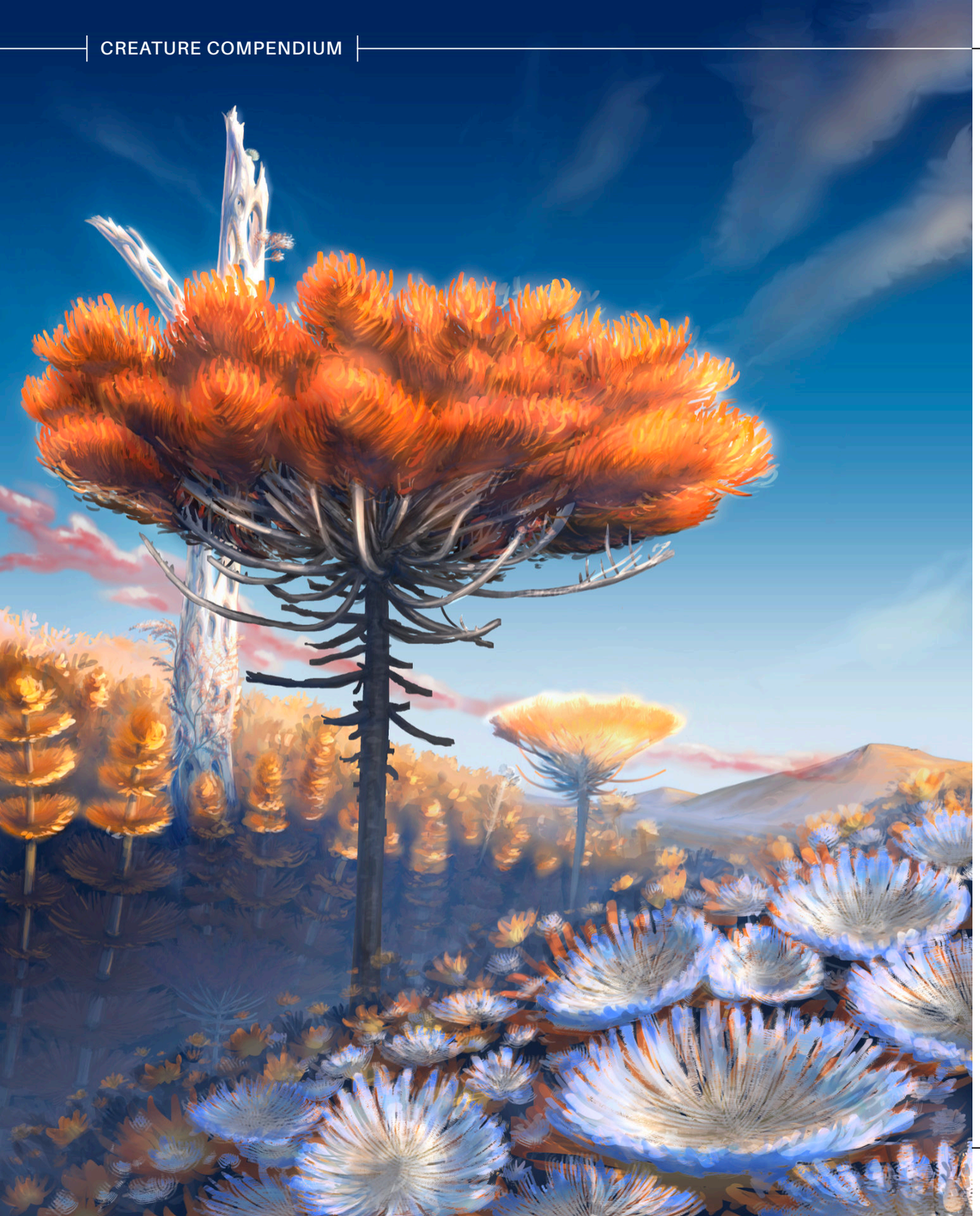


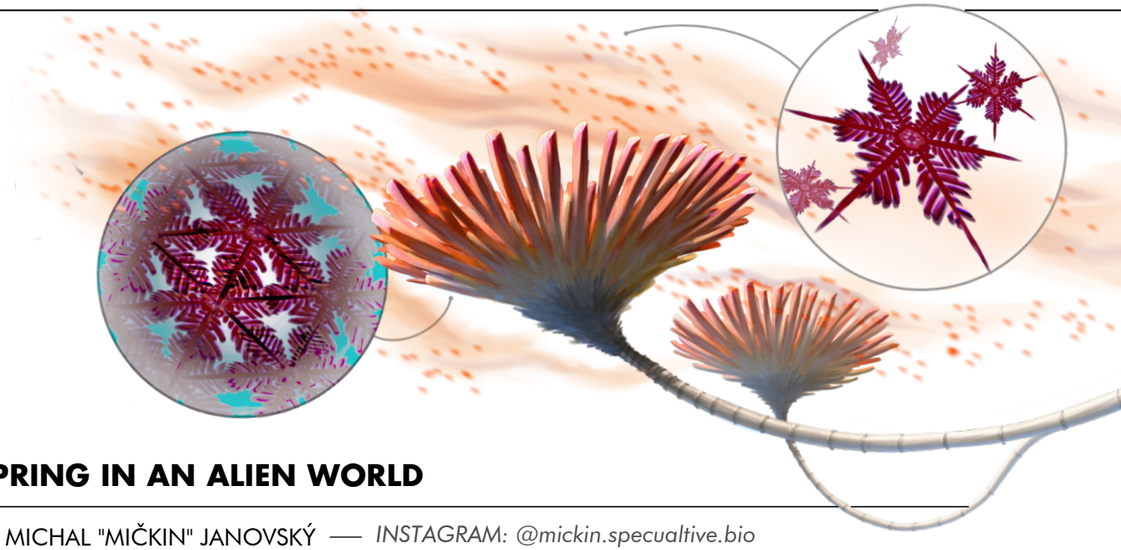
Desert Salty-Geyser Biome.



CREATURE COMPENDIUM

By Pedro Manoel Modanezi Martins





SPRING IN AN ALIEN WORLD

BY MICHAL "MIČKIN" JANOVSKÝ — *INSTAGRAM: @mickin.specualtive.bio*
PATREON: www.patreon.com/mickincreate
WEBSITE: www.tambaqi.wixsite.com/mickincreate

On Earth, we are accustomed to an axial tilt of 23.5 degrees which causes our planet's seasonal changes. But what would happen if an Earth-like planet had an axial tilt of 60 degrees? Let's explore some of the unique effects it would have on life.

