OPUNTIA 396

Early November 2017

Opuntia is published by Dale Speirs, Calgary, Alberta. It is posted on www.efanzines.com and www.fanac.org. My e-mail address is: opuntia57@hotmail.com When sending me an emailed letter of comment, please include your name and town in the message.

ROCKY MOUNTAIN WAY: CASCADE RIVER VALLEY

photos by Dale Speirs

The cover photo was taken October 5 from the south end of Lake Minnewanka looking northeast, and the one below from the western shore.

Lake Minnewanka is L-shaped and most of it was out of sight in the two previous photos. It was originally a small lake at the junction of the Cascade and Ghost rivers, deep down in canyons. In pioneer days before the area was annexed into Banff National Park, a dam was built at the mouth of the Cascade River just before it empties into the Bow River. The reservoir supplies water and power to Banff village to this day.

A coal mining village called Bankhead was established down in the Cascade canyon. It was relocated up the western slope to the base of Cascade Mountain when the canyon was flooded. The coal market died just after World War Two and the village, at one time bigger than Banff, is long gone. Scuba divers like to explore the flooded ruins of the old village.

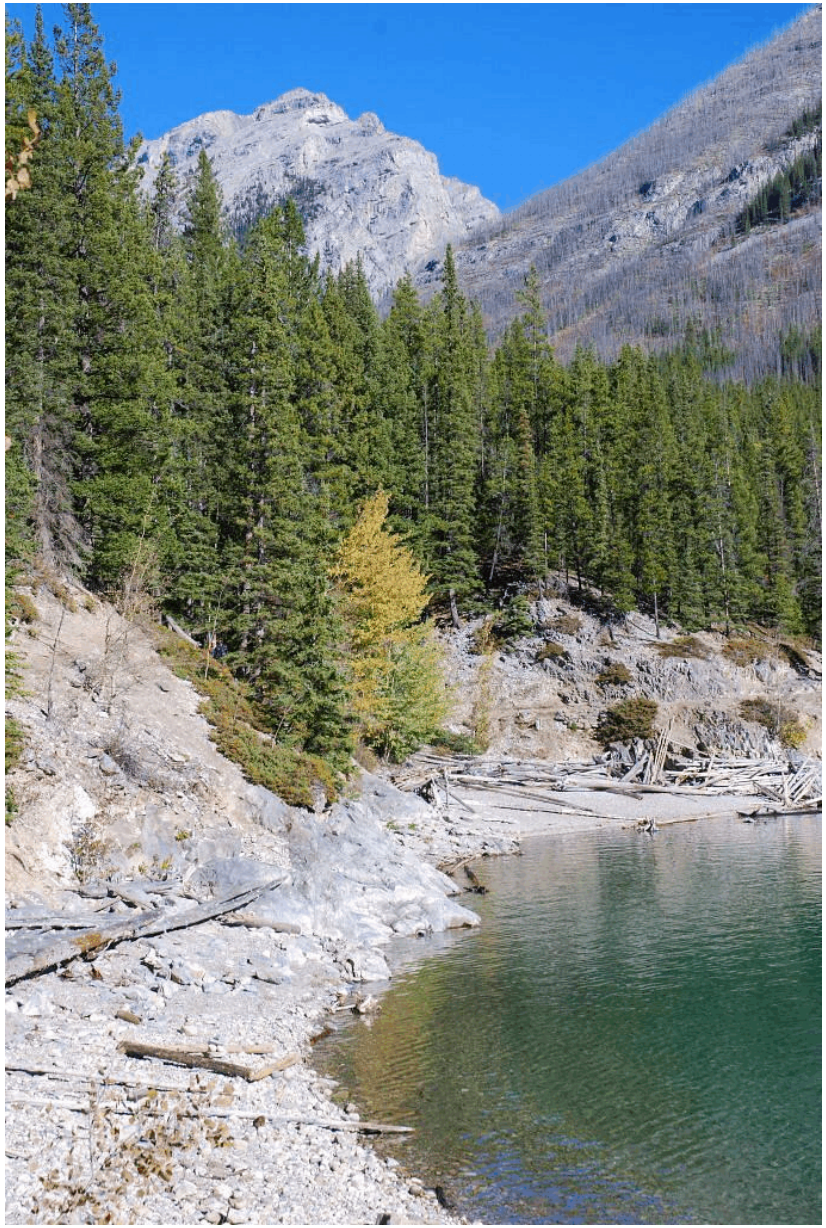
At left, this peninsula was once a ridge that jutted down to the canyon floor.

Below is the narrow trail on the western shore that leads to the Cascade River canyon, the part high enough to escape the flooding. Before the reservoir was built, the river fell down into the deeps via a series of waterfalls now immersed, hence the river's name.

I love taking photos of the crystal-clear waters of the mountain lakes and streams. At top left is the Lake Minnewanka shoreline. The rocks in the lower left corner of that photo are about 30 cm deep, while further out the water is about 100 cm.

The photo at lower left is the mouth of the Cascade River canyon, about 100 cm deep.

Below: Another shoreline view of the lake.



The trail crosses a wooden footbridge over the mouth of the Cascade River canyon. At left is the view looking downstream out into the lake.

Below: Looking upstream from the footbridge. Autumn is the dry season in Alberta, so the river has dwindled considerably from what it was during spring snow melt.

Downstream of Lake Minnewanka on the Cascade River is Two Jack Lake. This photo looks southeast at Mount Rundle. At the far end of the lake is the Cascade River outlet.

The photo was taken in early afternoon. This time of year, the Sun stays low on the horizon.

