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THE SIGNAL ORB



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Author's Forward

Mathematicians consider development of a proof to be an adventure, but few children find adventure in their school mathematics.

The Signal Orb is a novel intended for middle school students. The story evolves around the discovery of an object and the attempts by a trio of friends to decipher the number signals this object is found to emit.

The story presents some simple number sequences, a little computer science, and some puzzle-solving methodology. The story is told against the backdrop of the home and school life of a diverse group of middle school age students.

Since I'm an advocate of free and open-source software (FOSS), this novel was created using LibreOffice on a Linux desktop. Illustrations were created using Inkscape and the GNU Image Manipulation Program (GIMP). Creation of the eBook version was assisted by Calibre.

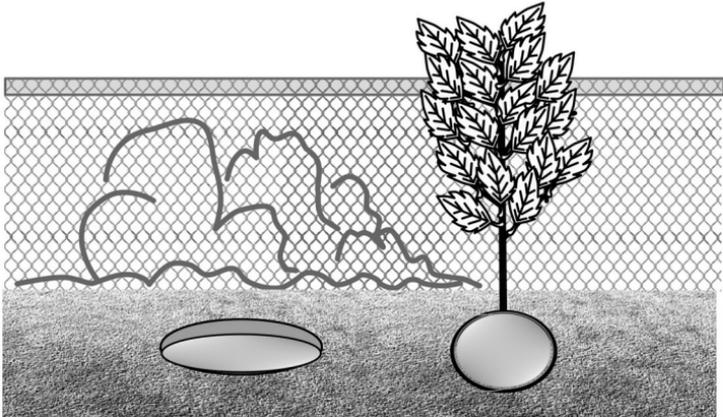
This is a work of fiction. All characters appearing in this work are fictitious. Any resemblance to real persons, living or dead, is purely coincidental.

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1 DISCOVERY

Matt yelled towards the open window of his house, about fifty feet away.

"Mom, is this a good spot?"

He could just hear his mother's reply over the noise of the kitchen dishwasher.

"Go about five feet back towards the fence, and maybe a few steps towards the garage."

Matt dragged the small tree towards the desired spot and held it upright to illustrate how it would look once planted.

"How's this?"

"Perfect!"

"But Mom, can't Michael do this? He's older and stronger than me."

"Michael's working on that big school project. We shouldn't bother him."

"He's probably just playing video games."

Matt's last statement didn't make it through, since the kitchen window closed before he was finished. He reluctantly picked up the shovel and started digging.

"What a way to spend a Saturday!"

A few shovelfuls in, and Matt's mind started to wander. It would have been nice if this were Sunday, instead. Then, maybe Dad would be the one digging the hole. Although Sundays were Dad's "day of rest," the job wasn't that hard, and Dad always enjoyed outdoor work. Not only that, but Dad might prefer to do the planting himself to have the job "done right the first time," which is something that he often said.

Matt's mother tried to keep Sundays work-free for his father, and Matt had to agree with his father's philosophy of not working on Sunday. His father was a carpenter, and Saturdays were just another working day to add to everyone else's Monday through Friday. The more he thought about that, the less annoyed he was to be digging the hole instead of his father. Michael, however, was another story! Matt was fairly certain that his brother was using the computer for video games and not homework.

Matt paused for a moment to survey his backyard. When he was too young to venture away from the house on his own, the backyard was his refuge. He and his friends enjoyed ball

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games on the wide expanse of green grass, and Matt had enjoyed digging a hole, deeper and deeper, in one corner with a small shovel and seeing what rocks were hidden underground. He dug out many small rocks, and there was one huge rock, as large as his head, that had taken him many days to excavate. That rock was still visible in the corner next to the fence, but the hole was now overgrown with weeds and grass.

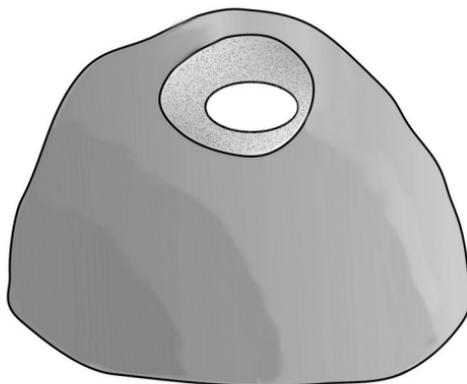
Well, it was back to Matt's task at hand, digging a hole for the tree. According to the Internet, a tree this size needed to be planted in a two foot hole. Matt didn't have a yardstick, but he figured that would be about up to his knee. This wasn't precise, but trees had been growing nicely without human intervention for millions of years, so Matt didn't think that an inch or two really mattered.

Matt had dug nearly to the bottom of his hole, when he shoveled up an unusual rock. This rock didn't look at all like the rest of the rocks in his dirt pile. This rock was very black and roughly spherical, about the size of a softball. As he picked it up to examine it, he noticed it had a crack. In fact, just a little pressure from his hands split away a large piece of rock to reveal something shiny on the inside.

Matt left the hole and headed for the water faucet. A short water rinse showed something golden inside the rock, and he considered smashing the rock with the shovel to reveal what was inside. Then he remembered learning about

fool's gold and decided the rock looked better the way it was than as a pile of smaller rocks.

Matt decided to keep the rock in its not-smashed state for a show-and-tell in science class. It wasn't that long ago that they had studied geology. His teacher would give him some extra credit.



2 SHOW AND TELL

Matt gave the rock a thorough washing with some soap and an old toothbrush. He blotted most of the water from it onto some paper towels, and he used a hair dryer to remove the last traces of water.

He plopped the rock into a plastic sandwich bag and headed for Michael's room. Matt was certain he would find his brother playing some game on his computer, but he was surprised to see he was actually typing something.

“Whatya doing?”

Michael looked up from the keyboard.

“Another history report. I hated the idea, at first, but this Jefferson guy was really interesting. Sure, he was President, but he was a smart guy,

and he invented a lot of things. He invented the swivel chair and a device for using secret codes. I guess that governments were interested in sending secret messages hundreds of years ago like they are today.”

Matt was happy that his own reports were expected to be just about a page long. In a few years, he would need to punch out something like the three to five pages that Matt needed to write. Matt waved the bag and the rock in Michael's direction.

“Found this in the yard. Two feet down, while I was planting Mom's tree.”

Michael was unimpressed.

“Yeah. I hear there are a lot of those things called rocks mixed up in the dirt.”

“No, no. Look here, inside!”

Matt handed the plastic bag to Michael, making sure the golden part was showing.

“I think it's fool's gold,” said Matt.

“Well, I'm happy you're old enough not to think you found real gold. Gold is expensive because it's hard to find. If I remember right, fool's gold is mostly iron, which is all over the place.”

Michael moved the bag from side to side to see the reflection from the gold.

“What are you going to do with it?”

“Well, we just studied geology in science class. I'm going to bring it to Mister Rizzo. Maybe he'll give me some extra credit.”

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“Yeah, I remember my time with “Dizzo.” He seems like a smart guy, but he's strange. Maybe all science types are like that. You sure wouldn't want to go into science if you end up like that.”

Matt didn't like hearing that. He thought he might like to be a scientist, himself, one day. He liked science, and he was pretty good with math.

“Rizzo is alright. You know, artists are like that, too. It's not just scientists.”

“Probably a reason not to be an artist, too. Anyways, the rock's interesting. You'll get your extra credit, but you're probably the one in your class who needs it least.”

Matt retreated to his room and left Michael to his report.