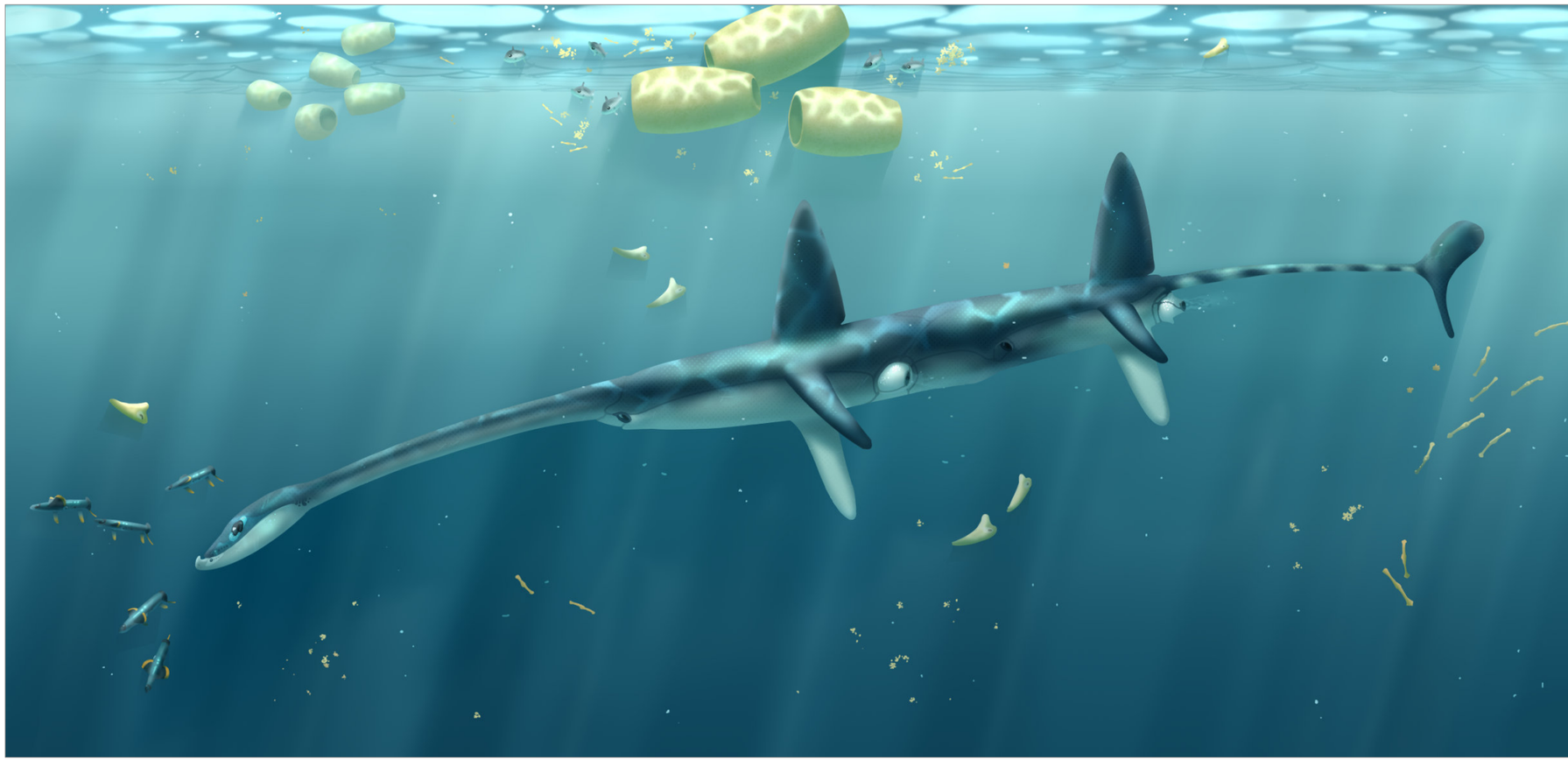
If a planet had an axial tilt of 60 degrees, the southern hemisphere would experience total darkness for a quarter of the year, and despite a full season without sunlight, moderate temperatures would persist thanks to the heat capacity of the ocean and thick atmosphere. Without the energy from their star, life forms have had to adapt by becoming nocturnal, hibernating, or surviving in the form of dormant eggs and spores. As the star rises over the horizon at the beginning of spring, temperatures increase, and powerful air currents cause heavy rainfall—triggering the blooming of phototrophic, snowflake-resembling aeroplankton called 'zore'. Billions of these aeroplanktonic creatures have spent the winter as spores within the soil. Zore forms the basis of the food chain, as there are few truly multicellular photosynthesizers. It may come as a surprise that, still, vast areas of land are covered in forest.

Each spring, tree analogs of this world called 'haluzes' (descendents from a motile worm-like ancestor) extend their feathery bristles to feed on the abundance of aeroplankton. A mutually beneficial relationship has been established between these air-sifters and their prey. Nowadays, most zore exist in two forms: free-floating and symbiotic. Each haluz grows leaf-like organs to accommodate colonies of zore, nurturing them with waste products and harvests of their photosynthesis in return. At the same time, massive swarms of reproductive life stages are released, attracting air-sifters that migrate for thousands of kilometers to feast on them… but that is a story for another time.

THE SOUTHERN OCEAN OF SINEDEY

BY SAVELY KOCHNOV — *TWITTER: @SavaAlienFish*

Giant madarna, a member of a unique branch of the ratoon sea serpent family, chases a flock of small fovits near the surface of warm open waters, teeming with various heliophytes—unique, mostly aquatic, mixotrophic organisms capable of actively swimming through water columns.



