

Figure 3. Muhammad B. Makki (1900–1981).

Historical Notes on the Commercial Mineral Specimen Industry in India

Without question, the founding father of commercial mineral collecting as a business enterprise in India was Burjor F. Mehta in Bombay, during the early and mid-60's.

Mehta, a trained geologist, had worked as a field officer with the Geological Survey of India during his younger years. In that capacity he had traveled widely in the hinterlands of India and had thereby observed a wide range of esthetically attractive crystallized and massive minerals, and ornamental rocks. In mid-life Mehta opted to leave the Survey and apply himself to his family's metal fabricating business in Bombay. Since he and his wife, Amy, were gregarious people who enjoyed travel, and were fortunate enough to possess the means to indulge that interest, they periodically visited Europe, in time establishing friends and contacts centered around Idar-Oberstein. Mehta started to export significant quantities of agate, fossilized wood, and a wide array of ornamental rocks and minerals to Germany, Italy, and other European countries for cutting, polishing and display, thereby establishing himself as the prime, perhaps sole, commercial exporter of Indian rocks and minerals, under the name "Geological Specimens—India."

The mineral specimens Mehta exported tended to be ornamental pieces, some as large as a meter across, resembling those he had encountered from the Bombay-Poona railway tunnel excavations and in departmental collections of the Geological Survey of India. They tended to be large ("bigger is better") and expensive, which was acceptable to European collectors. But such specimens found little favor in USA. (Ronald Romanella was probably the first American dealer to import Indian specimens to USA. Another American mineral dealer, whose name was Harry Sering, if I recall correctly,

visited India in the 60's, returning with a shipment of such specimens. He was still stuck with much of this stock when I visited his shop in the Midwest in 1972.)

As a result of his success in the European market, however, Mehta became well known in the Bombay, Poona and Nasik regions of Maharashtra as an acquirer/purchaser of unusual or interesting mineralogical and geological material. Every month or so he would drive his jeep to any operating quarries where he had learned that zeolitic minerals were turning up. Until Mehta's appearance on the scene, these had usually been discarded! He would offer to buy from the quarry workers whatever crystallized minerals they could arrange to deliver to his depot in Bombay. Thus began the system of "runners," which soon became an institutionalized aspect of the commercial mineral-collecting scene in Maharashtra.

Inevitably, his business drew the attention of others who attempted, with greater or lesser degrees of effectiveness, to replicate Mehta's profitable operation. His would-be competitors, however, lacked two of Mehta's key assets, namely, professional geological training, and a cosmopolitan sophistication that permitted him to operate with ease outside India. Only a few of Mehta's imitators survived, let alone thrived. Among those few were Hussein Tyebjee in Bombay and, until the early 1980's, B. H. Kela in Nasik.

Another notable pioneer in establishing India's fame in the realm of zeolite specimens was Muhammad Makki in Poona, whose sons Fasi and Mujahid went on themselves, after their father's demise, to quarry and extract some of the most spectacular specimens ever seen. Makki Sr., an unpretentious schoolteacher who lived in humble circumstances on the city's outskirts, was a rarity in India: a born naturalist with an



Figure 123. Mineral dealers Fasi and Mujahid Makki in Pashan quarry no. 2, source of some of the finest green apophyllite. Rustam Kothavala photo, 1976.

Discovery of Green Apophyllite at Poona

Since no mineral species is more definitely identified in the public mind with Indian zeolites than the superb emerald-green vanadian apophyllite (even though it is not really a zeolite) from the quarries at Pashan near Poona, a brief historical note about the discovery and exploitation of this material may be in order.

The Pashan quarries, which were shut down by government edict more than 12 years ago, have long since been overtaken and engulfed by the fast-expanding city of Pune (as Poona is now spelled). But in their mineral specimen heyday during the 1970's and 1980's the quarries dotted a line of bare hills overlooking a barren expanse of usually parched agricultural land. The only noteworthy nearby landmark on any map was the town of Khadakvasla, site of the National Defense Academy, India's "West Point," some 5 to 10 km away. The name "Pashan" applies today to a favored suburb of greater Pune, but in 1971, when bright green apophyllite was discovered in a few of the quarries, the name Pashan applied to a smattering of stalls that vehicular passersby would barely notice.

The green apophyllite discovery was made by an American couple, Nell Roe and her pastor husband, who were doing a stint as teachers in India at Spicer College, a Seventh Day Adventist institution situated in the countryside just a kilometer or two from the Pashan quarries. It turned out that Nell Roe had been an amateur mineral collector in America and had actually attended a mineral show or two. When the Roes stumbled across bright green apophyllite from one or two of the several Pashan quarries, they immediately realized that they were on to something very unusual. The rich green color was quite unlike the yellowish green hues that were commonly seen in blocky, pseudocubic apophyllite crystals from the Bombay-Poona railway cuts and tunnels. Another feature of the Pashan apophyllite crystals was their pronounced elongated tetragonal habit with well-developed pyramidal terminations.

The Roes knew little about valuation of mineral specimens and had no previous exposure to the cutthroat business of commercial mineral acquisition. Ingenuously seeking to capitalize on their fortuitous find, the Roes showed their apophyllite specimens to as many domestic and foreign mineral folk as they could turn up, among them Mehta, Tyebjee, Kela, and the young Makki brothers from India, as well as Currier and Kothavala from the USA. And once a specimen or two had been seen by a select handful of collectors in America, the rush was really on! Still, relatively little material actually changed hands. One reason was that the amount of specimen material being extracted at the quarries in those early days was small. Another was that no matter how high a price was offered to Nell Roe by mineral buyers, she held back, unwilling to sell more than a few of her pieces to any one buyer out of fear that she was being taken advantage of. Frustration prevailed. Several enraged mineral buyers stormed away from the Roe residence at Spicer College vowing never to come back. But they returned, of course, drawn inexorably by the uniquely beautiful green apophyllite crystals.

Naturally, all the more seasoned Indian mineral dealers tried to get specimens directly from the quarry workers, but to their astonishment they found that the workers exhibited unbudging loyalty to Pastor and Mrs. Roe. The green apophyllite pieces encountered during quarrying were steadfastly saved for the American missionary couple. It turns out that the American missionaries had made a practice of regularly visiting the quarries for a long while, even before they stumbled onto green apophyllite, in order to provide the desperately poor workers and their families with aid and assistance in the form of food items, basic health care, and simple human concern. Is it any wonder the workers remained true to the Roes?

The entire scene at the Pashan quarries changed almost overnight when the Roes, stressed out by trying to do business with hard-nosed mineral dealers, pestered by an unending series of mineral seekers and collectors, and intruded upon in their primary work for Spicer College, left India to relocate in the United States. It was a circumstance and opportunity that had been foreseen, prepared for, and patiently awaited by two enterprising, energetic, and capable young college men, Fasi and Mujahid, the sons of Mohammad Makki. Unlike their unassuming naturalist father, the young Makkis were fired with aspiration to be players on the international stage. Taking full advantage of their intimate familiarity with Indian languages and customs, their willingness to engage in backbreaking labor themselves, and their canny ability to navigate their way through the shoals of arcane bureaucratic regulations, the Makki brothers embarked on a unique Indian enterprise. First, they gained unassailable legal license and lease from the government to conduct quarrying at two of the dozen or so quarries in the Pashan Hills. Then they designed their operations in such a way that their primary product of value would be mineral specimens. The basalt excavated in the process (which was of poor quality, anyway, because it was shot full of amygdular fillings and cavities) would be disposed of for whatever it could bring. For the next 18 years or so, first the Makki brothers together, and later Fasi Makki on his own, gained world renown for the name "Pashan" and for the unsurpassably spectacular specimens, many of extreme beauty and delicacy, which were extracted from the "Makki quarries."