By a lucky circumstance, Matt's room was larger than his brother's room. When Matt's brother, Michael, was born, his room was the nursery, a small room perfect for a crib and the few baby items that a mother and child would need. At that time, the larger available room that would become Matt's room was used for storage.

When Michael was old enough for his own bed, he was given the opportunity to “graduate” to the larger room. His parent's motivation was that the nursery would be kept as it was for the next arrival, which would be Matt.

For some reason - Who knows how kids think - Michael wanted to stay in the only room he had ever known. His bed was placed there, and the crib was put into storage. When Matt came

along, the storage room was cleaned-out and became the new nursery, eventually becoming Matt's room.

The centerpiece of Matt's room, and the conversation piece of his friends who visited after dark, was the huge star chart placed on the ceiling above his bed. Matt had a hard time convincing his father to let him put it there, but it was decided that the few thumbtacks that were needed wouldn't leave any visible marks. Anyways, how many people even look at bare ceilings?

What was unique about Matt's star chart was that the stars and the constellation connecting lines glowed in the dark. Before his thumbtack problems with his father, Matt's mother had a problem with the idea that the star chart glowed in the dark. In her lifetime, things that glowed in the dark were radioactive, and anything radioactive was bad. She had read an article about how workers who painted glow-in-the-dark clock dials in the middle of the twentieth century got serious diseases because the paint contained radium.

Matt found information on the Internet that present day glow-in-the-dark items use a chemical, zinc sulfide, that's safe enough for glow-in-the-dark star charts. That got Matt thinking how cool it would be if he could glow in the dark, maybe for Halloween, but he was certain that his mother wouldn't like the idea. His brother, Michael, who knew more chemistry

at the time, said that the zinc sulfide might be safe for star charts, but you can never know how pure it might be, so slathering it on your face and skin is not a good idea. Plus, it could get in your eyes, nose, and mouth.

Matt gave up his superhero bedspread in the fifth grade, and he now had a nondescript bedspread of his mother's choosing. That was a result of some gentle peer pressure from his friends, who thought that fifth graders were too old for superhero bedspreads. He did have two superhero posters on his walls, which seemed to pass muster with his friends. He was sure that his brother, Michael, would like to have some swimsuit models on his walls, but he never put any up for Mom's sake. He wasn't sure what his father would have said.

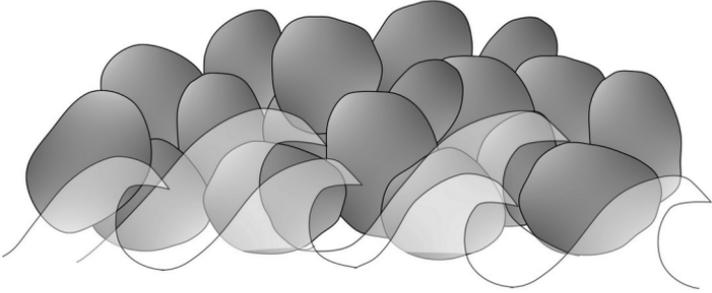
Since Matt had a corner room, he had windows on two walls. These were small windows, two on one wall, and one on the other, that were placed close to the ceiling. While there wasn't any view of ground level, unless he was motivated enough to stand on his bed, or move his chair to act as a step stool, he did have fresh air on the warmer days and a nice view of rustling tree leaves on one side, and blue sky on the other. Some nights, the Moon would shine through a window and light his room in a soft, white glow.

Matt's desk was essentially bare, except for a digital alarm clock, a desk lamp, and a small tray that held pens, pencils, and his prized ruler.

That ruler, given to him several years earlier by his father, who found it at the yard sale of a neighborhood engineer, was bright steel with engraved markings for inches and millimeters. It was unlike the flimsy plastic rulers that most kids had at his school; and, just to be safe, he never let it leave his room.

The near indestructibility of this steel ruler wasn't its best part. That was the stencil letters arrayed along its length. These were precisely cut through the steel - His father said they must have been cut by a laser, rather than stamped - and running a pencil through them allowed Matt to create the most perfect letters for report covers. Some of the students, like his friend, Gabe, had computer printers for that sort of thing, but his family couldn't afford the ink prices, so his stenciled letters were as good as he could get.

Matt carefully placed his golden rock on his desk and plopped onto his bed with a comic book. Since it was the weekend, he could afford some free time away from his school books. His mother would be calling them for dinner, soon, so there wasn't enough time for going outside or doing anything else.



3 ANOTHER SUNDAY

Sunday mornings at Matt's house started softly, and always ended in a frenzy as Matt's mother tried to get everyone out the door on time so they wouldn't be late for church. Their church was about a twenty-minute drive from the house, but parking was always a problem, so they tried to leave extra early to beat the rush. One thing that Matt enjoyed about church was the idea that after an hour's torture he got to have breakfast at a nearby fast-food restaurant. Sunday brunch, the Sunday fare of some of his fellow church-goers, was not in his family's budget, but hash browns and an egg and bacon muffin were.

Their father told Michael and Matt that before he met Mom, he never went to church. Sure, he went to church when he was a boy living at home with his parents, but when he was on his own, he never went. Most of his friends who went off to college didn't go to church either after they left home.

A few of the girls he went to high school with went to what their father called "Bible" colleges. Those girls went to church. Dad said that the girls were probably forced to go to these colleges by their parents. Some parents hear too many tall tales about what happens in college, and they're afraid to send their daughters anywhere but a Bible college. Dad suspected, however, that what happened behind closed doors at Bible colleges was the same as at other colleges.

Matt's father was just as happy not going to college. He never liked school, and he enjoyed outside work. And, when most of his friends were still hitting the books, he had married Mom, bought a house, and felt he was ahead of the game. Working Saturdays was the only thing that seemed to drag him down.

Their father's lifestyle wouldn't be an option for Michael or Matt. Matt's mother was insistent that both would attend at least a two-year college. Money was tight, so they were reminded to keep their grades up, so there would be some sort of scholarship to help with the expense. Matt's mother was always happy about his high

marks in science and math. Michael did OK himself, but not in science and math.

There was one other thing that Matt enjoyed about church. That was admiring the girls in their pretty Sunday dresses. There were no girls from his school at the church, so Matt had a selection of new faces to ponder. His church also had "Sunday School," so these girls were in those classes with him. Sunday School, however, didn't happen every Sunday, and it didn't happen at all during the summer.

That Sunday wasn't a Sunday School day. While some of the kids hated going both to church and to Sunday School, Matt was ambivalent. Sunday School did waste an extra hour, but there were some interesting Bible stories. There were war stories in the Bible along with the occasional miracle. Since he learned that some of the Bible had been written more than two thousand years ago, men were fighting wars for at least that long. It seemed like too long.

After the family's fast-food breakfast, it was back home for a quick change of clothes for Matt, followed by a long afternoon exploring the local forest. Forest might not be the proper term for the wide stand of trees and brush that lined a creek running near their house; but, when you're on the banks of the creek, you can't see any houses, so you might as well be in the middle of nowhere. Matt learned from his father that there was no chance that houses would be built there.

It would forever be as wild and unspoiled as it was now, since it was state land that acted as a flood barrier for the creek.

Matt enjoyed exploring this small swath of forest, and his frequent walks had left a trail through the underbrush. While his grade school science courses did teach him a little about nature, Matt had learned a lot by reading books. Many years ago, he had collected leaves into a scrap book and used a book to identify the species. There weren't that many species of trees, since the region supported only those trees accustomed to their climate, but there were many different plants in the underbrush. Often, Matt needed to examine the flowers and stems of many of those to accurately identify the plant species.

