Chapter 1 of:
An Ineradicable Mountie

Adventures of the First Woman Mountie

Book 10

www.laurieschramm.ca

Print ISBN: 978-1-7387599-2-7
ePub ISBN: 978-1-7387599-3-4

LAURIE SCHRAMM

This is a work of historical fiction, set in the 1970s. Although most of the historical references are accurate, a few are not, and names, characters, places, and incidents are either the product of the author's imagination or are used fictitiously. Any resemblance to actual persons, living or dead is entirely coincidental.

Chapter 1. DEEP DIVE

It is an unusual river. Not rare, exactly. There are at least a handful of similar rivers around the world: one near California, another near Greenland, several others near South America and eastern Africa, and possibly more that are yet to be discovered. Several factors combine to make these rivers unusual. One is flow rate; another is sediment load.

At some times of the year the river didn't flow at all; at other times the flow was barely more than a trickle; at still other times, the flow rate could be stupendous. This was one of the latter times.

The river, it was more like a thick suspension of fine particles than a river, swept through the canyon with an incredible volumetric flow rate that averaged 600 m3/s (~21,000 cubic feet per second) but surged, from time to time, to more than 1,000 m3/s (~35,000 cubic feet per second). These were the kinds of unimaginable flow rates that once characterized the majestic Colorado River, which makes its way from the Colorado mountains of the southwestern United States down through northern Mexico, and emptying into the Gulf of California. Such flow rates, however, only characterized the Colorado River before the 20th-century construction of a series of dams and reservoirs, including the Hoover Dam.

Although massive flow rates tend to conjure up images of spillways, the river's flow was far from one-dimensional: it twisted and turned like a snake. Although the direction of the flow was generally south-southwest, the canyon twisted and turned such that sometimes the flow was westerly while at other times it was east-southeasterly, an almost 180° change. The high rate of flow, when it was flowing at all, combined with the sudden changes in direction created more than enough turbulence to keep the particles suspended. In fact, the particles would not have a real chance to sediment out until much, much later when the canyon widened sufficiently for both the flow rate and the turbulence to be vastly reduced. That happened later, when the current left the canyon and fanned-out on the abyssal plain.

Even considering the river's ability to rival the majesty of the Colorado River, the high sediment load, and its highly turbulent flow, none of these are its most unusual feature. That honour is reserved for the fact that it is an undersea river. Its proper name is a turbidity current, and it takes life in a submarine channel, these being the typically understated terms used by the scientists that study such things; anyone else might call it an undersea river in an undersea canyon. This particular undersea canyon begins at a depth of 200 m (~660 ft) on the seaward edge of Canada's Pacific continental shelf, some 45 km (~30 mi) west of the shores of British Columbia[1]. Following its tortuous path, the undersea canyon plunges steeply while

[1] Although I have exaggerated a few things, downward-sloping submarine channels like the one described actually exist and were mostly discovered by sonar-mapping of the ocean floor in the 1980s (just slightly after the time of this story). When viewed from sonar maps, these submarine channels appear remarkably similar to on-land river systems. The water flowing in submarine channels carries a high loading of suspended sand and silt particles, making it more dense than normal seawater. Such flows are not continuous but occur in bursts that can last for days or even months, and triggering of the flows plus the flow rates themselves can be very similar to those of avalanches. For an example of a real-life, scientific study of the Bute Inlet channel near the British Columbia coast, see Maarten Heijnen, *et al.* "Rapidly-Migrating and Internally-Generated Knickpoints Can Control Submarine Channel Evolution," *Nature Communications,* **2020**, *11*, 3129.

extending outward for some 90 km (~56 mi), following the seabed down to the Pacific Ocean's abyssal plain, where the top of the canyon reaches a water depth of 2500 m (~8,200 ft).

***

June 4, 1979
The Pacific Ocean,
Somewhere off Canada's West Coast

"Lulu from Alvin, we're ready," said pilot Bill Olsen into the microphone of the submersible's radio. The Alvin was deep submergence vehicle (DSV) Alvin, and research vessel (RV) Lulu was its catamaran tender, both operated by the Woods Hole Oceanographic Institution[2].

"All systems showing normal. Oxygen and scrubber both on. ID light is on. Requesting permission to dive," continued Bill.

"Alvin, this is Lulu. Your launch altitude is 2,500 metres. You have permission to dive."

"Are you ready Doc?" said Bill, looking over to where Dr. Jayme Mackay was crouched on the bottom of the Alvin's personnel sphere, holding on with both hands to handles bolted to the sphere's walls. To his mind, the Alvin was rocking and rolling wildly in the choppy water, and was already having second thoughts about their planned trip. He tried to take some reassurance from the fact that Bill didn't seem the least bit fazed by the submersible's motion.

"Ready as I'll ever be," said Jayme, through gritted teeth.

With a grin, Bill turned his attention back to his microphone and the controls. "Roger, Lulu. Alvin is diving… Now."

"Here we go Doc!"

With those words Bill began pumping seawater out of the ballast tanks and the Alvin began to descend. Almost immediately, the rocking and rolling subsided and, with a quiet sigh of relief, Jayme released his grip on the handholds.

"Nice to get away from those waves on the surface, huh Doc?"

