



NAVIGATING THE NEXUS: HOW RESPONSIBLE SUPPLY CHAINS FOR COLORED GEMSTONES ADD VALUE AMIDST THE CHALLENGE OF SYNTHETIC MISREPRESENTATION

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INTRODUCTION

The gemstone industry is currently confronting a product integrity issue: the potential for synthetic or imitation gemstones to be mixed with natural stones in the supply chain, creating both consumer confusion and market integrity concerns. As the demand for transparent, ethically sourced products grows, traceable gemstone supply chains may become a key element in combating this issue. This paper explores the potential for introduction of synthetic and imitation gemstones into the market, and if so, what kind of gem varieties and to what extent. We also examine consumer perspectives on purchasing natural-colored gemstones versus synthetic or imitations. The industry is aware this mixing happening with natural mined diamonds and synthetic diamonds, but what about color? Companies know there is a robust system in place at many retailers and manufacturers for screening natural versus synthetic diamonds, yet mixing it is still occurring. So, what do we think is taking place when supplying companies know there is little to no screening to separate natural from synthetic/imitation available for less valuable colored gemstone varieties like quartz or small stones like ruby, sapphire and emerald? And what do we need to do about it?

The gemstone industry faces increasing pressure to provide carefully sourced, genuine products that meet consumer demands for honesty and transparency. The potential for synthetic or imitation gemstones to be misrepresented as natural stones is a considerable challenge. Most high-value natural gemstones today require a laboratory report to confirm their authenticity at the point of sale, due to concerns that they may be misrepresented as natural when they are actually synthetic, imitation, or treated gemstones. Any of these possibilities would significantly impact

the gemstone's value. However, these same laboratory reports are seldom conducted on less expensive stones such as amethyst or citrine, aqua or morganite, small ruby, sapphire or emerald, and a whole host of opaque gems that have readily available imitation options circulating in the market. More often than not, the cost and availability of testing outweighs the value of these lesser-priced gemstones. The proliferation of high-quality synthetics and the use of imitation stones, while having a place in the market, complicate gemstone identification and compromise consumer trust in the authenticity of natural stones. A gemstone is defined by a combination of beauty, durability, and rarity. Synthetic and imitation stones may possess beauty, and some may possess durability, but few, if any, possess rarity. Once a method to create gemstone look-alikes is known, companies rush into production to see who can produce the least expensive option. Historically, nearly every synthetic or imitation gemstone variety experiences a continuous decline in value until it reaches the cost of production. For these reasons, industry players must confront the challenge of distinguishing between natural and synthetic stones of lesser value if they aim to maintain consumer confidence across the jewelry industry, especially when consumers seek to own something rare, authentic, and beautiful.

Consumer trust is crucial to the gemstone industry. Ensuring the authenticity of gemstones sold as natural is a fundamental aspect of maintaining that trust. As the popularity of gemstones continues to rise, it is important for consumers to be informed about the differences between natural stones and their synthetic or imitation counterparts. Brands that fail to disclose the use of synthetic or imitation gemstones risk damaging their reputation and losing consumer confidence. It is essential for the jewelry industry to safeguard this trust in order to maintain its long-term success.

RESEARCH QUESTIONS AND OBJECTIVES

This paper will explore several key questions related to the presence and impact of synthetic and imitation gemstones in the market:

1. What are synthetic and imitation gemstones, and how do they compare to natural gemstones?
2. How can we effectively distinguish synthetic and imitation gemstones from natural ones?
3. Are synthetic or imitation gemstones entering the natural gemstone supply chain? If so, what is the frequency or volume of such occurrences? Is there ongoing research in this area?

4. If this infiltration is occurring on a large scale, how does it impact the industry and consumers? Do stakeholders in the industry and consumers care about this issue?
5. Can traceable supply chains help mitigate or eliminate the problem of synthetic and imitation gemstones entering the market?
6. How might the inclusion of traceable supply chains influence consumer behavior and trust in the gemstone market?

METHODOLOGY

This research utilizes both qualitative and quantitative data gathered from a range of sources. Interviews with gemstone laboratories, industry professionals, and trade participants provide key insights into current supply chain practices and traceability challenges. Consumer surveys and case studies contribute to understanding market behavior and trust. Additionally, the study includes a review of published articles that outline the differences between synthetic, imitation, and natural gemstones, as well as the methods used to distinguish them. The research also examines instances where synthetic or imitation gemstones are misrepresented as natural, with a focus on relevant case studies and industry reports.