These two quarries have proven to be by far the most abundant producers of deep green apophyllite out of the several quarries at Pashan. Clearly, the Makki brothers did a creditable job of assessing their potential. Other quarries, a couple of them within a distance of just a hundred meters or less, and apparently on the same stratigraphic horizon, have also produced fine mineral specimens of mesolite, calcite, "mirror" apophyllite, stilbite, and heulandite. But none of the other quarries have produced the spectacular "greens" that have made Pashan world-famous in mineral circles.

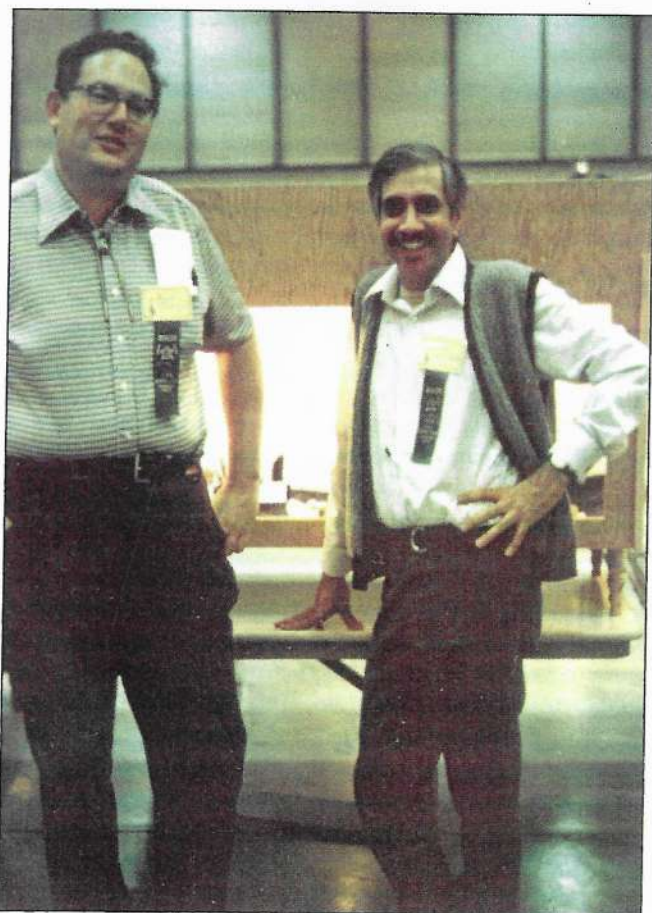
Ultimately, urbanization and population pressures from Pune's booming metropolitan expansion forced closure of the Makki quarries and the others in September of 1989.

Rustam Z. Kothavala

Figure 4. The author's first formal appearance as a show dealer, in his "Crystals of India" booth at the 1974 Tucson Gem and Mineral Show.



Figure 5. Smiling but serious rivals, Rock Currier (left) and the author at the Tucson Gem and Mineral Show, 1975.



Ignoring my protestations of inexperience, he stated bluntly, "It doesn't matter if you don't know prices. Nobody really does! Just put down whatever you think they're worth, or whatever you think they need to be worth in order for you to make a living as a mineral dealer. If they sell, you've priced 'em right. Or, maybe, too low."

Although I had made no reservation, I encountered no difficulty getting a second floor room at the fabled Desert Inn, a circumstance that became unimaginable just a year or two later. That fabled watering hole, unknown to the current generation of mineral people, was located at the northwest corner of Freeway and Congress. Becoming seedy as the years passed, the Desert Inn was finally condemned and torn down by the city of Tucson, circa 1993.

After I had priced and laid out my score or so flats of minerals, Bideaux arrived. Brief greetings were followed by a rapid survey of my wares. Expressionlessly, as is his wont, he then took a more careful second look. His only comment: "Rusty, you've got to understand, there really is no such thing as a ten-dollar specimen in Tucson."

That began my education in marketing fine minerals. Other nuggets followed.

"Some sellers give a 20% price discount to other dealers, on the assumption that the specimen is being bought for resale, even though that's often not the case. But if your specimen is exceptional, then don't hesitate to stick to the price you've quoted, even if the buyer is another dealer.

"When a dealer buys several specimens from you, he usually expects to buy them keystone. But you can set your own rules about that, if you wish."

"Keystone?" I asked, puzzled.

"Yes. Keystone means 50% off the marked price. That's to give the buyer sufficient margin to make it worth his while to buy and then resell your specimens."

"Oh! Well what do you think of my pricing, Dick?"

"You don't show enough price differentiation to reflect differences in specimen quality. Your best specimens are priced way too low compared with the average ones. When an otherwise choice specimen has an obvious flaw or ding on it, it doesn't lose just 20% of its full value. It loses closer to 80%." That came as a shocker to me, but Dick followed with a reassuring pat. "In general, I'd say the quality of your specimens is pretty good." Coming from Dick Bideaux, I knew that was lavish praise.

He was struck, I presumed, by my specimens of green apophyllite from Pashan. Those, and some sparkling mesolite sun-bursts, were the eye-catchers in what I had spread out, even though some of the best ones had already been picked out in Cambridge by the Harvard Museum.

"Now, where's that powellite specimen you talked about over the phone? Did Harvard get that too?"

"No, Dick." I reached into a box to get the specimen. "I put a price tag of \$1000 on it, as you suggested. But Cliff thought that was outrageously high. He said only a doddering old lady, with more money than brains, would buy it at that price." I handed the powellite specimen to Bideaux. He had already told me weeks ago, when I returned to Cambridge from India, that if my verbal



Figure 20. Fluorapophyllite, 15 cm, from Poona (collected 1989). Rustam Kothavala specimen; Wendell Wilson photo.



Figure 19. Andradite crystal, 1 mm, on stilbite from Bombay, Malad quarry, Kurar. Ottens collection and photo. Inset: idealized crystal habit of andradite.

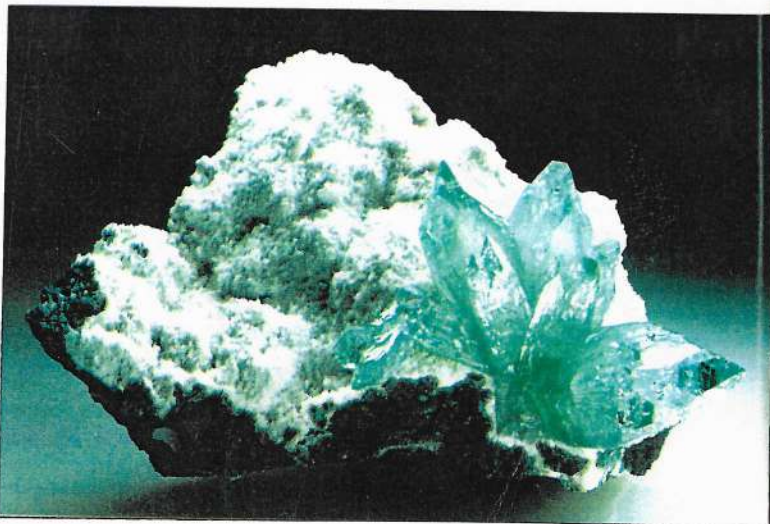
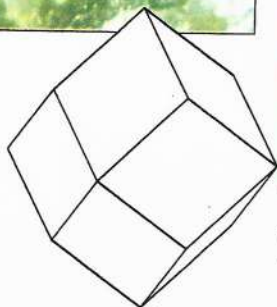


Figure 21. Fluorapophyllite, 9.6 cm, from Poona (collected 1989). Rustam Kothavala specimen; Wendell Wilson photo.

