The World of Pink Diamonds and Identifying Them

By Branko Deljanin, Dr Adolf Peretti, and Matthias Alessandri

Fig 1: Loose Colored Diamonds Collection. Courtesy of Francis Errera LTD, Hong Kong.

Introduction

Only one in 10,000 natural diamonds has enough color to be graded a fancy-colored stone (Fig. 1). Blue and pink diamonds, especially when they are saturated enough to be called fancy red, are considered the most expensive natural gems by weight in the world (Fig. 2). Rio Tinto's Argyle mine in Australia has produced large quantities of diamonds since 1985, the majority of which are brown stones marketed as 'champagne' and 'cognac'.

Less than 0.1% of diamonds produced exhibit some pink coloration, and yet they represent 10% of the value of all Argyle diamonds. In today's market, Argyle pink diamonds (with paperwork proving origin) command a premium of around 15- 30 % over non-Argyle pink diamonds.

Fig 2: Different shapes and colors for Argyle pink and blue diamonds. Courtesy of Rio Tinto Diamonds, Perth.

One of the challenges in today's gem industry is to quickly and accurately identify the origin of the color of pink diamonds - natural, treated or synthetic. GRS laboratories joined forces with the CGL-GRS lab (a joint venture of GRS lab Hong Kong and CGL Vancouver) to establish research centers in Switzerland, Hong Kong, Thailand and Canada with the intention to create a task force for joint research and discovery of the arrivals of new diamond treatments and synthetics in the world market (published March 2014. ref 2, 3).

Current research projects include new CVD-grown diamonds and the provenance of pink diamonds (in-house research). The purpose of this paper is to examine natural pink diamonds (from four continents) and synthetic pink diamonds that are currently found in the market and to give some suggestions as to what dealers can do to spot them using standard, inexpensive instruments. The commercial significance of the various types will also be touched on.

Impact of Auction Sales

In the late 1980s, the public perception surrounding fancy-colored diamonds began to change when the 0.95-carat 'Hancock Red' from Brazil was sold for almost $1 million per carat at a Christie's auction. This stone was studied by one of the authors (Dr. Adolf Peretti) at that time. Since then, Dr. Peretti has documented the extreme impact this one sale has had on subsequent prices and the corresponding recognition of fancy diamonds as a desirable asset class. The demand for rare colors increased and the media began to play a more active role in showcasing new and previously unknown such stones.

Prized for their rarity and beauty, pink colored diamonds are hot-ticket items today, thanks in part to celebrities such as Jessica Biel, who received a pink diamond engagement ring from Justin Timberlake, and the 6.10-carat pink sparkler that Jennifer Lopez received from Ben Affleck.

The highest price ever paid for a gemstone? The "Pink Star' diamond offered at Sotheby's November 2013 Geneva auction was sold for $83.02 million. The GIA-graded fancy vivid pink diamond, nearly doubled the 2010 record price of $46 million set, also for a pink diamond. The 59.6 carat oval-cut pink diamond was acquired by the auction house after New York buyer defaulted. The stone is recorded in Sotheby's inventory at about $72 million U.S. dollars. (Source: Reuters)

Geology of the Argyle Mine

Rio Tinto's Argyle mine is located in the remote northwest region of Australia, southwest of Kununurra and 2,200 km northeast of Perth (Fig. 3).

The Kimberley Craton consists of a central core of a thick series of nearly flat-lying sedimentary and volcanic rocks that were deposited between 1.9 and 1.6 billion years ago, underlain by a base of crystalline igneous and metamorphic rocks. Early in 1976, geologists from Ashton Joint Venture found certain indicator minerals (such as ilmenite, chromite, chrome diopside, and pyrope garnet) in stream-gravel concentrates which indicated the presence of diamond-bearing host rocks.

Lamproites are special ultrapotassic magnesium-rich mantle-derived volcanic rocks with low CaO, Al2O3, Na2O and high K2O. Leucite, glass, K-richterite, K-feldspar and Cr-spinel are unique to lamproites and are not associated with kimberlites. The diamonds in lamproites are considered to be xenocrysts and derived from parts of the lithospheric mantle that lies above the regions of lamproite genesis. Kimberlites are also magmatic rocks but have a different composition and could contain non-Argyle origin pink diamonds.