BACKGROUND

Synthetic Gemstones

The differentiation between synthetic, imitation, and natural gemstones is critical for understanding the current challenges the industry faces today. Robert Weldon, retired Director of GIA's Richard T. Liddicoat Gemological Library and Information Center, defines a synthetic gem material as "one that is made in a laboratory, but which shares virtually all the chemical, optical, and physical characteristics of natural mineral counterpart, though in some cases, namely synthetic turquoise and synthetic opal, additional compounds can be present." He goes on to say, "Synthetic gem crystals have been manufactured since the 1800s, and their production is often marked by the need for them in industrial applications outside the jewelry industry."¹ An example of this would be synthetic diamonds initially created for industrial use prior to the development of large, high-quality crystals for the jewelry industry. Despite this initial use, they still eventually made their way into the jewelry market.

Like imitations or simulants, synthetics are produced in large

quantities at a fraction of the cost of mining natural stones, significantly reducing the rarity and value of the finished gem. In recent years, advancements in synthetic gemstone manufacturing have led to higher-quality alternatives that closely resemble natural stones, though still do not yield a higher value synthetic. The most recent, and arguably the most impactful, is the advent of jewelry-quality synthetic diamonds. Diamonds of all sizes are a concern, but since diamonds over half a carat typically require a laboratory report, it is the smaller diamonds that pose a greater risk to the jewelry trade due to the potential for synthetics to be misrepresented as natural. This concern also extends to all sizes of quartz – such as amethyst, citrine, ametrine, smoky quartz, and clear quartz – which rarely have laboratory reports issued. See Figure 1 for a look at synthetic and natural quartz side by side. It also applies to less expensive, smaller stones like ruby, sapphire, emerald, aquamarine, and spinel.

Many popular gemstones have synthetic counterparts that are chemically indistinguishable from their natural versions. Some examples include:

- Quartz: amethyst, citrine, rose quartz, smoky quartz, and prasiolite
- Beryl: aquamarine, morganite, heliodor, goshenite, and emerald
- Corundum: ruby and sapphire
- Opal: play-of-color opals
- Spinel
- Turquoise
- Diamond



Figure 1: Comparison of synthetic quartz (left) and natural quartz (right)

These chemically indistinguishable synthetic gemstones are produced using various laboratory techniques, some of which include the Czochralski process or flux growth. While they share the same chemical composition as natural gemstones, the market can be deceptive for consumers who may not be aware that there are synthetic gemstones out there, especially if the synthetic stones are mixed with natural parcels.

Simulants or Imitation Gemstones

The term simulant or imitation may be defined as “materials, such as CZ, that look like another gem and are used as its substitute but have very different chemical composition, crystal structure and optical and physical properties. These simulants, also known as imitations or substitutes, can be natural or manmade.”¹

A brief introductory list for simulants or imitation gem materials includes example such as:

- Glass: commonly encountered
- Plastic: commonly encountered
- Quench-crackled quartz: periodically encountered
- Ceramic beads: periodically encountered
- Imitation turquoise: periodically encountered
- Imitation lapis lazuli: less often encountered
- Imitation black onyx: commonly encountered

Imitation gemstones, such as turquoise, lapis lazuli, and black onyx, are not chemically identical to their natural counterparts. Instead, they are made from alternative materials that mimic the appearance of genuine gemstones. The chemical and physical properties of imitations differ from those of natural stones, making it possible for trained gemologists to distinguish between natural and manmade relatively easily. However, the risk of mixing imitations with natural gemstones in a supply chain remains a significant concern when few, if any, suppliers or retailers are checking these small and less expensive gemstones. These synthetic, simulant, or imitations can be very convincing to the naked eye or someone without advanced testing equipment. Many of these simulants are produced in huge volumes for just pennies.

In Helen Serras-Herman’s article *Enhanced Lapidary Materials Fancy Compressed Blocks: The Latest Trend*, explores a number of natural materials that have been enhanced to create or improve another material. As noted previously, imitation gemstones can

be made manmade materials or natural materials. This may seem counter intuitive to say imitations can be made of natural materials, but Ms. Serras-Herman carefully reviews various types of treated opaque gemstones; dyed, impregnated, or small nuggets compressed back together with added resin (meaning a treated gemstone), as well as imitation or simulant gems made with other natural materials to imitate a completely different gem variety. An example given is the simulant of Sonora chrysocolla, which essentially looks identical to the natural gem but is made with a natural stone powder, dyed, then compressed in a resin and hardened.² This imitation is made with naturally occurring material and then treated to look like Sonora Sunrise which is composed of chrysocolla and cuprite. This article is designed to educate people about various different treatments done to natural opaque materials but also reviews how natural materials can be manipulated to look like a completely different gem variety, making the resulting product a simulant.

Another place explored to gather background on synthetic, imitation and simulant gem varieties was the WZDS Jewelry website. While browsing this site, DS Jewelry clearly labels both its cut and rough gem materials as imitation or synthetic. More than 25 pages of manmade materials are published, from synthetics of gem materials such as emerald, amethyst and citrine, to varieties of noncoital glass simulants like peridot, blue topaz, morganite, aqua and others. This site also illustrates the wide variety of simulants for opaque stones such as turquoise, lapis, malachite and more. Across the site, uncut rough material is available in a wide variety that imitates nearly every natural gemstone, both expensive and inexpensive.³ The question is once rough is purchased from the site and is cut, will that transparency of material type (synthetic or imitation) continue through the supply chain until it reaches the consumer?