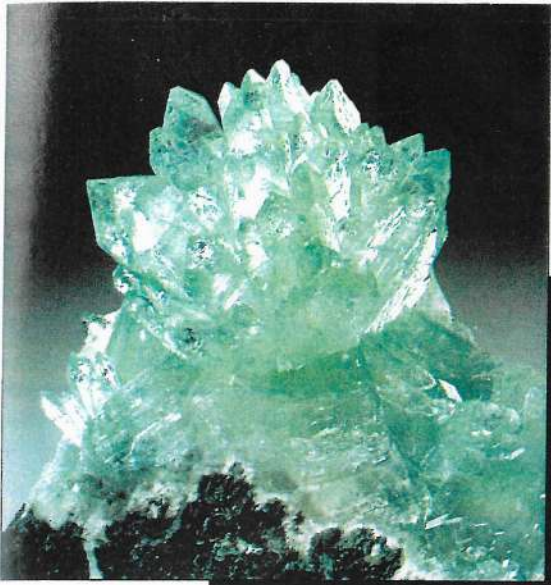


Figure 22. Fluorapophyllite, 5 cm, from Poona (collected 1989). Rustam Kothavala specimen; Wendell Wilson photo.



Figure 23. Fluorapophyllite, 8.9 cm, from Bambori, Ahmadnagar, Maharashtra. Superb Minerals India specimen; Jeff Scovil photo.

Figure 24. Fluorapophyllite, 2.8 cm, from Poona. William Severance collection; Jeff Scovil photo.



Figure 25. Fluorapophyllite, 10 cm, from Jalgaon. Ottens collection and photo.

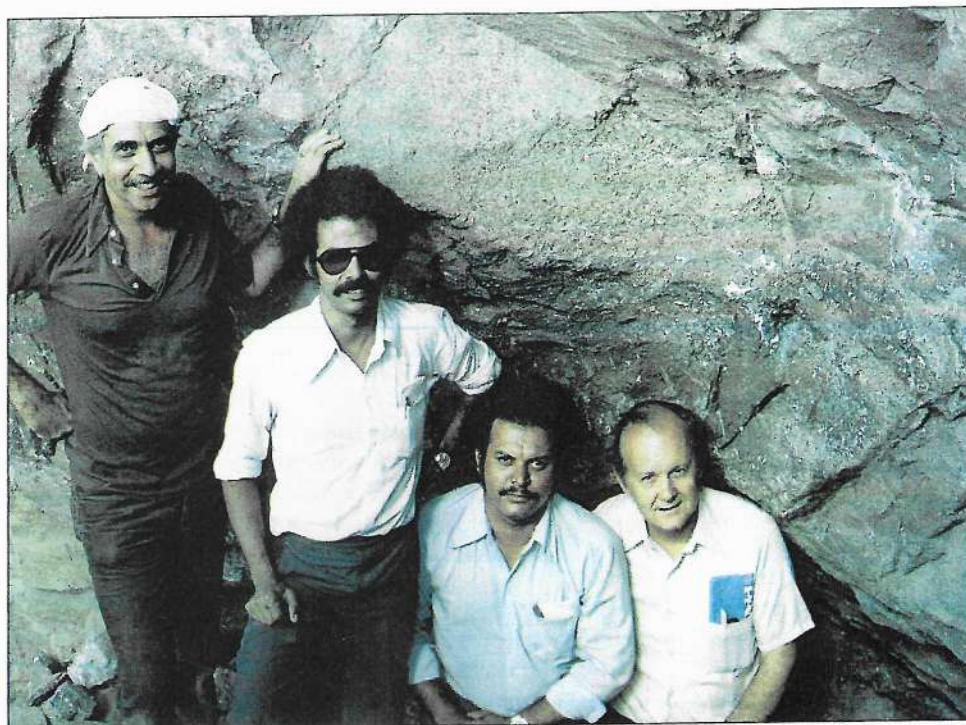


Figure 6. In front of the entrance to the cavity that yielded spectacular green apophyllite and mesolite at the Pashan quarry in December 1978; from left: the author, the brothers Fassi and Mujahid Makki, Paul Desautels. Photo by Toby Marotta.

Figure 7. The big apophyllite/mesolite packed on the floor of a Dodge pick-up truck for the trip from Boston to Washington, DC, December 1978.

quined verditer. Like green and white fireworks, frozen, crystallized, and captured at the peak instant of their detonation.

Time ceased. Then gradually inched back to life again. The scene before my eyes began to look less unfamiliar. Lining a cavity, whose farthest reaches remained in darkness, radiating sunbursts of colorless transparent mesolite needles, each one individually about 8 cm long, sat amidst crowds of vitreous green apophyllite crystals, most of them single, but here and there in bow-tie shaped clusters.

"Rustam," I said to myself silently, "Don't ever let this sight fade from your mind. Carry it with you like a talisman, all the way to your end." Then carefully, reluctantly, I withdrew my head from the cavity. Like Paul, I could say nothing. It was Toby's turn to be enchanted.

Having stared, and stared again, at this ephemeral masterpiece of nature's art, we stumbled our way down the talus slope to the jeep. Of course, I took photographs. But never before had I wished so intensely that I were a professional photographer of National Geographic caliber.

Paul remained uncharacteristically silent for a while. Then he spoke. "That was far and away the most fantastic mineral experience I've ever had."

"Seriously, Paul?"

"Yes, I really mean that."

Coming from Paul Desautels of the Smithsonian Institution, that was quite an accolade for Pashan Quarry No. 2, the Makki brothers, and Indian green apophyllite and mesolite.

Next morning we were taken to a house where about 20 specimens, extracted just days before from an adjoining cavity, were laid out on a table. One enormous piece . . . it might have weighed 20 kilos . . . sat on a large stool separately. It was stunning. An oval-shaped dome of rock, more than 30 cm across, was entirely crusted over with green apophyllite crystals 4 cm or more in length, perched on which were sporadic bow-tie shaped clusters of the same mineral. Standing upright on the apex and flanks of the piece were sunbursts, more than 10 cm in diameter, of glassy mesolite crystals identical in appearance to the ones we had seen in the cavity at Pashan Quarry No. 2. Amazingly, for its size, weight and delicacy, the great specimen showed no damage. I had never before seen a more impressive piece from India. Obviously, it caught Paul's interest.



After 20 minutes of looking and small talk, Paul pulled me aside. Looking directly into my eyes, he said, "Rusty, I want that specimen for the Smithsonian. You are going to have to figure out a way to get it to me there."

"How much are you ready to pay me for it once I get it to Washington?" I said.

Paul didn't hesitate a moment. "Ten thousand dollars."

That was a lot of money in 1978. Not yet knowing how I would ferry the huge but delicate piece with its fragile mesolite sunbursts from India to USA, I now asked Fasi Makki to take a walk with me outside.