COLOSSOSAURUS BASILUS

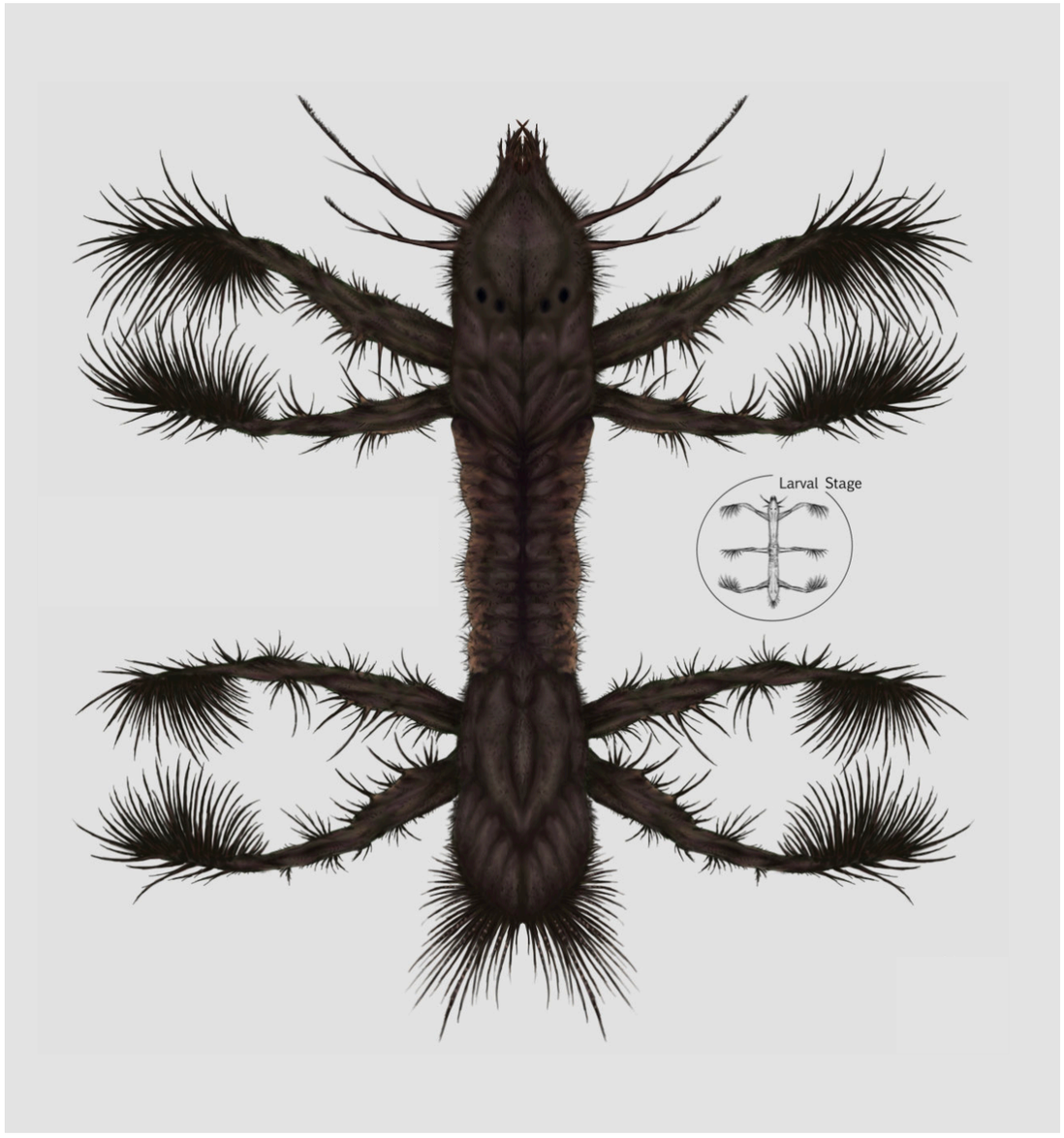
BY NOAH CREUTZIGER — *TWITTER: @noahcreutziger*

