

This is the story of Liam FitzGerald, and the forty-plus years he spent battling avalanches in Little Cottonwood Canyon, the birthplace of Avalanche Forecasting and Avalanche Control in North America.

**Throwing Stones in a Glass House:
A career battling avalanches in Little Cottonwood Canyon**
By Liam FitzGerald

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THROWING STONES IN A GLASS HOUSE

A career battling avalanches in
Little Cottonwood Canyon



LIAM FITZGERALD

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Print ISBN: 978-1-958877-72-2

Ebook ISBN: 979-8-88531-342-1

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Published by BookLocker.com, Inc., Trenton, Georgia.

Printed on acid-free paper.

BookLocker.com, Inc.

2023

First Edition

Library of Congress Cataloguing in Publication Data

FitzGerald, Liam

Throwing Stones in a Glass House: A career battling avalanches in

Little Cottonwood Canyon by Liam FitzGerald

Library of Congress Control Number: 2022917878

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A Note to Readers; In many parts of this book I have used terms that are particular to the avalanche world. Most of those terms are *italicized* when they first appear in the text, and are described in more detail in the *Glossary of Terms*.

Prologue: **Epiphany**

Deciding to lower the curtain on a life-long career is a seminal moment in a person's life. It can mean an end to many things; a cherished personal identity, a deeply embedded daily routine, or a love affair with a comfortably familiar life-style. It can also mark the beginning of the transition to a more normal life that sooner or later, faces all those who are lucky enough to have unique and interesting jobs. For me, that seminal moment came during an intense snowstorm on the night of February 23, 2013.

My job at the time was that of Supervisor and Lead *Avalanche Forecaster* for the Utah Department of Transportation Highway Avalanche Safety program in Little Cottonwood Canyon. I had held that position for the past fifteen years, and during that time it had gotten most all of my attention during my waking hours. That night, as I sat in the parking lot of the White Pine trail head, the headlights of my truck illuminating the foggy curtain of fat snowflakes that were still falling after hours of accumulation, watching the excruciatingly slow progress of perhaps 3000 vehicles trying to negotiate the steep, snow covered two lane road in order to get down and out of the canyon, I realized that I didn't want to do "this" anymore.

What made watching this exodus so painful was the fact that I considered the safety of every person participating in the bumper-to-bumper parade of cars, trucks, and SUVs, my responsibility, and that there were very few options available in order to maintain control over a situation I had allowed to develop, and that I felt was becoming increasingly dangerous by the minute.

Utah State Road 210 in Little Cottonwood Canyon is one of several busy mountain highways in North America threatened by

avalanches during the winter season. The road travels east from the Salt Lake Valley, climbing some 3,300 feet in elevation in about eight-miles, and ending in the Town of Alta near the head of the canyon. It can at times be a dangerous road.

There are other notorious roadways in the U.S. and Canada that are exposed to either more numerous or larger *avalanche paths*, such as Rogers Pass on the Trans-Canada Highway, the Seward Highway in Alaska, or Highway U.S. 550 over Colorado's Red Mountain Pass, but the road in Little Cottonwood Canyon has a fairly unique combination of conditions and circumstances that make it one of the more difficult highways to manage. For one, the sheer number of vehicles traveling the canyon road alone causes multi-hour traffic jams on a regular basis during the height of the ski season. This problem is exacerbated when you mix in the winter weather that not only produces the legendary 500+ inches of annual snowfall in the upper canyon, but also frequently coats the consistently steep grade with a wide variety of snow, slush, and icy conditions. This combination encourages careful and often slow driving up, and especially down the canyon.

The upper-half of the canyon road, approximately five miles in length, is a nearly continuous traverse through a variety of moderately large and frequently active avalanche paths. Along this section there is often very little distance between the *Track* portion of the path (the relatively steep terrain that connects the *Starting Zone* and the *Run Out Zone*) and the road itself. It's far more desirable if possible, to locate a road farther away from the steeper terrain, well into the Run Out Zone where lower slope angles allow for the moving snow to decelerate and in many cases stop before it can become a problem. When a road travels through steeper terrain near the bottom of the Track, relatively small avalanches can pose a threat to traffic. Even if one of these smaller events doesn't score a direct hit on a moving vehicle, it will most likely block travel in both directions. Then, due to the unusually high

traffic volume on Utah SR 210 during the ski season, within a few minutes the road will become a narrow, several-mile-long parking lot. We now have a situation where scores of stationary vehicles have become soft targets, directly in the sights of numerous adjacent and similarly configured avalanche paths, any one of which may be primed for a release even larger than the initial traffic-blocking event.