Impact of Mining Activities

The Argyle mine first started producing diamonds 30 years ago and reached its peak output of 42 million carats from the lamproite pipe in 1994. Since then, the output has fallen to a recent low of 10 million carats, but with the underground operation now in place, the annual output is expected to increase beyond 20 million carats per year. In March 2014, two of the authors (Branko Deljanin and Dr. Adolf Peretti)

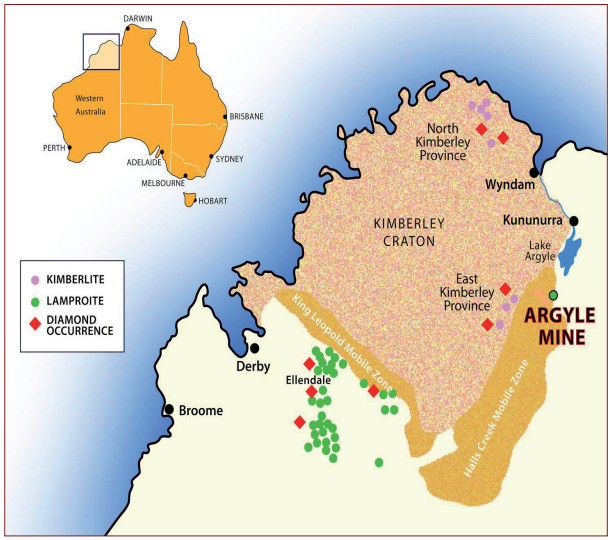

Fig 3: Location of Argyle diamond mine with geology. Courtesy of John Chapman, Perth.

Fig 4: B. Deljanin and Dr. Peretti at the Argyle mine in 2014. Courtesy of John Chapman, Perth.

made an expedition to the Argyle Mine and studied its geology and mining operations (Fig. 4). A unique information video was documented on this mine for possible movie release. They had a chance to visit the open pit operation that closed in 2013, the new underground operation and the processing/recovery plant. To date, 90% of the world's pink diamonds originate from the Argyle mine in Australia that has produced more than 790 million carats of diamonds so far. The fact that the mine was commercially able to transition successfully from open pit to underground operations is a good indication that the colored diamond market continues to thrive.

Processing

At the Argyle mine, the processing of lamproite rocks in order to find diamonds involves the following five basic operations:

1. Crushing the ore (in several steps)
2. Scrubbing the broken rock fragments with water to remove dust
3. Screening the ore into specific size fractions
4. Starting from a particular size fraction of the ore, concentrating the diamonds from other heavy minerals (e.g., garnet) using a heavy medium
5. Separating the diamonds from the other heavy minerals by means of X-ray screening

The average size of the Argyle rough is usually less than 0.10 carat (for crystals larger than 0.8 mm). The largest diamond crystal recovered to date (1991) was 42.60 carats. However, pink to red diamond crystals in general do not exceed 4 carats. Pink diamonds of 1 carat sizes are therefore considered 'single stones commanding special attention'.

More than 60% of the Argyle diamond crystals are irregular in shape (Fig. 5). Macles (twins) comprise about 25%, while 10% are naated or polycrystalline aggregates (industrial quality).

Although operations at Argyle have successfully moved underground, the mine's production life is only expected to run until approximately 2020. This limitation, combined with the rarity of pink diamonds, is a contributing factor to skyrocketing prices in recent times.

Argyle Pink Diamonds Testing And Value

Pink diamonds appeared only sporadically in jewelry until the discovery of the Argyle mine. In the mid-1980s, it became the first mine ever to produce a steady supply of melee (up to 0.10 carats) and smaller pink diamonds of less than one carat, along with the more rare 1.00 carat-plus pinks. The new mine supplied enough volume to make possible pavé setting jewelry with pink diamonds.

The entire annual production of Argyle pink diamonds greater than 0.50 carats could fit into the palm of one hand.

Fig 5: Brown and pink diamond crystals from the Argyle mine. Courtesy of Rio Tinto Diamonds, Perth.

Fig 6: The 1.68-carat Fancy Vivid Purplish Pink I1-RAD-Tweezers. Courtesy of Leibish, Tel Aviv.