"Paul wants me to pick up that great green apophyllite, with the mesolites on it, for the Smithsonian. It's magnificent." It was pointless for me to even think of trying to pull any wool over Fasi's eyes. He knew better than I did that the piece was far and away the most splendid green apophyllite display specimen to appear out of Pashan since quarrying for zeolite specimens began five years earlier. "How much do you want for it?"

Fasi knew he had me in a lock. Calmly he said, "Seven thousand dollars. Nothing less."

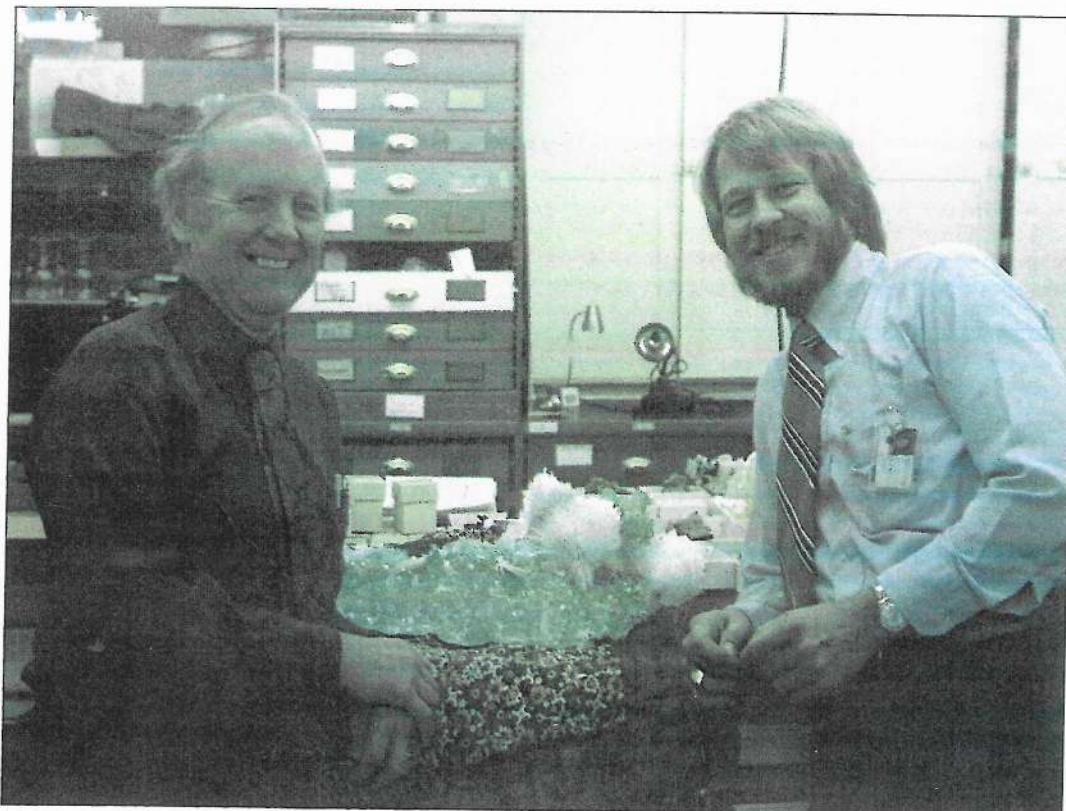


Figure 8. Smithsonian curators Paul Desautels and John White with the big apophyllite/mesolite, December 1978.

That was, I figured, about 14 times as much as I had ever paid in India for a single specimen. I did not feel confident that the crystals, particularly the upright mesolites, would survive the rigors of surface transportation to Bombay, then customs inspection, followed by several flights and stopovers to the USA. No, I decided, it was just too risky, unless I could work out something for insurance. Feeling certain that Fasi would stick to his figure of \$7000, because that would be a new benchmark price for a zeolite specimen in India, I tried another tack.

"I know you'd like to see this specimen of yours on display at the Smithsonian, Fasi," I said. "But getting it there undamaged is going to be almost impossible. I could end up with virtually nothing, perhaps actually nothing, if the great green is expropriated by customs authorities, or if the mesolites are destroyed. What then?"

I noticed Fasi's expression instantly harden. But before he could say anything, I continued my monologue. "So I agree to pay you \$7000 for the 'Great Green.'" He waited for me to finish. "But you've gotta help me with some sort of a cushion so things don't go terribly wrong."

Immediately, his facial muscles relaxed. "What do you mean?" Fasi said.

"Well, first, I have no means to get the piece to Bombay. So you're going to have to deliver it to me there, to my garage-workshop, in your vehicle."

"No problem. I can easily do that."

"Second," I said, "If I get anything for it, I won't get paid until after I deliver it to Paul's office in Washington. It'll take some weeks after that for the Smithsonian to issue me a check. So it'll be a month, maybe two, before I can remit your money to you. Will that be OK with you?"

"That's not an obstacle," he said. "We've had similar arrangements before. They've worked without difficulty."

Now for the kicker, I thought. "As I said, I may end up with nothing but a \$7000 loss in this deal. So I've gotta have some insurance." I paused to let my words sink in.

"What do you mean?" said Fasi, a little uncertainly.

"I want you to throw in the rest of the specimens on the table for free. That'll be my insurance." With visions of his 'Great Green' on display in the heart of America's pre-eminent museum collection, and having already been honored with a personal visit to Pashan by the Smithsonian's mineral chieftain, I knew Fasi would not refuse.

His brow furrowed momentarily. Then he said, "OK. I agree to that." We shook hands on the deal. Then I measured the exact dimensions of the Great Green.

All that remained was for the Makkis to discuss the disposition of the specimen material in the cavity we had all inspected the previous day. Fired by their financial success and by the presence of Paul Desautels, the Makki brothers came up with an outrageously daring vision. They would cut out a complete intact cross-section of the cavity, they said, with all the crystals in place, naturally, and ship it under their personal care and supervision to Washington. Would Desautels buy the entire cross-section for the Smithsonian? Of course, Paul said he would, though neither he nor I had the slightest expectation of ever witnessing that reality.

Sure enough, after a couple of months, I learned that the effort to cut out an intact cross-section of the cavity had collapsed just like the cavity itself. Eventually, the remnant specimens were picked up by me and other foreign dealers for resale in Europe and the USA.

With Desautels homeward bound for Washington, my attention turned to how I would transport the Great Green across the planet. Packing it was out of the question. Any packing material would play havoc with the mesolite sprays. And customs inspections would add to the carnage. The specimen would have to be carried open and exposed. There was no other option.

To that end, in my Bombay garage-workshop, I cut a rectangle of thick plywood with dimensions that were just an inch wider on all four sides than the specimen, to serve as a base. Two loops of strong nylon strapping were firmly screwed to opposite edges of the plywood and taped together at the top to create a suspended horizontal pallet, which could be lifted by one hand.

Quarrying for Green Apophyllite at Pashan

Since no mineral species is more definitely identified in the public mind with Indian zeolites than the superb emerald green vanadian apophyllite (even though it is not strictly a zeolite) from the quarries at Pashan near Poona, a brief historical note about the discovery and exploitation of this material may be in order.