"I'll say." Dr. Mackay was a chemcial oceanographer from the Department of Earth, Atmospheric and Planetary Sciences at MIT. He'd already asked Bill to simply call him Jayme, but it appeared that Bill preferred to refer to his scientist passengers as 'Doc.' Probably easier that trying to remember new names on every single dive, Jayme thought.

"We'll be dropping at a rate of 40 metres a minute, which will put us on the ocean floor in an hour."

"Sounds good," replied Jayme. He was working hard to sound calm and professional, but he was more excited about this dive than he'd been about anything for years.

"Nervous Doc?" asked Bill, who didn't miss much. He was well used to the varying

[2] The *RV Lulu* was Alvin's tender from 1965 to 1983. It was succeeded by the *RV Atlantis II*, which served as *Alvin's* tender from 1984 to 1996, and the *RV Atlantis* (the second Woods Hole Oceanographic Institution ship to bear this name), which served as *Alvin's* tender from 1997 to the present day.

reactions, and indeed personalities, of the scientists he took on these trips.

"Yeah. Maybe just a bit. The only diving I've done before this has been SCUBA diving, so I'm used to going down a lot more slowly, and I've never gone below about 140 feet."

"Well, I know that the thought of a 2,500-metre dive can sound pretty scary, especially if you work out the pressure at that depth…"

"Yeah, 250 atmospheres; about 37,000 psi."

"You did work it out!" Bill laughed.

"I couldn't help it. I'm trying to blank out the image of us lying underneath a big column of water that's a mile and a half tall."

"Well, it helps me to remember that the cockpit we're riding in is a very carefully constructed titanium sphere – that's the best shape for withstanding pressure, as you know – and the walls are three inches thick. That and the fact that I've done this many times now, and I survived every time."

"I imagine you've done this quite a few times," said Jayme, trying to sound nonchalant.

"You could say that. This will be my forty-ninth dive in the Alvin. I was a commercial diver and an underwater-ROV[3] pilot before that, but this is much better: no decompression charts to worry about, and you get to see and experience so much more from in here."

"How deep have you gone then?" asked Jayme.

"The max for me has been 3,500 m, and we're rated for operations down to 4,000 m, so we've got lots of capacity for this trip[4]."

"This will be more than enough for me, I think. Wow, it's getting darker out there already!" Jayme was sitting at one of Alvin's two passenger/scientist stations, the other one being empty for this trip, and he had a choice of several viewports to look out plus a video monitor that was connected to a TV camera which, in turn, was mounted above the forward viewport.

"Passing 30 metres," said Bill, who had been swivelling back and forth in his seat, checking the myriad of gauges, indicator lights, and readout screens that surrounded both men. Already, at this depth, what little sunlight could still penetrate the water cast everything in hues of dark blue. "Another four or five minutes and we'll be out of the photic zone[5]. Then we'll be deeper than the sun's rays can penetrate, and it's going to be pitch black out there."

"I know the theory, but it's completely different to experience it in practice," said Jayme, noticing for the first time that with the outside temperature cooling rapidly, water was beginning to condense on the titanium walls.

Seeing him notice the condensation, Bill took an index finger and drew it down a trickle

---

[3] Remotely Operated (Underwater) Vehicle (ROV).

[4] At the time of this story, *Alvin's* maximum operating depth was 4,000 m (13,124 ft). Subsequent overhauls and upgrades increased its diving capability to 4,500 meters (14,800 feet; in 1994) and, ultimately, to 6500 meters (21,325 feet; in 2021). The 2021 upgrade gives *Alvin* access to an estimated 99% of the ocean floor. See: "History of Alvin," Woods Hole Oceanographic Institution, https://www.whoi.edu/what-we-do/explore/underwater-vehicles/hov-alvin/history-of-alvin/

[5] The euphotic (or 'photic') zone is the layer of water in a lake or ocean that receives sunlight. It is only in this layer that photosynthesis occurs, supporting the processes that contribute nutrients into the water. For this reason, the photic zone houses most of the aquatic life.

of water that was making its way down the forward viewport, then licked the water from his finger. “Fresh water, not seawater, so nothing to worry about, but it’s a bit disconcerting the first time you see it, isn’t it?”

“Just a bit. I suppose this thing creaks and groans sometimes too, as the pressure builds?”

“Only when we hit something Doc,” chuckled Bill, “only when we hit something.”

A few minutes later, Bill announced “Passing 200 metres. We’re below the photic zone now, but watch when I turn on the lights.” Reaching for one of the control panels, he toggled several switches to switch on all of the forward-facing lights.

“Whoa. Marine snow!” Jayme watched in fascination as the lights illuminated thousands upon thousands of tiny aggregates of phytoplankton and other organic debris. “Look how they appear to be floating upwards even though I know they must be sedimenting downwards. That means that we’re diving faster than the aggregates are sedimenting, creating the illusion that they’re rising.”

“Nice going Doc. That’s the kind of thing that often confuses people on their first dive, but you have to think in terms of relative motions in three dimensions. You’re really getting the hang of this business,” said Bill, encouragingly.

“Will we see this all the way down?”