The largest Argyle pink diamond is 'The Pink Jubilee', an 8.01-carat, half-rough, half-polished diamond. Its original weight was 12.76 carats, the largest pink rough stone ever produced by the western Australian mine.

Over the last five years, the demand for pink diamonds has increased in part due to the following factors:

- Exposure in mainstream media, most often in the form of celebrities buying them, as well as record-breaking prices at major auctions
- Australia's strict adherence to the Kimberley Process and the proven "conflict free" Australian origin
- The overall rarity of pink diamonds compared to other colors

Fig 7: Tiara with 175 Argyle pink diamonds with origin paperwork, offered for $2.25 million. Courtesy of Linnneys Jeweller, Perth.

Yaniv Marcus, from the diamond investment division of Leibish & Co. Israel, said: "In the last 20 years the value of rare fancy color diamonds such as a 1.00 carat Fancy Intense Pink with VS clarity has increased 30 fold. This increase is mainly caused by the desire of investors to find an alternative investment vehicle to secure wealth over a long period of time, and to pass it on to the next generation."

The rarest pink and blue diamonds are sold at annual tenders held in major cities around the world to a select group of diamond dealers. Only a few kilos of pinks are produced every year. These are mostly small diamonds and, as mentioned, a small portion of approximately 50 stones of over 1.00 carat are found each year. These stones gain strong attraction when they are sold in specially organized Argyle tenders.

Leibish made the decision to buy a 1.71 carat Fancy Intense stone and re-cut it to a 1.68-carat, Fancy Vivid Purplish Pink, radiant-shaped diamond, one of the largest Argyle vivid pinks currently available (Fig. 6). One of the luckiest combinations of numbers in the Chinese language is 168 as the numbers when spoken rhyme with the words which mean 'Forever Wealthy'.

Testing with standard gemological instruments, it is helpful to screen for Argyle diamonds that usually have very specific inclusions and a pronounced blue fluorescence under UV light. Checking fluorescence reaction is a very useful screening test when Argyle pink diamonds are mounted in jewelry (Figs 7, 8). When loose and examined under CPF (Cross Polarized Filters), Argyle pinks display a strong strain typical for type Ia natural diamonds (that contain nitrogen as impurity). In 2007, one of the authors (Branko Deljanin) initiated a research project, in conjunction with an international team, on the characterization of pink diamonds of different origins (ref.1). It found that under a UV lamp, Argyle stones exhibit

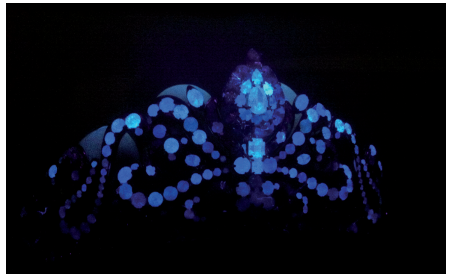

Fig 8: All Argyle diamonds in tiara fluoresce strong blue under LW light. Courtesy of NCJV, Perth.

typical fluorescence that corresponds to typical visible spectra and a characteristic 'fingerprint' in the infrared part of the spectra. While rare Golcondas and Brazilian pink diamonds are typically type IIa (do not contain nitrogen), Argyle pinks comprise nitrogen and are type Ia diamonds.

Fig 9: Fancy red 5.11-carat Moussaieff Red in ring. Courtesy www.moussaieff.co.uk

Argyle-type diamonds have specific characteristics that are quantifiable as the result of 'Advanced FingerprintingTM'. The data for every individually analyzed diamond is archived in the GRS research repository. To the best of our knowledge, Argyle diamonds are almost exclusively of a specific type (that will be reported in our next publication) and to date we have not discovered this type in any other mines in the world. There is no guarantee that this will be the case in the future, but as new mines with pink diamonds emerge on the market, such as the Lace mine in South Africa in the second quarter of 2015, their production will be tested and results compiled along with existing research.