All this is compounded by the fact that Highway 210 is a dead-end road. Every vehicle that travels up the canyon in order to reach the resorts of Snowbird and Alta passes through thirty-five avalanche paths on the way, and must pass through those same paths on the way back down once the resorts have closed. Few places, especially in the upper part of the canyon, can be considered safe from being over-run during a serious avalanche cycle; this means there are very few areas where traffic or people can hide out and wait until things calm down. So if the decision is made to allow traffic into the canyon at the beginning of the day, the floodgates have been opened. Several thousand vehicles will be headed up the road during the morning hours, and they all need to get back down safely at the end of the day.

A lot can happen - snow, weather, and avalanche wise - between the time the first wave of day-skiers arrive, and when the last of the stop-and-go traffic exits the canyon some eight to ten hours later. The night of my epiphany, February 23rd, was shaping up to be one where all of these negative factors just might come together and turn things into a real mess. It was another in a long line of stressful, worrisome, and draining episodes that were starting to wear me down.

It hadn't always seemed so hard.

Chapter 1:

Legends

My professional avalanche career began in the fall of 1968, when at the age of twenty-two, I somehow landed a job on the Squaw Valley¹ Ski Patrol. I could barely ski at all. Other than a few years in the military after high school, I had spent all my life at, or near sea level in and around the San Francisco Bay Area. My time in the mountains had been limited to a month or so the previous spring, when a friend from Santa Cruz, who was a Patroller at Squaw, let me take up residence on his couch and gave me a crash course in skiing. Prior to that, I never had a pair of skis on my feet. Like I said, I could barely ski. But I was enthusiastic, reasonably strong, and must have had a high tolerance for pain. It was either fate, or maybe I was just lucky, but somehow I got the job.

The winter of 1968-69 (for avalanche workers the “winter” usually begins in the fall, and ends sometime in the spring) is remembered for copious amounts of snow in many parts of the western U.S., and it was especially memorable in the Sierra Nevada Mountains. I think the total snowfall that season in the Lake Tahoe area was close to 600 inches, and looking back, it seems like it was always snowing. My car got stuck in the driveway of the house in Squaw Valley where I rented a room, sometime around Christmas. I found it with an avalanche rescue probe the following April, right where I left it, buried under ten-feet of snow. It was actually fortunate for me that it did snow so much during my first year as a Patroller, because that meant much of my time at work was spent slogging through deep, untracked snow deposited by a nearly endless procession of Pacific storms, while running *avalanche control* routes. This saved me from some of the humiliation of continually

¹ Following the 2021 season, the ski area changed its name from *Squaw Valley* to *Palisades Tahoe*.

demonstrating to everyone else on the crew how poorly I skied, especially during the first month or so of the season. When it did become necessary for me to ski, it was often in deep, un-tracked snow, so in a reversal of the evolutionary path most people follow in learning how to ski, I slowly became a passable powder-skier long before I could do much more than simply survive when skiing hard-pack.

That first year on the Ski Patrol seemed like a continuous “*Groundhog Day*” of arriving at the resort early in the morning for *avalanche control* work, throwing “bombs” (the generic term used by Patrollers for the explosive charges they use to initiate avalanches) and skiing powder much of the day, and cavorting with my friends and co-workers at night; then getting up the next morning and doing it all over again. By the time the season ended and several of us had left on a celebratory road trip to Mexico’s Pacific coast, I was totally enamored with my job, hooked on powder skiing, and captivated by the avalanche phenomena.

There were only thirteen of us on the Squaw Valley Professional Ski Patrol back then, with volunteers from the National Ski Patrol, regular people with regular jobs (we casually referred to them, and most everyone else who didn’t live in the Squaw Valley-Lake Tahoe area, as “Flatlanders”), showing up to help us handle the horde of skiers that would invade our world on weekends and holidays. The size of the resort in the late-1960’s pales in comparison to the size of the present-day Squaw Valley, but it still seems remarkable to me that so few of us were able to deal with the crowds, and with the avalanche problems that existed even in that compact version of the ski area as well as we did.

