GEMOLOGICAL PROFILE

ABOUT SGL LAB

'Peace of mind, Assured' is not just a slogan for SGL and its team members but a promise which is the result of the latest science and state-of-the-art equipment with the highest possible quality standard and analytical infrastructure ensuring that each and every diamond passes through stringent quality checks for grading and certification, across all our laboratories worldwide.

SGL is co-headquartered in New York & London with other laboratories in Dubai, Mumbai, Surat, Jaipur, Kolkata, Hyderabad, Bangalore, Thrissur, Coimbatore & Pune.

SGL offers a broad spectrum of gemological courses to students from the industry, trade, and academia. The study of gemology is a fascinating undertaking that is ever-changing and challenging, Gemology combines elements of science, business, art, and history hence only a few professions can come together on such a broad and diverse range of fields. At SGL, gemology is a passion that we are always happy to share with our students, so if you have an interest in gemstones - whether it be with a view to developing your career within the industry, or simply as a hobby contact us at education@sgl-labs.com

All laboratory gemologists have a scientific and gemological education and work on a high level of experience and integrity. The laboratory is equipped with the most modern analytical instruments. This ensures that the authenticity of gemstones, origins, and possible treatments can be tested in the most scientific and reproducible manner with objectivity and expertise ensuring the integrity and accuracy of every analysis and report issued.

SGL employs more than 475 talented women and men across 5 countries that makes them an international team member working with an open-minded group that offers a diversified work environment and many interesting career perspectives.

CONTENT

INTRODUCTION

Diamonds are true products of nature, grown millions of years ago in the earth's crust, brought up to the surface by geological processes, and eventually found by a man who brings out its color and brilliance by cutting and polishing.

The gemmologist's eye looks beyond the sparkling outer appearance of the stones, attempting to understand how they have formed. Minute crystals, inclusions and subtle growth features trapped in their interior are witnesses of their formation millions of years ago, and in tens or even hundreds of kilometers below the earth. This inner life allows us to detect their identity, authenticity, and even their geographic origin.

We intend to share with you the story that your diamond tells us on its very individual history and personality.

HISTORY & SYMBOLISM OF DIAMOND

Diamond has been considered the most precious stone. The word diamond is derived from Late Latin 'diamas', from Latin 'Adamas', which is of Greek origin meaning "invincible, untamed". India is where the diamonds were discovered, dating back almost 2400 years ago until the 1730s India was the only known source of diamonds in the world. The first-ever diamonds found were in the center of India after the thunderstorms in the fields. People believed that strong lightning led to the formation of diamonds and was considered to be a gift from the gods. It was unknown to these early diamond gatherers that they lived over a colluvial deposit of diamonds, which is a deposit close to a diamond pipe where the diamonds were being re-deposited by wind and rain. And when the thunderstorms washed away a layer of the topsoil thereby exposing the diamonds contained in the ground deposits. The Golconda mines are located between two rivers in the region of central India. Most of the diamonds were found in alluvial deposits of those rivers, these deposits remained to be the main source of the Indian diamonds before the prime volcanic source was found. It is important to know that most of the world's finest diamonds came from the Golconda region of India. Names such as the Nizam diamond, Koh-i-Noor, the Orlov, the Hope, and the Sancy diamonds. Though all of these diamonds came from the alluvial deposits in the Golconda region it was only with the find of the Majhgawan lamproite diamond-bearing volcanic pipe India found its prime source. As the European demand for diamonds grew at a fast pace, the production of the Indian diamond deposits began to dwindle by comparison. In 1725 a group of gold miners working alluvial deposits in Brazil stumbled upon an area that produced diamonds mixed in with their gold ore. A new diamond source had been found! It was later found that 12 areas of Brazil produced diamonds. These ranged all the way from the southern region outside of Sau Paulo, to an area that encompassed the entire Amazon River delta. Brazil was able to produce a huge amount of diamonds, resulting in the diamond market price fall by almost 70% shortly after the Brazilian diamond discovery. With the availability of a huge source of diamonds at cheap prices, the demand for diamonds in Europe increased. And eventually, the easily mined alluvial diamond deposits in Brazil started to diminish as the deposits were worked out. This caused an eventual shortage of rough diamonds in a market of huge demand, which in turn caused prices to increase dramatically. As is the case in any economy of supply and demand, the sudden decrease in diamond availability in the late 1740s, and the ensuing dramatic increase in price caused the diamond markets to virtually collapse.

