The Technetium Rush

by Wil McCarthy

Materials can have many uses, some of which are talked about more openly than others....

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Fact: The element technetium is produced in minute quantities by red giant stars so far away that the light they're emitting now will someday shine on your grandchildren's grandchildren. For our purposes here, that's far enough not to matter. Closer to home, the element is sometimes generated by the collision of molybdenum atoms and "heavy hydrogen" from the sun, or by the natural decay of uranium. These are freak occurrences, though; aside from the transuranics (which are about as stable as a life of crime), technetium is the rarest element in the natural universe and forms no known minerals.

Fact: Of the thirty-two possible crystal classes, only one—the gyroidal isometric—had, until recently, never been found in the mineral world. Is it mankind that abhors a vacuum?

Fact: On March 20, 2008, Delhi University-trained geologist Rakesh "Rocky" Solanki, on an apparently routine survey of the alluvial clays north of Bhilwara, Rajasthan, found a deposit of fluorescent orange crystals that he couldn't identify, and so brought back to his Jaipur office for examination. Later named Tc solankite, the crystals were hard, translucent, vaguely lustrous and—considering their gyroidal structure and 20 percent technetium composition—quickly valued at $5,000 per gram. This is 300 times the price of platinum and twice that of clear uncut diamonds, so we're talking about serious money here. Let's be clear about that.

Since the material had apparently washed down from the nearby Arvalli Mountains sometime in the past thousand years, Solanki's discovery touched off, almost immediately—the greatest land rush since the Canadian diamond wars of the 1990s. But can we really believe Solanki's gambling debts, criminal connections, and curious patterns of stock and land ownership have nothing to do with his sudden good fortune?

Hey, no one's on trial here; the guy may be as innocent as a bride. Or, this may be one of the most sordid chapters in the oft-opprobrious history of mineral science. Place your bets and let's get moving; this rag doesn't pay me by the hour.

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Our story begins with the Canadian Diamond Rush of 1991, when geologists Charles Fipke (a forty-five-year-old with a mere bachelor's degree) and Stewart Blusson (with a pilot's license and twenty years in the bush) braved arctic winters and hungry bears to outwit the De Beers cartel and 258 other mining companies to lay claim to four of the world's richest diamond sites, imprisoned romantically beneath the arctic permafrost. Over a three-year period, fueled by hope and JP4 kerosene, a swarm of helicopters and geological shock troops staked out fifty-three million acres of mineral claims. It was a tale of rogues and spies, claim-jumpers and border skirmishes, camouflage nets, and electronic spoofing. But Fipke was *born* for this world, staying always one step ahead, and ultimately it was his science, more than any skullduggery, that sealed the day. Diamonds are found in volcanic chimneys called "kimberlite pipes," and when the dust and snow had settled he was in possession of all the important ones, leaving only dregs and downwash for his rivals. Unpretentious as any storybook hero, Fipke was worth a billion rupees by the turn of the millennium and yet maintained a modest lifestyle, even continuing his fieldwork. Dirt beneath his fingernails, yes. What a bloke.

Did Rakesh Solanki—then an impressionable teen on a middle-class Bahawalpur cotton farm—hear the tale on NDTV, or read about it somewhere? Or did it simply echo in the public spirit until that afternoon in Bhilwara, when it suddenly gelled?

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Jump ahead two years, to 1996. While America's Internet balloon began its historic inhale, while India's economy struggled out of a thousand-year recession, Rakesh Solanki was a farm boy in a big-city college. In pictures of the day he peers out from behind thick glasses, exuding the funny, cheery confidence of a man well out of his depth and loving it. His grades were fine, his studies went well, but on the side, he was prowling the streets of Delhi, looking for the things young men have always sought. No doubt panning for loose women, our intrepid Rocky instead discovered beer, then hemp, then betting parlors where dice and football could—and often did!—finance the next round of amorous prospecting.

And still his grades were good. Never ruled by his wild side, Solanki ploughed his way through three semesters of foundation courses and was showing particularly well in the earth sciences, which would, he seemed to assume, become an interesting, if modest, career. And then something happened. Like a thunderclap, the petite poetess Abha Abhilasha Vyas crashed into his life. Although we may suspect the irony was lost on our randy young fellow, Ms. Vyas's name can of course be translated as "desire for things that glitter"—an omen further punctuated by the manner of their meeting, in Kamla Nagar's dilapidated Kothari Gamehouse.