Two Jack Lake got its name from two separate pioneers who settled in the valley at different times in the late 1800s, both of whom coincidently had the same name.

The photo at right is of the sparkling diamonds of light when looking down the lake toward the Sun. It really needs to be seen on video to capture the sparkling.

Below is a shot looking straight down through the crystal water.

Looking northeast at Mount Inglismaldie. It was amazing how the water colour changed depending on the angle of viewing.

GROUND CONTROL TO MAJOR TOM
by Dale Speirs

The Dawn Of The Space Age.

It was a proud and lonely thing to be an SF fan in the 1920s and 1930s, when mundanes ridiculed the idea of space travel, unaware that Dr Goddard in the USA and the Germans were laying the foundations. SF stories about space travel were triumphal, whether a backyard inventor putting together his own rocket or a government project that spared no expense because it was only taxpayer's money.

But not all efforts succeeded. "Into Space" by Sterner St. Paul (1930 February, ASTOUNDING) relates how Prof. Montescue flew his own spacecraft to his death. As every high school physics student knows, the mathematical formulas describing gravity are the identical form to those describing electromagnetism; only the names of the variables are different.

Montescue's research confirmed that the two were different expressions of the same force. (Not so in the real world, I hasten to add for those who flunked high school physics.) On that basis, Montescue built a spacecraft that used electromagnetism to reduce its gravity field to zero.

The spacecraft would thus float up into space. Montescue therefore made plans to visit the Moon. Up, up, and away he went. The problem was what happened when the spacecraft approached the Lagrange points, where gravitational forces between Earth and Moon balance.

The spacecraft left Earth at high speed, but the further out into space it went, the more it slowed down until it reached a Lagrange point. There it stuck because there were no gravitational gradients for the superscience propulsion device to use. The Professor slowly asphyxiated as his oxygen supply ran out. What was to have been a quick there-and-back-again trip instead became a miscalculation that sealed his fate.

DANGEROUS ASSIGNMENT was an old-time radio series about Steve Mitchell, who narrated most of each episode, who worked for an unnamed American spy agency. (This and hundreds of other OTR shows are available as free mp3s at www.archive.org) Each week Mitchell trotted off on exactly the same mission, to retrieve some MacGuffin from hostile natives, some of whom lived in the USA but more often in Communist Europe or Asia. He was slugged unconscious one or two times per episode, and should have been in an institution for the brain damaged. The series was not missed when it went off the air.

"Retrieve Data On Nazi Buzz Bomb" is a 1951 episode of the show, written by Bob Ryf and Adrian Gendot. When his boss tells him he must locate secret plans for a Nazi buzz bomb, Mitchell points out that it has been five years since the war ended, and the military must have plenty of buzz bomb samples in their testing grounds. However, the plans in question are for an advanced version that was never put into production, and was still ahead of anything the USA had in 1951.

The only clue is a man who probably smuggled the plans into the USA after the war. Mitchell can't find him but does locate a cousin, who, it turns out, was the executor of the spy's estate, he having died shortly after coming to New York City. Mitchell figures the man must have hidden the plans in a false bottom of his traveling trunk.

Trouble is, the cousin sold the trunk to a used furniture dealer. Mitchell tracks him down, finds the trunk was sold to a stripper who is doing a tour of England. She in turn loaned it to her boyfriend who is with an acrobatic group on a gig in Denmark. As Mitchell chases about from pillar to post, someone is killing the people who had connections to the trunk, probably a Soviet spy.

By the time the death toll ends, and after Mitchell has been slugged unconscious twice, he finds himself returning to New York City. Both the stripper and the cousin had their own ideas of the value of the plans, and weren't as patriotic as they should have been.

The plot is standard to the point of boredom, and Mitchell's droning narration doesn't help either. The twist ending relieves the tedium a bit.

V-S DAY is a 2014 alternative history novel by Allen Steele. Its history diverges from our timeline by supposing that in 1941 the German missile project was ordered by Hitler to abandon the V2 and concentrate on the trans-Atlantic rocket. When the Americans get wind of the project, Roosevelt orders an interceptor spacecraft, with Robert Goddard in charge of building it. Because the technology did not yet exist for automatic guidance systems, both sides used manned spacecraft.

The story begins when Wernher von Braun and Walter Dornberger are summoned to Wolfsschanze. Hitler and Goering want something better than the V2 because it is far less efficient in delivering bombs to Britain than the Luftwaffe. As Field Marshal Wilhelm Keitel says: "*Altitude isn't the question, Herr von Braun. Range is the issue*."

A trans-Atlantic spaceship won't do much damage, but the psychological damage to the Americans will be immense, just as it was the first time Tokyo was bombed. It will force Americans to divert personnel and resources to the home front after they realize they are no longer able to hide behind the Atlantic.

Like most alternative histories, assorted famous names are dragged in. Lt Cmdr Ian Fleming is working with Major General William Donovan. They meet with FDR about the German project, code-named Silbervogel. The decision is to shift resources away from the Manhattan Project to a defensive spacecraft. Goddard is roped in, cantankerous old coot that he may be notwithstanding.

In due time, the American spacecraft, named Lucky Linda, is made operational. When Silbervogel launches with a payload to be dropped on New York City, it is waiting. They duel over the skies of New York State, but it is not a dogfight. Lucky Linda fires two missiles in front of Silbervogel's flight path.

The warheads are a mass of ordinary roofing nails. Dispersed ahead of the Silbervogel, its supersonic impact with the nails shreds it.

The novel reads well. The narrative carries the reader along with the story.

The Moon's Men Doth Ebb And Flow Like The Sea.