“Probably not. Most of this stuff gets eaten up by deep-sea organisms in the first thousand metres or so. Back where the bottom drops away from the continental shelf, a lot of it will settle on the sloping seafloor, but most or all of it will disappear long before we get to the depths we’re heading for.”

“Can we take some pictures?”

“Sure can.” Bill showed Jayme the controls for the forward-looking, high-resolution video camera. A small, black-and-white video monitor showed the view from the camera. Jayme pushed the record button, but only kept the Sony U-matic machine recording for a minute in order to conserve space on the ¾” videocassette tape.

“I recommend adding some layers before you get chilled,” advised Bill. It had become progressively colder inside the submersible, and both men put on the sweatshirts, sweatpants, and thick, wool socks they had brought with them.

“Hey look!” said Jayme. Although Bill had switched the external lights off, they could see several species of bioluminescent jellyfish, made visible by the bluish light they emitted.

“Neat huh? If we’re lucky we’ll see an anglerfish or two when we get deeper. Being in here and seeing the really weird-looking marine animals always makes me think of the adventurers in the Jules Verne book[6] when they’re in the Nautilus and they get their first look through its viewing ports.”

“I know what you mean. I loved reading that story as a kid.”

For the next 45 minutes, neither man said very much, Jayme with his attention focused on looking through the viewports for more marine life, and Bill monitoring the submersibles various systems, and their depth. Then, looking over from his gauges, Bill said, “We’re 200 metres from the bottom. Please keep an eye out through one of the lower viewports and call

[6] Jules Verne, *Twenty Thousand Leagues Under the Seas: A World Tour Underwater*, originally published in serial form between 1869 and 1870, and in illustrated book-form in 1871.

out as soon as you see the bottom. OK?"

"OK," replied Jayme.

"Turning on all external lights," said Bill, flipping switches.

"There's the bottom," announced Jayme after a few minutes.

"Releasing weights and adjusting buoyancy," said Bill, as he pulled two levers causing two 90 kg (200 lb) descent-weights to be released and fall away to the ocean floor. They could both immediately feel the change as Alvin's descent rate plummeted to zero. Bill was busy for a few moments, making small adjustments to the Alvin's buoyancy until he was satisfied. Then he looked over and said, rather formally, "We have arrived."

"Incredible," said Jayme, "just floating over the bottom!"

"Allowing for an hour to return to the surface, that gives us seven hours bottom time. Where do you want to go?"

"How about northwest for an hour and a half, then southwest for an hour and a half. Depending on what we've seen by then, maybe southeast for an hour and a half, then northeast, completing a diamond-shaped course."

"You got it," said Bill. "Engaging side thrusters."

The next three hours were spent following Jayme's suggested northwest and southwest courses, but without seeing much of interest. Along the way, the two men ate their lunches of sandwiches and coffee.

For the next hour and a half, they turned again and headed southeast. This was much more profitable, as they began to sight sizeable lumps on the seafloor. Jayme was interested in any such 'lumps' that might turn out to be manganese nodules. Such nodules would be made up of concentric layers of manganese and iron hydroxides that had been built up over time, much like the way oysters and mussels create pearls through the buildup of many layers of tiny calcium carbonate crystals. They actually stopped quite a few times for a closer look at prospective looking lumps.

"There's some more. Starboard side!" exclaimed Jayme, at one such point. As Bill brought the Alvin in for a closer look, Jayme was able to see that they had indeed found another bed of perhaps a hundred nodules, most of which were about 5 to 10 cm (2-4") in diameter.

"Recording now," said Jayme, triggering the starboard-side video camera, whose signal was automatically sent to the VCR. "Can we grab a couple of samples?"

"Sure thing," replied Bill, setting the Alvin to hover-in-place and reaching for the controls of the starboard-side manipulator arm. The Alvin was equipped with two hydraulic-robot arms that could be used to retrieve samples or manipulate tools or experimental gear. "Placing two samples in box number four," said Bill, using the starboard arm to pick up the samples and place them in one of several marked boxes that had previously been lined-up in the Alvin's sample basket. Meanwhile, Jayme had stopped recording and was making notes on this latest finding of probable nodules, the counter readings for the corresponding video images on the VCR, and the sample box number into which Bill had placed the two samples.

"Can you give me the coordinates for these ones?" asked Jayme, who wrote the chart coordinates down in his notebook as Bill fed them to him.

"That's amazing," Jayme continued, "four probable module fields we've found. I think that when we get back home, the chemical analyses will confirm that these last two sets are

actual manganese nodules."

"Always nice to have happy customers," quipped Bill. "Ready to move on?"

"You bet. How about if we try going a bit further due south, before we take the final leg back to our starting point?"

"Yours to command," said Bill, lifting the Alvin a bit higher from the ocean floor and starting up two of the thrusters.

Within minutes, Jayme exclaimed, "Whoa. What's that?"

Bill didn't answer for a moment, as he was intently looking at the same thing that Jayme had spotted: it looked like a valley, or canyon, cutting into the ocean floor. "Looks like a rift valley. This is the kind of thing you get between two oceanic plates, but it can't be a rift valley because we're way too far north to be seeing the edge of the Pacific Plate. It must be something else."

"Too bad," said Jayme, "because I'd love to find a hydrothermal vent[7]. A black smoker[8] would tie-in nicely with the manganese nodules."