Today, Matt wasn't looking for leaves. Instead he was looking for rocks, but not just any rocks, but rock types that he didn't already have in his collection. Under his bed, in a wooden box, Matt had amassed a heavy assortment of rock types, most of which he had discovered along the shoreline of the creek, and some of which he had found on family vacations. Several rocks he had found in the parking lot landscaping of restaurants during these family vacations.

One of his prized rocks was a lump of coal he had found at the creek. A hundred years ago, coal was found in nearly every house, since that's how homes were heated. After natural gas heating had become universal, all the old coal

bins in cellars were cleaned out and used for more useful things like storage. Matt's lump of coal must have been discarded, somewhere, and used as filler material when the creek was deepened and widened.

The creek construction, which happened long before Matt was born, was done to reclaim the usually swampy areas near the creek by deepening, straightening, and widening the waterway. All that digging unearthed many rocks from deep in the ground - Rocks that probably had never seen daylight in their entire existence. This lucky event gave Matt a larger variety of rocks for his collection.

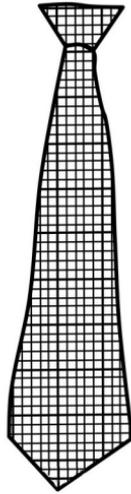
The water line of the creek was not that far below the shoreline. In family excursions along the interstate highways, Matt always marveled at the places where they had cut the roadway into the side of a mountain, exposing the deep layers of rock beneath the soil. The term, layers, was appropriate, since the rocks did appear to be different types of rock stacked on each other. He had learned in school that such layers were formed over millions of years of Earth's history from small processes, such as flecks of soil carried on the wind, that combined to give such thick layers.

As he walked along the shoreline of the creek, something shiny caught his eye. He bent down to retrieve a rock with shiny flecks, a piece of mica. Matt pocketed the stone, which was already mostly cleaned by the action of the

water, and he kept his eyes to the ground as he walked further along. Rock collecting was easier when he had first started, since nearly everything he saw was new and unusual. Now, he needed to be selective with what he took home; or, as his brother exaggerated, the floor under his bed would collapse from the weight. He had even chipped away pieces from some of his larger rocks to make room for others.

A little farther down the shore, Matt found another shiny object, but this time it was a half-buried aluminum can. Matt didn't think that anyone else traveled along his section of the creek, so the can was likely carried there from far upstream. For trash like this, Matt always carried a plastic shopping bag to collect the items for proper disposal at home. When he did this for durable metal items, like this can, he always had the idea that he might be denying some future young archaeologist an exciting discovery.

Although he hated to leave, the long afternoon shadows told him that it was time to get back home. His mother would soon have dinner ready, and after dinner it was back to the books. Most of his teachers assigned just light reading for the weekends, but he had a history report due on Tuesday, and he hadn't done that much work on it as yet. Fortunately, his choice of American Presidents was Teddy Roosevelt, and he had found more than enough interesting stuff to fill the two pages he needed for the report.



4 SHOW TIME

Bad enough that it was Monday, but it was raining, too. Matt's rain jacket offered little protection against the rain, but he didn't mind. It looked good on him, and that mattered more. Meredith shared her umbrella at the bus stop, so he wasn't that wet when he arrived at school.

Matt had not trusted his golden rock to his back pack. He stashed it in his lunch box, putting the thermos in his back pack to make room. A thermos could be replaced, but his rock was unique. Not only that, it was an investment. It was insurance for getting an "A" in science for the marking period.

At his locker, Matt organized his morning books. Science class wasn't until sixth period, after lunch, but Matt stashed the plastic bag with the rock in his right front pocket, so he could show it off during lunch. When that happened, it would be clean hands, only, and the rock stays in the bag!

His show-and-tell to his best friends, Tom and Jorge, would need to wait until lunch, since they didn't share homeroom with him. The homerooms were assigned alphabetically, Matt's last name was high up in the alphabet, but Tom and Jorge were near the bottom. It didn't seem fair that your name would mark you for life, like that. As his father said, that was a small injustice compared with some other things he would face as he got older.

Matt's homeroom seat was alongside the windows, so he usually passed this boring few minutes staring out the windows, wishing he were outside. Today's rain made it better to be inside, rather than out, and the rain-streaked windows made it hard to see outside, anyways, so he just looked around the room, trying to find something interesting.

As usual, a few of his classmates were struggling to finish their homework in one subject or another before the first bell. Matt was somewhat lucky to have a study period early in the morning, so he was able to tidy some loose ends then, if he needed to.

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While he was looking around the room, Hillary's gaze met his, eye to eye. Matt usually didn't like people to think he was staring at them, so he usually looked away, quickly, when this happened. Hillary was different. She smiled at him before turning back to rearranging her papers for the day. He felt more comfortable with Hillary than with the other girls. Perhaps there would be a future opportunity for Matt and Hillary to get together, maybe at a party hosted by a mutual friend. Matt's reverie ended when the bell rang to signal the end of homeroom and the need to scurry to the first class.

The morning came and went like most Monday mornings, with a study period, English class, then History, and finally lunch. There might as well have been no teacher for English, since, once again, it was one student after another called to the front of the room to read a short poem. The only poems that Matt enjoyed were the limericks he would find occasionally on the Internet. Not surprisingly, there were no limericks read in English class.

Finally, lunch time arrived, and it was time to show off his rock to Tom and Jorge. Since Matt's History teacher spent some time after the bell reminding the class about their president reports, due the next day, Matt arrived at the cafeteria slightly later than his friends. All of them were "brown-baggers," although they each carried lunch in a lunch box, and not a bag, so there was no need to wait in line for their food.

Tom and Jorge were seated at their usual table, in one corner of the room near a window, and Matt joined them.

Tom was the first to speak.

"So, I heard that you've been enjoying the delights of poetry. I heard that poetry is a great way to get girls!"

"Well, if that's true," replied Matt, "Then maybe I should pay more attention. Actually, I think the girls in my English class are just as bored as I am. So, what's for lunch?"

Matt wasn't interested in everyone's sandwiches, but their snacks. Mothers had a way of giving the same snacks, over and over, but the boys compensated by sometimes trading with each other. Jorge pulled his usual graham cracker package from his bag, but Tom was more secretive, opening the bag to let Matt peer inside. He had a bag of peanuts.

Matt whisper-yelled at Tom.

"Your mother packed you peanuts! She knows that this is a peanut-free school!"

"No, she didn't pack them. She packed me a box of raisins, not the sweet, yellow kind, but the dry, brown kind, so I replaced them with these peanuts. I'll eat them from the brown bag, and no one will know."

"There's a problem with that," said Jorge. "Let's say that your greasy peanut hands touch something like a pencil that's touched by someone else, and they put the pencil or their

fingers in their mouth. Bad news if they have a peanut allergy.”

Tom replied.

“Is anyone dumb enough to put their fingers in their mouth at this dirty place?”

“Are you willing to take that chance?”

Tom paused for a moment, looking at his beckoning peanut snack. “Yeah, you’re right. I’ll leave them in the bag and take them home. Are the buses peanut-free, too?”

“Probably,” said Matt, “But I still wouldn’t take the chance if they weren’t. But, forget the peanuts, I have something here to show you.”