"Rocket From Manhattan" is a 1945 episode of the old-time radio series LIGHTS OUT, written by Arch Oboler. The first spaceship is returning from an orbit around the Moon, a la Apollo 8, but in the year 2000. The crew wax philosophical as they impatiently wait out the hours back to Earth. A scientist on board, who had served in the Manhattan Project, tells the others that the lunar craters looked exactly like the bomb craters he saw in the New Mexico desert. Talk about your ominous forebodings.

The astronauts become gloomy when they contemplate the idea that the Moon may have had life but its inhabitants blew themselves into extinction by carpet-bombing each other with nukes. Having set up the obvious plot, the spaceship then gets within landing range of Earth when a full-scale global thermonuclear war begins. Someone down there had gone beyond fission and fusion bombs and invented one that destroyed Earth's atmosphere in minutes.

Some of the science is garbled since Oboler never let facts get in the way of the story, assuming he knew them. However, it is interesting how well the episode stands up over time. Modernize a few details, correct the factual errors, and it would be an even better cautionary tale for our times.

Oboler wrote this play a few days after the atomic bombing of Japan. It was one of the first works of fiction inspired by the actual attacks, although other SF writers had previously written stories about the possibility of total war with superbombs obliterating civilization.

"First Encounter" was a 1964 episode of the radio series THEATER FIVE, written by Leonard Stad. I review it as an example of something that would have just barely passed muster as a story in the 1890s or possibly the earliest SF pulps in the 1920s, but certainly not five years before the first Moon landing.

The spaceship of Orion 1 lands on the Moon, the first human expedition. The astronauts, including one woman whose main function is to scream, discover that the Moon has a breathable atmosphere. Stad's ignorance of basic astronomy is appalling, for if an atmosphere existed even in attenuated form it would have been detected by astronomers centuries before, because the edge of the Moon would be fuzzy and weather patterns could be seen.

There are invisible creatures who capture the astronauts and take them down into caverns where their civilization exists. The invisibility is explained with gibberish about how the creatures have pigments outside the human range of vision. The Lunies have machines that enable telepathy and thus can communicate with humans.

They lecture the astronauts about how the Moon once had many cultures who got into an all-out nuclear war, hence the cratering. The survivors formed a single unified culture dedicated to peace. So much so, that they tell the astronauts there will be an embargo on future human expeditions to the Moon.

The astronauts escape and take off in their spaceship back for Earth. As they land, they discover that Lunies had stowed away on the spaceship and were going to colonize Earth. The neat little twist is that they believe the only route to lasting peace is a single culture, and the only way to produce a single human culture is to manipulate them into a global nuclear war.

The story was dated even before it was broadcast. The scientific background was nonsense. It could have been saved by setting it on Mars or, better yet, a fictional planet in some other stellar system where the facts wouldn't get in the way of the story.

"Recovering Apollo 8" (2007 February, ASIMOV'S) by Kristine Kathryn Rusch is set in a timeline where Apollo 8 had an engine misfire during its lunar orbit insertion burn. This was not beyond the realm of possibility in our timeline. It went sailing off into an elliptical orbit around the Sun, with no hope of rescue for the astronauts. To confirm this is alternative history, Rusch later mentions in passing that Apollo 20 crashed into the Moon.

Forty years later, Apollo 8 has looped back near Earth, and a spacecraft is sent out to retrieve it. After successfully stowing it in the cargo bay, the capsule is opened and found to be empty. The astronauts had decided that instead of suffocating together in a tin can, they would rather float freely in space forever. So the modern generation begins another search, this time trying to track down three bodies orbiting the Sun. A well-written story.

Palaeorocketry.

"Point Of Departure" is a 1957 episode from the old-time radio series X MINUS ONE, based on a story by Vaughan Shelton. It begins with an archaeological research team translating ancient Egyptian tablets that describe a solar-powered energy source that could provide escape velocity thrust while only operating at 10% of its capacity. From there, the stars.

An engineering firm begins building a spaceship based on the tablets, even before all of them have been translated. The first spaceship takes off and disappears into the wild blue yonder.

Only after it has gone do the rest of the translations come in. They describe an Egyptian vessel built the same way which did not return for four years. When it did, the solar reactor was fused into a lump and all that was left of the crew was their clothing. The project manager of the modern spaceship must now face the Board of Directors and the District Attorney. It will not end well.

Spaceship Troubles.

"S-O-S" is a 1950 episode of the old-time radio series MYSTERIOUS TRAVELER, written by Robert A. Arthur and David Kogan. The story begins with a flashback from the ending, which ruins any suspense.

A small gang of men heist uncut diamonds from a spaceliner. It is planned as a bloody adventure, ending with the ship being destroyed before it can radio for help and the gang escaping on a lifeboat with the diamonds. The authorities will assume the diamonds went down with the ship.

Unfortunately the thieves didn't know about one small security detail. The captain and crew prevail, and the heist fails. Instead of taking them into port for trial, the captain puts them in a lifeboat with disabled engines and sets them adrift into endless space.

The beauty of this story is that the spaceship is only referred to as liner until the climax, and anyone listening will assume it is a story about a transAtlantic steamship. A neat twist, and everything still fits together after the revelation.

"Murder On The Space Shuttle" is a 1981 episode of CBS RADIO MYSTERY THEATER, written by G. Frederick Lewis, based on a story by Jacques Futrell. (Available as a free mp3 from www.cbsrmt.com) This isn't the 1980s style of shuttle, but a big futuristic one carrying hundreds of passengers to a far, far destination two weeks from Earth.

Not too bad of an episode, although it is evident that the writing was too firmly rooted in the 1980s. A spaceship carrying hundreds of passengers on a fortnight's trip would not be referred to as a shuttle.

