The RADIUM GIRLS

THE DARK STORY OF AMERICA'S SHINING WOMEN

KATE MOORE

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For all the dial-painters

And those who loved them

I shall never forget you…

Hearts that know you love you

And lips that have given you laughter

Have gone to their lifetime of grief and of roses

Searching for dreams that they lost

In the world, far away from your walls.

—*Ottawa High School yearbook, 1925*

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PROLOGUE

PARIS, FRANCE

—1901—

The scientist had forgotten all about the radium. It was tucked discreetly within the folds of his waistcoat pocket, enclosed in a slim glass tube in such a small quantity that he could not feel its weight. He had a lecture to deliver in London, England, and the vial of radium stayed within that shadowy pocket for the entirety of his journey across the sea.

He was one of the few people in the world to possess it. Discovered by Marie and Pierre Curie late in December 1898, radium was so difficult to extract from its source that there were only a few grams available anywhere in the world. He was fortunate indeed to have been given a tiny quantity by the Curies to use in his lectures, for they barely had enough themselves to continue experiments.

Yet this constraint did not affect the Curies' progress. Every day they discovered something new about their element: "it made an impression on photographic plates through black paper," the Curies' daughter later wrote, "[I]t corroded and, little by little, reduced to powder the paper or the cotton wool in which it was wrapped…What could it *not* do?"[1] Marie called it "my beautiful radium"[2]—and it truly was. Deep in the dark pocket of the scientist, the radium broke the gloom with an unending, eerie glow. "These gleamings," Marie wrote of its luminous effect, "seemed suspended in the darkness [and] stirred us with ever-new emotion and enchantment."[3]

Enchantment… It implies a kind of sorcery, almost supernatural power. No wonder the U.S. surgeon general said of radium that “it reminds one of a mythological super-being.”[4] An English physician would call its enormous radioactivity “the unknown god.”[5]

Gods can be kind. Loving. Benevolent. Yet as the playwright George Bernard Shaw once wrote, “The gods of old are constantly demanding human sacrifices.”[6] Enchantment—in the tales of the past, and present—can also mean a curse.

And so, although the scientist had forgotten about the radium, the radium had not forgotten him. As he traveled to that foreign shore, through every second of his journey, the radium shot out its powerful rays toward his pale, soft skin. Days later, he would peer in confusion at the red mark blooming mysteriously on his stomach. It looked like a burn, but he had no memory of coming near any flame that could produce such an effect. Hour by hour, it grew more painful. It didn’t get bigger, but it seemed, somehow, to get *deeper*, as though his body was still exposed to the source of the wound and the flame was burning him still. It blistered into an agonizing flesh burn that grew in intensity until the pain made him suck in his breath sharply and rack his brains for what on earth could have inflicted such damage without his being aware.

And it was then that he remembered the radium.

PART ONE

KNOWLEDGE

1

NEWARK, NEW JERSEY
UNITED STATES OF AMERICA

—1917—

Katherine Schaub had a jaunty spring in her step as she walked the brief four blocks to work. It was February 1, 1917, but the cold didn't bother her one bit; she had always loved the winter snows of her hometown. The frosty weather wasn't the reason for her high spirits on that particular icy morning, though: today, she was starting a brand-new job at the watch-dial factory of the Radium Luminous Materials Corporation, based on Third Street in Newark, New Jersey.

It was one of her close pals who had told her about the vacancy; Katherine was a lively, sociable girl with many friends. As she herself later recalled, "A friend of mine told me about the 'watch studio' where watch-dial numerals and hands were painted with a luminous substance that made them visible in the dark. The work, she explained, was interesting and of far higher type than the usual factory job."[1] It sounded so glamorous, even in that brief description—after all, it wasn't even a factory, but a "studio." For Katherine, a girl who had "a very imaginative temperament,"[2] it sounded like a place where anything could happen. It certainly beat the job she'd had before, wrapping parcels in Bamberger's department store; Katherine had ambitions far beyond that shop floor.