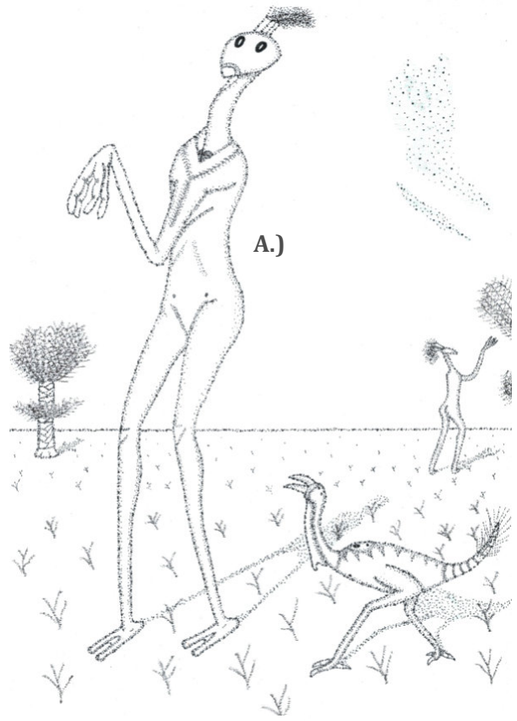
As it did throughout the Mesozoic, the title of apex herbivore goes to the titanosaurs. Interestingly, these giants are not descended from great titans such as Dreadnoughtus or alamosaurus, but instead from small armored saltasaurids. Thanks to their coating of armor and their huge size, modern titans such as *Colossosaurus basilus* are difficult to tackle, even for the biggest of tyrannosaurs. Much like elephants, titanosaurs manipulate and maintain the health of their environment around them. Their movement creates paths through dense forests, their claws till the earth, and their large amount of dung helps fertilize the region.

THE PURPLE MUDBIRD *(CHAETOMOLPASTES PORPHYR)*

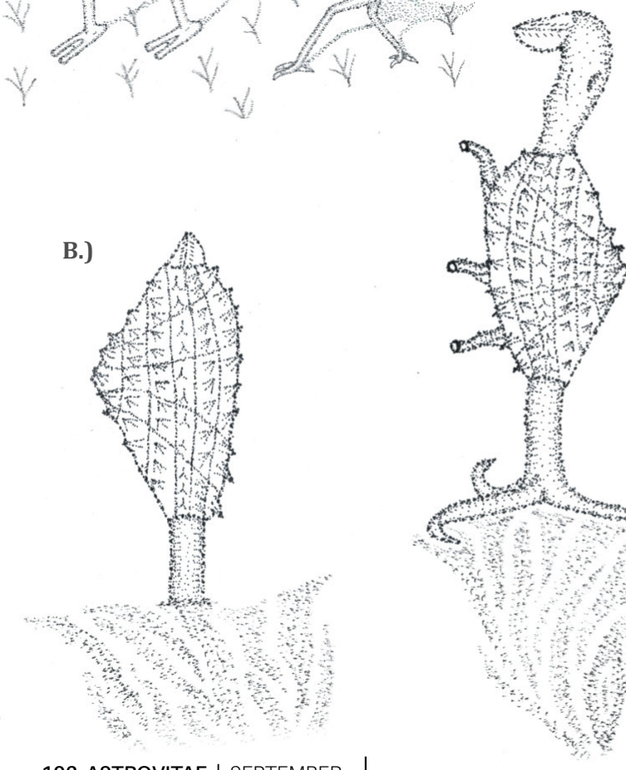
BY BRAEDEN LAROCHE (TWISTED DEPTHS) — *INSTAGRAM: @twisting.depths*

The purple mudbird is a small, aquatic tick descendant which dwells in muddy shallows. It detects and snags prey with its long bristles which also serve to protect the organism from potential predators (of which they have many due to their 10-12 centimeter size). Uniquely, this animal swims with jerky, undulating motions which make their bristly arms seem to "dance," which is a more graceful process in their six-limbed larval stage before they molt and develop their fourth pair of legs: a trait derived from their tick ancestors.