It's hard to believe all the witnesses who claim to have been there at the time, but this much seems certain: Clad in a green and gold blouse of questionable

opacity, she leaned in front of Rakesh Solanki, so that his view of the TV was replaced with a view of her slight but shapely bosom, and said in Hindi, “Hey, goggles, be a darling and lend me a fifty.”

“Buzz off,” he answered in English, craning for a view of the game.

To which she replied, “Come on, mate, I’ve seen you up at the college. I’m a physicist, right? Fascinated with the laws of probability. Help a girl with her homework.”

For Vyas this was presumably no big deal. She was indeed studying physics at Delhi, but she’d grown up in this neighborhood and was known here, and the young man before her did have a certain awkward charm, a bit of money, and an obvious taste for the calendar girls posted round on the walls. Did she really expect the loan? Was she just kidding around? Alas for Solanki, still picking metaphorical cottonseeds out of his sandals, it was love at first (well, second) sight. Here was everything he’d ever dreamed of: a pretty, intelligent woman with a smart mouth and a taste for big-city adventure. The aforementioned bill was handed over with a smirk, and when wagered and lost, was gallantly replaced with another. And thus in five quick minutes was the pattern of their relationship set for all that followed.

Pity him if you like. Pity them both if you must. But listen to all of it before passing judgment; youthful innocence can turn on a heel only, and I mean *only*, if we choose to allow it.

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Jump ahead to the turn of the millennium. Stock markets were high, cash was flowing as freely as water, and armies of young programmers in Mumbai and Calcutta were sweeping Y2K bugs out of American and European software. Even Kashmir was working its way toward a ceasefire, lending a dreamy (if fragile) quality to the season.

Having completed two years of graduate school, Solanki’s darling Abha Vyas had taken a job at the WRC or Waste Reprocessing Centre of the Kakodar Nuclear Power Station in Jaipur, “breaking big ones into little ones,” as they say. That is, bombarding spent uranium fuel rods with the neutron emissions from a thorium reactor, so that massive, long-lived radioactive elements, like plutonium and neptunium, could be broken down into short-lived ones, like radon and actinium. On the side, she was now seeing her science-orientated poems published regularly in *Varnamala* and *Kavya Bharati*, which paid almost nothing but which stoked her professional reputation and, presumably, her self-esteem. Not that she needed much help in that area.

Rakesh Solanki, meanwhile, who’d been unable to secure anything more than temporary contract employment in his chosen field of geology, was working instead

as a forklift operator for the waste disposal firm of Joshi Bhopal, which removed and buried the effluent from, among other places, the Kakodar Nuclear Power Station. It is tempting to speculate that Vyas pulled in a favor somewhere to get him the job, for union jobs were scarce in Jaipur at that time, but there's no evidence of it.

Solanki had of course worked with a variety of machines on his parents' farm, including forklifts, and was by all accounts a capable driver, well liked by his bosses and coworkers, who consulted him sometimes for his earth-science expertise during trenching and filling operations. According to newspaper reports, the team once found a large green nugget of copper oxide in their Malpura dump, which Solanki proclaimed to be "alluvial," or washed down from higher ground. Since the nugget—though interesting—had little monetary value, Solanki was allowed to keep it, and we can suppose the brief local fame brought on by its discovery had some impact on his later thinking. The papers called him a "Joshi Bhopal staff geologist," and he liked the sound of that.

Anyway, while he was hardly a rich man, Solanki's salary was enough to rent not only a small apartment in Jaipur, but also an office in which he slowly built a modest but respectable soil and mineral identification lab, whose services he advertised in the same papers who'd reported his copper find. Business was not exactly booming, but he collected enough odd jobs to build a résumé, and in his spare time, through a combination of personal fieldwork and bargain hunting in the city shops, amassed a rock collection large and photogenic enough to pose in front of. He'd be ready for the newspapers—or TV, or internet bloggers—the next time they showed up.

So things were going well, and it seems natural enough that Vyas and Solanki, lovers now for two and a half years, should tie the knot and move in together, which is exactly what they did. The ceremony was small, brief, and sparsely reported, and though the newlyweds expressed a desire to travel overseas, in fact the honeymoon was a week in Alibag (near Mumbai), paid for by Solanki's parents and lightly subsidized by Vyas' widowed mother. Affectionate and outgoing in public, the two were in many ways the perfect couple, to the relief of both families and the mild envy of their friends.