TECHNOLOGY'S ROLE IN DISTINGUISHING SYNTHETIC AND IMITATION GEMSTONES FROM NATURALS

Gemologists utilize a variety of tools and methods to differentiate between synthetic, imitation, and natural gemstones. Techniques such as spectroscopy, microscopy, and refractive index measurements are all commonly used to identify synthetic gemstones. However, these methods are not foolproof, particularly when dealing with high-quality synthetics that closely resemble their natural counterparts. Some advanced equipment like EDXRF chemical analysis machines, Raman scattering machines, FTIR testing machines, Fluorescent Spectrography, as well as other

advanced testing machines are used today, but either continued improvement or new additions will be necessary to adapt to identifying more sophisticated synthetics or imitation gemstones.

Efforts to develop methods to distinguish synthetic or imitation gemstones has spanned decades. In *A Simple Procedure to Separate Natural from Synthetic Amethyst on the Basics of Twinning*, written by R. Crowningshield, C. Hurlbut, and C.W. Fryer, it is stated that, "Since 1970, when synthetic amethyst first became available, it has created problems in identification for Gemologists. Although inclusions have proved reliable in distinguishing synthetic from natural, until recently no test was available to separate the flawless or near flawless stones that represent the bulk of the fine faceted stones on the market."⁴ This statement not only identifies the time frame during which synthetic quartz was studied but also highlights how inclusions were once a reliable indicator for distinguishing 'fakes' from natural stones. Over time, the manufacturing of synthetic quartz, along with many other synthetic gem varieties, has significantly improved, allowing them to more closely imitate natural gems. However, identification methods have also advanced.

Another article titled, *Synthetic Gem Materials in the 2000s: A Decade in Review*, written by Nathan Renfro, John I. Koivula, Wuyi Wang, and Gary Roskin, details the extent of the synthetics market in the preceding 20 years. It includes the addition of synthetic diamonds to the ever-growing list. The authors' conclusions and predictions of synthetics becoming more challenging to identify and separate in the coming years were certainly accurate. The authors questioned, "Will the jewelry industry be ready for these developments? When you consider that many synthetic growth processes are more than a century old and still plague the trade, our preparedness must be questioned. If trade people continue to submit flame-fusion synthetic rubies, sapphire and spinel to gem laboratories for identification, then one must ask: How are they handling the thousands of carats of more technologically advanced flux-grown hydrothermal and Czochralski-pulled synthetics?"⁵

The end of the article details an example that one of the author's experienced with a former classmate in 1977. He was handed "a parcel of seven stones purchased over the internet as heated sapphire."⁵ The classmate had assumed that "worst-case scenario [they] would [turn] out to be Beryllium diffused."⁵ Unfortunately, after the stones were closely examined, it was determined that they were all flame-fusion synthetic sapphires. There was not a single heat-treated natural stone in the parcel. This experience

is more common than one might think, even among trained and experienced gemologists. It highlights how easy it is for consumers to unknowingly purchase such stones at a premium price, believing they are getting natural gemstones as advertised.

CURRENT SCREENING TECHNOLOGIES

Synthetic diamonds have been in circulation for several years, with notable advancements in synthetic production technology in the past 10 years. These advancements have allowed synthetic diamonds to rival natural diamonds in terms of availability, appearance, and physical properties. Because of this, individual companies involved in the diamond industry have developed procedures and policies to separate synthetics from naturals, utilizing sophisticated screening machinery and techniques. These have come to the market relative quickly and are in regular use today.

Mass screening technologies, such as those based on X-ray fluorescence (XRF) or Raman spectroscopy, are beginning to be used to identify colored gemstones on a larger scale. Though no practical or affordable application of these advanced techniques is available to be used on small colored gemstones or less expensive colored gemstone varieties, such as quartz. While these technologies do offer promise, their ability to detect synthetic gemstones across all stages of the supply chain remains limited. More research is needed to improve the scalability and affordability of these testing methods for a wide range of colored gemstone varieties.