"Let's take a look," said Bill. "Do you want to explore to the northeast or the southwest?"

"Flip a coin. How about to the northeast, since that's the way we were going to head next anyway?"

"Agreed. Here we go." Bill maneuvered the Alvin over the lip and then down into the canyon. Holding place at about ten feet from the bottom of the canyon, he turned the Alvin to port and began to follow the canyon as it meandered in lazy curves, but generally in a northeast direction.

"Is it my imagination, or is the bottom moving?" asked Jayme.

"It can't be moving... No, wait a minute. I think you're right," said Bill, sounding surprised. "That's odd. Let's take a closer look." As Bill brought the Alvin down, closer to the bottom of the canyon, they could clearly see that the bottom was, in fact, moving, and in the opposite direction to their own.

"Recording," said Jayme, as he switched on one of the video cameras.

"Good thinking," said Bill. "We have found some kind of undersea river. See how dark it looks. It must have a high concentration of suspended solids to be dense enough to remain at the bottom of the canyon. I've never heard of anything like this before."

"Me neither," said Jayme. "How cool is this!"

As both men continued to watch, something seemed to change in the flow below them.

"Are we speeding up, or is the flow increasing."

"It's not us," said Bill, taking a confirmatory look at his instruments.

Jayme, meanwhile, had been intently staring at the 'river' below. "It's definitely speeding up."

"And it's either gaining in volume or else the canyon is getting less deep," said Bill,

---

[7] Hydrothermal vents are places where seawater can percolate down through fissures in the ocean floor and come into contact with hot magma. The superheated seawater (which doesn't boil due to the extremely high pressure) then re-emerges, sometimes carrying small sulphide-mineral particles and having a similar appearance to the smoke plumes that arise from active volcanoes on the earth's surface. Such plumes are referred to as black smokers. Hydrothermal vents were first discovered by scientists on *DSV Alvin* in 1977.

[8] Black smokers were first discovered by scientists on *DSV Alvin* in 1979.

pumping some air into the ballast tanks to maintain the Alvin's distance from the top of the flow.

"Still speeding up," reported Jayme, who was becoming mesmerized by the flow but still able to look at it scientifically.

"Yes," said Bill. "If it keeps on accelerating like this, I think we should pull out of the canyon and continue to watch from the side." These words were no sooner spoken than both men lost all visibility as the Alvin was completely engulfed in a cloud of swirling sediment and their cameras and viewports alike were completely blacked out.

"Blowing more ballast, and thrusting to port," said Bill, reaching for the necessary controls, but it was too late as he had already lost control.

Unseen by both men, the turbidity current – at their location at least – was now flowing faster and faster, very much like an avalanche. As it did so, the Alvin began to spin about its axis, disorienting both of its occupants. Had they had the instruments necessary to measure the turbidity current's volumetric flow rate, such instruments would have shown that it rapidly increased to 600 m3/s (~21,000 cubic feet per second) and then surged to more than 1,000 m3/s (~35,000 cubic feet per second). They didn't need any instruments, however, to know that the Alvin was not only spinning about its horizontal axis, but was being forced into somersaults as well. Both men were being tumbled around inside the Alvin's personnel sphere.

"Can't maintain position," exclaimed Bill, as he desperately tried to hold himself in place with one hand, while straining to reach and operate controls with the other.

Completely disoriented, but concerned that they could be swept into a collision with the almost vertical walls of the canyon, or indeed the ocean floor itself, Bill instinctively decided to head the Alvin into the only direction he knew would be safe: up! The hard-won experience gained through his previous 49 dives on the Alvin now came to his rescue. Despite the Alvin's forced acrobatics, and the impacts on his body which caused his head and every other moveable part of him to move in jerks, first one way and then another, his hand reached out and automatically found the right control to blow more ballast, causing Alvin to rise up and out of the swirling torrent.

At first it felt like the Alvin wasn't responding. Either that, or the raging current was not going to release its hold on them. But, the laws of physics had not been repealed, and Alvin's increased buoyancy ultimately prevailed, enabling them to break free. As the spinning and somersaulting ceased, Bill quickly reset Alvin for neutral buoyancy.

"Are you OK Doc?' asked Bill, the urgency clear in his voice.

"Actually, I think I am," responded Jayme, sounding surprised. "Just shaken up, and I'll probably have some colourful bruises to show-off later, but nothing worse. That was a scary ride! I'll bet you haven't done that before."

"You're right there. I'll admit I was a bit worried when we started tumbling and I couldn't get at the controls. Alvin wasn't designed for that kind of maneuver. When we get back home, I'm going to recommend we install some kind of harness system for the pilot and passengers. You did a fantastic job of keeping out of my way just then. If we'd been carrying our normal load of three people, I think someone would have been seriously injured, and I might not have been able to blow the ballast as quickly."

"I was half expecting you to eject the sphere[9]."

"I came close. If I hadn't been able to blow enough ballast to lift us out, then ejecting was going to be next. I certainly have never had to do that before!"

"Hey!" exclaimed Jayme suddenly. "We've got our visibility back. Have a look outside." Sure enough, the viewports had cleared completely, and the two men had a clear view of the cloudy-looking torrent flowing below them.