After a bit of badinage between the ship's captain and his First Officer, during which they explain things to each other they both know perfectly well, the officer goes off to check on the communications officer, who turns out to be dead.

The ship's crew are not detectives, but they manage an investigation. A small tube is found which might have been used as a dart gun. Or did the defunct have a bad heart? The ship's doctor is incompetent but since he dies of something else, that leads to nothing.

A woman claims to be the dead man's fiancee but there is no record of her ever having been together with him socially or otherwise. Clues accumulate but nothing is illuminated.

There are constant communications between the spaceship and Earth, which help explain some of the plot. The culprit is trapped by a set-up but the listener has a good idea of the guilty person's identity prior to the finale. The plot is not particularly original. This story could have taken place on a train, a steamship crossing the Atlantic Ocean, or an isolated manor house during a storm. Where's Bat Durston when you really need him?

THE AVENGERS, the British television spy series, not the comic book superheroes, spawned a series of spinoff paperbacks with original stories done by work-for-hire writers. Paperback #9 in the series, published in 1969, was MOON EXPRESS, written by Norman Daniels (pseudonym of old-time pulp writer Norman Arthur Danberg).

John Steed, the suave bowler-hatted spy who worked for MI5, was by this time assisted by the young and beautiful Tara King, Mrs Peel having departed to reunite with her husband. In this novel, Steed and King investigate some sharp-practice men who claim they can take investors to the Moon.

The actual Moon, not just figuratively. The cost is £100,000 and includes the right to claim mineral rights on the Moon. Somehow the confidence men are able to simulate a voyage to the Moon, from launch to the three-day trip to a landing and brief exploration, followed by a safe return to Earth.

Steed and Tara arrange to take such a trip and are stymied as to how it is done. One flaw is that on landing, they should have felt the lesser gravity, but this seems to be overlooked. Instead of prospecting for a claim, they make a run for it in the dark and eventually work themselves out of what seems like a lunar desert in the night to what they discover is the desert in South Dakota.

The Moonship was simply transported by airplane using ingenious deceptions so that the victims wouldn't be aware they were flying horizontally from England to South Dakota and back. It was an expensive operation, but on the other hand, £100,000 was worth a lot more in those days before Nixon destroyed the gold standard and triggered double-digit inflation.

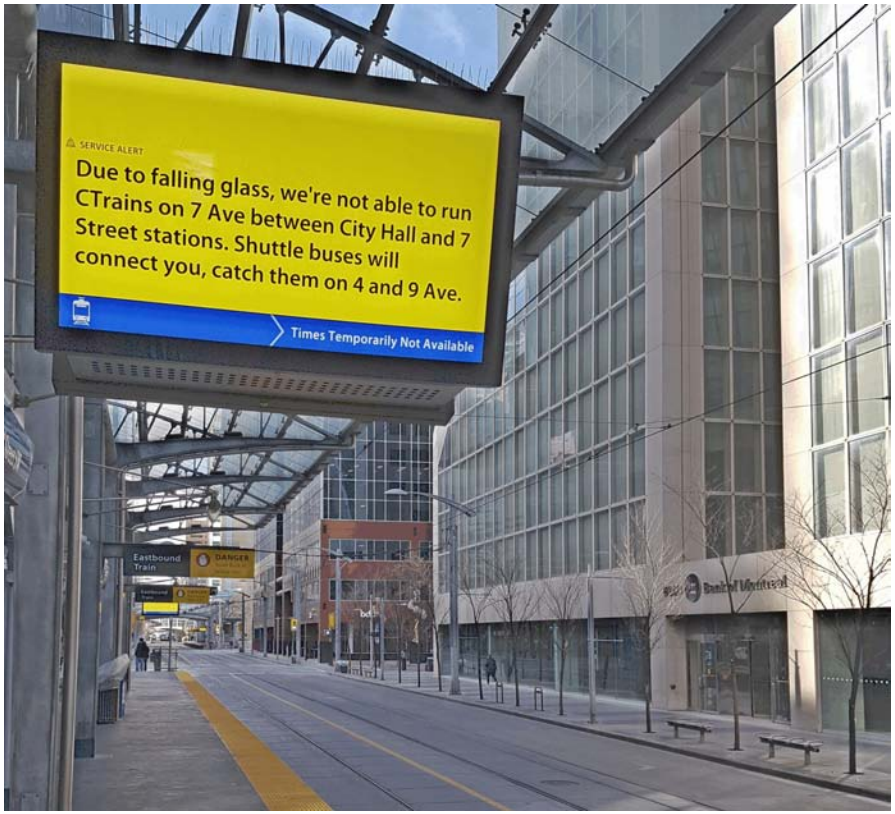
TRANSIT FANNING IN CALGARY: PART 21
by Dale Speirs