COLORED STONE SUPPLY CHAIN

The colored gemstone supply chain is a complex network that spans sourcing, cutting, distribution, and retail sales. Major players in the market include mining companies, gem dealers, gem cutters, jewelry manufacturers and retailers, with key trade routes located in regions such as East Africa, South America, and Southeast Asia. It is estimated that 80% of all colored gemstones are produced by small scale ASM (Artisanal and Small-Scale Mining) operations. In most cases, this small-scale production is consolidated into larger rough parcels, enabling the production of volume cutting lots for calibrated gemstones. However, this practice makes traceability much more challenging. When gems are produced by ASM miners and then grouped into larger batches for sale, it creates an opportunity for synthetic or imitation stones to be introduced and mixed with natural materials. The challenge

of ensuring authenticity in this global supply chain requires significant attention to supply chain management. Ensuring authenticity in this global supply chain requires constant and thorough supply chain management. The introduction of a rapid, affordable screening system to separate manmade and natural gemstones could play a crucial role in verifying authenticity as gemstones move through the supply chain. With only a few companies performing proprietary colored stone screenings and no laboratories focused on this, the need for such a system will become even more critical over time.

FREQUENCY OF SYNTHETIC OR IMITATION GEMSTONES ENTERING THE SUPPLY CHAIN

This is an ethically complex and challenging subject to research because those who cut synthetic or imitation gems and mix them with natural stones to sell are unlikely to voluntarily disclose their actions. It is common for a dealer to unknowingly purchase hammered mixed rough, or for a dealer to purchase finished gems that were already blended, without transparent disclosure. This means many companies are buying these lesser valued gemstones already cut and, in many cases, are not even aware they are selling synthetic stones as natural.

As we mentioned earlier, very little routine laboratory testing is happening on less expensive colored gemstones. Few trade companies want to take on the expense of an individual laboratory report that may cost anywhere from \$40-100 USD. This is especially true when they are selling the stone at \$30 wholesale. There are a few brands doing their own proprietary testing, but that is not widespread across the industry. We do know this mixing is happening in diamonds of all sizes, so it is reasonable to assume there is a strong possibility it is happening in colored gemstones, where there is no universal or mass testing available.

To further support the likelihood of this possibility, the Stuller Gemstone Procurement team shared that they perform spot checking for synthetic mixing, but where they see higher volumes of mixing tends to be in retailer submissions for Stuller to set their independently provided gemstone. They also shared their research from US import statics uncovering that the “US government documentation of diamond imports in 2023 shows 14% of the dollar value was synthetic diamonds, and for international shipments the number was 24%.”⁶ If this was looked at by units, it would mean well over half of all the diamonds imported to the US were synthetic. Given this huge volume of synthetic diamonds

coming in, we would have a significant product integrity problem if universal mass screening was available today. In correspondence with Angelo Palmier, he stated that GCal screens diamonds for naturals and synthetics, primarily once they are set in finished jewelry. The prevalence of synthetics varies from 1-5% across their testing.⁷

Now, let's examine a case study involving more valuable, colored gemstones that were submitted to a laboratory as natural, but yielded surprising results. In Leah Meirovich's article, *Synthetic Sapphires Submitted to GIA as Natural*, four sapphires reviewed were submitted for analysis in their rough, uncut form, believed to be natural stones. Of the four stones, the laboratory determined the largest stone (48.63 carats) was a glass imitation. Two of the other stones "had surfaces coated with resin, which resembled matrix composed of materials commonly seen on natural rough corundum. After testing further, GIA determined both were lab grown sapphire". The last stone "GIA observed some natural looking fingerprints and strong, straight inky-blue banding. The lab confirmed the stone was a natural sapphire from Madagascar that had been heat treated."⁸ This is a particularly noteworthy case because it illustrates the mixing of a simulant (glass), two synthetics, and one natural heat-treated gemstone, each misrepresented as natural in various ways. It highlights the growing issue of mixing and misrepresentation of colored stones, even in higher-value gemstones that are likely to be sent to a lab. This is why so many valuable gems, diamonds and one-of-a-kind colored gems, require laboratory reports today.

The challenges posed by synthetic diamond mixing parallel the concerns in the colored gemstone industry, where high-quality synthetics may be difficult to distinguish from natural counterparts. Currently, laboratories can only test in small groups, at a high cost per unit. When separating naturals from synthetics or imitations. These are effective in testing most or all quartz varieties, plus ruby, sapphire, emerald, spinel, and certain other varieties. However, there is no volume screening available. While researching this paper it was quite encouraging to find that some strides are being made in mass colored-stone testing. Tom Moses, GIA's Laboratory Director shared that they "have been testing automation for identifying small rubies and blue sapphires. We will release it in mid-2025. The testing time should be about one stone per second in sizes down to 1 mm. We share your concern in this area."⁹

The mixing or misrepresentation of synthetic/imitation and natural

gemstones can also be found regularly at industry trade events. Latta Keswani, GG and Reema Keswani, GG noted that, "at several recent trade fairs, we were surprised to find that an abundance of synthetic quartz varieties, ranging from rock crystal to amethyst and citrine, were being sold as natural gem materials. We also heard stories about quartz synthetics being sold as natural stones from experts, dealers & retailers alike."¹⁰ This article features a beautiful citrine bead strand made up of 49 faceted 20 mm beads. After submission to GGTL Laboratories in Switzerland these proved to be synthetic citrine.