I was one of several rookies on the Patrol that winter, and us “new guys” seemed to mix well with the older, seasoned veterans, some of whom to my amazement, had worked there for as long as five-years. We took our job pretty seriously, as we should have, and

even though on occasion we may have been a little overly dramatic about some of what we did, there was a real, albeit somewhat primitive, sense of a “pursuit of excellence” in snow safety related matters that was perpetuated by the group as a whole. Even back then, Squaw Valley was recognized as a ski area with an abundance of complex avalanche terrain, and there was a well established tradition of the Ski Patrol doing battle with the elements in order to make the place safe for the public. That tradition was a tremendous source of pride for all of us. Monty Atwater, the original “Avalanche Hunter”, and founding father of the avalanche profession in this country, had been a principal figure in the *snow safety* program at Squaw during the 1960 Winter Olympics, just eight years prior to our arrival. And although it seemed to many of us that eight years was an awfully long time, we could still feel the affect of his larger-than-life presence in the work that we did, in how the resort was run, and even in the attitude of many of the “locals” who were not actually a part of the avalanche community. Most people seemed to understand that Ski Patrollers, although a bit unrestrained and full of testosterone, were actually doing an important job, and worthy of, if not outright respect, at least a little tolerance. There were other Squaw Valley snow safety luminaries during that period that we looked up to as well including; Wally Ballinger, Leroy Hill, and the legendary Dick Reuter.

Reuter was a mountain of a man, tall and rangy, with topographical facial features that like the landscape, seemed to have been shaped and eroded over time by the elements. He epitomized for me, and I’m sure for others as well, what a “mountain-man” should be. By the time I arrived at Squaw he was well into middle age, and had migrated from the Ski Patrol, of which he had been a member in the 1950’s and early 60’s, to the position of Head Mechanic and Supervisor of Chairlift Maintenance, along with his other job, that of de facto Mountain Manager. During that period in Squaw’s history, chairlift operations were a constant problem, and it was quite normal for him to spend his day skiing from one mechanical

malfuction to another, climbing lift towers, reviving stalled drive-motors, replacing worn-out equipment, and belaying stranded skiers from broken-down chairlifts, all the while carrying a backpack full of tools and equipment that most of us could barely lift, let alone ski with. He once told me, *“When I was your age, I was tougher than bark on a tree”*; I truly believed him. Although Reuter was no longer part of the Ski Patrol, he was still a part of the avalanche crew. It seemed to many of us that he was the “spiritual leader” of the snow safety program, although I’m sure he would have at best found that title ridiculously amusing, and at worst totally incomprehensible. His direct connection to the early days of ski area avalanche control work was intoxicatingly inspiring, and he maintained a natural humility and a lack of bravado, while at the same time exuding unquestionable courage, strength, grit, and occasional “boyish” humor. The Headwall of Squaw Peak was his “Moby Dick”.

Legend had it, that sometime back in the 1950’s, Reuter had been caught in a large avalanche while blasting the Headwall. He was carried downslope by a giant wave of moving snow and “spit-out” somewhere near the bottom, amazingly still in one-piece. This event seemed to have forged a special relationship between him and his formidable adversary. The Headwall of Squaw Peak is not an unusually long avalanche path, but it is fairly wide, and has a notably convex shape. It loads excessively with westerly winds that deposit tons of moisture laden snow in a huge wind-roll along the difficult to reach steeper section, just above mid-slope. To reach the area of greatest deposition with explosives required either the use of military artillery (available to the Patrol around the time of the 1960 Winter Olympics, but taken away a short time later), or some brave soul “hanging it out” by skiing down the side of the slope above the “roll” in order to throw a shot (explosive charge) into the right location. Whether the avalanche that caught Reuter occurred while he was carefully inching his way out onto the face in order to throw his shot, or whether it was initiated by the shot he threw,

and broke out above him as he hunkered down in an assumed “safe-spot” I’m not certain, but in either case, he must have considered himself lucky to have survived. In looking at photos from that era of huge *Fracture Lines* on the Headwall, it’s easy to see how getting caught in one of those monsters could be a life-changing experience. Although badly beaten, he had not been defeated, and he would return to face his nemeses on many occasions, often with some terrified neophyte in tow.

According to stories I had been told, back in the early days the Patrol on occasion had to hike from the lower-mountain to the top of the ski area after a big storm (because the chairlift[s] couldn’t run due to too much snow) in order to do the avalanche control work necessary to open the resort. The task of breaking trail through deep snow to the top of Squaw Peak with a backpack full of dynamite would be enough to exhaust most anyone, but once they got there they had to turn-around and run outlandishly long and time-consuming *hand charge routes* on their way back down. That would have made for a long day. Also, on the difficult and lengthy hike up, they had to pass under terrain they later intended to blast once they reached the top and could access the avalanche starting zones.