The Pashan quarries, which were shut down by the government more than 12 years ago, have long since been overtaken and engulfed by the fast expanding city of Pune (as Poona is now named). But in their mineral specimen heyday during the 1970's and 1980's the quarries dotted a line of bare hills overlooking a barren expanse of usually parched agricultural land. The only noteworthy nearby landmark on any map was the town of Khadakvasla, site of the National Defense Academy, India's "West Point," some 5 or so kilometers away. The name "Pashan" applies today to a favored suburb of greater Pune, but in 1971, when bright green apophyllite was "discovered" in a few of the quarries, the name Pashan applied to a smattering of *beedi* and *chai* stalls that vehicular passersby would barely notice.

An American couple, Nell Roe and her pastor husband, who taught at Spicer College, not far from the quarries, must be credited with first bringing Pashan green apophyllite to the attention of collectors, though Fasi Makki maintains that it was his father, Makki Sr., who first discovered the occurrence in the early 1960's. The green color, more intense than any seen before, was quite unlike the yellowish green hues that were commonly seen in blocky, pseudocubic apophyllite crystals from the Bombay-Poona railway cuts and tunnels. Another feature of the Pashan apophyllite crystals was their pronounced elongated tetragonal habit with well-developed pyramidal terminations.

Naturally, all the seasoned Indian mineral dealers tried to get specimens directly from workers at the quarries, but to their astonishment these hopefuls found that the workers exhibited uncompromising loyalty to Pastor and Mrs. Roe. The green apophyllite pieces encountered during quarrying were steadfastly saved for the American missionary couple. It turns out that the American missionaries had made a practice of regularly visiting the quarries for a long while, even before they stumbled onto green apophyllite, in order to provide the desperately poor workers and their families with aid and assistance in the form of food items, basic health care, and simple human concern. Any wonder the workers remained true to the Roes! (Makki, M. F., personal communication.)

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overnight when the Roes, stressed out by trying to do business with hard-nosed mineral dealers, pestered by an unending series of mineral seekers and collectors, intruded upon in their primary work at Spicer College, suddenly relocated from India to USA. It was a circumstance and opportunity that had been foreseen, prepared for, and patiently awaited by two enterprising, energetic, and capable young college men, Fasi and Mujahid, the sons of Mohammad Makki. Unlike their unassuming naturalist father, the young Makkis were fired with aspiration to be players on the international stage. Taking full advantage of their intimate familiarity with Indian languages and customs, their willingness to engage in backbreaking labor themselves, and their canny ability to navigate their way through the shoals of arcane bureaucratic regulations, the Makki brothers embarked on a unique Indian enterprise. First, they gained unassailable legal license and lease from the government to conduct quarrying at two of the dozen or so quarries in the Pashan Hills. Then they designed their operations in such a way that their primary product of value would be mineral specimens. The basalt excavated in process (which was of poor quality, anyway, because it was shot full of amygdular fillings and cavities) would be disposed of for whatever it could bring. For the next 18 years or so, first the Makki brothers together, later Fasi Makki on his own, gained world renown for the name "Pashan" and for the spectacular specimens, many of extreme beauty and delicacy, which were extracted from the "Makki Quarries." These may be the only successful mining or quarrying operations in India that have been conducted primarily for mineral specimens. (The quarries at Jalgaon may be later examples of the same, but I am not familiar enough with that locality to comment on it.)

The two "Makki Quarries" have proven to be by far the most fecund producers of deep green apophyllite out of the several quarries at Pashan. Clearly, the Makki brothers did a creditable job of assessing the potential of their quarries. Other quarries, some within a distance of just a few hundred meters or less, and apparently on the same stratigraphic horizon, have also produced fine mineral specimens of mesolite, calcite, "mirror" apophyllite, stilbite, and heulandite. But none of the other quarries have produced the spectacular "greens" that have made Pashan world famous in mineral circles.

Ultimately, by September 1989, urbanization and population pressures from Pune's booming metropolitan expansion forced closure of all the quarries at Pashan (Wilson, W. E., "What's New in Minerals: Tucson Show 1990," *Mineralogical Record*, May-June 1990, v. 21, p. 255-256).

In his jeep, Fasi delivered the apophyllite specimen from Poona to Bombay, as he had promised. The great specimen fit perfectly on the pallet I had prepared. The base sat on the plywood without any rocking. It was heavy, very heavy, but I could manage to lift it with just my right arm. The administrative red tape had been cleared; the export clearance documents were in hand. The moment for flight had arrived.

Except for one small shoulder bag with our passports and tickets, neither Toby nor I carried any hand luggage. I would need every fiber of my strength to carry Great Green on its pallet. Toby would focus his entire attention on keeping the inevitable curiosity-driven gawkers at bay.

I knew from long experience in transporting mesolites that customs officials and other kinds of inspectors would find it impossible to keep from sticking a finger out to touch the mesolite sunbursts. To prevent anyone from inadvertently creating such a calamity, Toby's job was to literally grab any hand that strayed too close to Great Green. We had gone over this drill several times in Bombay. Good thing too. At every point en route, in airports and on the airplanes, there were gasps of wonder and disbelief, expostulations of "What IS that?," oohs and aahs, from bureaucrats, functionaries, passengers, and crew members. We paid no attention to anything other than protecting and defending Great Green. Except for Toby's having to physically tackle several mesmerized but

Early Dealing in Deccan Minerals

Without question, the founding father of commercial mineral collecting as a business enterprise in India was Burjor F. Mehta in Bombay, during the early and mid-1960s. Mehta, a trained geologist, had worked as a field officer with the Geological Survey of India during his younger years. In that capacity he had traveled widely in the hinterlands of India and had observed a wide range of esthetically attractive crystallized and massive minerals and ornamental rocks. In mid-life Mehta opted to leave the Survey and apply himself to his family's metal fabricating business in Bombay. Since he and his wife, Amy, were gregarious people who enjoyed travel, and were fortunate enough to possess the means to indulge that interest, they periodically visited Europe, in time establishing friends and contacts centered around the German gemstone and lapidary center at Idar-Oberstein. Mehta started to export significant quantities of agate, fossilized wood, and a wide array of ornamental rocks and minerals to Germany, Italy, and other European countries for cutting, polishing and display, thereby establishing himself as the prime, perhaps sole, commercial exporter of Indian rocks and minerals, under the name *Geological Specimens—India*.

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As a result of his success in the European market, however, Mehta became well known in the Bombay, Poona and Nasik regions of Maharashtra as an acquirer/purchaser of unusual or interesting mineralogical and geological material. Every month or two he would drive his jeep to any operating quarries where, he learned, zeolitic minerals were turning up. Until Mehta's appearance on the scene, these had usually been discarded! He would offer to buy from the quarry workers whatever crystallized minerals they could arrange to deliver to his depot in Bombay. Thus began the system of "runners," which soon became an institutionalized aspect of the commercial mineral-collecting scene in Maharashtra.

Inevitably, his profitable enterprise drew the attention of others who attempted, with greater or lesser degrees of effectiveness, to replicate Mehta's enterprise. His would-be

competitors, however, lacked two of Mehta's key assets, namely, professional geological training, and a cosmopolitan sophistication that permitted him to operate with ease outside India. Only a few of Mehta's imitators survived, let alone thrived. Among those few were Hussein Tyebjee in Bombay and, until the latter 1970's, B. H. Kela in Nasik.