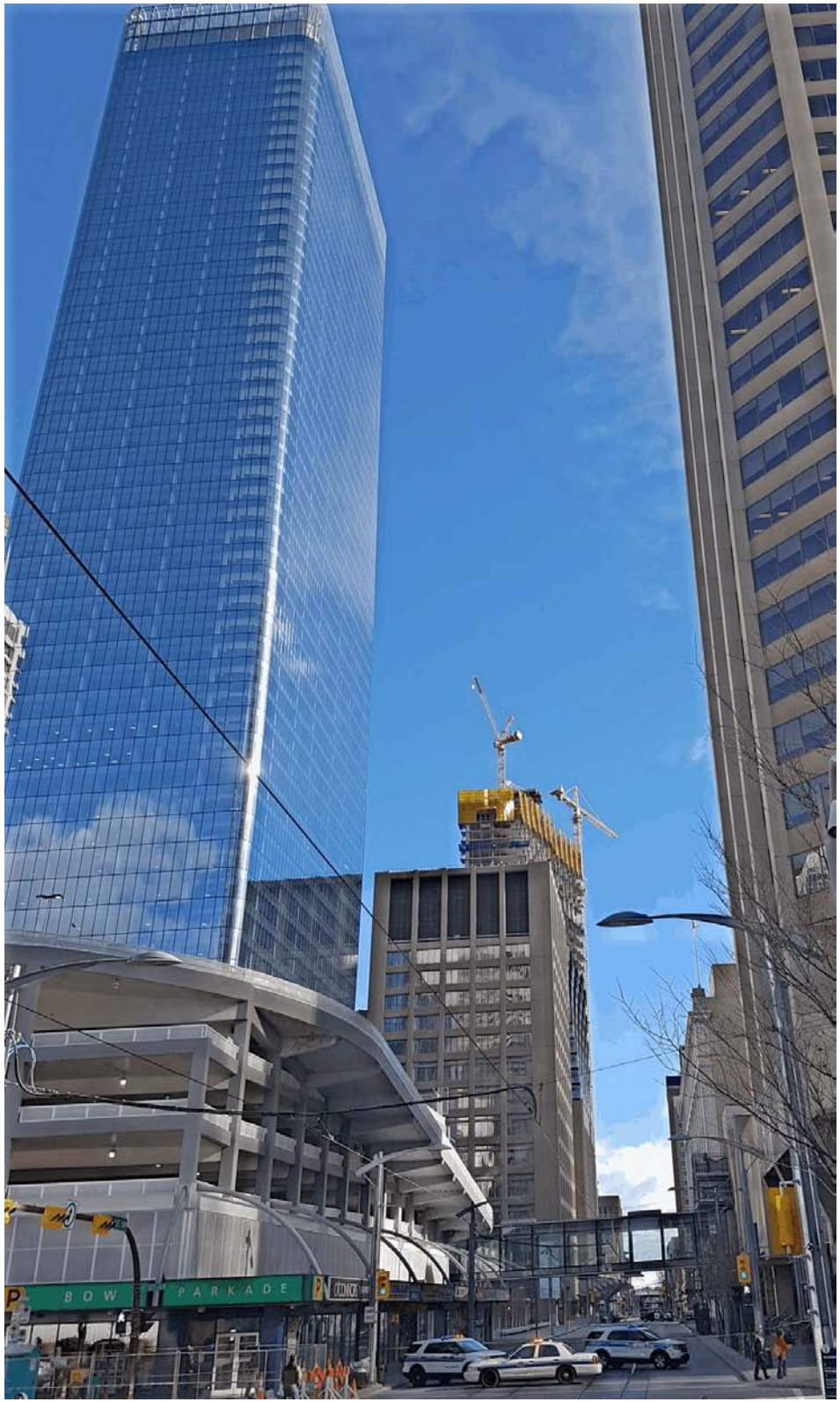
[Parts 1 to 20 appeared in OPUNTIAs #256, 258, 260, 264, 269, 275, 283, 298, 302, 327, 333, 341, 348, 357, 359, 365, 369, 371, 392, and 394.]

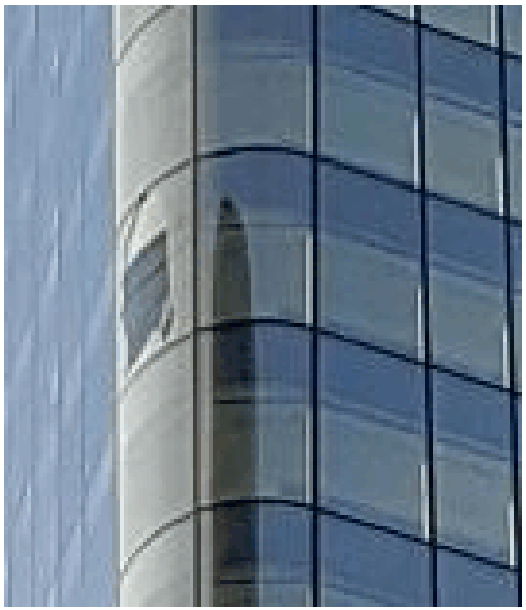
Single-Point Failures.

On Sunday, October 29, strong chinook winds blew out a window on the 23rd floor of Brookfield Place, overlooking the downtown LRT tracks at the corner of 7 Avenue and 1 Street SW. Police and firefighters cordoned off two blocks along the avenue, shutting down the LRT trains, plus another two blocks along the streets. At right, the blue skyscraper, Brookfield Place, is the culprit. The broken window is not visible at this angle. The skyscraper was only opened a few months ago, so the landlord expects the warranty is still valid.

For those wanting to travel to distant suburbs on the LRT line, it was more than just hiking to the emergency buses at the next station. They then had to wait for the trains to shuffle back and forth across the switches in order to reverse course. I'm glad I'm not a cross-town commuter on the LRT lines.







The repair crew could not approach the broken window until the winds died down, which was the next day. Monday, September 30, must have been a nightmare for morning commuters. The broken window was on the northeast edge of the tower, around the corner from the previous photos. I took these photos from a Plus 15 pedestrian overpass nearby. (The orange horizontal streaks in the photo at right are reflections from within the overpass.)

Commuter trains can carry more passengers than buses but they have one weak spot, what engineers refer to as a single-point failure. If a track is blocked by a derailed train or washout, the system stops dead. Buses can detour around road blockages. In fact, both routes that I commonly ride in Calgary have frequent detours on them due to road closures, but that just means shifting the routes over one block and running them down an adjacent street.