Traveling under uncontrolled slide-paths just after a big storm is risky business in any era, but this was a time before the development of the avalanche rescue beacon, a device that would later become a standard part of every Ski Patroller’s safety gear, and greatly improve the chances of being found alive if caught and buried. According to Norm Wilson, another heroic character from that era, not only were there no beacons available to the Patrol, no one on the crew wore an *avalanche-cord* either, over concern that they might be considered a “sissy” by the rest of the group. Stories like these were both incredibly romantic and very humbling to a young Patroller. Being part of a latter generation of avalanche hunters, we understood that what we were doing was fairly unique

and at times dangerous, but compared to the heroic struggles of our predecessors, we had it fairly easy.

The rather violent history Dick shared with the Headwall seemed to require that he confront his “demon” whenever it seemed that conditions might be right for another large avalanche. Those conditions would usually develop during the big, multi-day winter storms for which the Lake Tahoe area is famous. As it turned out, the ‘68-‘69 winter produced an abundance of those types of weather events, thus providing a new generation with numerous opportunities to follow Reuter on his noble crusades. In fact there were so many “big-storms” that season that by mid-winter several chairlifts had lost their bottom-stations entirely due to the remarkably deep snowpack. It was a strange site to see chairlift cables eerily running into the snow, with lift-shacks, bull-wheels, and drive-motors, completely buried and nowhere to be seen. A few other lifts had suffered catastrophic derailments after attempts were made to run them without first ensuring the top unloading ramps were not totally “drifted-in” with snow. As a result of these mishaps, the Patrol lost a portion of the normal lift-served access to the upper mountain for several weeks that winter. During that period, when it became necessary to do control work, we would ride the Gondola to the mid-mountain restaurant at Gold Coast, climb into an old *Tucker* snow-cat, and ride as far up towards the ridge as it could take us. Then in a setting that made us feel a little like our heroic predecessors, we would get out with our packs stuffed full of explosives, and hike to the top. The journey took us over, as well as through the top of Squaw Peak², across the Headwall, and finished-up near the Saddle of KT-22. The effort

² A part of the ascent traveled through a Federal Aviation Administration VOR/DME facility tunneled into the top of the mountain that reminded me of the “Mines of Moria” in Tolkien’s *Lord of the Rings*. Water seeped through the solid rock walls, and the walkway, which was poorly lit, included what seemed like at least a hundred-or-so, old wooden stairs one had to climb before emerging once again out onto the frozen, barren, and incredibly windy summit.

would take most of the morning to complete, and in the end we were only able to open a portion of the resort. This was probably not a very good business model, but it made for some great stories recounted over the numerous pitchers of beer we would consume at the end of the day.

I still have vivid images of the first trip I made to the Headwall with Reuter, part way through my rookie season. I remember it being cold, grey, and very windy, with blowing snow obscuring the track I was trying to follow, giving me an unpleasant feeling of vertigo. At first, I considered being selected to accompany Dick on one of his epic treks an acknowledgement of my ability to endure the harsh weather conditions we expected to encounter, but traveling along the ridgeline with visibility limited to fifty feet or less, I began to wonder if I was cut out for the job. We had been outside in some pretty nasty weather for quite some time, and I was feeling wet and cold. Dick, who was nearly deaf, the result of his repeated exposure to explosives and artillery, didn't seem to hear my requests to stop, just for a minute, so that I could un-fog my goggles, and rearrange myself somewhat in order to keep the wind and blowing snow out of collar, sleeves, hat, and any other breach in the barely adequate winter clothing we wore at the time. But I could hear him, muttering either to himself or perhaps to me, thinking incorrectly, that I was right behind him. Due to the poor visibility, it was unclear to me just where we were, but he kept trudging along at a pace I found difficult to keep up with. I was determined however not to fall too far behind, for one, over the fear that I might get lost and die, but more importantly, because I didn't want him to think that I wasn't up to the task.

When I finally caught up with him it was because he had stopped and I assumed that meant we had finally reached our objective. He had removed the 150' coil of half-inch manila rope that had been slung around his neck and shoulders and was tying it off to a lift-tower. He tied the other end around his waist, and then told me to

put him “*on-belay*”. I had never put anyone “*on-belay*”, and I didn’t think this was a very good time to start, but in my attempt not to show how close I was to suggesting we call the whole thing off and head to someplace warm and dry, I grabbed the rope and said, “OK”. Then with several explosive charges tucked in his coat, he proceeded to walk over the edge, and out of sight. I immediately felt very alone.