Another notable pioneer in establishing India's fame in the realm of zeolite specimens was Muhammad Makki in Poona, whose sons Fasi and Mujahid went on themselves, after their father's death, to quarry and extract some of the most spectacular specimens ever seen. Makki Sr., an unpretentious schoolteacher who lived in humble circumstances on the city's outskirts, was a rarity in India: a born naturalist with an abiding fascination for the wondrous beauty of crystals he encountered during his rambles in the Poona region and elsewhere in Maharashtra. Motivated more by love of India and minerals than by aspirations of profit, Makki had been scouring basalt quarries for collectable specimens for many years. Hearing of Burjor Mehta's appetite for specimens, Makki, carrying a box or two of his self-collected mineral specimens, traveled to Bombay to seek out this man who was reputed to be channeling Indian mineral specimens to foreign collectors. It was a meeting that would dramatically change the lives of both men and their families, and establish once and for all India's preeminent position as a source of superb zeolite collector specimens for the world market.

The conjunction of Mehta's professional geological knowledge, financial resources and European connections, with Makki's painstakingly accumulated knowledge of collecting sites and his eye for beauty ensured that Indian zeolitic minerals would no longer be unknown or out of reach to European collectors. But their introduction into the American collectors' market would await the simultaneous entry in 1972, of two new mineral dealers, Rustam (Rusty) Kothavala and Rock Currier, into the Indian mineral field. First, as fiercely competitive rivals battling for turf in India, then as uneasy but mutually accepting colleagues, and finally, as easygoing friends, these two men strove over the next 20 years to outdo each other in discovering astonishing finds in India and bringing back spectacular specimens that have found their way into every major mineral museum in the world. Kothavala introduced American collectors to Indian mesolite (misidentified for decades as "natrolite"), mordenite, cristobalite, and powellite; Currier did likewise with goosecreekite and yugawaralite.

Rustam Z. Kothavala

in important areas like Jalgaon, Nasik or Bombay they are almost always present—and monitor other exposures such as wells and building foundation sites. They make quarry workers aware of the value of mineral specimens, and advise on promising zones in which to watch for them. The runners buy specimens as free-lance middlemen, sometimes even from cavities not yet collected out. They compete with each other intensely, and decisions about prices usually are reached immediately. For very rare or exceptional specimens, the runners often are not able to decide on a purchase

price without consulting their dealers; they need information about going prices on the market, and may also need a cash advance, since they seldom have large sums on hand. Most runners work in groups. While one or two of them remain on site, a third takes recently collected stock to Bombay, Nasik or Poona to offer to the dealers. Specimens purchased are roughly sized and packed at the quarries. Raw, unrefined cotton (which is readily available and cheap), as well as newspaper, is usually used as packing material.

Collectors often do not know that the well-composed specimens

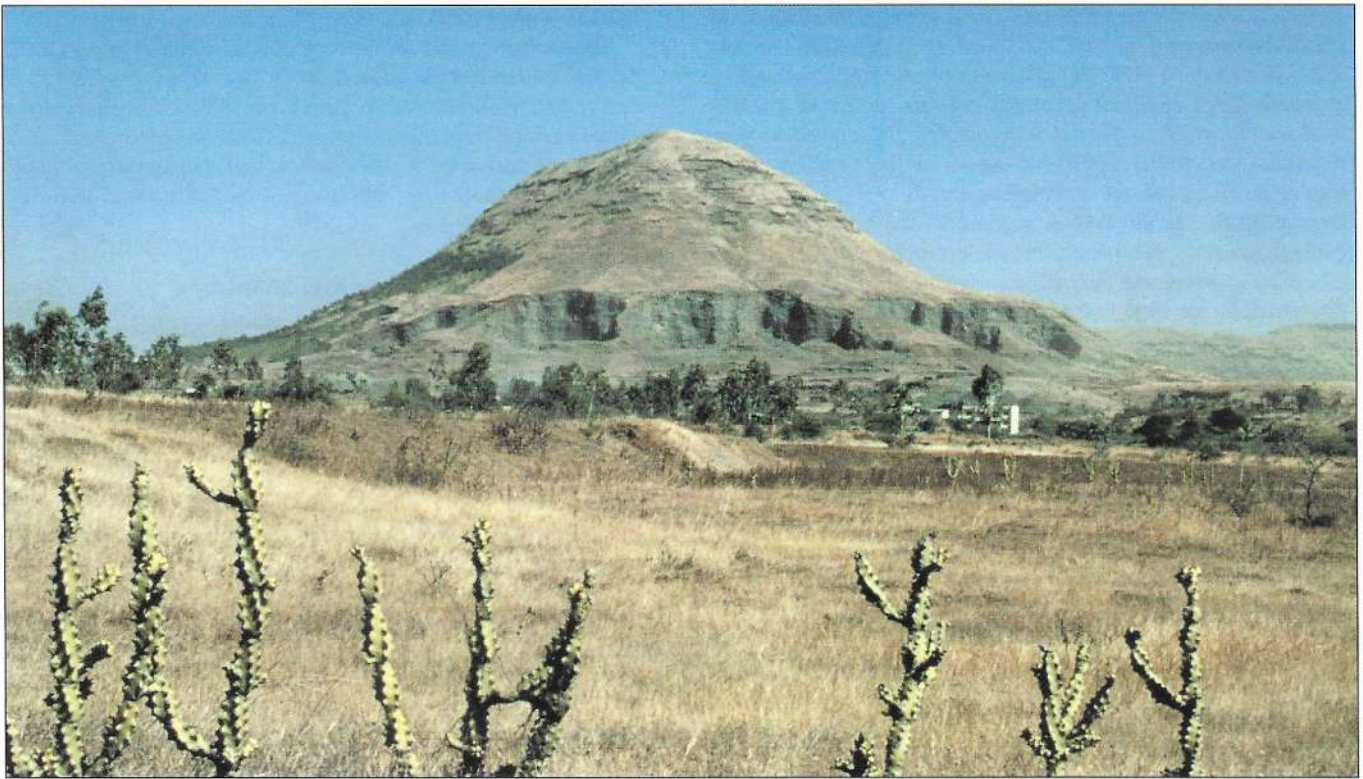


Figure 130. Pandulena Hill near Nasik, source of fine powellite. Ottens photo.

white crystals to 10 cm long. The crystals rarely have sharp terminations, but rather look frayed; this is due not to any dissolution but to incomplete initial crystallization. Scolecite formed after stilbite and is generally the last species to have crystallized in the Nasik basalts. Some earlier statements to the contrary, mesolite has not yet been found in Nasik.

Calcite is abundant, mainly in colorless crystals, but infrequently with a beautiful yellow color. Mostly simple rhombohe-

drons, the crystals, sometimes more than 10 cm across, are often overgrown by stilbite and apophyllite, and then can only be recognized by the cleavage planes visible on the undersides of the specimens. Calcite twins have not been observed in this region.

In addition to the beautiful combinations of green apophyllite with salmon-colored stilbite, it is Nasik's spectacular specimens of **powellite** that have made the locality famous among collectors. In 1972 the first specimens of apophyllite with an unidentified



Figure 131. Pashan Hills quarry no. 2, source of superb green apophyllite until being closed in 1989. Rock Currier photo, 1974.



Figure 56. Cavansite crystal aggregates on matrix, 8 cm, from the Wagholi quarry, Poona. Hans-Jürgen Wilke collection; Manfred Henkel photo.



Figure 57. Cavansite with stilbite, 4.2 cm, from the Wagholi quarry, Poona. Zeolites India specimen; Jeff Scovil photo.

Figure 58. Cavansite rosettes with stilbite on heulandite, 15 cm, from the Wagholi quarry, Poona. Ottens collection and photo.