Francis Errera, director of Francis Errera Ltd Hong Kong, an expert in natural fancy color diamonds declared: "I can't remember any better investment than pink diamonds. Even smaller sizes like 0.30 or 0.50 carat pink diamonds are so rare, increasing by 15-25 % per year since 1986. When I started marketing pink diamonds in 1977, a one carat Intense Pink diamond, and eye-clean clarity used to be sold for the same price as a one-carat colorless F color Internally Flawless stone. Today, the value of a one-carat Fancy Intense pink diamond with eye-clean clarity is about 25 to 30 times the value of a one carat diamond in F color and IF clarity. I really think that the future of pink diamonds prices will be brilliant, and I would advise all my best friends and clients to continue buying the pinks as an alternative investment form."

Historical Review and Characteristics of Non- Argyle Pinks

After India's major production of diamonds began in the 17th century (including rare, large Golconda colorless and pink diamonds), Brazil was the next primary source for colorless and colored diamonds, including rare pink stones originating from the panning of gravel in Brazilian rivers in the 17th century and until the present. It was in one such small river that a boy found a red 13.90-carat diamond crystal while swimming. In 1990, the crystal was subsequently purchased by William Goldberg Diamond Corp., and cut to produce a 5.11-carat fancy red, the largest of its kind. In 2001, it was purchased by Moussaieff Jewellers for $1.8 million per carat and re-named the 'Moussaieff Red' (Fig. 9).Originating from approximately one gram of carbon that turned red as a result of a right combination of pressure and temperature, the stone is currently valued at over $20 million. One of the authors (Branko Deljanin) had a chance to see this rare stone while working in New York.

Many other pinks have been mined in the last 100 years from special carrot shaped magmatic rock called kimberlite (central and south Africa, Russia, Canada). The following are known sources of pink and purple non-Argyle diamonds and their claim to fame regarding important stones in historical order:

- **Indonesia** (Borneo-Kalimantan); more pinkish brown, oldest diamond mining from rivers, starting in the 16th century.
- **India** (Golconda - 186 carats, Light Pink the 'Darya-i-Nur', Golconda - the 34.65-carat "Princie" Fancy Intense pink diamond sold in 2013 for $39,323,750, the 28.15-carat 'Agra' pink diamond) from kimberlite in the 17th century.

Fig 10: 0.25-carat rough Russian purple diamond. Courtesy of GRS, Hong Kong.

Fig 11: 9.99-carats of rough purple diamonds from the Diavik mine, Canada. Courtesy of Corona jewellery, Toronto.

- **Brazil** (Minas Gerais - the 5.11-carat "Moussaieff Red" in 1990) - from rivers in 18th century until now.
- **South Africa** (56.90 carats, the Fancy Vivid Pink 'Pink Star') - from kimberlite in late the 19th century until now (the Lace mine in South Africa in 2015).
- **Venezuela** (Santa Elena) - pink diamonds found in rivers in the 1920s until now.
- **Tanzania** (the 23.60-carat 'Williamson Pink', flawless) - in 1947 from kimberlite.
- **Congo** (Katanga Province - Kasai, a mixture of brown and pink) - from rivers in the mid 20th century.
- **Russia** (Siberia - Mir, mostly purple diamonds, Fig. 10) - from kimberlites in 1950s until now.
- **Canada** (Northwest Territories - Diavik mine in 2003, pinkish-purple diamonds, Fig. 11 and Northern Ontario - Victor mine in 2006, light pink) - from kimberlite, for the last 10 years.
- **Lesotho** (23.82-carat pink rough diamond from the Kao mine) - in 2014 from kimberlite.

It is interesting to note that some diamonds from different countries (like Russia and Canada) have very similar characteristics regarding color (more purple than pink) and gemological characteristics (no fluorescence, type Ia) indicative of the similar geological environments in which they were formed.

"Pink-color diamonds are rare, and especially in Canada. I am thrilled, on behalf of the Ontario government, to present this 2.74-carat pink diamond (Fig 12) as the first pink diamond from the De Beers Victor mine, cut and polished in Ontario," said Michael Gravelle, Minister of Natural Resources, Canada.

Pink diamonds of type IIa (like the 59.60-carat Pink Star) could be much larger than Argyle pink diamonds and have characteristic "tatami pattern" under CFP (Cross Polarized Filters) and not show any fluorescence or only faint reaction under UV lamp (table 1). Natural type IIa diamonds may be extremely large and of high clarity but normally contain some graining. Pink diamonds from Central Africa, Canada and Siberia tested at GRS labs also do not show fluorescence under the LW UV lamp and have very different 'fingerprints' in spectra (impurity positions) when tested with advanced instruments (UV-VIS, FTIR and PL spectrometers), so it is possible to distinguish them from Argyle pinks.