But real life hides clouds behind its silver linings, and within that cramped apartment our lovebirds were not quite as happy as they seemed. The affections of a good woman had mellowed Solanki's wandering ways, but the reverse cannot be said for the bride herself, whose weekend gambling was now fueled by a substantially higher income. Once a quirky affectation, the betting now assumed the proportions of a full-blown addiction, for which (at Solanki's insistence) she several times sought counseling. But Vyas, now Abha Solanki, either couldn't or wouldn't mend her ways, and by the end of 2003 she had managed not only to spend most of their combined income, plus her dowry and Rocky's nest egg, but to accumulate (by some accounts) up to a quarter-million rupees in debt, to unsavory characters in

whom sympathy was not a notable trait.

"I'm trapped," Rakesh told a friend that winter. "I can't afford the pills to keep her in at night, and without them we come home poorer every week."

To which the friend claims to have replied, "Smart guy like you, Rocky, ought to imagine a way out. Think of a monkey stealing oranges through a fence, eh? He can't pull his hand out, or he thinks he can't, because he won't let go of the orange."

"But I like my orange," said Rocky. "I *adore* my orange."

"Well, then," said the friend. "Only one thing for it: You've got to scale the fence."

"Meaning what?"

"Meaning you're the smart one, and I'm hungry. Let's eat, eh? And then let's drink your troubles away."

But the comment must have struck a chord. *May* have, I meant to say, because what happened next was passing strange and can't be definitely linked to Rakesh Solanki in any way. The paper's solicitor is standing over me as I write this, making sure I don't commit libel. Well, like I say, nobody's calling the man a criminal. Just very, improbably lucky.

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Imagine you're an unknown scientist in a backwater town, and your wife—who makes more money than you—is publishing poetry. How do you feed your own ego and reassure yourself you still wear the family trousers? By publishing scientific papers, of course. This isn't easy to do; it takes weeks to write one, and even a minor journal like South Asia Geology Review turns away most of what it receives. If you're lucky and the journal editors see promise in your work, it can then take months or even years to get the niggling details just right. For a professor with a gaggle of students at his beck this is perhaps no big deal, but it's enough to drive a lone man to drink and to drive a drinking man to despair. Rooting around in an online database, I could only find three papers by Solanki, with hints that he might have published two more.

But here's where it gets interesting, because while two of these papers are about alluvial minerals in the Malpura clay, the third one is entitled, "Possible Economic Uses for Purified Reactor Waste." Now, it isn't strange for a man to have such ideas, who spends his days burying the poison churned out by his wife's employer. Indeed, Abha—with a knowledge of physics and chemistry complementary to Rocky's own—may have provided some of the inspiration herself. But it chucks a spanner in the otherwise-functional tale of rags to

well-deserved riches because it tips the Solanki hand four years prematurely. It was a minor paper in a minor journal; safe to hope no one would remember it there. Ah, but this is the information age, when nothing but nothing is ever truly forgotten.

Let's roll back a moment here and take a look at the stuff that put Solanki where he is today. Technetium is a white and very shiny metal, similar to platinum, although it's subject to oxidation and will turn gray and powdery if you bake it long enough. It has the eleventh-highest melting point of any element, and its eight neighbors on the periodic chart have all been used to strengthen, harden, and stabilize steel and other alloys, including the tungsten filaments of incandescent lightbulbs, which were still common at the time of Solanki's writing. Four of the neighbors are also colorful additives in glazes and dyes, suggesting a variety of uses for that rarest of birds, technetium, if only people could be gotten interested in it. More importantly, as a so-called beta emitter, it generates a slight but constant electric current, which prevents other metals from corroding. "As a hardener and surface treatment," wrote Rocky, "our friend is simply unmatched."

He even goes so far as to suggest—and this is no speculation on my part!—that a technetium alloy cut with gold and palladium would be perfect for high-value coinage. "Hard, bright, untarnishable and rare, it would be the numismatist's answer to diamond, for such a coin might last nearly forever."

Now, with a radioactive half-life of several million years—meaning a very slow decay, hence little radioactivity—"Tea" (as Solanki playfully called it) is considerably safer than the potions we swallow in radiomedicine, and in fact is only about four times as hazardous as ordinary concrete and granite, which as we all have heard, emit low levels of radon gas. So does a gaslight mantle, as it turns out, although gaslights are even rarer than tungsten filaments and may be unfamiliar to readers who've grown up under the cold glare of the white LED. Nevertheless, to place a coin of technetium in one's pocket, immediately adjacent to one's reproductive organs, would take a bit of faith.