Figure 62. Pentagonite cluster, 3 cm, from the Wagholi quarry, Poona. Hans-Jürgen Wilke collection; Manfred Henkel photo.



Figure 59. Pentagonite crystals to 1.3 mm wide, from the Wagholi quarry, Poona. Hidemichi Hori collection and photo.

Figure 60. Pentagonite crystal group, 1.5 cm, from the Wagholi quarry, Poona. Hidemichi Hori collection and photo.

Figure 61. Pentagonite twins to 1 mm, from the Wagholi quarry, Poona. Ottens collection and photo.

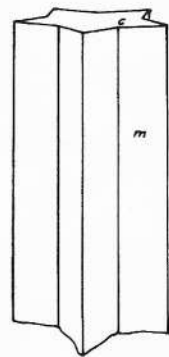
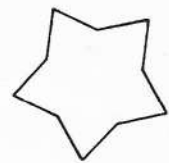


Figure 63. (above left) Five-pointed-star twin of pentagonite, 1 mm, of the type that gave the species its name. Hidemichi Hori collection and photo. (Right) Idealized crystal drawing of a pentagonal twin (from Staples *et al.*, 1973, *American Mineralogist*, 58: 409).

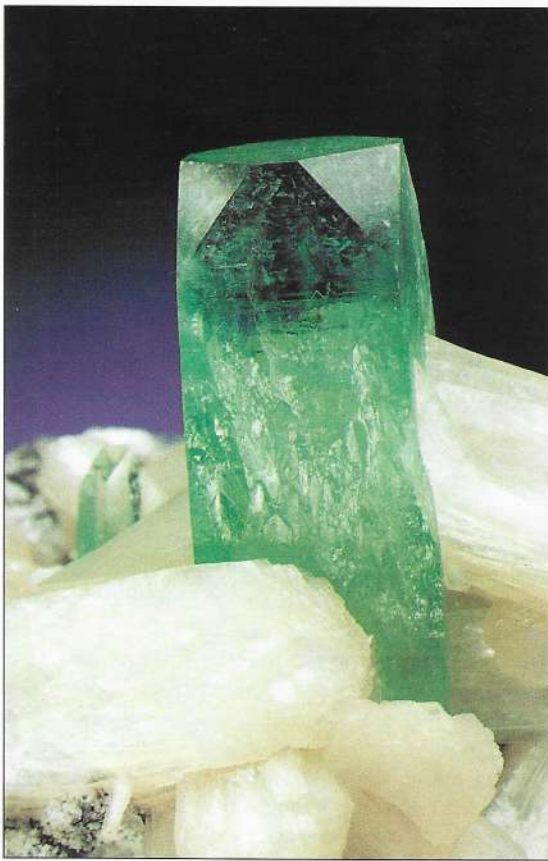


Figure 26. Fluorapophyllite crystal, 4.8 cm, with stilbite from Jalgaon. Roberts Minerals specimen; Jeff Scovil photo.

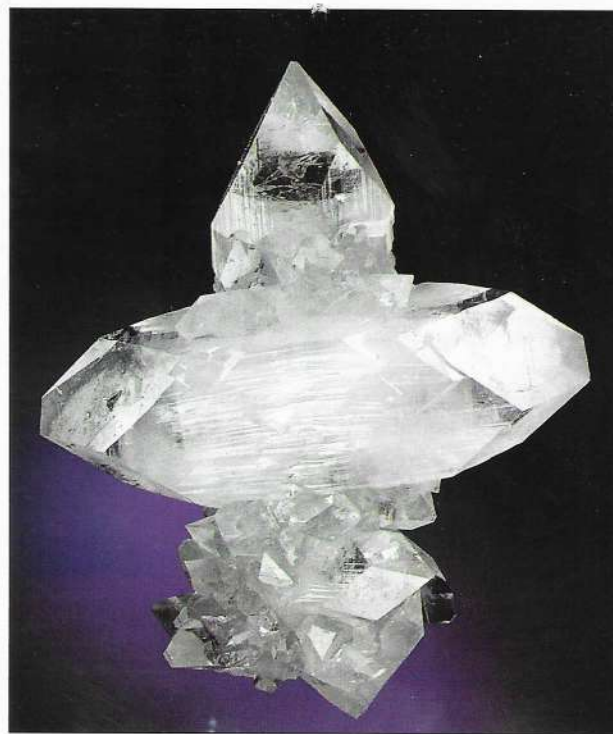


Figure 27. Fluorapophyllite, 10.5 cm, from Jalgaon. James McEwen collection; Jeff Scovil photo.

Figure 28. Fluorapophyllite with stilbite, 13 cm, from Jalgaon. Mountain Minerals International specimen; Jeff Scovil photo.



the growth of pyramidal over prism faces cannot be confirmed; for example, the bluish green apophyllites of Jalgaon have the highest vanadium content yet found, but prism faces dominate over pyramids, and their pyramid faces are not more fully developed than in completely colorless crystals from the same locality.

The green apophyllite crystals from Poona and Jalgaon clearly illustrate differences in the influx of solutions for neighboring cavities. In quarries in the Pashan Hills near Poona, apophyllite has formed in a basalt with particularly large cavities, these cavities having partly resulted from cessation of flow in lava channels

under an already hardened crust. The cavities are widely interconnected, so that uniform solutions circulated among them. By contrast, in quarries at Jalgaon-Sawda the cavity-bearing basalt stratum is 2 meters thick, hard, nearly impermeable, and almost wholly without channels connecting the cavities. It is not surprising that neighboring cavities here often display very different mineralization. Whereas at Poona, green apophyllite is found almost exclusively, deep green crystals occur only rarely in Jalgaon.

Since the Deccan basalts have an average vanadium content of around 300 ppm, the fact that significant vanadium has entered the

Discovery of Green Apophyllite at Poona

Since no mineral species is more definitely identified in the public mind with Indian zeolites than the superb emerald-green vanadian apophyllite (even though it is not really a zeolite) from the quarries at Pashan near Poona, a brief historical note about the discovery and exploitation of this material may be in order.

The Pashan quarries, which were shut down by government edict more than 12 years ago, have long since been overtaken and engulfed by the fast-expanding city of Pune (as Poona is now spelled). But in their mineral specimen heyday during the 1970's and 1980's the quarries dotted a line of bare hills overlooking a barren expanse of usually parched agricultural land. The only noteworthy nearby landmark on any map was the town of Khadakvasla, site of the National Defense Academy, India's "West Point," some 5 to 10 km away. The name "Pashan" applies today to a favored suburb of greater Pune, but in 1971, when bright green apophyllite was discovered in a few of the quarries, the name Pashan applied to a smattering of stalls that vehicular passersby would barely notice.

The green apophyllite discovery was made by an American couple, Nell Roe and her pastor husband, who were doing a stint as teachers in India at Spicer College, a Seventh Day Adventist institution situated in the countryside just a kilometer or two from the Pashan quarries. It turned out that Nell Roe had been an amateur mineral collector in America and had actually attended a mineral show or two. When the Roes stumbled across bright green apophyllite from one or two of the several Pashan quarries, they immediately realized that they were on to something very unusual. The rich green color was quite unlike the yellowish green hues that were commonly seen in blocky, pseudocubic apophyllite crystals from the Bombay-Poona railway cuts and tunnels. Another feature of the Pashan apophyllite crystals was their pronounced elongated tetragonal habit with well-developed pyramidal terminations.