From the tension on the rope I could tell that he was out there somewhere in the grey void, but I didn’t know exactly where. Over the incessant roar of the wind I could hear one-shot go off, and then another, but I had no idea what might be happening. A few moments later, the tension on the rope relaxed, and I assumed that meant he had either been swept-away by an avalanche, or that he was hiking back up. Eventually his hulking frame appeared over the top of the break-over and still muttering to himself, he rejoined me at the tower. He said that the shots he had thrown had failed to produce any significant results, and that one of them had been a “dud” (an explosive charge that fails to detonate after the fuse is lit). Then for reasons that eluded me back then, we just stood there, in silence, while the wind continued to pound-away at us, for what seemed like an unusually long period of time. Just as it felt like hypothermia might be setting in, he rather casually instructed me to attach myself to the end of the rope he had just removed from his waist, and to go back down and retrieve the shot that hadn’t gone off. This did not sound like a good idea. Was the charge likely to detonate just as I reached to pick it up? Was the slope likely to avalanche when I got out on it, and after breaking the rope, take me and the supposed dud on a terrifying, life-ending ride down to the flats? This seemed beyond what might be considered a reasonable request, but once again, in an attempt to make him think that I was not as uncomfortable with the situation as I really was, I tied myself in (with his help) and headed-off into the unknown.

I understand now that he must have been pretty sure I was going to make it back up safely, or else he would not have let me go. And, that he was giving me a chance to feel like I was contributing to the effort that was required to get the job done. After all, this is what Ski Patrollers and avalanche workers around the world do, they put themselves in harms way so that others can travel, work, or recreate in an environment that, without their efforts, would otherwise be very unsafe.

Chapter 2: *New Horizons*

By the end of my third winter as a Squaw Valley Patroller, not only had I survived with only a few stays in the hospital, I had also maintained a keen interest in all things-avalanche. This continued fascination, as much as anything would shape what the rest of my life was going to be like.

In the fall of 1970, rumors began to spread throughout the ski-industry that a big, new resort was slated to open in the Wasatch Mountains of northern Utah in the not-too-distant future. Initially there seemed to be few details available to the outside world about this proposed development, other than what I thought was its rather strange name. But in spite of the lack of information, just the idea of a new ski area in the western U.S. sparked a keen interest, especially among members of the baby-boom generation who had become attracted to the "mountain" lifestyle.

It so happened that a few months later, the Mountain Manager at Squaw, a fanatically hard working but often authoritarian and caustic German named Hans Burkhart, was hired to oversee the construction of the aerial tram and the three chairlifts that would become the genesis of *Snowbird*, the new "Super-Resort" that was the source of the rumors. His description of the area was quite alluring, and he informed the few of us he had made privy to his role in this grand scheme, that Snowbird would be located just over the ridge from the legendary Alta Ski Area in Little Cottonwood Canyon. Alta, as far as I knew was famous for two things, powder skiing and avalanches, both major attractions for me at that point in my life. So at the end of the 1970-71 season when Hans offered me a job as part of the crew that would be building the proposed tram and chairlifts, I took the offer without much hesitation. To be considered worthy of employment on a project like this was

somewhat of an honor, it suggested that Hans held you in fairly high esteem, and that you were considered to be “a good worker”, a title I have aspired to attain throughout my entire life.

As soon as I knew for sure that I had the job and would be headed for Utah, I asked my sweetheart, Marjorie Ann Heitman, to marry me. She was the wonderful girl I had met the previous summer while working in North Idaho, and had convinced to come live with me in Squaw for the winter. The prospect of doing something totally new, in a totally new location, inspired me to make an even bigger change in my life. So even though some of my closest friends half-jokingly warned her to think carefully before accepting my proposal, she said yes.

Our wedding took place in June of 1971, in the vast and incredibly beautiful meadow that forms the entrance to Squaw Valley. Back then, except for a few horse stables and corrals at the far end, it was still in its natural and pristine state, and was, we thought, the perfect setting for our celebration. It was a day full of love, peace, good vibes and everything else that our counter-culture world was famous for at that time. My parents (who elected not to attend) called it a “hippie-wedding”, which I suppose it was, but it was also a beautiful and diverse gathering of many of the people (including the rusticated Dick Reuter) who had helped launch me on the path I would follow for the rest of my working life.