Matt pulled the plastic bag containing his rock from his lunch box, in the place where the thermos was kept. At that point, he remembered that he had left the thermos in his back pack. He had placed it there to make room for the rock, and the back pack was in his locker. No problem. The milk inside would keep to the end of the school day and he would just have some water with lunch. He slid the bag onto the lunch table, careful that there wasn’t anything on the table surface to smudge the bag.

“It’s a rock,” said Tom. “So, why are you showing us a rock?”

Matt rotated the bag so that the golden interior reflected light from the overhead fixtures towards Tom and Jorge.

“I think it’s fool’s gold, and so does my brother, Michael. I dug it up in my backyard when I was planting a tree for my mother. It was

pretty deep in the ground. I'm going to show it to Rizzo."

"Can I touch it," asked Jorge.

"Yeah, you can handle the bag, as long as your hands are clean, but don't take the rock out. I spent a long time cleaning it."

Jorge wiped his hands on his shirt, just in case, then he took the bag and rotated the rock from side to side. Tom watched at his shoulder.

"That gold patch is really bright," said Tom. Did you use some sort of window cleaner on it?"

"No, just water. I read about fool's gold on the Internet. It's called iron pyrite, and some types of pyrite will stay shiny for quite some time. It's been just as shiny for the last two days, so I suspect it will stay shiny for a long time. I was just hoping it would be shiny when I showed it to Rizzo, and it looks like I got my wish."

Jorge asked, "Are you sure it's really fool's gold? Would Rizzo try some tests to make sure?"

"Well, I don't think that it's important enough to test to be sure. There are chemical tests where you put on a drop of acid and smell it - It should smell like rotten eggs - But I hope he doesn't want to try that, since it would ruin it. Some other tests would need better equipment than what we have at the school. I would just like to keep it on my shelf in the same state that I found it."

"I agree with you," said Tom. "It looks nice, so you should just keep it the way it is."

Matt put the rock back in his lunch box, Tom kept his peanuts in its bag, and they talked about other things for the few remaining minutes of lunch. When the bell rang, Matt went off to science class and Mr. Rizzo.

As he entered the classroom, Matt noticed that Rizzo was still wearing the tie he had worn for all of last week. It was a tie that had a grid pattern, not unlike the graph paper they used in math class. Perhaps it was one of his favorite ties; or, maybe, he didn't have that many ties. It could be that a teacher's salary wasn't enough to buy that many ties, but it was probably just as true that the students didn't even notice the tie, so it didn't matter. Matt also wondered why Rizzo wore a tie at all, since his other teachers didn't. He might think that it made him look more professional, or something like that.

"Mr. Rizzo?"

Rizzo looked up from the papers he was collecting on his desk.

"Oh, hello Matt. What can I do for you?"

"I've got something to show you. It's a rock that I found at home over the weekend."

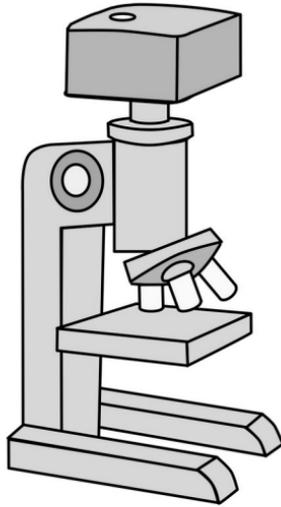
Matt placed his lunch box on the desk, opened it, and extracted the rock that was still in the plastic bag, and handed it to Rizzo.

"I think that it's fool's gold." Matt paused and then decided to show his knowledge. "Iron pyrite."

Rizzo turned the bag around in his hand, examining it closely.

“Might be.” He handed the bag back to Matt. “If you have time after school, we can examine it under a microscope; but, right now, we need to start class.”

Matt stuffed the rock back into his lunch box. “Sure, I’ll be here.”



5 AFTER SCHOOL

After science class, it was gym, Spanish, and math. Math was somewhat more interesting, since they did some spreadsheet math. In the class example, they had a list of students and their grades for five tests, and the problem was to average the grades for each student, and then rank the students according to grade. Matt learned the techniques rather quickly, and he had the problem done before most of the other students. That gave him some time to work on his homework problems.

When math class was finished, Matt went back to Rizzo's science room carrying his lunch box with its contained rock. He had stashed his

books in his locker first and checked the time when he would need to catch the late bus. The late buses were typically filled with band members, some student club members, and many sports team members. Matt usually scanned the bus windows to choose a bus with some friends whom he could be with for the ride, but that wasn't always possible.

Rizzo was at his desk, apparently scoring test papers from another grade, but he immediately stopped what he was doing when Matt entered.

"So, Matt, let's examine your rock more closely. We'll use the video microscope, so we can both see things at the same time."

Rizzo and Matt walked towards the back of the room to the video microscope and its monitor. Mr. Rizzo had told the class how high quality microscopes were too expensive for schools to buy when he was young. That was because the lenses needed to be polished from glass, and very bright light sources were needed so the magnified images could be seen with the unaided eye. Nowadays, lenses were molded by the millions from plastic, and computer video cameras could create bright images from dimly lighted objects.

"We'll use the macro lens," said Rizzo. "That way we can focus on the gold within the crevice in the rock. The camera has enough resolution that we can digitally zoom into a very small area. First, we need to take the rock out of the bag. Let's do this the proper way, using gloves."

Rizzo did a long reach to the back of the tabletop and fetched a box of gloves. Rizzo was a good teacher, and he explained things as he went along. "Some gloves are made from latex, but those are usually powdered so they don't get sticky. We use gloves made from acrylonitrile. They don't need powder, and they're good for another reason - Some people have an allergy to latex."

He handed a pair of gloves to Matt, and soon both their hands and the rock were protected. Matt handed the bag to Rizzo, who pulled out the rock and placed it under the microscope lens. While alternating between adjusting the illuminating lights and changing the rock position and microscope focus, an excellent image of the gold area appeared on the monitor. Rizzo seemed confused, as he fidgeted with the focus, again and again.

"That's strange," he said. "The gold surface seems to be perfectly smooth. Minerals like pyrite will always have some surface irregularities, usually parallel lines that are actually "steps" on the crystal surface. Let's get some pictures."

Rizzo accessed a menu on the monitor, typed in a name for the image, and then pressed a button labeled, "Capture." He moved the rock around several times, refocused, snapped an image, and did the same again. Then he placed a ruler at about the same position as the gold

patch in the rock, focused, and captured that image.

"It's important to have a scale reference for microscope images," he said.

When all this was done, Rizzo put the rock back into the bag, he turned off the microscope and its associated equipment, and he handed the bag back to Matt. Taking his gloves off, he gave Matt a quick analysis of what was happening.

"Matt, I'm puzzled. This doesn't seem to be a simple piece of fool's gold as we thought. I took all those photos, since I'm going to email them to a professor friend of mine at the university. He has some pretty fancy equipment in his laboratory, and he might help us find out more about your rock. Perhaps, he will let us visit him so he can look at the rock."

Matt was excited.

"Did I find some new mineral?"

"Probably not," said Rizzo. "Whatever it is, it might be rare, that's why my professor friend might be interested. I'll send my email, and we'll see what happens."

Matt had a lot to think about as he rode home on the bus. He kept the rock in his lunch box, since he was unwilling to handle it on the bus, where anything might happen. He didn't have the rock in his hand, but it was firmly in his mind.



6 UNIVERSITY INVITATION

Mr. Rizzo had good news for Matt just before science class the next day. Rizzo's professor friend at the university was interested enough in Matt's rock to invite them to his laboratory some day after school. Rizzo gave Matt a permission slip for his parents to sign, with a list of three possible dates, and he checked a box indicating that they would travel in his car. The slip listed an option that Matt's parents could drive him to and from the university themselves, and even stay there if they wished, but Matt knew that wouldn't happen. He would travel with Rizzo.