With little to no research in the mixing of less expensive gemstones, published opinions and personal interviews of industry experts were gathered to offer more anecdotal or supporting personal observations.

In GemGuide's article titled *Gem Focus Feb 2019: Amethyst*, the rich history of amethyst among other interesting anecdotes are discussed. The GemWorld staff goes on to state, "Synthetic hydrothermal quartz is easily and inexpensively produced for many industrial applications. This method also makes varieties of quartz available for the gem market. While the identification is not too challenging, lower priced amethyst and other quartz varieties [are overlooked when it comes to] full identification." They further note that "Since this situation is not disclosed from the very beginning of the production chain, consumers are generally oblivious to the high possibility of their jewelry being made of synthetic amethyst. This is particularly common in inexpensive mass production jewelry set with calibrated stones."¹¹ There is a clear expressed concern here that synthetic stones are likely being sold as natural due to supply chain issues and the lack of consumer awareness of the possibility.

This same concern is expressed in SSEF's 2021 publication, *The Resurrection of Synthetic Colored Stones* written by Dr. M.S. Krzemnicki. The author states, "Occasionally, we encounter synthetic stones at SSEF that are submitted by our clients. Usually, they are quite surprised [when we identify synthetic stones]—at least in the colored stone market — [this issue] has very much vanished in people's minds and [no longer] considered a real threat when purchasing stones from an unknown supplier or at a local gem market."¹² Krzemnicki's conclusion indicates that synthetic and imitation options in the market have resulted in the jewelry trade no longer even considering if they might be buying and selling synthetics as a natural stones.

One of the veteran gem dealers interviewed for this research, who asked to remain anonymous, said they have known for years that synthetic amethyst and ametrine rough have been coming into Brazil from China saying it is hammered and mixed with natural rough. The current challenge is there is no proof of this practice taking place because there is no affordable mass screening available to either prove or deny it.¹³

We have established that the industry is dealing with a great number of synthetic and imitation options in the market today. While some varieties readily come to mind, there are others that few would think of questioning. An example of this would be peridot. Historically, when buying calibrated peridot on the open market, the ‘rule of thumb’ is that you could assume 15% was actually a green glass simulant. An instance of this was documented by Bear Williams, GG, EG of Stone Group Laboratory, in an article from GemGuide titled *Synthetic Peridot Gem Alert*. The article starts with stating, “Things are not always what they appear to be. In today’s world, new treatments and synthetics are appearing on a more regular basis. Many of these newer treatments, imitations, and synthetics are getting harder to separate from their natural counterpart.”¹⁴ Williams reviewed two peridots submitted to Stone Group Laboratory to confirm they were natural. After review of the first peridot, “The final verdict on this was that it was a very crafty piece of lead glass with just the right colorant to look like the real thing. (Note): The AGTA-GTC has also had recent incidents involving glass imitations of peridot submitted for identification.”¹² Continuing on to the review of the second stone revealed it was actually a flame-fusion synthetic corundum made to simulate the green of peridot. “This material was a dead ringer for peridot. The fact that both these types of peridot simulants were faceted with native-looking cuts lends credibility to their authenticity.”¹⁴ In the end, even with a very authentic looking cut, they were nothing more than simulants of natural peridot.

In a personal interview with Mr. Williams, he recounted numerous times where he had encountered gems being offered as natural that, after investigation, proved to be otherwise. Some of these instances were individual bigger stones, but others were samples taken from larger lots while performing spot checks for large US retailers. He expressed, “I can’t tell you how many things were caught in that time. Sometimes, just singles or a small batch, and sometimes entire shipments that were presented as one product that turned out to be something else. Examples were a turquoise shipment that was all dyed magnesite, or black opal passed off as

natural that was smoke treated.”¹⁵

Another interesting perspective appeared as a reprint in “The Roskin Report” written for the Italian “Gemological Review” in December 2024. It stated that Teri Brossmer observed “When a buyer’s decision is based on false or misleading information... the reputation of the entire gem and jewelry market is damaged. The failure to disclose gemstone characteristics is the real issue. Overpricing will always exist, but a knowledgeable buyer makes decisions based on provided information.”¹⁶

Almudena Gómez Espada concurred that “In [her] opinion, the lack of transparency is detrimental because it can deter potential customers.” There are also cases where characteristics are correctly disclosed, but the price is fraudulently inflated. Jeffery Bergman noted, “failure to transparently disclose gemstone characteristics regarding treatments, synthetic origin, or outright imitations is a much larger problem compared to overpricing.”¹⁶