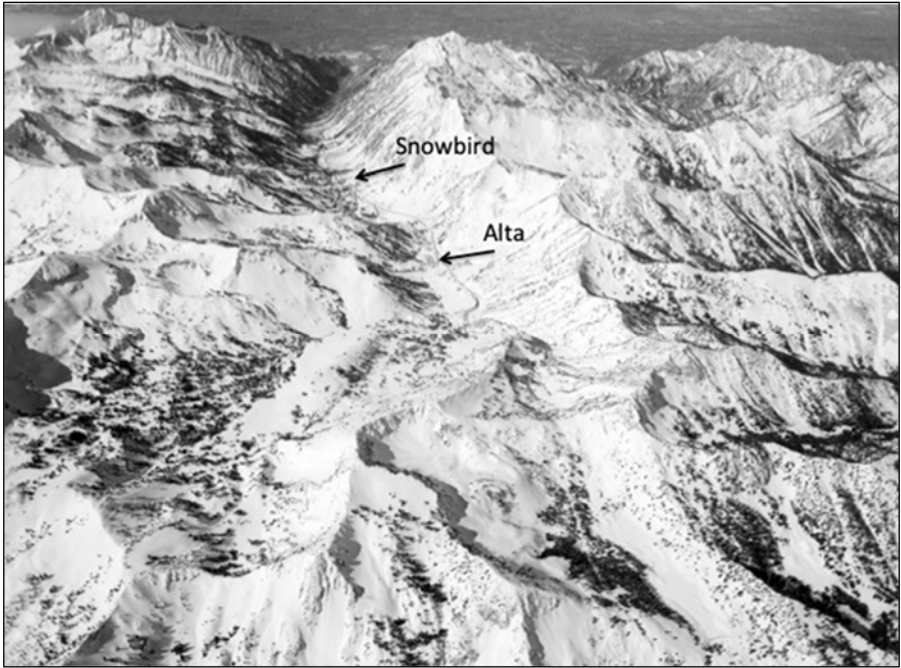
We left for Utah the following evening.

After driving all night across Nevada and western Utah, we arrived at the bottom of Little Cottonwood Canyon around noon the following day. Construction of a sewer line for the “new” resort caused a several-hour delay on the canyon road, so we didn’t make it up to Alta until sometime in the afternoon. Other than some very rudimentary instructions of how to get there, we had no idea what to expect. We were driving Marjorie’s Ford station wagon with our

bicycles and an old wooden icebox strapped to the top, and all of our worldly possessions, plus a kitten and a puppy, on the inside; we must have looked a little like the *Clampetts* when they arrived in Beverly Hills. I was used to the small ski-town settings of Squaw Valley and Tahoe City, but Alta seemed several orders of magnitude smaller than either of those. Driving slowly through “town”, which consisted of five relatively small ski-lodges, one set of condos, a few other random buildings, and the Alta Ski Lift Company parking lot, we spied some guys who looked like they might be locals, and asked if there was any place to buy groceries, and where we might set-up camp? They gave us a rather blank look, and then said that neither of those opportunities were available in Alta. They told us that the nearest store was down in the “valley”, a forty-five minute drive away, but that there was a U.S. Forest Service campground about four miles down the road that they thought was open.

We found the campground, and also the campground signs that read “No Dogs Allowed”, and “Camping Limit 10 Days”. This presented an immediate problem, since we had a dog (and a cat), and needed a place to stay for the next several months, not just a week and a-half. There seemed to be no other place even remotely close where we could go. The other campground in the canyon, a mile or so up a dirt road in an area called Albion Basin, was still snowed-in, and usually didn’t open until July 24th, “Mormon Pioneer Day”. Things were beginning to look a little grim, and the wisdom of our decision to pull-up stakes and head for Utah seemed to be in question. But it turned out that the enforcement of many of the campground rules was fairly lax, and the Forest Service employees we met seemed to be happy that a lovely young couple, who obviously seemed to be quiet, law-abiding, and responsible, were willing to stay in the campground all summer and “keep an eye on things”. We found a cozy site next to a small stream that ran into Little Cottonwood Creek, which at that time of year was still “raging”, and happily set-up camp, preparing for an extended stay.

Viewing the terrain in Little Cottonwood Canyon with the eye of an avalanche worker was an impressive sight. It's a glacially formed, east-west running canyon with the ridge lines on both sides adhering fairly consistently to the 11,000 foot contour line. Near its mouth, the canyon is comprised mostly of granite, with steep walls and sub-ridges climbing nearly 5,000 feet in elevation from the creek. The mid-portion of canyon becomes wider, and the granite begins to give way to quartzite, with broader valleys and gulches off to the south, while the north side maintains its steepness, punctuated by deep gullies several thousand feet in length that connect the open slopes near the ridgeline to the canyon floor. In the upper canyon the terrain becomes a little less steep, and the rise to the ridgeline is reduced to around 1,700 feet. It's here where the Town of Alta was established in the late-1860's, it's early inhabitants choosing one of the wider parts of the canyon to call home. In general, the terrain in Little Cottonwood Canyon can be described as "steep", and it seems that no matter what you're doing you're always either going Up, or Down. This ever-present topographical condition makes everything one does there just a little more difficult.