She was an attractive girl of just fourteen; her fifteenth birthday was in five weeks' time. Standing just under five foot four, she was "a very pretty little blonde"[3] with twinkling blue eyes, fashionably bobbed hair, and

delicate features. Although she had received only a grammar-school education before she left school—which was "about all the education that girls of her working-class background received in those days"[4]—she was nevertheless fiercely intelligent. "All her life," *Popular Science* later wrote, "[Katherine] Schaub…had cherished [the] desire…to pursue a literary career."[5] She was certainly go-getting: she later wrote that, after her friend had given her word of the opportunities at the watch studio, "I went to the man in charge—a Mr. Savoy—and asked for a job."[6]

And that was how she found herself outside the factory on Third Street, knocking on the door and gaining admittance to the place where so many young women wanted to work. She felt almost a little star-struck as she was ushered through the studio to meet the forewoman, Anna Rooney, and saw the dial-painters turning diligently to their tasks. The girls sat in rows, dressed in their ordinary clothes and painting dials at top speed, their hands almost a blur to Katherine's uninitiated eyes. Each had a flat wooden tray of dials beside her—the paper dials were preprinted on a black background, leaving the numerals white, ready for painting—but it wasn't the dials that caught Katherine's eye; it was the material they were using. It was the radium.

Radium. It was a wonder element; everyone knew that. Katherine had read all about it in magazines and newspapers, which were forever extolling its virtues and advertising new radium products for sale—but they were all far too expensive for a girl of Katherine's humble origins. She had never seen it up close before. It was the most valuable substance on earth, selling for $120,000 for a single gram ($2.2 million in today's values). To her delight, it was even more beautiful than she had imagined.

Each dial-painter had her own supply. She mixed her own paint, dabbing a little radium powder into a small white crucible and adding a dash of water and a gum arabic adhesive: a combination that created a greenish-white luminous paint, which went under the name "Undark." The fine yellow powder contained only a minuscule amount of radium; it was mixed with zinc sulfide, with which the radium reacted to give a brilliant

glow. The effect was breathtaking.

Katherine could see that the powder got everywhere; there was dust all over the studio. Even as she watched, little puffs of it seemed to hover in the air before settling on the shoulders or hair of a dial-painter at work. To her astonishment, it made the girls themselves gleam.

Katherine, like many before her, was entranced by it. It wasn't just the glow—it was radium's all-powerful reputation. Almost from the start, the new element had been championed as "the greatest find of history."[7] When scientists had discovered, at the turn of the century, that radium could destroy human tissue, it was quickly put to use to battle cancerous tumors, with remarkable results. Consequently—as a life-saving and thus, it was assumed, health-giving element—other uses had sprung up around it. All of Katherine's life, radium had been a magnificent cure-all, treating not just cancer, but hay fever, gout, constipation…anything you could think of. Pharmacists sold radioactive dressings and pills; there were also radium clinics and spas for those who could afford them. People hailed its coming as predicted in the Bible: "The sun of righteousness [shall] arise with healing in his wings, and ye shall go forth and gambol as calves of the stall."[8]

For another claim of radium was that it could restore vitality to the elderly, making "old men young."[9] One aficionado wrote: "Sometimes I am halfway persuaded that I can feel the sparkles inside my anatomy."[10] Radium shone "like a good deed in a naughty world."[11]

Its appeal was quickly exploited by entrepreneurs. Katherine had seen advertisements for one of the most successful products, a radium-lined jar to which water could be added to make it radioactive: wealthy customers drank it as a tonic; the recommended dose was five to seven glasses a day. But as some of the models retailed for $200 ($3,700), it was a product far out of Katherine's reach. Radium water was drunk by the rich and famous, not working-class girls from Newark.

What she did feel part of, though, was radium's all-pervasive entry into American life. It was a craze, no other word for it. The element was

dubbed “liquid sunshine,”[12] and it lit up not just the hospitals and drawing rooms of America, but its theaters, music halls, grocery stores, and bookshelves. It was breathlessly featured in cartoons and novels, and Katherine—who loved to sing and play piano—was probably familiar with the song “Radium Dance,” which had become a huge hit after being featured in the Broadway musical *Piff! Paff! Pouf!* On sale were radium jockstraps and lingerie, radium butter, radium milk, radium toothpaste (guaranteeing a brighter smile with every brushing) and even a range of Radior cosmetics, which offered radium-laced face creams, soap, rouge, and compact powders. Other products were more prosaic: “The Radium Eclipse Sprayer,” trumpeted one ad, “quickly kills all flies, mosquitoes, roaches. [It] has no equal as a cleaner of furniture, porcelain, tile. It is harmless to humans and easy to use.”[13]

Not all of these products actually contained radium—it was far too costly and rare for that—but manufacturers from all kinds of industries declared it part of their range, for everyone wanted a slice of the radium pie.

And now, to Katherine’s excitement, thanks to her job, she would have a prime seat at the table. Her eyes drank in the dazzling scene before her. But then, to her disappointment, Miss Rooney ushered her into a room that was separate from the main studio, away from the radium and the shining girls. Katherine would not be dial-painting that day—nor the day after, as much as she longed to join the glamorous artists in the other room.