In 2014-15, GRS and CGL-GRS labs compiled an impressive database of all current major pink diamond producing countries using standard and advanced instruments. Some preliminary results based on studied and published articles are shown in Table 1 for general interest, and production from new sources will be tested as they become available.

Fig 12: The largest Canadian pink diamond set in a ring, 2.74-carat Light Pink SI1. Courtesy of HRA group, Vancouver.

Screening for Natural and Synthetic Diamond Types

Approximately 97% of all natural diamonds are considered type Ia, with the presence of nitrogen (N). These can occur in all colors including purple and pink. 1% of all diamonds are orangey-yellow to brown type Ib, and less than 2% are type IIa colorless, pink or light brown. Type IIa and IIb diamonds are the rarest of diamonds due to the absence of nitrogen impurities, but IIb contain boron and therefore they are blue.

Synthetic diamonds are created using either high pressure, high temperature (HPHT) or carbon vapour deposition (CVD). Nowadays, sizes from 0.50 to 1.50 carat are common. These processes can produce near-colourless type IIa, yellow type Ib, pink type Ib or IIa (after annealing and irradiation), and blue type IIa (new GRS research, see http://www.gemresearch. ch/news/2013-11-07_BlueDiamond/CVD-BlueDiamond.pdf) as well as type IIb. As such, knowing the approximate diamond type is a great help in the initial screening of diamonds. Some instruments like the type IIa

Table 1: general characteristics of pink natural & lab-grown diamonds using standard gemological instrument

Origin of Pink Diamonds	Magnification	Pattern under Cross Polarized Filters	LW/SW UV Fluorescence
Argyle (western Australia)	Graphite spots, "frosted" feathers, parallel pink octahedral graining	Strong multicolored TYPE Ia pattern	LW: med/str. blue SW: weak/med blue
Brazil, India - Golconda, Lesotho, South Africa, Tanzania	Weak parallel pink octahedral graining, mostly clean or high clarities	"Tatami" pattern in TYPE IIa	LW: none to weak blue (strong orange-Golconda) SW: none (weak orange - Golconda)
Brazil, Canada, Congo, Indonesia, Russia, Venezuela	Crystals, pinpoints, med/str. parallel pink octahedral and surface graining	Medium to strong TYPE Ia pattern	LW: none to med/strong blue SW: none to weak blue
HPHT-grown (synthetic)	Metallic crystals, cloud of flux white "pinpoints", cubo-octahedral zoning	Absence of any pattern indicates synthetic origin	LW: strong orangey red SW: strong red
CVD-grown (synthetic)	Black "pinpoints" in one plane (parallel to seed), no graining, amorphous black carbon, blackish clouds	Strong "columnar pattern" indicates synthetic origin, but "Tatami" similar to natural IIa is possible	LW: strong pinkish orange SW: strong pinkish red

Fig 13: Pink diamond of unknown origin between cross polarized filters under the microscope. Courtesy of CGL-GRS, Vancouver.

diamond spotter developed by SSEF are not enough to identify possible synthetic or treated origins of diamonds. It can only screen if a diamond is transparent to UV and if it is low in nitrogen, indicating a type IIa, IIb or a rare type IaB.

Visually, natural and synthetic diamonds can look very similar when comparing size, cut, color and clarity. Their commercial values differ significantly, however, which highlights the importance of detection and disclosure. For example, colored synthetics can easily cost 50-60% less than their natural counterparts. In the case of colourless lab-growns, the price difference is around 30-40%.

The Cross Polarized Filters (CPF) method is relatively simple and inexpensive to set up, and only requires a set of two linear polarization filters (or a portable polariscope) that are attached to any microscope (Fig. 13) or portable light source. To use the CPF method, position the suspected diamond between the Cross-Polarized filters and rotate it in transmitted light to observe birefringence patterns ('strain'). In combination with the simple CPF method, the fluorescence technique can be used to screen for diamond types and help identify a possible synthetic origin of a colored diamond.