Everyone knows, of course, that soon thereafter, technetium coins were in fact minted and sold by a private company called the Palwal Mint and Trust, which can in no way be connected to Rakesh Solanki, Abha Solanki, or the Kakodar Nuclear Power Station. The content and purity of the coins has been verified by any number of outside bodies—matching very closely to the recipe laid down in Solanki's paper—but the actual source of the metal has never been identified. Still, it's a known product of Energy Amplifier Thorium Reactors (or "EATERS," as their proponents call them), of which KNPS is one of only three operating in India, in a total of four worldwide. And about three months before the coins were first unveiled, the Kakodar station was shut down for a day on the excuse of "plumbing adjustments," although an internal memo called it, more specifically, "repairs to correct an unauthorized modification."

The evidence is circumstantial at best; no court would base a conviction on it.

The best we can do is dream a little dream; could Abha, short of funds as always, have monkeyed with her precious reactor to produce an excess of technetium for her hubby to dispose? A physicist friend confirms it is possible. Could Rakesh—dressed up in some ungainly homespun radiation suit—have broken open one of his barrels one night, dropped the slag in some centrifugal furnace of his own design, refined out the "tea," and then buried the whole apparatus along with the waste? Again, there's nothing in the laws of physics—or probability—to deny it.

It should be noted, in all fairness and charity, that if such a venture occurred—and I'm not saying it did—the Solankis do not seem to have profited from it. Indeed, they never moved from their apartment, never bought a car, never took that trip overseas. Not then. But if they owed a lot of money to gangsters, one supposes a lot of strange things could happen around them, with or without their grudging consent.

At any rate, the coins—real enough for any skeptic—were sold in lead-lined jeweler's boxes, and that's where most collectors have kept them. In many western countries and in China and Japan, importation of the coins was prohibited, and in the United States they were classified as a terrorist munition for which five unlucky collectors were handed stiff jail sentences. Don't answer the phone, Yank; let freedom ring and ring. Eventually the Indian government got tired of the diplomatic heat and shut the enterprise down, but before they did, the coins made a lot of money for someone.

Imagine Rakesh Solanki stewing about that.

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It's a fact of life in the prison business that prisoners sometimes escape. This should not surprise us; the jailer goes home at night, while his charge remains, staring at walls, the light fixtures, the bars of his cage. Escape is *all* he thinks about. And wasn't Solanki a prisoner of circumstance? Of poverty, of love?

This much is a matter of record: He somehow scraped up the funds to purchase salt-poisoned farmland in the Arvalli foothills. A parcel here, a parcel there, slowly adding up to hundreds of dry, worthless hectares. Geologically speaking, though, these peach-colored sites were rich in molybdenum and rhenium and manganese—chemical relatives of technetium. This was *before* he found the gyroidal crystal. Unlike his idol Charles Fipke, Solanki didn't follow a trail of clues back to their source; he bought the source and then, miraculously, discovered the distant clue. Or so he would have us believe.

Perhaps he found his treasure on private lands and then bought the lands without informing the owners of their worth and *then* filed his mineral claim. Poor scientist that he was, he could perhaps be forgiven for such a fraud; he sold the land for enough money to retire on several times over. And since the original

landowner—a cotton farmer like himself—has made out even better by unloading the rest of his farm, there can be little cause for rancor between them. What a bloke.

Unfortunately, there's a snag. "Tea's" longest-lived, least-radioactive isotope is technetium 98, and to the extent it occurs in nature at all, that's the form we'd expect to find. The metal content of Tc solankite, however, includes high levels of Tc 97, which according to my physicist friend, "occurs only as a result of a slow neutron process, which would not occur naturally and certainly not in the uranium-poor Arvalli."

Mmm-hmm.

I'm not saying Solanki whipped that crystal up himself and then hid it in the ground as part of a real estate swindle. Such an accusation would be irresponsible. Still, a funny thing about hoaxes is that they require fantastic skill to pull off. The public may be duped easily enough, but to fool an art expert, fool a geologist, fool the press and the government and assorted thugs and parasites, one has to forge an object of such exacting proportion and composition that to a casual eye—and even to a battery of preliminary tests—it appears genuine. Curse the counterfeiter though we may, we cannot help muttering our admiration through the other side of our mouths. A fine job indeed, the rascal. How did he *do* that?

For better or worse, though, the Solankis are unlikely to hang onto their fortune for long. With the land sale finalized and the rupees in the bank, the happy couple have gone at last for the overseas vacation they've dreamed about all these years. Their destination? Las Vegas, Nevada.

Best of luck, mate.