Matt decided to hold off on presenting the permission slip to his parents until after dinner,

since his father would be home then. If he had just given it to his mother when he returned home from school, she would have just said that she would need to discuss it with his father. Matt didn't see any problems with getting permission; but, when parents are concerned, who could tell.

Matt completed his homework before dinner, which was a lot easier for him now than when he was younger, since there were fewer distractions at his age. The after-school programs on television were targeted towards younger children, so there weren't any distractions there. He was too young for a smart phone, and his parents probably couldn't afford to get him one when he was. There was an unexpected sprinkle of rain as he came home on the bus. Since this might be a prelude to a heavier downpour, he wasn't tempted to go outside. Even if it didn't rain any further, the grass was all wet.

Dinner was a treat. Matt's mother had decided to try a recipe she had seen on television for marinated chicken. She had followed-up by getting detailed instructions on the Internet, and she was happy to see that she had all the ingredients already at home, except dried garlic flakes. Since nobody in the family liked garlic, she just made the recipe without the garlic flakes, marinating the raw chicken in an oil, vinegar, spice mixture overnight in the refrigerator. Everyone agreed that the baked

chicken was superb, and Matt's mother promised to make it again, soon.

Just before the table was cleared of dishes, Matt retrieved the permission slip from his pocket and handed it to his father with a short explanation. After he had told his brother, Michael, about the rock, he had shown it to his parents, so they knew what this was all about. Since they encouraged his science education, they had been happy to see his initiative in wanting to show the rock to his science teacher. His father had some questions about the permission slip, the first of which was directed to Matt's brother, Michael.

"Michael, you had this science teacher, Rizzo, didn't you? What's he like?

For once, Michael didn't refer to him as "Dizzo."

"Mr. Rizzo is an alright teacher. He seem to really like science, and he likes to teach science to the students. He's been at the school for a long time, so he's safe."

Matt had never considered this "safety" aspect of his trip, but Michael was a lot older.

His father's next question was to Matt.

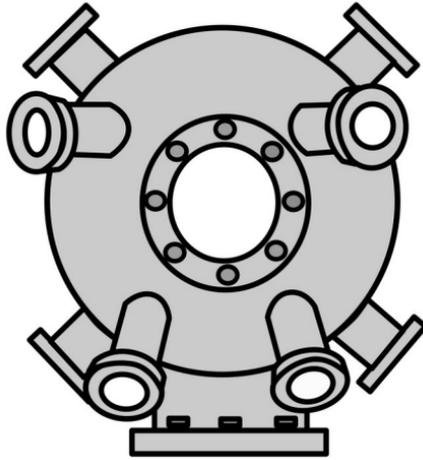
"This says that you'll be getting back late, maybe six o'clock. Do we need to get you at the school?"

"Mr. Rizzo said he would drive me right home, if that's OK with you."

"Mom will keep your supper for you to eat when you get home." Matt's father then turned

to Matt's mother, " Hon, will you get me a pen so I can sign this?"

And that was that. Matt decided that Thursday of that week would be a good day for the trip, since not much was happening in his classes on Friday. The next day, Matt handed the permission slip to Rizzo, and the trip was in motion for the day after next.



7 FIELD TRIP

Matt didn't know what to expect at the university, but he knew he had to remember to bring the rock. He would also insist that the tests be ones that didn't spoil the rock in any way. Rizzo had told him that a lot of information could be obtained "non-destructively," what they did with the classroom microscope. The university had what was called a "scanning electron microscope," which was a microscope that used electrons instead of light, and it could magnify images a lot more than the school microscope. It could also scan to see what chemical elements that gold patch might contain.

Thursday, after school, Matt met Rizzo in his classroom, where Rizzo verified that Matt had remembered to bring the rock, the reason for the trip. They left the building through a door that Matt had never used. The door led through a short walkway directly to the parking lot and to Rizzo's car. Because of his job, Matt's father drove a truck, but his mother had an older car that she used for shopping and other things. Rizzo's car looked far older than Matt's mother's car, so it might be true that teachers don't earn much money.

It was a very short drive to the university, but there was still a little time for conversation. Rizzo asked Matt about his other classes, and whether he thought he would like going to college to become a scientist. Rizzo was pleased that Matt was doing well in math, since math was an important part of all the sciences. Rizzo confessed to Matt that math had been hard for him when he was in school, but his grades were good enough to get him into college to study science. When he got to college, his math skills improved. It was interesting for Matt to hear about the school experiences of a teacher, but it was hard to imagine that Mr. Rizzo was once his age having the same problems.

"Most of the math I learned, I never used," Rizzo laughed, "But, as one of my professors told me, you never know what parts of math are the ones you won't use, so you still need to learn it all!"

THE SIGNAL ORB

The university parking lot had a guard at a gate house. Rizzo showed him the email invitation from his professor friend, the guard gave him a campus map in which he had circled one of the buildings, put a card on the dashboard below the windshield, and directed him to a visitor's parking space. Since it was late in the day, there were few cars on campus.

Rizzo knew his way around the university, so he didn't need to refer to a map. The campus was decorated with occasional sculptures, some of which were collections of odd, geometrical shapes. There were a few college students walking on campus, and it was interesting to think that his brother, Michael, was nearly old enough to be a student here. Matt's college years, however, were still far, far away.

They finally arrived at a modern looking building apparently named after some person. There were a few students in the lobby area, some sitting in chairs, and some sitting on the floor. They were talking, either to each other, or on cellphones, reading, or typing on laptop computers. Rizzo and Matt went up a stairway to the second floor, which seemed more like a floor of an office building than that of a school, passed through a corridor labeled "Materials Science," and finally arrived at an open office door. The name on the door was "Professor Zimer."

Rizzo knocked. "Rolf, I've arrived with my student, Matt, and his curious rock."

The office was filled with books and piles of papers, and it had a very large computer display at the desk. The screen had an image of some atoms pieced together like the ball and stick models in Rizzo's class room. This image, however, had many more atoms than any model in Rizzo's classroom. The jovial man at the desk looked about the same age as Rizzo. He wasn't wearing a white coat, as Matt had expected, and he rose to shake hands with Rizzo, and with Matt.

"Joe, good to see you again, especially when you're bringing along a young scientist!"

Matt blushed slightly.

"Can I see this mysterious rock?"

Matt reached into his pocket, retrieved the plastic bag containing his golden rock, and he handed it to Professor Zimer. Zimer rolled it over in his hand, admiring the shiny golden patch that reflected the office lights. Zimer then addressed Matt.

"Matt, did Mr. Rizzo explain what we do here?"

"He told me about the electron microscope," answered Matt, "And I did notice that this part of the building is labeled 'Materials Science.'"

"Materials Science is an interesting field. Of course, that's what a materials scientist would say!" Rizzo and Professor Zimer laughed. "The formal definition of Materials Science is the study of the structure and properties of materials. If you look around, everything is a

material, from the bricks in this building, the clothes on your back, and the electronics inside my cellphone. There's a little chemistry, physics, and engineering in what we do here. It's easy to find interesting materials, like your rock, to study. Let's get a closer look at your rock with the SEM. Follow me."

They turned right at the office door, then around a corner in the hallway, finally arriving at an elevator on the left.

"We'll take the elevator to the basement level."