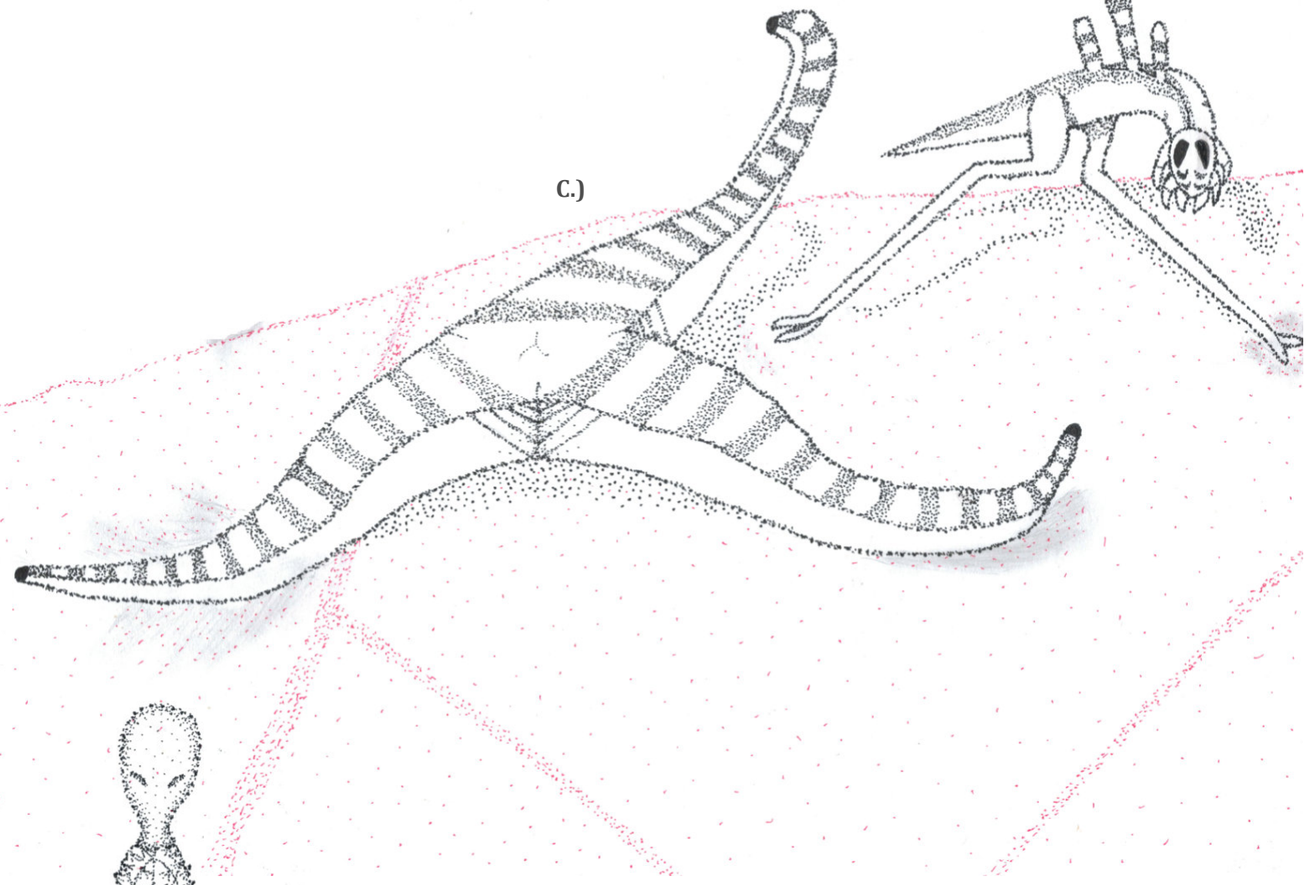




A.)



B.)



C.)

COLLECTION OF MARTIAN ANIMALS

BY T.K. SIVGIN — *INSTAGRAM: @t.k.sivgin*
WEBSITE: www.hardeshur.blogspot.com

A.) The Great Ushabti.
B.) Malacoda.
C.) Hortax and Yrp.

ISSUE CONTRIBUTORS:

CHIEF EDITOR

Domenic Pennetta

NEW ARTISTS

Aldrich Hezekiah

Maja Orešković Igrić

Noah Creutziger

Pedro Manoel Modanezi Martins

T.K. Sivgin

REOCCURRING ARTISTS

Alejandro Martínez Fluxá

Braeden Laroche (Twisted Depths)

Christian Cline

J.F.

John Meszaros

Maryana Simpson

Michal "Mičkin" Janovský

Paul Drenckhahn (SteveMobCannon)

Savely Kochnov

Veknor

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Reinhard Gutzat

J.F.

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