"That's interesting," said Bill, his attention split between scanning his instruments and the sights below them, "the water temperature has increased by seven degrees. I wonder where all that flow is coming from."

"No idea. Have you ever heard of anything like this before?"

"Heard of it, yes; it's called a turbidity current[10]. Seen one before, no; this is a first. I hope you got all that on tape," said Bill, grabbing a tissue to wipe the sweat from his eyes.

"Still rolling," said Jayme. "Just look at it. It's like a living thing." From their vantage point, the two men could see that the surface of the turbidity current was sharply distinct from the clear seawater above it, and it undulated as it flowed.

"How far off-course do you think we are?" asked Jayme.

"I'm not sure. I'd guess that current was flowing at more than 20 kilometres per hour when it was tossing us around, so it would have taken us at least three kilometres out before we got out of it."

"What do you want to do now?"

"Well, we should start making our way back. Why don't we just stay to one side, like we are now, and follow it back as long as it keeps going in a north-easterly direction. That's roughly where we would have been going anyway. This way, you can keep observing the thing for a while."

"Works for me. I'm going to shut off the VCR for a while to save tape. Can you imagine us showing a recording of this at the national oceanographic conference? We'll be a sensation!" continued Jayme.

"The odds of finding this undersea channel system at the same time as that sediment surge must be one in a million," said Bill. "Maybe we should start buying lottery tickets."

"Not me," retorted Jayme. "Lotteries are a tax on the mathematically-challenged, and besides, that was already a once in a lifetime experience. I think that was my quota."

Dr. Mackay was wrong, however, as the two men were about to get another surprise.

As the Alvin travelled to the northeast, and approximately parallel to the turbidity current, Jayme continued to exclaim in amazement at what they were seeing. "This is so

---

[9] In an emergency, *Alvin's* spherical personnel capsule can be separated from the rest of the submersible, at which point its extreme buoyancy would cause a rapid ascent to the surface.

[10] Phenomena like this have occurred in real life. In 2013, off the coast of California, a 119 m tall 'turbidity current' swept down an underwater canyon at a depth of 400 m (~1,500 ft), engulfed and lifted a five-ton ROV off the seafloor, and pushed it several hundred metres off-course. See Esther J. Sumner and Charles K. Paull, "Swept Away by a Turbidity Current in Mendocino Submarine Canyon, California," *Geophysics Research Letters*, **2014**, *41*, 7611–7618.

damn exciting! And my first trip too."

"You're not worried? That was a pretty close call we just had back there you know."

"Are you kidding? There's so much to see, I could stay down here forever."

Bill just smiled to himself, remembering how nervous the Doc had seemed when they first descended into the sea.

After their recent excitement, both men enjoyed the uneventful quiet of the next ten minutes, and even Dr. Mackay began to lose interest in the turbidity current that was still flowing off their starboard side. Perhaps it was for this reason that he moved to the other side of the submersible for a look out one of the part-side viewports.

"Say Bill, am I seeing things again or is the bottom beginning to rise over there off the port bow?"

"Hmmm, I think you're right," said Bill, after a long look. "Want to get closer?"

"Why not."

"Bottom's definitely rising," said Bill, after maneuvering over in the direction Jayme had indicated. "Might be some kind of plateau up ahead."

"Rising faster now," said Bill, after another ten minutes. "Looks like the texture of the seabed is changing too. Let's take a closer look." Blowing some air from the ballast tanks, he took Alvin close to the bottom. "Well, well," he said after taking a close look. "I think we're on the edge of a seamount."

"An extinct volcano? Here?" said Jayme, his skepticism made clear by his tone of voice.

"Why not?" countered Bill. "You could have argued that there wouldn't have been an underwater canyon with a raging turbidity current out here!"

"Touché. Well, what next then?"

"We're still in good time, let's keep going."

As they continued on, the bottom rose by several tens of metres; then by several hundreds; then many hundreds. As it did, the topography of the bottom changed again.

"Look," said Jayme, I think I see nodules again except they don't look right. Can we go over to starboard a bit? Can you see the lumps on the bottom that I'm talking about?"

"Yes. They don't look like manganese nodules to me either. Heading over there now."

When they were so close that one of the robotic arms was almost touching the bottom, Bill stopped and held Alvin in a hover. "What do you think now?"

"Looks like some kind of metal crusts, but its different from any kind of iron or manganese deposit I've ever heard of. Either the iron or manganese precipitated out in a different form, or it's a different metal entirely."

"What kind of other metal could it be?"

"Gold would be nice, wouldn't it?" said Jayme, but he wasn't serious. "We're on a seamount, right? So, something spewed out by a volcano and then precipitated and deposited here. Could be lead, zinc, arsenic, copper… even cobalt, maybe. Is it OK if we collect some samples?"

"Sure. Anything but arsenic though, OK?"

"Running tape again," Jayme hadn't even heard him. "What's the depth here?"

"1,250 metres," said Bill, consulting the depth gauge. "Picking samples now, and placing them into sample boxes five and six. It's a good thing these sample boxes have lids or we'd

have lost your earlier samples with all that somersaulting we did a while back."

"That's right! I never even thought of that. I'm sure glad you know what you're doing down here."