While on the elevator, Professor Zimer explained that sensitive microscopes typically needed to be at the lowest levels of a building where there were fewer vibrations. Their magnification was so great that any vibration would give an out-of-focus image.

"If we try, we can even see when the elevator is in use," said Zimer, "But that doesn't affect our studies that much."

The elevator door opened, and Professor Zimer motioned them to the left. After passing a few doorways, they arrived at a door labeled "Zimer: Microscopy." The room they entered looked a little like parts of Rizzo's class room. There was a long black bench with a built-in sink, some faucets connected to hoses, and glassware everywhere. Off to one corner was a machine with several display screens that seemed to be releasing gas somewhere in back. It was a little

noisy, with the hum of one or more motors. There was someone seated at the machine.

"This is Jeff, one of our graduate students," said Zimer as Jeff rose and nodded their way. "I asked Jeff to prep the SEM for us and help analyze your rock. He works with this scanning electron microscope often, so things will happen more quickly with Jeff here. Jeff, here's the rock I was telling you about."

Professor Zimer handed the plastic bag to Jeff, who was already wearing some blue gloves. Jeff took the rock out of the bag, and he gave a running explanation of what he was doing, just as Rizzo had done when they had examined the rock on the video microscope.

"First, we need to clean this really good, since any little bit of oil or something like that will spoil our vacuum. We first clean things using solvents in this ultrasonic cleaner."

Jeff placed the rock on a paper towel on the table, then he grabbed it with some plastic forceps and gently put it into the vat of the ultrasonic cleaner. A flip of the switch produced a little noise.

"That's not the ultrasonics we're hearing. It's just some vibration in the cleaner caused by the ultrasonics. The ultrasonic waves are too high-pitched for people to hear"

After about a minute, Jeff extracted the rock with the forceps, held it over the cleaner so the residual solvent could drip back into the vat, then he once again placed the rock on the paper

towel. After that, he grabbed a gun-shaped object attached to a hose. This gun, which he called an "air gun" was used to blow away any remaining solvent on the rock.

"Now it's time for the SEM," Jeff said as he carefully grabbed the rock, again with the forceps, and placed it inside the machine. After a few adjustments in the position of the rock, mostly to ensure that the golden patch was facing up, Jeff closed the door on the rock chamber, fixed a latch, then pressed a button. A gurgling noise came from the back of the machine.

"That's the vacuum pump doing its thing," Professor Zimer said. "When most of the air is out of the chamber, which doesn't take that long, since the chamber is small, a more powerful turbo pump will kick in to make the vacuum even better. It all takes just a few minutes. A good vacuum is important, since electrons would hit the molecules of gas in the air and not make it all the way to material we want to image. When the vacuum is below a certain limit we'll be able to scan the rock. While we're waiting, perhaps Jeff can explain what he does here. There are some images he can show you on the screen."

"The metals that things are made from," Jeff said as he tapped an aluminum handle on a drawer, "Aren't pure elements. This handle, which looks like the aluminum of a beverage can, isn't just aluminum, since pure aluminum

wouldn't be strong enough. It's mostly aluminum, with a few other elements mixed in."

Jeff pulled up an image of what could have been some abstract artwork. As he explained, it was a map of the elements in an aluminum alloy with each element shown in a different color.

"You can see that the elements don't just mix uniformly. Some of them will clump together. What you have is aluminum with bits of these clumps distributed everywhere in the metal. It's a little hard to explain, but these clumps make the usually soft aluminum hard enough to be used for things like door handles and parts of airplanes."

While Jeff was talking, the machine beeped.

"Looks like our vacuum is ready, now," said Jeff. "Let's take a closer look at the rock."

Jeff sat at the machine controls, typed some commands on a keyboard, turned some knobs until a portion of the the rock appeared on a display screen, and then he used a joystick to move the rock and zoom into the gold patch. As Professor Zimer explained, the rock and patch had no colors on the display, since the electrons used to form the image only allowed black-and-white images.

Jeff pointed to a short white line on the rock image. "That's our reference scale, which is a millimeter. Right now we're doing just a little better than an optical microscope. I'll magnify ten times."

Jeff turned a switch, and a magnified, but slightly out-of-focus image of the gold patch appeared. After some adjustment, the image came into sharp focus.

“Jeff, what are those features? They seem to be in a rectangular array. Some sort of surface defect? Magnify another factor of ten.”

Jeff complied, doing the same adjustments as before to bring the gold patch into focus. What appeared was a group of square pits that resembled an ice cube tray. The ice cube tray was surrounded by an outline, a groove in the surface. The rest of the surface was perfectly smooth.

“OK,” said Professor Zimer, “That doesn’t seem natural. Jeff, get an element map.”

Jeff moved over to another display screen, tapped a few commands into a second keyboard, and a graph appeared with several spikes. Jeff used a computer mouse to tag the two highest spikes with a particular color from a list of choices, he pressed another key on his keyboard, and slowly an image of the gold patch was created, one line at a time. The gold patch now appeared yellow, while the ice cube tray and outlining groove were blue.

“I choose yellow, because that’s really gold,” said Jeff. “The blue is platinum, and all other elements are absent.”

“Well,” said Professor Zimer, “Your fool’s gold made fools of us all - That’s really gold. What it is and how it got there is anyone’s guess. That

regular pattern might be a tool mark, and the little bit of platinum is not much of a mystery. Platinum is often mixed with gold to make it harder, since gold is too soft to endure frequent handling. It might be a piece of gold jewelry that somehow got embedded into some rock. Jeff, we're done with the SEM, but there's one other thing I would like to try, so break vacuum and retrieve the rock."

Matt was at first a little disappointed that his rock didn't contain a nice specimen of fool's gold, but then he started to think. A big chunk of gold might be worth a lot of money! He would need to crush the rock to see how much gold was inside, and he wasn't yet sure that he wanted to do that.

There was a slight wheezing sound, and Jeff opened the vacuum chamber to get the rock, which he placed back onto the paper towel with the forceps. Professor Zimer grabbed the rock with his gloved hand. He motioned towards the door.

"Let's go down the hall to the X-ray room. Since gold has a much higher atomic number than whatever elements are in the rock, we should be able to see the shape of this object using X-rays."

Just a few doors down the corridor was a door labeled "Zimer: X-ray." The door also had warning signs about X-rays. When they entered, they saw several machines that were surrounded by plastic boxes. Zimer explained that the plastic was a special type that shielded people from X-

rays when the machines were on. There were even switches on the doors that prevent the machines from generating X-rays if the doors were open. There was no one in the room. At the door were clip-on badges that Professor Zimer distributed to Matt and Rizzo.

“These are radiation badges. There are never any problems, but the badges are a way to tell later how bad things were if something went wrong. Don’t worry, especially since we’ll all be out of the room when the X-rays are on.”

Matt remembered how when he had dental X-rays, the dentist left the room, since the X-ray switch was outside the door. He wondered why it was OK for him to get the X-rays, but not the dentist, but the dentist explained that for Matt it was a one-time event, but for a dentist it would happen many times each day, which might not be too good.

Professor Zimer opened one of the plastic doors, placed the rock on a platform, and then closed the door.

“The platform rotates to get views from all directions. I’ll set the timer, then we’ll step outside for a few minutes while the machine does its thing.”

Professor Zimer clicked the computer mouse of the machine to set the proper operations, then it was their cue to leave the laboratory. Professor Zimer and Rizzo talked while they were waiting. The two had apparently gone to college together, but Professor Zimer went on to

graduate school for his doctoral degree while Rizzo had become a teacher. While they were talking, Matt could hear a faint beep from the laboratory.