In GemWorld’s *Gem Focus October 2021: Prasiolite* by Cigdem Lule, PhD, FGA, GIA, GG, DGA for Gemworld has one of the most concerning statements. In the article Dr. Lule states, “One might argue that the price point of quartz-group gemstones is so low that the complications about their varietal differences or origins should not be a concern. It is an ethical dilemma. The seller is responsible for disclosing the correct information on any gemstone on offer regardless of their value.” She claims, “Apart from the varietal name discussions, the natural vs. synthetic origin of single crystal quartz varieties from rock crystal to amethyst and their disclosure are very questionable in global markets. According to researchers, it is not unrealistic to think the majority of single-crystal quartz varieties in the market such as amethyst and citrine are simply synthetic. There is practically no quick and economic way of separating the synthetic quartz from the natural, therefore all gets mixed in the marketplace.”¹⁷



Figure 2: Manmade synthetic ametrine (top center), nanosital glass imitation ametrine (lower left), and natural ametrine (lower right)

When speaking to Dr. Lule, she had a lot to say about the subject. She shared numerous occasions she observed specific gems sent in for identification and how much turned out to be something other than what the gems were sold as. She also spoke directly to a company recently at one of the US gemstone and jewelry tradeshow about stones resembling tourmaline. When she asked the vendor what they were, she was told they were fluorite stones. After checking the stones, they proved to be synthetic quartz made in a tourmaline color. She believed this dealer was offering the stones as they had been sold to him, and didn't even know they were synthetic quartz.¹⁸

Beyond quartz variety gemstones, there is a whole host of other gem varieties with credible synthetic or imitation options. These include black onyx, malachite, lapis lazuli, red jasper, mother of pearl, turquoise, and more.

In GemWorld's Gem Notes article titled *Imitation Turquoise*, an analysis is presented of turquoise bead samples taken from a large lot purchased from a Chinese vendor, who had labeled the material as stabilized turquoise. These were sent to Stone Group Lab for more detailed analysis. "Using Raman, an exact identification was determined. The material was identified as dyed magnesite, a member of the calcite group that is commonly used in stucco." They add that, "21 million tons of magnesite is mined annually, [and] its susceptibility to take dye increases the likelihood that the trade will see it more frequently as an imitation for opaque bead materials."¹⁹

"Of course, the sad part of this story is the intent to defraud that occurred. This import firm was prudent in their quest for honesty and sent a sample to us for examination. Had the strand not been

investigated, these strands would have soon ended up in major retail chain stores that they supply, being sold as turquoise. You can imagine the ramifications that could have resulted in the sale of thousands of these strands."¹⁸ While these bead strands may be perceived as inexpensive, when you consider it being sold in thousands of strands at a time, it multiplies into a significant amount of money.

Across the various interviews conducted for this paper, many in the trade expressed the belief that 50% or more of beads on the market today are simulants or imitations. During that time, the opportunity to conduct field research also presented itself. After visiting a large national bead retailer, I decided to purchase a handful of bead strands to analyze. I bought these from the "gemstone bead racks" and brought them back to our office to review. All proved to be some sort of imitation or simulant. I then met with the retail buyers of the store a few weeks later. I pointed out that all the beads I had purchased, listed as citrine, fire agate, amethyst, black agate, and carnelian, were in fact simulants. The response I received surprised me. "That doesn't surprise us," was their answer. These same beads were still in the gemstone bead section three months later.



Figure 3: Imitation gemstone beads

INDUSTRY VIEW ON WHAT CONSUMERS HAVE TO SAY

When I posed the question "do consumers care if they are sold a natural and it turns out to be a synthetic or imitation?" to various professionals in the trade, I received a variety of responses anywhere from an emphatic "OF COURSE THEY DO"²⁰ to "these are cheap stones, and the consumer just cares about the look."²¹ Under certain conditions, maybe both are right. Though, the lack of transparency is where the issue occurs. If consumers only care

about the look and they are told at the point of sale that the gems are not real, then there is absolutely no ethical dilemma. There is also no problem if the purpose of the synthetics and imitations is simply to offer a beautiful and affordable item also disclosed as a synthetic gemstone. The concern arises when the customer is told directly, or by omission, that the stones are natural, but then later the consumer finds out they are synthetic.

While at a loss for research on consumer attitudes in the case of unknowingly purchasing synthetic or imitation gems, there was some interesting research done on consumer attitudes toward synthetic and natural stones as a whole. Solitaire International published an article titled *Colored Stone Preferences Among Younger Generations*, which looked into a variety of attitudes in reference to colored gemstones. “Given the choice between natural or synthetic gemstones, 70% chose natural gemstones. Only 6% selected synthetic, while an additional 15% expressed no interest.”²² While this survey did not ask how they would feel if they purchased a natural gem and later found it was synthetic, we can arguably assume the 70% who preferred natural gems over synthetic would be disappointed.