The Roes knew little about valuation of mineral specimens and had no previous exposure to the cutthroat business of commercial mineral acquisition. Ingenuously seeking to capitalize on their fortuitous find, the Roes showed their apophyllite specimens to as many domestic and foreign mineral folk as they could turn up, among them Mehta, Tyebjee, Kela, and the young Makki brothers from India, as well as Currier and Kothavala from the USA. And once a specimen or two had been seen by a select handful of collectors in America, the rush was really on! Still, relatively little material actually changed hands. One reason was that the amount of specimen material being extracted at the quarries in those early days was small. Another was that no matter how high a price was offered to Nell Roe by mineral buyers, she held back, unwilling to sell more than a few of her pieces to any one buyer out of fear that she was being taken advantage of. Frustration prevailed. Several enraged mineral buyers stormed away from the Roe residence at Spicer College vowing never to come back. But they returned, of course, drawn inexorably by the uniquely beautiful green apophyllite crystals.

Naturally, all the more seasoned Indian mineral dealers tried to get specimens directly from the quarry workers, but to their astonishment they found that the workers exhibited unbudging loyalty to Pastor and Mrs. Roe. The green apophyllite pieces encountered during quarrying were steadfastly saved for the American missionary couple. It turns out that the American missionaries had made a practice of regularly visiting the quarries for a long while, even before they stumbled onto green apophyllite, in order to provide the desperately poor workers and their families with aid and assistance in the form of food items, basic health care, and simple human concern. Is it any wonder the workers remained true to the Roes?

The entire scene at the Pashan quarries changed almost overnight when the Roes, stressed out by trying to do business with hard-nosed mineral dealers, pestered by an unending series of mineral seekers and collectors, and intruded upon in their primary work for Spicer College, left India to relocate in the United States. It was a circumstance and opportunity that had been foreseen, prepared for, and patiently awaited by two enterprising, energetic, and capable young college men, Fasi and Mujahid, the sons of Mohammad Makki. Unlike their unassuming naturalist father, the young Makkis were fired with aspiration to be players on the international stage. Taking full advantage of their intimate familiarity with Indian languages and customs, their willingness to engage in backbreaking labor themselves, and their canny ability to navigate their way through the shoals of arcane bureaucratic regulations, the Makki brothers embarked on a unique Indian enterprise. First, they gained unassailable legal license and lease from the government to conduct quarrying at two of the dozen or so quarries in the Pashan Hills. Then they designed their operations in such a way that their primary product of value would be mineral specimens. The basalt excavated in the process (which was of poor quality, anyway, because it was shot full of amygdular fillings and cavities) would be disposed of for whatever it could bring. For the next 18 years or so, first the Makki brothers together, and later Fasi Makki on his own, gained world renown for the name "Pashan" and for the unsurpassably spectacular specimens, many of extreme beauty and delicacy, which were extracted from the "Makki quarries."

These two quarries have proven to be by far the most abundant producers of deep green apophyllite out of the several quarries at Pashan. Clearly, the Makki brothers did a creditable job of assessing their potential. Other quarries, a couple of them within a distance of just a hundred meters or less, and apparently on the same stratigraphic horizon, have also produced fine mineral specimens of mesolite, calcite, "mirror" apophyllite, stilbite, and heulandite. But none of the other quarries have produced the spectacular "greens" that have made Pashan world-famous in mineral circles.

Ultimately, urbanization and population pressures from Pune's booming metropolitan expansion forced closure of the Makki quarries and the others in September of 1989.

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Figure 29. Fluorapophyllite crystal, 4.5 cm, on stilbite from Jalgaon. Marvin Rausch collection; Jeff Scovil photo.

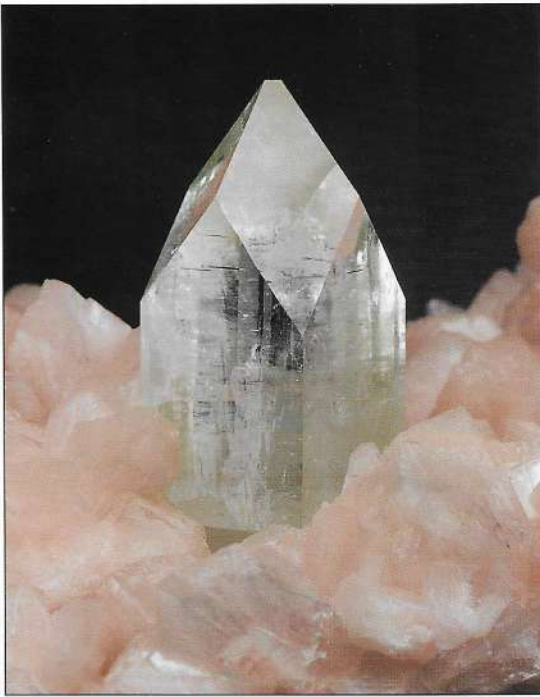


Figure 30. Fluorapophyllite with stilbite, 7.1 cm, from Jalgaon. Shirley Fiske collection; Jeff Scovil photo.

Figure 31. Fluorapophyllite with stilbite, 7.8 cm, from Jalgaon. Jeff Scovil collection and photo.



Figure 32. Fluorapophyllite with stilbite, 8.5 cm, from Nasik. John Lucking collection; Jeff Scovil photo.



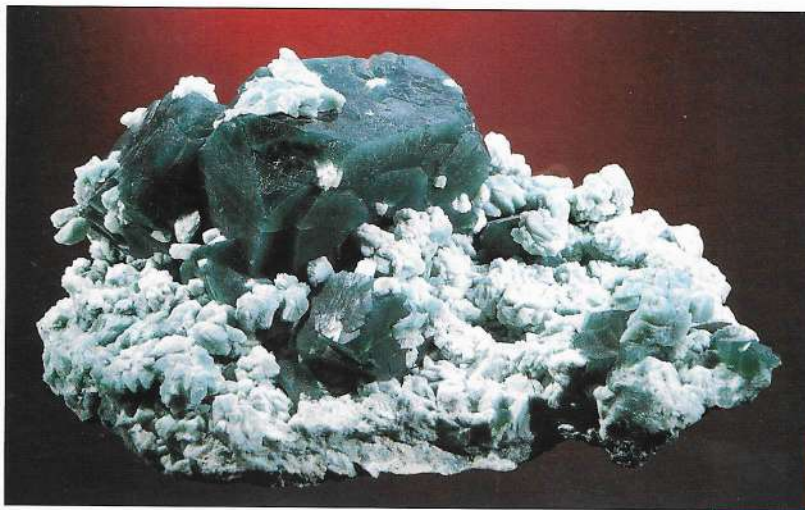


Figure 33. Apophyllite colored a deep blue-green by inclusions of celadonite, with heulandite, 8 cm, from Malegaon. Hans-Jürgen Wilke collection; Manfred Henkel photo.

Figure 34. Fluorapophyllite, 5.8 cm, from Jalgaon. Al Partee collection; Jeff Scovil photo.



Figure 35. Fluorapophyllite, 5.3 cm, from Jalgaon. Keith Proctor collection; Jeff Scovil photo.



Figure 36. Yellow fluorapophyllite crystal cluster, 2.5 cm, on quartz from the Alibag quarry. Ottens collection and photo.



Figure 37. Fluorapophyllite on stilbite, 13 cm, from Rahuri, Maharashtra. Hans-Jürgen Wilke collection; Manfred Henkel photo.