"It's done," said Zimer. "Let's look at the images."

They entered the laboratory, and Professor Zimer once again did his click dance with the computer mouse. The screen filled with eight back-and-white images. All the images were circles on an irregular background.

"Now, that's interesting," said Zimer. "The irregular blotch is the rock, and it appears that the gold object inside is a perfect sphere, a golden sphere."

Rizzo asked, "Is the sphere solid gold?"

"We can't tell from the X-ray, since even a thin gold shell would shield what was inside. As I remember, the rock wasn't that heavy. If it was solid gold, it would be a lot heavier. Let's get an estimate of the density. The machine software can give us an estimate of the volume of the rock and the sphere. Let's see whether I remember how to do this."

Professor Zimer clicked around the screen and finally got some number that he wrote on a scratch pad.

"Now for the weight."

There was a digital scale in the laboratory. Zimer put the rock on the scale pan, wrote the weight on the scratch pad, and did some quick pencil-and-paper math.

“Most rocks have a density of five grams per cubic centimeter. I don’t know off-hand what the density of gold is, but it’s a lot more - We can look it up, later. What I can tell you is that the total density of the rock, including the sphere, is less than what a solid rock’s density should be. What that means is that the gold sphere is mostly hollow, or filled with some light material. It’s probably good that you didn’t try to smash the rock, since that probably would have crushed the sphere.”

“So, what could it be?”

“My original guess was that it was some sort of jewelry,” said Zimer, “...But seeing that it’s so large makes me think that it’s some sort of ceremonial artifact, and it might not be that old. Home builders typically bring in soil to level a lot before building a house. This fill dirt could come from anywhere, maybe a demolished old church. What now looks like a rock may have been a carefully crafted box, carved from solid rock, to hold this precious object. After some time, the halves of the box fused together from water and mineral action in the ground.”

Matt replied, “What do we do next?”

“If it were my rock, I would pass it to some archaeologists at the university. They’re very good at chipping rock away from buried objects. However, they might be too busy to look at this object. It isn’t associated with some ancient temple or burial ground, so it’s not that

interesting to them. I could cut the rock in half..."

"No, I wouldn't want to do that! I'd like to keep the rock as it is."

"That's a good plan, too," said Zimer. "It's your rock, so you have the final say."

Rizzo thanked Professor Zimer for his help, and he even remembered to hand back their radiation badges. Zimer said he would email the rock images so Matt has some materials to make a science fair project out of this excursion. On the way back home, Rizzo explained a little more how electron microscopes and X-ray machines worked, and Matt was just a little late for dinner.



8 MYSTERY

Matt put his rock on the shelf. When he received the scanning electron microscope and X-ray images from Mister Rizzo, he had his mother print them out at the local office supplies store, and he placed the photos on the shelf in back of the rock. Whether his rock contained pyrite or some fancy doorknob, it was still his most prized possession.

At lunch, Matt told Tom and Jorge about his university adventure, and how the rock was not what it had first appeared.

“Now, there’s a mystery,” said Jorge. “Since you’re not willing to hack away at the rock, I guess it will remain a mystery. At least you aren’t losing any money, since there doesn’t

seem to be that much gold inside. It's just an odd Christmas tree ornament."

Tom interjected, "Maybe later, when the thrill is gone, you will want to break the rock away to find out what mysterious object you've been keeping for such a long time."

"At least I've got an easy science fair project," said Matt. "It will look good with all those microscope and X-ray images on a poster board, and the rock on the table. I might win a ribbon."

"I think you'll need more, like a real piece of fool's gold in comparison," said Jorge. "You can get those really cheap on the Internet."

Tom had another idea. "You know what I think it might be?"

"What?"

"Well," said Tom, "I don't think the rock was meant to be opened. I think they made the hole in the two pieces of rock, lined the hole with some gold foil, filled it, and then heated everything together, like they do for making pottery, so it would become a solid piece of rock."

"Why would they do that?" Jorge asked.

"It was meant to be on someone's fireplace mantle. It was a fancy urn for some dead person's ashes. Probably had an inscription carved into the stone on the outside."

"Gross!"

Tom laughed. "Now that's a funny thing to have in your room!"

“Forget Tom’s idea,” Jorge said. “There are a lot of things that rock could be. It could be part of a satellite that fell back to Earth.”

“Then how did it get inside the rock? My idea is the best so far,” said Tom.

Matt was thinking about the rock during his afternoon classes. Tom’s explanation did make a lot of sense, since it explained why the gold sphere was hollow and encased in rock. Was it OK for him to keep some dead stranger’s ashes in his room? Maybe he should just put the rock back into the ground like he found it. He needed to think about this.

All this was running through his head that night as he lay in his bed trying to get to sleep. This was harder than usual. His brother, who had a later bed time because he was older, was playing a video game in his room. The beep-beep sound, while very soft through the shared wall of their bedrooms, was getting to be annoying. Matt got out of bed with the pretense of going to the bathroom, but his real objective was to tell Michael to turn down the volume.

He put on his slippers, exited his room, and walked down the hall, only to discover that Michael must have quit the game. Matt decided that since he had come all that way, he might as well follow-through with his bathroom trip. As he exited the bathroom, he was happy that the video game sounds from Michael’s room were still gone.

Back in his room and back in bed, Matt heard the beep-beep sounds return. He cupped his pillow over his ears to deaden the sound, and tried again to sleep. He was surprised to hear the beep-beeps continuing a half hour later, past Michael's bed time.

"Don't Mom and Dad hear that," he thought. "Michael's going to get in trouble."

Matt sat up in his bed, and that's when he discovered the source of the beeping sound. It wasn't coming through the wall of his room. It was coming from inside his room! He got out of bed and walked around, trying to pinpoint the origin of the sound. Matt found that the beep-beeps were coming from the rock!

Matt was at first afraid to touch the rock. Latching on Tom's conjecture of what the rock was, Matt imagined that the ghost of whatever person's ashes on the inside had decided to haunt his room. After a minute, he decided that a ghost wouldn't be making beep-beep sounds like a video game. He got his flashlight and shined it on the rock to examine it more closely. When he did, the beep-beep sounds stopped, and the rock stayed silent after he turned the flashlight off.

Did he imagine the whole thing? After all, the rock had been on his mind all day. Maybe he was actually asleep, and this was just a dream. Since he never believed the idea that you could pinch yourself awake in a dream, Matt just went back

to bed. At that point, he was so tired he fell asleep quickly.

The next morning, after arising, Matt stared long and hard at his presently silent rock. Had it all been a dream? Should he carry the rock with him to school to see whether it started to beep again? He decided against that, since he would be straining his ears to hear the rock, and not his teachers, all day.

Back at home after school, Matt had the still silent rock on his desk as he did his homework. Now he was convinced that he had imagined the whole thing. It was nearly an entire day since the rock had supposedly beeped at him, and it had never made any sound between its discovery and last night. Logically, there's no way that an object embedded in an old rock, golden or not, could possibly beep. That's all there was to it.

After a night of usual activities, it was time again for bed. The rock was still on Matt's desk where he had placed it after school. He wasn't concerned that the beeping would start again; otherwise, he would have buried the thing in one of his drawers under a lot of clothing to muffle the sound. He turned out the light, plopped his head on the pillow, and waited for sleep.