Instead, she would be serving an apprenticeship as an inspector, checking the work of those luminous girls who were busy painting dials.

It was an important job, Miss Rooney explained. Although the company specialized in watch faces, it also had a lucrative government contract to supply luminous airplane instruments. Given there was a war raging in Europe, business was booming; the company also used its paint to make gunsights, ships’ compasses, and more shine brightly in the dark. And when lives were hanging in the balance, the dials had to be perfect. “[I was] to see that the number outlines were even and [thorough] and to

correct minor defects,”[14] Katherine recalled.

Miss Rooney introduced her to her trainer, Mae Cubberley, and then left the girls to it, resuming her slow march up and down the rows of painting girls, casting a watchful eye over their shoulders.

Mae smiled at Katherine as she said hello. A twenty-six-year-old dial-painter, Mae had been with the company since the previous fall. Although she was new to the industry when she joined, she already had a reputation as a brilliant painter, regularly turning in eight to ten trays of dials daily (there were either twenty-four or forty-eight dials in each tray, depending on the dial size). She had quickly been promoted to training other girls in the hope that they would match her productivity. Now, in the little side room, she picked up a paintbrush to instruct Katherine in the technique that all the dial-painters and inspectors were taught.

They were using slim camel-hair brushes with narrow wooden handles. One dial-painter recalled: “I had never seen a brush as fine as that. I would say it possibly had about thirty hairs in it; it was exceptionally fine.”[15] Yet as fine as the brushes were, the bristles had a tendency to spread, hampering the girls’ work. The smallest pocket watch they painted measured only three-and-a-half centimeters across its face, meaning the tiniest element for painting was a single millimeter in width. The girls could not go over the edges of these delicate parameters or there would be hell to pay. They had to make the brushes even finer—and there was only one way they knew of to do that.

“We put the brushes in our mouths,”[16] Katherine said, quite simply. It was a technique called lip-pointing, inherited from the first girls who had worked in the industry, who came from china-painting factories.

Unbeknownst to the girls, it wasn’t the way things were done in Europe, where dial-painting had been in operation for over a decade. Different countries had different techniques, but in none was lip-pointing used. Very likely this was because brushes weren’t used either: in Switzerland, there were solid glass rods; in France, small sticks with cotton wadding on the ends; other European studios employed a sharpened

wooden stylus or metal needle.

However, American girls did not take up the lip-pointing technique with blind faith. Mae said that when she first started, not long after the studio had opened in 1916, she and her colleagues had questioned it, being "a little bit leery"[17] about swallowing the radium. "The first thing we asked," she remembered, "[was] 'Does this stuff hurt you?' And they said, 'No.' Mr. Savoy said that it wasn't dangerous, that we didn't need to be afraid."[18] After all, radium was the wonder drug; the girls, if anything, should benefit from their exposure. They soon grew so used to the brushes in their mouths that they stopped even thinking about it.

But for Katherine it felt peculiar, that first day, as she lip-pointed over and over, correcting defective dials. Yet it was worth persevering: she was constantly reminded why she wanted to work there. Her job involved two types of inspection, daylight and darkroom, and it was in the darkroom that the magic really happened. She would call the girls in to discuss their work and observed, "Here in the room—daylight barred—one could see evidences of the luminous paint everywhere on the worker. There was a dab here and there on her clothes, on the face and lips, on her hands. As some of them stood there, they fairly shone in the dark."[19] They looked glorious, like otherworldly angels.

As time went on, she got to know her colleagues better. One was Josephine Smith, a sixteen-year-old girl with a round face, brown bobbed hair, and a snub nose. She had worked at Bamberger's too, as a saleslady, but left to earn the much higher wage of a dial-painter. Although the girls weren't salaried—they were paid piecework, for the number of dials they painted, at an average rate of 1.5 cents a watch—the most talented workers could walk away with an astonishing pay package. Some earned more than three times the average factory-floor worker; some even earned more than their fathers. They were ranked in the top 5 percent of female wage-earners and on average took home $20 ($370) a week, though the fastest painters could easily earn more, sometimes as much as double, giving the top earners an annual salary of $2,080 (almost $40,000). The girls lucky

enough to gain a position felt blessed.