In a JCK article titled *Consumers View Natural, Lab-Grown Diamonds Differently*, Says De Beers, the results of a consumer survey revealed that 60% of consumers view natural diamonds as “authentic” compared to 6% for synthetic stones.²³ Again, the survey did not ask consumers’ opinions if they were to buy a natural stone only to later find they were sold a synthetic. It likely would be those same 60% who do not look at synthetics as “authentic” that would view this as unacceptable.

The legal requirement in the United States is another aspect the industry should consider when discussing synthetic misrepresentation. In an interview with Sara Yood of Jewelers Vigilance Committee, she shared very clear and definitive answers to some key questions.

Eric Braunwart (interviewer): What does the law say when a company sells a group of stones and 20% turn out to have synthetic/imitation mixed in?

Sara Yood (interviewee): There is no accepted tolerance level for this: undisclosed synthetic gemstones or imitation gemstones sold as natural violate the FTC guidelines and would be considered fraud under the law.

Braunwart: What is the situation if the seller doesn’t know there are synthetics/imitations mixed in?

Yood: Ignorance is not a defense here -- sellers are liable for undisclosed synthetic and imitation gems sold as natural, even if they did not know. In some cases, they would be able to turn around and sue their supplier for misrepresentation/fraud, but it’s a good reminder to all that testing and grading is incredibly important!

Braunwart: What if the stone’s value is just \$15 each? Is there a value limit?

Yood: Nope!

Braunwart: What is the situation when a seller offers a strand of citrine beads and just says they are citrine? Is “natural” inferred if there is not any imitation or synthetic clarifier in front of “citrine”?

Yood: Yes, under the FTC Jewelry Guides, the name of a gemstone without qualification implies that it is a natural stone.²⁴ As seen in Figure 4, without identification of “imitation” in the name, these beads are assumed to be natural based on the FTC guidelines. This is a clear example of misrepresentation.



Figure 4: Imitation gemstone beads misrepresented as natural citrine, carnelian, fire agate, and black onyx

THE ROLE OF CONSUMER EDUCATION

Many of the experts interviewed felt educating consumers about the differences between synthetic, imitation, and natural gemstones is crucial for maintaining trust in the marketplace. Consumers who understand the implications of purchasing synthetic stones, whether for social or financial reasons, are more likely to make informed decisions. Many felt it should not be the

consumers' responsibility to protect themselves. To support this, there are consumer-directed publications available, such as the buying guides by Renee Newman and Antoniette Matlins that do have some information on the possibility of synthetic or imitation stones being offered as natural, and some things to watch for.

There certainly is a role for consumers in this discussion that is not being utilized. It seems even the Federal Trade Commission agrees as shown in their consumer advice article *Buying Gemstones, Diamonds, and Pearls*. They urge consumers to get involved and that, "Learning the terminology used by sellers of gemstones will help you decide if the particular piece of jewelry is what you are looking for and if it is worth the price."²⁵

THE POWER OF TRACEABLE SUPPLY CHAINS

First, what does the term 'traceable supply chain mean'? In a broad sense it means that the gems have been documented as they move along the supply chain. This may be from the very start when the stones are mined, or it may start somewhere further down the supply chain.

If done properly, each person along the supply chain should have visibility and be informed enough to understand what came before them. In colored stones this can be a tall order because 80% or more of all colored stones are produced by small-scale artisanal miners. Many of these artisanal miners do not produce enough 'rough' gems to make it worthwhile to go directly to cutting. So, it is often combined with five or ten other small miners' production to make a group large enough to cut or sell. This is especially common in small sizes (under .25 carat) of gem rough or inexpensive stone varieties. When this happens, it becomes very difficult to track which individual stones came from which individual mine. The broker, or aggregator, must carefully look at each small group of rough to avoid the introduction of simulants or synthetics. In the case where small groups are aggregated together, they often are produced in a similar area. Colored stone supply chains would look at this as regional production rather than mine-specific. Aggregating does present the risk and possibility of synthetic/imitation rough gems being mixed in simply because it comes from numerous small miners that the broker or aggregator may not necessarily oversee directly. Again, this is why it is important for any broker or aggregator to carefully check all the small parcels of rough prior to combining for sale.

Another stage in the supply chain where mixing can occur is in

cutting. Once these stones are cut, they are most often combined into larger lots of similar gems, commonly from different origins. This happens to make large enough groups that will appeal to a volume stone buyer. At this point, many of these parcels are purchased and added to other lots of similar size and quality gems, again opening another point for potential mixing, and this risk continues to grow as it flows through the supply chain without proper tracking and tracing. As one can see, there are plenty of points where synthetics and imitation gemstones can enter the supply chain because each time these stones change hands, or change shape, there is the opportunity for other stones to be added in.

Only through careful inspection and documentation at each of these stages can traceable supply chains help solve the mixing problem. This would need to be equivalent to the Japanese jidoka quality inspection system developed by Toyota, where quality is inspected at every station along the production line. When done properly, this means problems are identified along the supply chain and addressed before going to the next buyer.