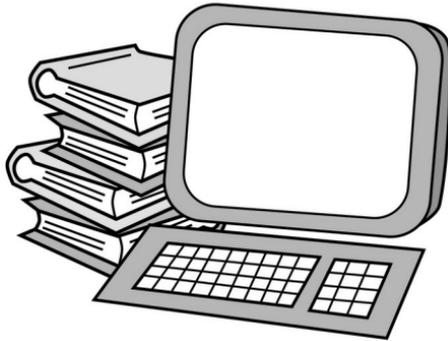
"Beep-beep-beep..."

"Oh no, not again!" thought Matt, as he jumped out of bed and walked to the rock. The rock was still beeping, ever so softly. Matt held the rock to his ear to make certain that the rock was making the sound. It was.

“So, it wasn’t a dream,” thought Matt. “Maybe I’m just going crazy!”

Matt flipped on his desk lamp, and the beeping stopped. At that point he got the idea that the reason the rock never beeped during the day was because of the light. When it was stuffed in his lunch box, or in his pocket, it would be dark, but the sound was too faint to be heard when it was covered. Matt flipped off the light, expecting the beeping to restart. It didn’t.

He remembered the night before, when his flashlight stopped the beeps. When he turned the flashlight off, the beeps didn’t restart then, either. Matt sat at his desk for a while, thinking. Maybe light was the key, but there needed to be a few hours between the rock’s silent and beeping states. Then, bored with the whole thing, he went back to bed. He needed an expert opinion on this, and he knew just whom to ask.



9 GABRIEL

It was time to call on Gabriel.

Gabe, as everyone called him, was his school's computer expert. Although they shared just two classes, Gabe was in Matt's homeroom. Gabe was a lot smarter than Matt, so he ended up in the more advanced classes. One class they shared was English, principally because Gabe's parents had immigrated from Poland, and they spoke Polish at home more frequently than English. If Gabe had been born here, maybe he would have been in college by now. Matt considered him to be that smart.

While the other students were clicking fuzzy animal icons on their screens, Gabe was busy

typing. That's because he wasn't playing games. He was writing computer programs like the ones that make the games work. Gabe enjoyed mathematics, and most of his programs did mathematics and not games. It seemed to Matt that Gabe would have been better off at a private school, where the teachers could better advance his early interest in computers. It might be that, just like Matt's family, money was a problem, and those private schools aren't cheap. It might also be that Gabe's parents thought it was better for Gabe to experience the broad spectrum of students in the public schools.

Gabe started to learn computer programming in the fourth grade. His father introduced him to a simple programming language called Logo in which he could write programs to draw simple shapes on a computer screen. When he outgrew that, he started writing programs in a language called PHP. Gabe said the advantage of PHP over other languages was its built-in ability to do complicated things, like finding the day of the week for a certain date in the future, with just a single line of code. He said that was a good cheat when he was younger, but it helped him get the experience he needed to write computer code in other languages.

PHP also gave Gabe the ability to put pages on the Internet, like the survey he did as part of a school social studies project. That web page had questions that could be answered by clicking on boxes on a scale of one to five. Behind the

scenes, Gabe's computer code captured answers and collected them in a nice form for his report. Gabe's computer code also included a way to prevent people from taking the survey more than once - It checked a number that showed their Internet connection. That was a good feature, knowing the personalities of some of the students.

Gabe had the advantage that his father was a computer professional. Matt didn't know exactly what Gabe's father did. Gabe mentioned something about robots, but more like the ones that filled milk bottles than the ones that attack cities. One thing he did know was that Gabe's computer, a hand-me-down from his father, was really fast, and it had a huge screen. The huge screen always had many windows opened at once, and it was a flurry of activity. Matt was somewhat envious, but he realized the computer found better use in Gabe's bedroom than his own.

One other thing that distinguished Gabe's computer was the operating system. Matt knew enough about computers to know that there were a few different types, and these were different because the operating systems, the computer code that organized things into windows and icons, were different. What this meant to most people was that programs you could run on one computer wouldn't run on some others.

Gabe's computer ran Linux, an operating system no one else in his school used. Unlike the

other, “user friendly,” operating systems that shielded a person from the internal workings of the computer, Linux was an operating system that hid nothing. It was more difficult to use than the others, but it was much more powerful.

Linux had one definite advantage over the other systems. Whenever you wanted a program that did something like video editing or telling you the phases of the Moon, you could get it for free from the Internet. Linux programmers liked to share their programs and improve the ones already out there, so there were many free programs available online. For Gabe, this also meant that the ability to write his own programs was built in, free of charge.

Matt's problem, as his father defined problems of this type, was one of salesmanship. Matt had to “sell” Gabe on the idea that what he was asking was really interesting and worthy of his time. His father was always saying, “time is money,” so asking for a person's time was like asking him for some money.

Both Matt and Gabe arrived for homeroom very early each morning because of the bus schedule, so there was enough time before the start of the school day for Matt to ask for Gabe's help. Gabe was in his usual pose with his nose in a book.

“Hey, Gabe. Got a minute?”

“Oh, hi Matt. Sure. Rizzo told us about your rock, or, should I say, mystery object inside of a

rock, in our advanced science class. What are you going to do with it?"

"I don't know who else would be interested in it, except for people who would want to slice it open to see what's inside. I'd rather not do that." Matt was thinking that was true, now, more than before, because of the beeps. "I'll just keep it for myself."

"You should buy one of those plastic baseball boxes and put it in there. It would look good on your shelf. The rock might be too large for the standard baseball box, but there must be some larger options. So, what else is up?"

Matt looked around to make sure that their conversation was private. Not that it was really important to have privacy, but you never know.

"Gabe, there's something about my rock you can help me with. Your computers can analyze sounds and make sounds, too, can't they?"

"Yeah, all that's easy. Ha! Is your rock talking to you? Now, that would be interesting!"

"No, no. Nothing like that. But I think it's making some sort of sound, a really faint sound."

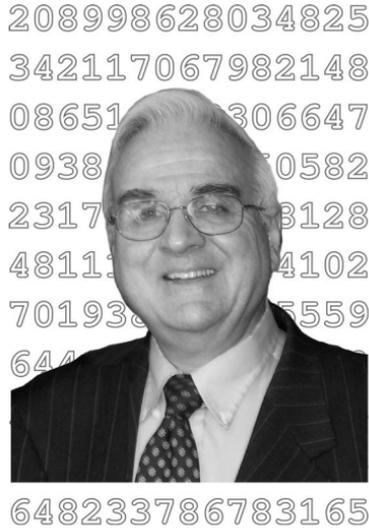
Gabe thought for a minute.

"Sure, I'll help, but this probably has a simple explanation. Maybe temperature changes are causing gas to leak from cracks in the rock. Or, maybe, it's magnetic, and the electricity in your room is causing it to buzz. If it's anything like that, we can figure it out. What about tonight, your house, seven o'clock? I'll bring my laptop."

"Thanks."

Matt retreated to his desk as most of the rest of the class entered. No, it wasn't a buzz, and he wasn't the proud owner of a farting rock, but he would let Gabe and his computer hear for themselves.

About the Author



Dev Gualtieri received his PhD in 1974 and had a thirty-five year research career in physics and materials science.

He is listed as an inventor on thirty-six US patents, and on numerous international patents. His eclectic research interests included superconductivity, chemical thermodynamics, magnetism, optics, electronics and computer science. At one time, he was an internationally recognized expert in crystal growth.

Dr. Gualtieri is now retired, and he resides in Northern New Jersey with his wife, Anne. They have a son and daughter who reside with their families in Pennsylvania.