*Little Cottonwood Canyon, looking west towards the Salt Lake Valley.
Photo: Olympus Aerial Photography*

The other thing that impressed me was how lush it was. Late spring/early summer in the Wasatch Mountains is a glorious time, when the deep snowpack has usually receded to the upper elevations, but is still putting forth rivulets and streams everywhere. All that water combined with the blazing Utah sun results in a burst of new plant growth each year, with thick underbrush and a variety of evergreen and deciduous trees covering most anyplace below tree line that can hold soil. Much of the timber in the upper canyon had been harvested in the 1800's, to shore-up the labyrinth of mine tunnels hollowed out below ground in the search for silver, as well as to build the boarding-houses, general stores, stables and saloons, that sprung-up in the "overnight" fashion of most mining-era towns throughout the American west. In the mid and lower portions of the canyon the trees were mostly left uncut. Here the size and species of the

standing timber often define the boundaries of larger avalanche paths. Aspen trees are often the first to repopulate areas that have been overrun by avalanches, and indicate the areas most often inundated. Stands of fir and spruce on the other hand, may suggest immunity from the smaller, more recurrent avalanche events, but may bare signs of damage from less frequent but larger avalanches in the past. Avalanches also limit the size to which trees of any type can reach, as once they grow to the point where they can no longer flex or bend when over-run by big, fast moving avalanches, they often get snapped off at the snow surface, or ripped out by the roots.

Before I moved to Utah, I had heard a rumor that the somewhat mythical U.S. Forest Service Snow Rangers at Alta had managed to acquire most all of the *Head "Deep-Powder"* skis known to exist at that time. These were considered specialty skis even in those days that had little use in anything but deep snow. What I assumed this meant was that the snow at Alta was always light and untracked, and that those guys, due to the nature of their jobs which I imagined combined equal parts metaphysics and commando warfare, did a lot of powder skiing. Images of these faceless individuals, who for some reason I assumed were much older than me, and who I imagined possessed an other-worldliness like that of warrior monks living in remote mountain monasteries, throwing bombs, and skiing bottomless powder, was easy to conjure-up. Why else would anyone collect so many powder skis?

As I came to understand later, many of the rumors actually weren't true, the Snow Rangers hadn't hoarded all the old skis, and for the most part they were pretty ordinary people, and the snow that covers the slopes isn't always light, dry, untracked powder, but it's usually pretty good, and there's a lot of it. There's a good reason why Utah license plates proudly proclaim, without the least bit of humility, that their state has the "Greatest Snow On Earth".

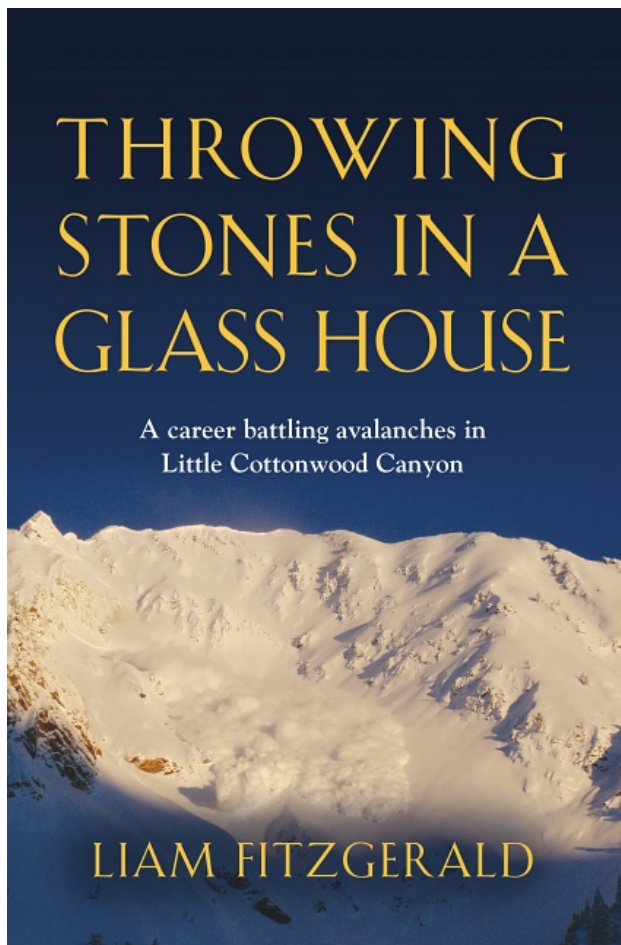
The U.S. Forest Service-Alta Guard Station, located at an elevation of 8,700 feet in the upper reaches of the canyon, has kept snow, weather, and avalanche records since its inception in 1939, with very accurate and complete records dating back to the winter of 1945-46. These records indicate an average annual snowfall, measured from November 1st, to April 30th, of around 500", and the average annual *Snow Water-Equivalent (SWE)* of all that snow at 42". This snow to water ratio equates to an average *snow density* of roughly 8% the density of water. By comparison, the average new snow density in the Sierra Nevada Mountains is around 13%. Now that may not sound like much of a difference, but believe me it is, and it has a lot to do with the somewhat legendary status Utah skiing holds within the Winter Sports community.