SUMMARY OF FINDINGS

1. Misrepresentation of gemstones is happening and has been over hundreds of years. Mixing natural with synthetic diamonds is happening. Mixing less expensive varieties of colored gemstones is believed to be happening, but there is no information to prove or disprove this.
2. There is no consensus as to how much mixing may be taking place in colored gemstones.
3. There are tests that can separate natural gemstones, as well as all imitation and nearly all synthetics colored stones.
4. Currently, there is no mass screening available for less expensive colored gemstones, though GIA will debut a volume screening for small corundum in 2025.
5. Consumers perceive natural gemstones to be a more desirable product than synthetic or imitation gems, but there is currently no research available to determine attitudes if they were sold a natural that later turned out to be synthetic.
6. Nearly every industry professional interviewed during the research phase of this paper believes more consumer education materials are needed.
7. There are more consumers interested in authenticity and accurate information about the gemstones they buy than those

who are just looking for something pretty.

8. Traceable supply chains have the opportunity to help avoid synthetic mixing if done properly, but they themselves are not a guarantee to eliminate the issue all together.

CONCLUSION

The gemstone industry must embrace traceability and transparency to remain competitive and enticing in the minds of consumers, particularly those entering as the next buying generation. Retailers should prioritize consumer education and consider spot checking of less expensive colored gemstones or consider traceable supply chains to help mitigate a variety of risks including synthetic and imitation gemstone misrepresentation. Retailers should vet any of these ‘traceable supply chains’ to see if there are rigorous protocols in place that will genuinely help eliminate synthetic and natural mixing.

The development of more efficient and cost-effective screening technologies is crucial to assure colored stone gemstone integrity. Proper separation between natural gemstones and their manmade counterparts is essential to protect consumer confidence in the entire colored stone industry. Part of this advancement in technology needs to be usable for less expensive mass-produced gemstones.

Today’s consumers are increasingly aware of the importance of transparency in their purchasing decisions. Many expect companies to disclose more about the journey of the gemstone, including its origin. That said, these same consumers would expect to get a natural gemstone if they believed it was so at the time of purchase, no matter how inexpensive it may be. ‘Caveat emptor’ (Latin for ‘buyer beware’) is not going to be a slogan that should be associated with the colored gemstone industry.

Moreover, there is a lack of awareness regarding the risks posed by synthetic and imitation colored gemstones’ misrepresentation in the jewelry trade itself. This gap highlights the need for industry-wide education as to the risks retailers run, as well as the benefits they can accrue from selling authentic natural-colored gemstones.

We do know that a certain amount of mixing is happening in smaller sizes and less expensive gems. I believe it is necessary for the gem and jewelry industry to know what they are selling whether it is a \$15 stone or a \$15,000 stone. We know the majority of the \$15,000 stones will have gemstone reports done, but what about the less expensive gems that are likely to sell in a volume

compared to the one expensive colored gemstone for every 1,000 of the former. These inexpensive gems are “starter” gemstones and if we want consumers to continue to be excited to buy, we need to ensure the product integrity is intact to gain their trust from the start. This means the industry needs to develop affordable mass screening to support spot checking of high volume, less expensive gems to improve or assure the integrity of supply chains. The industry must take educating themselves on what is, or can be, misrepresented seriously and set a plan to address the issue directly. Just hoping or assuming the issue does not exist because you are working with inexpensive gems, or that it will just “go away,” is not a solution.

Given the use of instant messaging and social media that the younger generation relies on, the industry will one day find itself in an explosive social media scandal if no action is taken, and it will be extremely hard to undo the damage. Traceable supply chains can help support the consumer’s quest for authenticity, and for the stories of the lands and people who mine, cut, and set these stones into jewelry. We must understand that the consumer is the ultimate end of this supply chain, and it is imperative that the consumer is included in this conversation. Prioritizing the consumer and ensuring they get what they believe they are purchasing, no matter the actual value of the gemstone, will help guide the industry in making the changes required for long-term sustainability.

To close, I will leave you with one of the most salient comments given during my interviews: “**Knowing is difficult, believing is easy.**” - Cigdem Lule

ADDENDUM

Gemstone Treatments:²⁴ This is an entirely additional issue that this paper does not go into depth on, but it should be mentioned. It is a subset of natural gemstones, but the FTC states that any gemstone that undergoes any treatment that is not permanent, requires special care, or changes the value of the gem, must be disclosed to the consumer.

Many natural gemstones undergo treatments, such as heat treatment, diffusion, and fracture filling, among others, to improve their appearance. While these treatments are common, their undisclosed use can lead to consumer dissatisfaction. Consumers expect transparency regarding the treatments gemstones have undergone, as untreated stones are often valued more highly than treated stones. Again, with a robust tracing system these

treatments should be known to the seller and passed on to the consumer.

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