The procedures explained here are relatively simple, easy to learn, and inexpensive. A CPF set and UV lamp costs about

$500. In the light of several occurrences of salted parcels of undisclosed diamonds reported in the last few years, vigilance and an understanding of gemological tools are critical to ensuring confidence in the supply line. CGL-GRS offers workshops on the use of standard instruments in screening for natural, treated and synthetic diamonds, the next one is at Mediterranean Conference in Greece, June 28 2015.

Synthetic diamond producers, such as AOTC Canada (HPHT-grown) and Scio Diamonds USA (CVD-grown) increased their production of pink diamonds by 5-10% over the last five years to meet higher consumer demand for more affordable but still color-stable pink lab-grown diamonds.

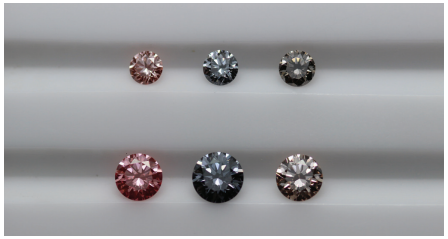

Fig 14: Group of PDC Orion pink and blue, Scio Diamonds brown CVD grown diamonds. Courtesy of GRS, Hong Kong

GRS and CGL-GRS labs acquired pink CVD-grown diamonds from a new producer Orion (PDC), Hong Kong, and compared them to pink diamonds of different origin (Fig. 14) from our research collection that includes natural pink diamonds from Argyle, natural pink non-Argyle diamonds from six different locations, CVD-grown plus irradiated and annealed pink diamonds by Scio Diamonds USA, HPHT enhanced, irradiated and annealed natural pink diamonds, HPHT-grown and irradiated pink diamonds by Chatham USA, HPHT-grown and irradiated diamonds by a Russian producer, HPHT-grown and HPHT-grown and irradiated diamonds by AOTC, Canada.

Characteristics of HPHT- Grown diamonds

AOTC, Chatham and Gemesis employ a traditional temperature gradient method to grow their stones. The capsule contains 'seeds' and metal-based material that will act as a solvent for the graphite and a catalyst to enable crystal growth. Nitrogen enters the growth capsule, making most of the synthetic diamond yellow, but they could be irradiated to produce pink color or nitrogen could be 'removed' to produce colorless stones. The majority of synthetic crystals are 1-4 carats, or 0.50-2.0 carats once they are polished. Even diamonds as big as five-carat polished, near-colorless, HPHT-grown diamonds were made in Russia by New Diamond Technologies in February 2015.

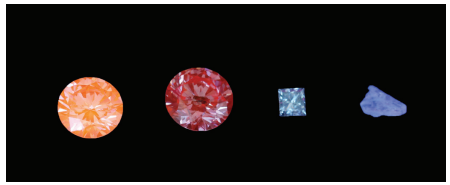

Fig 15: Synthetic pink diamonds show the strong pinkish orange (CVD on left) and orangey red (HPHT on center left) fluorescence in LWUV, and Argyle pinks react blue (center right and right). Courtesy of GRS, Hong Kong.

When 20 years ago these lab-grown diamonds entered the market, they were small and included (SI1-I2) and it was easy to separate them from natural stones based on triangular metallic incisions. But growing technology improved and over 70% of HPHT-grown diamonds are VS or better clarity. Luckily, due to irradiation treatment, HPHT-grown pink diamonds have characteristic strong orangey red reaction under both LW and SW UV light (Fig. 15) and it's a good screening technique to pick up these stones, even from parcels of melee pink diamonds or mounted stones. These diamonds are grown in a relatively short time in very stable controlled environments and will not show any pattern (stress) under CPF.

Characteristics of CVD- Grown Diamonds

In 2014, GRS and CGL-GRS reported on a new generation of Orion PDC Hong Kong pink CVD-grown diamonds of much more 'natural looking' fancy colors of all sizes (orangey pink and purplish pink) and higher clarity (VVS-VS) that are in the market (ref.3). They are harder to identify than HPHT-grown pink diamonds using standard gemological instruments. In this clarity range, it is not possible to distinguish them from pink natural diamonds just by using a loupe or microscope. In some CVD stones, black inclusions (assumed to be non-diamond carbon) are visible, and when located in one plane perpendicular to the direction of growth, they are a reliable indicator of the diamonds' CVD origin. Blackish irregular clouds that are found in this CVD-grown pink diamond from PDC are also a reliable indicator (Fig. 16).