But it's not just the amount or the quality of the snow in the Wasatch that makes for such great skiing; it's also how the snow is deposited. Often during prolonged storms (those lasting 24 hours or more) the snow density in the early stages is higher, forming a soft but somewhat supportable base layer that covers the old snow surface and fills in any irregularities there may have been. As the storm progresses and the new snow depth increases, the density usually decreases, with the last six inches or so often as low as four or five percent. Add to this the fact that the snow that falls towards the end of the storm is often accompanied by very low wind speeds. This means that your skis are riding on the denser snow from the beginning of the storm while the lightest snow is what surrounds your body, swirling around you without resistance, obscuring your vision and sweeping over your head. Skiing down a steep slope through this perfectly layered frozen dessert really does give one the sensation of floating - very fast floating. Sometimes it becomes necessary to stop in the middle of an otherwise outstanding ski run through this magical stuff to take a desperately needed breath; this is because with each turn you make, you are engulfed in an icy powder cloud and often end up inhaling more snow than air. The unwanted interruption is never desirable, but it's often essential.

There are three primary snow climate zones in the western United States; Maritime, Continental, and Inter-mountain. The Maritime, as one would expect, is closer to the ocean and is strongly influenced by the warm, moist air masses that roll in from the sea. The typical Maritime region snowpack tends to be deep, and has a high Snow Water Equivalent (SWE). The Cascades and the Sierra Nevada are examples of mountain ranges that have a Maritime snow climate. At the opposite end of the scale is the Continental snow climate, which is normally associated with regions located well inland, at higher elevation, and far from the warmer temperatures found closer to the ocean. The Continental snow climate is influenced by colder, dryer air masses, and less frequent storms, resulting in a snowpack that is shallower and colder, and has a much lower SWE than that of the Maritime. The Rocky Mountains of Montana, Colorado, and New Mexico, exemplify the Continental snow climate. The third is the Inter-mountain snow climate; this region occupies the area between the Cascade and Sierra Nevada ranges and the Rockies, and would include the mountains of Utah and Wyoming, and to a somewhat lesser degree, parts of Montana, Idaho, and Nevada. It is somewhat of a “Goldilocks” snow climate, characterized by conditions associated with both the Maritime, and the Continental. Some winters in the Inter-mountain region may have more of a Maritime influence, while others may resemble more of the Continental, but most are a distinct blend of both. The elevation of the Inter-mountain region is on average higher than that of the Maritime, but lower than the Rockies. Temperatures are normally colder than what one experiences in the Sierra, but slightly warmer than in Colorado. Snowpack depths approach those of the Maritime region, but the average new-snow density is closer to that of the Continental. One could say that the Inter-mountain snow climate combines the best aspects of the other two.

These blessings however come with a price. The colder temperatures and lower snow densities that contribute to such

great skiing conditions, also contribute to the development of weak layers in the snowpack that are made up of crystals known as *Facets* (often referred to as *Depth Hoar* in the latter stages of development). While not as pervasive or well developed as the faceted layers commonly found in the Rockies, they are much more prolific in an Inter-mountain snow climate than what one sees in the Sierra or Cascades. Weak faceted layers can form at just about any time between October and April, but are most likely to develop early in the season, and usually form the bottom layer of the snowpack in the Inter-mountain area. The Inter-mountain region is also known for its long-duration storms, with sustained periods of high intensity snowfall. The combination of big storms that deposit several feet of snow in a short period of time, and a complex, and in many instances structurally weak snowpack, is a great recipe for avalanches. Add the other prime ingredient, steep terrain, and you have the “perfect storm”. If Squaw Valley or Stevens Pass represent the quintessential Maritime snow climate ski areas, and Crested Butte or Telluride exemplify the Continental, the ski areas in Little Cottonwood Canyon are the poster-children for the Inter-mountain.



This is the story of Liam FitzGerald, and the forty-plus years he spent battling avalanches in Little Cottonwood Canyon, the birthplace of Avalanche Forecasting and Avalanche Control in North America.

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