"I'd like to claim genius, but we only added the hinged lids to these sample boxes after losing an entire dive's worth of samples when we surfaced in a gale off the coast of Florida a couple of years ago. After being raked over the coals for that, and even though it hadn't been our fault, we designed something better so it wouldn't happen again."

"Plato would have been proud," said Jayme.

"How's that?"

"Plato. He wrote 'The true creator is necessity, who is the mother of our invention' but I'm not sure that the quote originated with him[11]."

"Sounds like a fancy way of saying you should learn from experience."

"Well, if it's an experience you don't want to repeat, then I guess it is, in a way."

"OK. Samples collected and loaded. I'm afraid I can't give you coordinates this time: I don't know exactly where we are. Do you want to ascend here and see if we can get a fix? Then we can radio the ship to come get us?"

"Yes, I guess so…" said Jayme, thinking hard. "No. Wait. I have a better idea. We're still more or less on the right heading, correct?"

"Well, we were until we came over to follow this seamount, but we can retrace our path and get back on the heading we were following before that."

"And you've logged all of our course changes all along, right?"

"As best I could, yes, of course."

"OK then. Can we retrace our route, forget about the underwater canyon, and get back on our originally planned northeast heading?"

"Sure."

"And it should take us at least close to where we started?"

"I doubt it, but in a vague sense, yes."

"OK then. Let's do that, and when we get back, we'll tell them about the underwater canyon, and getting swept off course and all that…"

"Yes…" said Bill, knowing there was more to come.

"And can we say absolutely nothing about the seamount and the samples from it. At least until I can get them analyzed?"

"Ah ha. You do think there's something important about those samples. Don't you."

"Let's call it a hunch. It might be a longshot, but if I'm right, I want to be sure about what we've found before anyone else knows the location. OK? If this turns out to be an important discovery, I want to be the first to publish an article about it."

"OK by me. Backing off the slope now." Bill adjusted the ballast so the Alvin ascended 10 metres, then used thrusters to change course, heading them back towards the undersea canyon and the still flowing turbidity current. When the canyon was back in sight, he adjusted course and they followed the seabed northeast.

---

[11] See Plato's *Republic*, 1894 translation of the 4th century BCE original: "The true creator is necessity, who is the mother of our invention." Plato's quote may have been adapted from a similar one: "Necessity is the mother of invention," which appears in one of Aesop's *Fables* (6th century BCE).

Ninety-five minutes later, Bill said, “I think we’re as close to our original descent position as we’re going to get. Ready to go up?”

“You bet. What a fantastic trip!”

“You won the jackpot on this one. Usually they’re pretty routine.”

“Releasing weights,” said Bill, as he pulled two levers causing two more of the 90 kg (200 lb) weights to be released and fall away to the ocean floor. Alvin, of course, immediately began to ascend and the seabed quickly disappeared from sight.

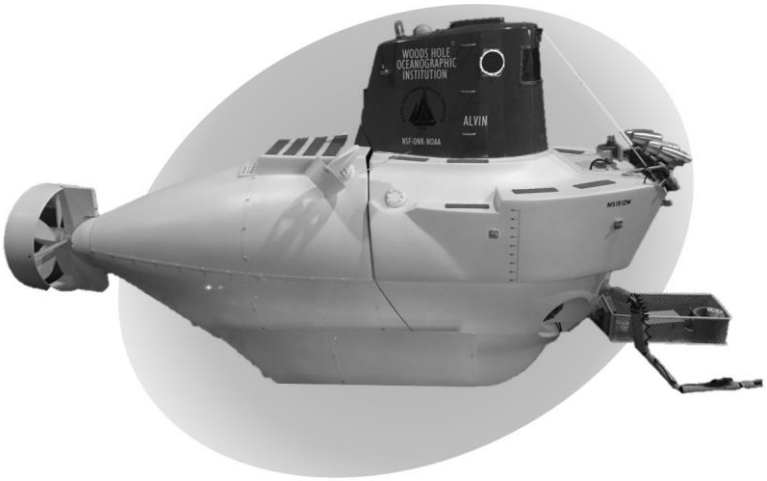
“Going up!” quipped Bill.

“I’m glad we don’t need to worry about decompression stops like you do with SCUBA. After what we’ve been through, we’d need a lifetime of decompression stops before we could surface.”

The journey to the surface was uneventful. Once there, they found themselves to be tens of kilometres away from their starting point, but Bill was able to reach the Lulu by radio. Two hours later, Alvin had been hoisted aboard and both men were relieved to be able to climb out and stretch their cramped legs in the late afternoon sun.

Overnight, while Bill and Jayme slept, the Lulu made for the port of Vancouver. Rising early, Jayme collected his samples, videotapes, and personal gear, said his goodbyes, and took a cab to the airport to fly home. Before doing so, he reminded Bill of his promise to help him keep secret the nature and location of the seamount and the metal-crust samples, at least until he’d had a chance to get them properly analyzed.