All new pink color CVD samples are type IIa diamonds, very

low nitrogen diamonds. Observed between crossed polarized filters, they produce two general patterns: a natural-looking pattern similar to the 'tatami pattern' of type IIa natural diamonds and a 'columnar pattern' typical of CVD-grown diamonds (Fig. 17).

A quick screening of loose and mounted pink diamonds is possible by using UV illumination in a dark room. Strong pinkish orange (LW = SW) reaction is observed in type IIa pink CVD-grown diamonds as seen in Fig. 15.

In cases where the diamond is determined to be a type IIa based on the 'tatami' pattern, it is important to refer it to an advanced lab to determine whether the color is natural, treated or the stone is CVD-grown. After an initial screening with standard instruments, most pink diamonds should be tested with additional spectroscopic analysis to confirm their synthetic origin, because multistep treated natural diamonds can also show strong orange fluorescence under UV light.

Gerald McGuire, President and CEO, Scio Diamond Technology Corp. said: "SDT routinely makes rough gems in the 3-5 carat range and along with our joint development partner, Renaissance Diamonds Inc. we are delivering 1-2 carat finished gems (Fig. 14B). Scio Diamond announced a joint venture with partners in China to produce CVD-grown diamonds at a much lower cost. Scio Diamond is currently producing high-quality lab-grown pink diamonds that are priced reasonably and within the reach of many customers who favor pinks."

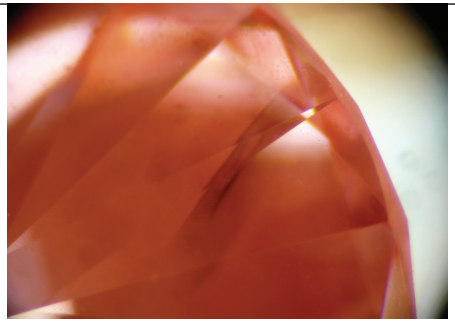

Fig 16: Pink CVD-grown Orion PDC stones have specific blackish "feathers". Courtesy of GRS, Hong Kong.

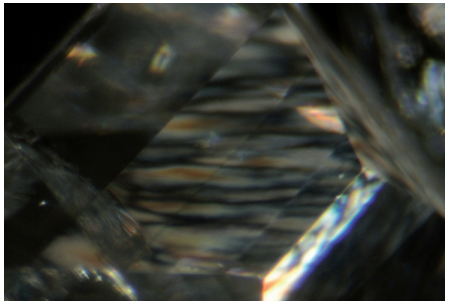

Fig 17: Columnar pattern under CPF of Scio CVD-grown Type IIa diamond indicates that diamond is grown by deposition. Courtesy of GRS, Hong Kong.

A Rosy Future

These days, consumers are very conscious about product origin. In addition to demanding fair trade coffee, there has been a growing interest in knowing where colored diamonds are coming from. Dealers and jewelers should both be ready to provide the answer. It is reported by Partnership Africa Canada, an active member of the Kimberley Process, that diamonds (including pink diamonds) from Venezuela (Santa Elena, on the Brazilian border) are illegally transported to Brazil and Guyana, and exported further through the Kimberley Process chain (ref.4). These authorities are asking to exclude Brazil and Venezuela from the Kimberly Process if they cannot halt the illegal transport of diamonds from their territories. Rio Tinto Diamonds in Australia and Canada are following all the rules implemented by governments regarding tracking of their diamonds, and it is believed that consumers are willing to pay an extra premium in order to know that their diamonds are coming from those conflict-free countries. Many labs, including GRS Lab (Hong Kong) Ltd, have joined the Kimberley Process.