Josephine, Katherine learned as they talked, was of German heritage, just like Katherine herself. In fact, most dial-painters were the daughters or granddaughters of immigrants. Newark was full of migrants, hailing from Germany, Italy, Ireland, and elsewhere; it was one of the reasons the company had opened the studio in the city in the first place, for the large immigrant communities provided a workforce for all sorts of factories. New Jersey was nicknamed the Garden State for its high agricultural production, but in truth it was just as productive industrially. At the turn of the century, the business leadership of Newark had labeled it the City of Opportunity and—as the girls themselves were finding out—it lived up to its name.

It all made for a thriving metropolis. The nightlife after the factories closed was vibrant; Newark was a beer town, with more saloons per capita than any other American city, and the workers made their downtime count. The dial-painters embraced the social bonhomie: they sat together to eat lunch in the workroom at the Newark plant, sharing sandwiches and gossip over the dusty tables.

As the weeks passed, Katherine observed the challenges as well as the attractions of dial-painting: Miss Rooney's constant observation as she walked up and down the studio, and the ever-present dread of being called into the darkroom to be reprimanded for poor work. Above all else, the girls feared being accused of wasting the expensive paint, which could ultimately be a dismissible offense. But although Katherine could see that there were downsides, she still longed to join the women in the main room. She wanted to be one of the shining girls.

A quick learner, Katherine soon excelled at her inspecting, not only perfecting the art of correcting defective dials with her lip-pointed brush, but also becoming adept at brushing off the dust with her bare hand or removing excess paint with her fingernail; the technique taught her. She worked as hard as she could, longing for promotion.

Finally, toward the end of March, her perseverance paid off. "I was

asked to paint dials," she wrote excitedly; "I said I would like to try it."[20]

Katherine had achieved her ambition through merit—but there were also wider forces at work in that spring of 1917. Dial-painters were about to be in demand as never before: the company now needed all the women it could get.

2

For the past two and a half years, the war in Europe had left America mostly untouched, except for the economic boom it brought. The majority of Americans were happy to stay out of the horrific trench warfare happening across the Atlantic, stories of which had reached them undiluted by distance. But in 1917, the neutral position became untenable. On April 6, just a week or so after Katherine's promotion, Congress voted America into the conflict. It would be known as "the war to end all wars."

In the dial-painting studio on Third Street, the impact of the decision was immediate. Demand rocketed. The studio in Newark was far too small to produce the numbers required, so Katherine's bosses opened a purpose-built plant just down the road from Newark in Orange, New Jersey, closing the Third Street factory. This time there wouldn't only be dial-painters on site; the company had grown so much it was to do its own radium extraction, requiring labs and processing plants. The Radium Luminous Materials Corporation was expanding massively, and the new site comprised several buildings, all located in the middle of a residential neighborhood.

Katherine was among the first workers through the door of the two-story brick building that would house the application department. She and the other dial-painters were delighted by what they found. Not only was Orange an attractive, prosperous town, but the second-floor studio was

charming, with huge windows on all sides and skylights in the roof. The spring sunshine streamed in, giving excellent light for dial-painting.

An appeal for new workers to help the war effort was made, and just four days after war had been declared, Grace Fryer answered the call. She had more reason than most to want to help; two of her brothers would be joining the several million American soldiers heading to France to fight. Lots of dial-painters were motivated by the idea of helping the troops: "The girls," wrote Katherine, "were but a few of the many who through their jobs were 'doing their bit.'"[1]

Grace was a particularly civic-minded young woman. "When Grace was just a schoolgirl," a childhood friend of hers wrote, "she planned to be a real citizen when she grew up."[2] Her family was of a political bent; her father Daniel was a delegate to the carpenters' union, and you couldn't grow up in his house without picking up his principles. He was out of work rather a lot, as unionism was not popular at that time, but while the family may not have had much money, they did have a lot of love. Grace was one of ten children—she was number four—and she was especially close to her mother, also called Grace; perhaps because she was the eldest girl. There were six boys and four girls in total, and Grace was close to her siblings, especially her sister Adelaide, who was nearest to her in age, and her little brother Art.

Grace was already working when the call-up came, in a position that earned about the same as dial-painting, but she left to join the radium company in Orange, where she lived. She was an exceptionally bright and exceptionally pretty girl, with curly chestnut hair, hazel eyes, and clear-cut features. Many called her striking, but her looks weren't of much interest to Grace. Instead, she was career-minded, someone who at the age of eighteen was already fashioning a prosperous life for herself. She was, in short, "a girl enthused with living."[3] She soon excelled at dial-painting, becoming one of the company's fastest workers, with an average production rate of 250 dials a day.

A young woman called Irene Corby also signed on that spring. The