With the LRT trains, all of which cross through the downtown core on the same trackage, a blocked downtown track causes severe delays. Articulated double-length buses have to be brought in, with the extra cost of drivers, to carry passengers from a station upstream of the blockage to the next available station downstream, forcing commuters to change twice.

Fiction.

While browsing through www.gutenberg.org, I came across a 1912 collection of short fantasy stories by E.M. Forster titled THE CELESTIAL OMNIBUS AND OTHER STORIES. The middle story "The Celestial Omnibus" is about an archaic omnibus that traverses Surbiton, England, and Heaven.

A young boy notices an old sign across from his house that says "To Heaven". The sign points up a blind alley which has an unseen bend at its terminus that can't be seen from the street. A neighbour, Mr Bons, tells the boy and his mother that the sign was put up long ago by the poet Shelley. This prompts the boy to go up to the end of the alley, which he had never bothered to do before because there was nothing in it. He finds a faded piece of paper tacked up.

Rather an odd piece of paper, and he read it carefully before he turned back. This is what he read:

S. AND C.R.C.C. Alteration in Service.
Owing to lack of patronage the Company are regretfully compelled to suspend the hourly service, and to retain only the Sunrise and Sunset Omnibuses, which will run as usual.

It is to be hoped that the public will patronize an arrangement which is intended for their convenience. As an extra inducement, the Company will, for the first time, now issue Return Tickets! (available one day only), which may be obtained of the driver.

Passengers are again reminded that no tickets are issued at the other end, and that no complaints in this connection will receive consideration from the Company. Nor will the Company be responsible for any negligence or stupidity on the part of Passengers, nor for Hailstorms, Lightning, Loss of Tickets, nor for any Act of God.

The next morning the boy goes out just before sunrise and discovers there is indeed a horse-drawn omnibus waiting.

It had two horses, whose sides were still smoking from their journey, and its two great lamps shone through the fog against the alley's walls, changing their cobwebs and moss into tissues of fairyland. The driver was huddled up in a cape. He faced the blank wall, and how he had managed to drive in so neatly and so silently was one of the many things that the boy never discovered. Nor could he imagine how ever he would drive out.

"Please," his voice quavered through the foul brown air, "Please, is that an omnibus?"
"Omnibus est", said the driver, without turning round. There was a moment's silence. ...
"About when do you start?" He tried to sound nonchalant.
"At sunrise."
"How far do you go?"
"The whole way."
"And can I have a return ticket which will bring me all the way back?"
"You can."

"Do you know, I half think I'll come." The driver made no answer. The sun must have risen, for he unhitched the brake. And scarcely had the boy jumped in before the omnibus was off.

The horses steadily pull the omnibus up and up, until they are treading on a rainbow that takes them into Heaven. The boy returns on the Sunset omnibus, and is punished by his parents for staying out all day and then telling them such a fabulous story that it had to be a pack of lies.

Mr Bons, however, does believe him. The next day they set out on the Sunset Omnibus. As they mount the rainbow bridge, he panics and jumps out of the omnibus, falling to his death far, far below. It is not Heaven he will go to.

LETTERS TO THE EDITOR

[Editor's remarks in square brackets. Please include your name and town when sending a comment. Email to opuntia57@hotmail.com]

FROM: John Purcell 2017-10-29
College Station, Texas

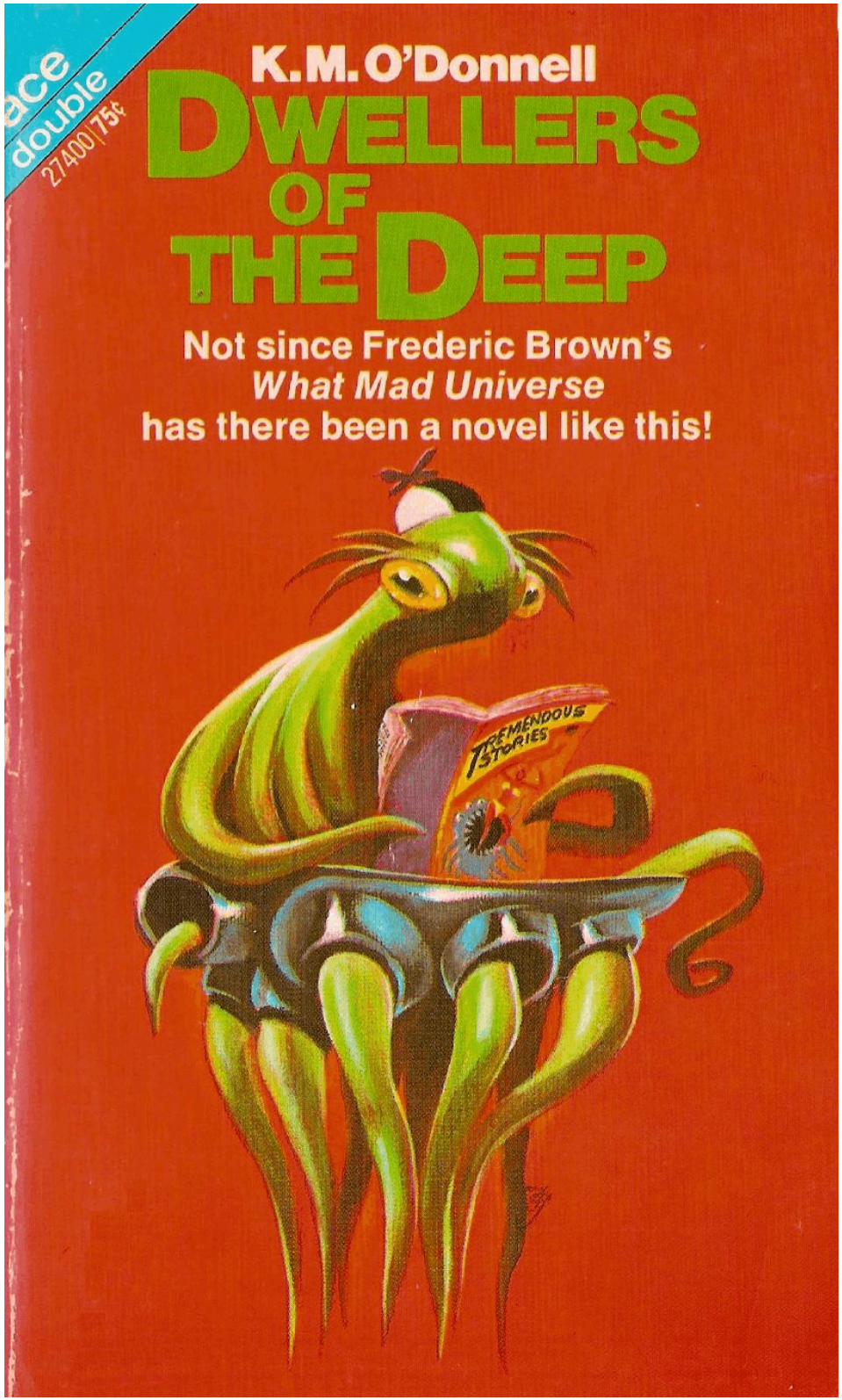
I enjoyed the photos of the Beakerhead 2017 Festival in OPUNTIA #391. It sure looks like a lot of fun with the kind of out-there arts and crafts my wife and I would enjoy. We like kinetic and tactile art, especially the kind that brings the viewer into the work itself. Fun stuff, this. Thank you for the great photos.