Some hours later, when Bill had finished cleaning up Alvin’s insides, he was about to exit the submersible when he remembered that he was going to need to consult the ship’s log while preparing his trip report. It’s funny that Dr. Mackay was so insistent on me promising to keep the seamount’s location a secret, when all anyone would have to do is ask for a copy of the Alvin’s log and compare the entries with a hydrographic chart of the area, he thought to himself. Sitting down on the pilot’s seat he reached for the log, and on some impulse that he wouldn’t have been able to explain, he flipped to the pages with the entries from the previous day’s dive. This, however, was an exercise in futility, because the relevant pages had been cleanly cut out of the log book with a knife.



DSV *Alvin*

“Son of a bitch!!” said a horrified Bill. “These damn scientists will do anything to be the first to publish their discoveries.”

June 18, 1979
Department of Earth and Planetary Sciences,
Massachusetts Institute of Technology (MIT),
Cambridge, MA

After returning to his MIT laboratory, Jayme had cut several sections through one of the nodules recovered from the ocean floor (seamount?) and photographed them. The sections clearly showed that each nodule had a very thick crust covering a lump of what looked like basalt, an igneous rock formed from lava. Taking two of the sections, he separated the crusts from the inner cores and then sent one pair for mineralogical analysis and the other pair for chemical analysis.

It took more than a week for the analyses to be completed, but it had been worth the wait. The results confirmed that the inner cores were basalt, which was not very interesting, but the crusts were largely made up of vernadite (a manganese oxide) and a mixture of hydrous iron oxides, which was more interesting. It was the chemical compositions of the crusts that got him really excited.

It was at this point that he made a phone call to a colleague at the U.S. Geological Survey.

“You remember that paper you presented in Anaheim last year? The one on strategic minerals where you said that we don’t have any domestic cobalt mine production anymore and have to get the metal from imports and a bit of recycling?”

“Yes, sure. Why?”

“And you said that most of the imports come from overseas, except for what we can get from Canada, and that there’s some kind of security concern because we need cobalt for the superalloys that are used in jet engines, including jet fighter engines, and we don’t want to be at the mercy of other countries for critical resources like this?”

“Yes, yes, I do remember, and I’m glad you actually paid attention to my talk. But why? What’s up?”

“Well, I may have discovered a partial solution to your problem. I’ve just been looking at the assay results for some rock samples I found on the ocean floor off the west coast. My first thought was that they were manganese nodules, which wouldn’t be news in terms of mineralogy, but this would be the first such discovery so close to the North American coast. The thing is, they didn’t look right to me. Now it turns out that they’re actually seamount nodules. That means they’re like ferromanganese nodules except that they occur as ferromanganese crusts on lumps of basalt rather than nodules, which are more homogeneous[12]. You with me so far?”

[12] In the late 1970s, ferromanganese (i.e., iron and manganese compound) crusts were not generally

"I think so. You're found a few lumps of basalt covered with manganese and iron oxides in the Pacific somewhere, and they're closer to the U.S. than anyone's ever seen before. Sounds great, you should get a nice paper published about them."

"No, no. The mineralogy isn't the exciting part, it's the chemistry. The chemical analyses showed cobalt concentrations of nearly two percent."

"What? You're pulling my leg!"

"Not at all, the samples I ran came back averaging 1.7 mass percent cobalt."

"No. You must have made a mistake. The only mineable cobalt deposits in North America are in Canada and Mexico[13]."

"Maybe on land, but I checked the analyses and I think I've found a deposit off the coast."

"OK. Now you have my complete attention. Where, exactly, did you say that you found them?"

"I didn't but, look, this has to be kept secret until I give the word. OK? You promise?"

"I promise. Just tell me where you found them."

"All right. We were doing a deep dive near the edge of the continental shelf off Canada's western coast and we were in an ocean-floor canyon when a turbidity current caught us. The name turbidity current doesn't do it justice, it was more like a tidal wave, and it tossed us around and then threw us way off course. When we recovered, we followed the current upstream for a while – from a safe distance – and came across a seamount covered in unusual-looking nodules. We grabbed some samples, and they turned out to be seamount nodules with high cobalt contents."

"OK. And how many of these nodules were there lying around?"

"I don't know. Too many to count. They seemed to cover the whole mountainside. Hundreds, thousands, maybe millions of them?"

The phone line went silent.

"Are you still there?" asked Jayme.

"Yes…. Who else knows about this?" the colleague asked, after a few more moments.

"No one. Well, almost no one. The submersible pilot knows I found some interesting nodules, and that I got excited about them and collected samples, and he knows the general depth and area, but he doesn't know the precise location, nor what we actually found."

"Why not?"

"Partly because I didn't explain what the nodules are nor what I thought they might contain, and partly because after we were blown off course, we only have the log entries for the rest of the trip back to the ship. To figure out the seamount location, you'd have to take the ship's position and use the log to work backwards. Before I left the submersible, I quietly cut several pages out of the submersible's log book and took them with me. I haven't tried to back-out the course yet, but no one else can do it either as long as I have the logbook pages."

"So, the pilot knows you collected some interesting samples and that you wanted to

---

distinguished from ferromanganese nodules. When a distinction was made, these crusts were referred to as seamount nodules.

[13] Jayme's colleague was referring to numerous Canadian cobalt-producing mines (in Newfoundland and Labrador, Québec, Ontario and Manitoba) and to the El Boleo mine near Santa Rosalía, Mexico.

keep the exact location a secret?"