Fig 14B: Group of Scio Diamonds pink CVD-grown diamonds. Courtesy of Scio Diamonds, Greenville, USA

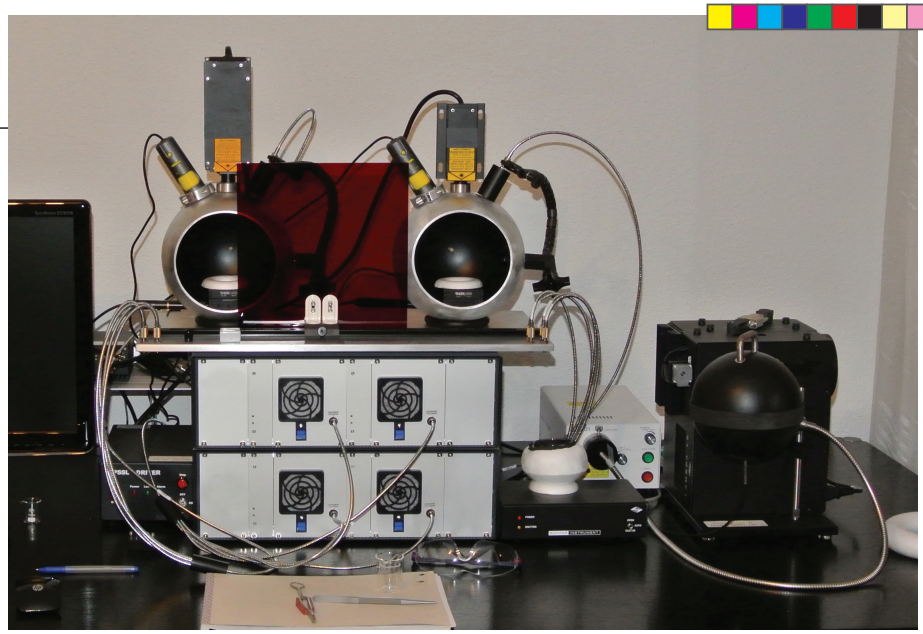

Fig 18: Photo luminescence instrument for diamonds in three GRS labs. All measurements are conducted at liquid nitrogen temperatures at photoluminescence analysis system with two laser sources at 405nm und 532nm and UV-VIS-NIR instrumentation with high resolution. Courtesy of GRS, Hong Kong.

Gemology is evolving and more advanced instruments are being used in gem labs for routine testing of diamonds and colored gems. The most widely used methods for separation of natural, treated and synthetic diamonds are optical methods (absorption and photoluminescence) that are used in gem labs to identify these stones. Representatives from GRS and CGL-GRS labs and other researchers on colored and synthetic gems and diamonds will present their findings at the 1st Mediterranean Gemmological and Jewelry Conference in Athens. See more on speakers at: www.gemconference.com.

Finally, it is possible to separate natural pink diamonds from all categories of treated and/or laboratory-grown diamonds, loose or mounted, of any size, by use of a combination of standard (see summary table below) and advanced gemological instruments as in Fig. 18.♦

Branko Deljanin: CGL-GRS Swiss Canadian Gemlab Inc, Canada (info@cglworld.ca)
Adolf Peretti: Dr. Peretti Co LTD, Thailand and GRS Laboratories (adolf@peretti.ch)
Matthias Alessandri: GRS Lab (Hong Kong) Ltd, Hong Kong, China

References:

1. *'Characterization of pink diamonds of different origin: Natural (Argyle, non-Argyle), irradiated, HPHT-treated, treated with multi-process, coated and synthetic'* B. Deljanin, D. Simic, A. Zaitsev, J. Chapman, T. Middleton, A. De Stefano, et al; Proceedings Volume of Diamond and Related Materials, 2008.
2. *'New Generation of Synthetic Diamonds Reaches The Market: Lab-grown Bue CVD Diamonds'*, Peretti A , Herzog F., Bieri W., Alessandri M., Günther D., Frick D., Cleveland, E., Zaitsev A.M., Deljanin B. Contribution to Gemmology, March 2014.
3. *'New Generation of Synthetic Diamonds Reaches the Market: Lab-grown Pink CVD Diamonds'*, Deljanin B , Herzog F., Bieri W., Alessandri M., Günther D., Frick D., Cleveland, E., Zaitsev A.M., Peretti A . Contribution to Gemmology # 14, 2014.
4. *'Triple Jeopardy'*, Partnership Africa Canada http://www.ddiglobal.org/login/resources/triple-jeopardy-2005-04.pdf