All of those mystery story synopses and reviews remind me to read more fiction in that genre again. Lately I've been on an old science fiction kick, in this case, John Brunner's work of 1959 to 1965, which includes a passel of Ace Doubles in my book collection. I think this phase won't last very long, and just might shift gears completely and read one of the Brother Cadfael books I own. Or I'll go to the local public library and find a couple recent mysteries. Whatever strikes my fancy will work just fine.

[I never tried to get a complete run of the Ace Doubles but did pick up a number of them back when Calgary had secondhand bookstores. For those who haven't seen them, Ace Doubles were two novels bound back-to-back and upside-down, usually by different authors. My favourite is DWELLERS OF THE DEEP by Barry Malzberg under his pseudonym K.M. O'Donnell, a humourous parody of New York City SF fandom, mixed in with an alien invasion.]

2012: DOOMSDAY sounds like the kind of cinematic clunker I'd enjoy. The more ludicrous, the better. On a related note, there likewise have been a ton of god-awful Frankenstein monster movies produced during the 1960s, so it's remarkable that the two Frankenstein flicks reviewed are actually halfways decent. An interesting departure from these is the 2014 movie I, FRANKENSTEIN that brings the focus back on the creator. The SyFy Channel has shown it a lot this month, well, it is October and Halloween is in two days, so that makes sense, and I'm wondering if you've seen it. Considering how that movie could have turned out, it really is not that bad.

I Also Heard From: Joseph Nicholas



Mousis, O., et al (2017) **Scientific rationale for Uranus and Neptune in situ explorations.** PLANETARY AND SPACE SCIENCE doi.org/10.1016/j.pss.2017.10.005

Authors' abstract: *The ice giants Uranus and Neptune are the least understood class of planets in our solar system but the most frequently observed type of exoplanets. Presumed to have a small rocky core, a deep interior comprising ~70% heavy elements surrounded by a more dilute outer envelope of H_2 and He,*

Uranus and Neptune are fundamentally different from the better-explored gas giants Jupiter and Saturn. Because of the lack of dedicated exploration missions, our knowledge of the composition and atmospheric processes of these distant worlds is primarily derived from remote sensing from Earth-based observatories and space telescopes.

As a result, Uranus's and Neptune's physical and atmospheric properties remain poorly constrained and their roles in the evolution of the Solar System not well understood. Exploration of an ice giant system is therefore a high-priority science objective as these systems (including the magnetosphere, satellites, rings, atmosphere, and interior) challenge our understanding of planetary formation and evolution.

Here we describe the main scientific goals to be addressed by a future in situ exploration of an ice giant. An atmospheric entry probe targeting the 10-bar level, about 5 scale heights beneath the tropopause, would yield insight into two broad themes: i) the formation history of the ice giants and, in a broader extent, that of the Solar System, and ii) the processes at play in planetary atmospheres. The probe would descend under parachute to measure composition, structure, and dynamics, with data returned to Earth using a Carrier Relay Spacecraft as a relay station.

Norris, C.A., and B.J. Wood (2017) **Earth's volatile contents established by melting and vaporization.** NATURE 549:507-510

Authors' abstract: *The silicate Earth is strongly depleted in moderately volatile elements (such as lead, zinc, indium and alkali elements) relative to CI chondrites, the meteorites that compositionally most closely resemble the Sun. This depletion may be explained qualitatively by accretion of 10 to 20 per cent of a volatile-rich body to a reduced volatile-free proto-Earth, followed by partial extraction of some elements to the core. However, there are several unanswered questions regarding the sources of Earth's volatiles, notably the overabundance of indium in the silicate Earth.*

Here we examine the melting processes that occurred during accretion on Earth and precursor bodies and report vaporization experiments under conditions of fixed temperature and oxygen fugacity. We find that the pattern of volatile element depletion in the silicate Earth is consistent with partial melting and vaporization rather than with simple accretion of a volatile-rich chondrite-like body. We argue that melting and vaporization on precursor bodies and possibly during the giant Moon-forming impact were responsible for establishing the observed abundances of moderately volatile elements in Earth.