"Right, but he deals with academic scientists all the time, and I told him that I wanted to keep everything secret so I could be the first to publish the discovery in a scientific journal…. Actually, that really was my reason at the time but, now that I've had the analyses done, I think I've stumbled onto something bigger than that."

"Yes, much larger. You sure you were still off the Canadian coast when you actually found the nodules?"

"Oh yes. Why? Does it matter?"

Jayme's colleague choked up and had a coughing fit. When he recovered, he said "Holy Mother of God! Of course it matters! Look, leave this with me for a couple of days, OK? I need to make a couple of calls. I won't identify you, and I'll only speak in general terms."

"OK. Sure. Thanks," said Jayme.

Jayme's colleague first called his immediate supervisor, then his ultimate boss, the Director of the U.S. Geological Survey. The director then placed calls to the U.S. State Department and the President's National Security Advisor, following which several face-to-face meetings were hurriedly organized.

Within two days, Jayme received a call back from his colleague.

"Hi Jayme. How would you like to visit Ottawa?" were his first words.

***

July 2, 1979
Logan International Airport,
Boston, MA

The taxi carrying Dr. Jayme Mackay and his daughter Josie pulled up at the curbside check-in stand and they waited as the driver opened-up the trunk and removed their luggage.

Having checked their tickets, the airline attendant filled out baggage tags and placed them on each of their suitcases.

"There you go sir. You can go on in. The departure gate will be listed on the monitors in the terminal."

Pocketing his tip, the attendant moved on to another taxi that had just pulled up alongside.

Focused on their trip, neither Jayme nor Josie took any notice of the large black van that had parked immediately behind their taxi, and they would have been amazed to learn that it had actually followed them all the way from their home.

As Jayme and Josie walked towards the terminal building, a large man exited from the van and walked purposefully up to where Jayme and Josie's suitcases stood at the curb, waiting to be conveyed to the baggage-handling area inside the terminal. Bending over, he looked carefully at one of the airline tags.

"Can I help you sir?" asked the baggage attendant, who had returned with more suitcases.

"No, thank you," said the man. "I've lost a bag and thought this might be it, but it's not.

Guess I'll have to keep looking."

"Sorry to hear that sir. There's a lost and found area inside the terminal if you need help."

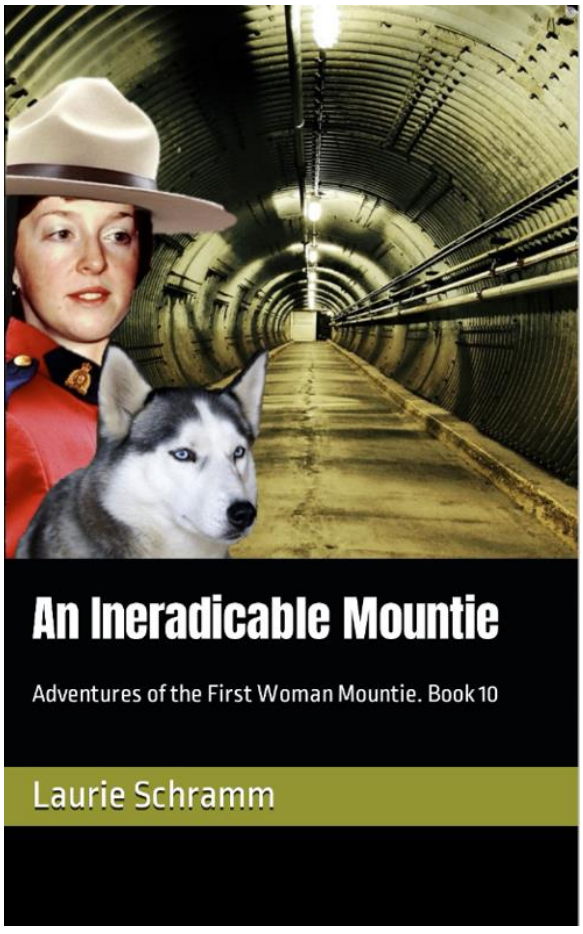
"Yes. I'll bear that in mind," said the man, as he turned and walked back to the large black van.

"Well?' said the driver, as the man got in and settled into the van's passenger seat.

"The bags are tagged for Ottawa. I got the flight number."

"Right. Let's go call it in," said the driver as he checked his side mirror and pulled away from the curb.

RCMP Constable Alexandra Houston's adventures continue in: ***An Ineradicable Mountie. Adventures of the First Woman Mountie Book 10***, by Laurie Schramm, 2023.



Available on all Amazon websites worldwide,

Print ISBN: 978-1-7387599-2-7
ePub ISBN: 978-1-7387599-3-4.

For more information see:

www.laurieschramm.ca

ADVENTURES OF THE FIRST WOMAN MOUNTIE

Book 1: An Inconvenient Mountie

Book 2: An Inconspicuous Mountie

Book 3: An Indestructible Mountie

Book 4: An International Mountie

Book 5: An Inseparable Mountie

Book 6: An Indispensable Mountie

Book 7: An Inexorable Mountie

Book 8: An Intrepid Mountie

Book 9: An Intimate Mountie

Book 10: An Ineradicable Mountie

Book 11: An Incommunicado Mountie