Fleury, B., et al (2017) **Organic chemistry in a CO_2 rich early Earth atmosphere.** EARTH AND PLANETARY SCIENCE LETTERS 479:34-42

Authors' abstract: *The emergence of life on the Earth has required a prior organic chemistry leading to the formation of prebiotic molecules. The origin and the evolution of the organic matter on the early Earth is not yet firmly understood. Several hypothesis, possibly complementary, are considered. They can be divided in two categories: endogenous and exogenous sources. In this work we investigate the contribution of a specific endogenous source: the organic chemistry occurring in the ionosphere of the early Earth where the significant visible light-ultraviolet contribution of the young Sun involved an efficient formation of reactive species.*

We address the issue whether this chemistry can lead to the formation of complex organic compounds with CO_2 as only source of carbon in an early atmosphere made of N_2, CO_2 and H_2, by mimicking experimentally this type of chemistry using a low pressure plasma reactor. By analyzing the gaseous phase composition, we strictly identified the formation of H_2O, NH_3, N_2O and C_2N_2. The formation of a solid organic phase is also observed, confirming the possibility to trigger organic chemistry in the upper atmosphere of the early Earth. The identification of nitrogen-bearing chemical functions in the solid highlights the possibility for an efficient ionospheric chemistry to provide prebiotic material on the early Earth.

Zellner, N.E.B. (2017) **Cataclysm no more: New views on the timing and delivery of lunar impactors.** ORIGINS OF LIFE AND EVOLUTION OF BIOSPHERES 47:261-280

Author's abstract: *If properly interpreted, the impact record of the Moon, Earth's nearest neighbour, can be used to gain insights into how the Earth has been influenced by impacting events since its formation about 4.5 billion years (Ga) ago. However, the nature and timing of the lunar impactors, and indeed the lunar impact record itself, are not well understood. Of particular interest are the ages of lunar impact basins and what they tell us about the proposed lunar cataclysm and/or the late heavy bombardment, and how this impact episode may have affected early life on Earth or other planets.*

Here, the existing information regarding the nature of the lunar impact record is reviewed and new interpretations are presented. Importantly, it is demonstrated that most evidence supports a prolonged lunar (and thus, terrestrial) bombardment from about 4.2 to 3.4 Ga and not a cataclysmic spike at about 3.9 Ga.

Pearce, B.K.D., et al (2017) **Origin of the RNA world: The fate of nucleobases in warm little ponds.** PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES USA 114:11327-11332

Authors' abstract: *There are currently two competing hypotheses for the site at which an RNA world emerged: hydrothermal vents in the deep ocean and warm little ponds. Because the former lacks wet and dry cycles, which are well known to promote polymerization (in this case, of nucleotides into RNA), we construct a comprehensive model for the origin of RNA in the latter sites.*

Before the origin of simple cellular life, the building blocks of RNA (nucleotides) had to form and polymerize in favorable environments on early Earth. At this time, meteorites and interplanetary dust particles delivered organics such as nucleobases (the characteristic molecules of nucleotides) to warm little ponds whose wet-dry cycles promoted rapid polymerization.

We build a comprehensive numerical model for the evolution of nucleobases in warm little ponds leading to the emergence of the first nucleotides and RNA. We couple Earth's early evolution with complex prebiotic chemistry in these environments.

We find that RNA polymers must have emerged very quickly after the deposition of meteorites (less than a few years). Their constituent nucleobases were primarily meteoritic in origin and not from interplanetary dust particles.

Ponds appeared as continents rose out of the early global ocean, but this increasing availability of targets for meteorites was offset by declining meteorite bombardment rates. Moreover, the rapid losses of nucleobases to pond seepage during wet periods, and to UV photodissociation during dry periods, mean that the synthesis of nucleotides and their polymerization into RNA occurred in just one to a few wet-dry cycles. Under these conditions, RNA polymers likely appeared before 4.17 billion years ago.

Tashiro, T., et al (2017) **Early trace of life from 3.95 Ga sedimentary rocks in Labrador, Canada.** NATURE 549:516-518

Authors' abstract: *The vestiges of life in Eoarchean rocks have the potential to elucidate the origin of life. However, gathering evidence from many terrains is not always possible, and biogenic graphite has thus far been found only in the 3.7–3.8 Ga (gigayears ago) Isua supracrustal belt. Here we present the total organic carbon contents and carbon isotope values (d13C) of graphite and carbonate in the oldest metasedimentary rocks from northern Labrador.*

Some pelitic rocks have low d13C values of -28.2, comparable to the lowest value in younger rocks. The consistency between crystallization temperatures of the graphite and metamorphic temperature of the host rocks establishes that the graphite does not originate from later contamination. A clear correlation between the d13C values and metamorphic grade indicates that variations in the d13C values are due to metamorphism, and that the pre-metamorphic value was lower than the minimum value.

We concluded that the large fractionation between the d13C values, up to 25‰, indicates the oldest evidence of organisms greater than 3.95 Ga. The discovery of the biogenic graphite enables geochemical study of the biogenic materials themselves, and will provide insight into early life not only on Earth but also on other planets.