THE 4Cs OF DIAMOND QUALITY

DESCRIPTION

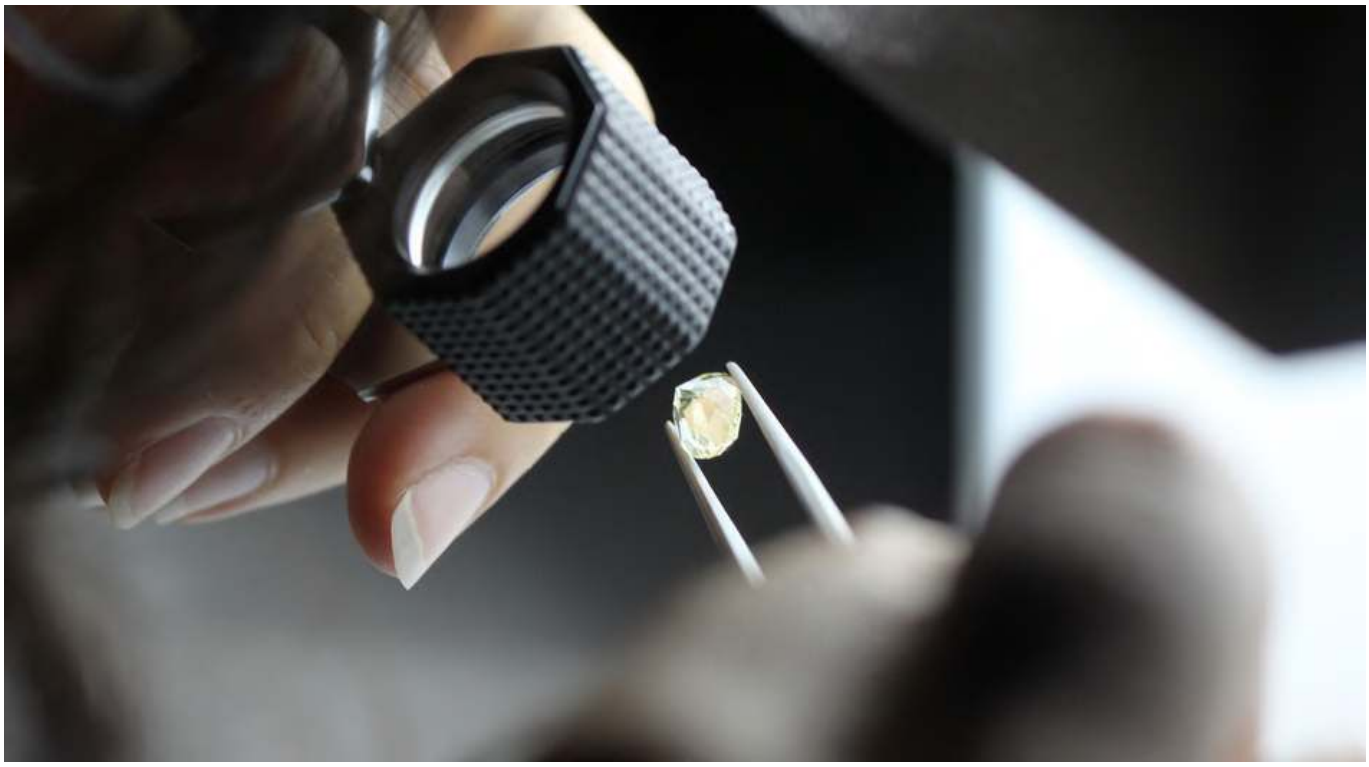
Diamond grading is based on the 4Cs: cut, color, clarity, and carat. The combination of these four factors determines the quality of a diamond.

WEIGHT (CARAT)

Diamonds are minerals formed deep in the earth, under specific geologic conditions. Not only is a delicate mineralogical balance essential for diamonds to be formed, but also specific pressure and temperature conditions. Furthermore, a sufficient supply of a rare combination of chemical elements is another necessity required for the formation of diamonds. The strongest material known to man, a diamond consists purely of carbon, making it the only gem consisting of a single element (it consists of 99.95% carbon). The remaining 0.5% is believed to consist of trace elements, which can have an effect on the color of a diamond but are not a part of its chemical structure or molecular make-up. The skill of a craftsman plays an important role that can enhance or lower the beauty of a gem & which can reduce wastage and retain more weight from the rough.

COLOR

One of the most important criteria of a diamond is its color. Most people believe diamonds are colorless, but even those diamonds that look colorless are usually slightly tinted yellow, brown or grey. A colorless diamond is like a clear white glass it allows more light to pass through the less tinted it is; it would also have more sparkle and fire. Exceptionally colorless diamonds are very rare and are therefore more valuable. Diamonds that range from colorless to light yellow or light brown fall within the normal color range.Diamonds also come in a range of colors. These fancy colored diamonds which exhibit color outside the normal range are extremely rare. They range from any color from blue to green to bright yellow. They are called fancy colored diamonds and are more valuable because of their color and rarity. The D to Z scale does not apply to fancy colored diamonds. The scale from D to Z measures the lack of color in a diamond.



SHAPE & CUT

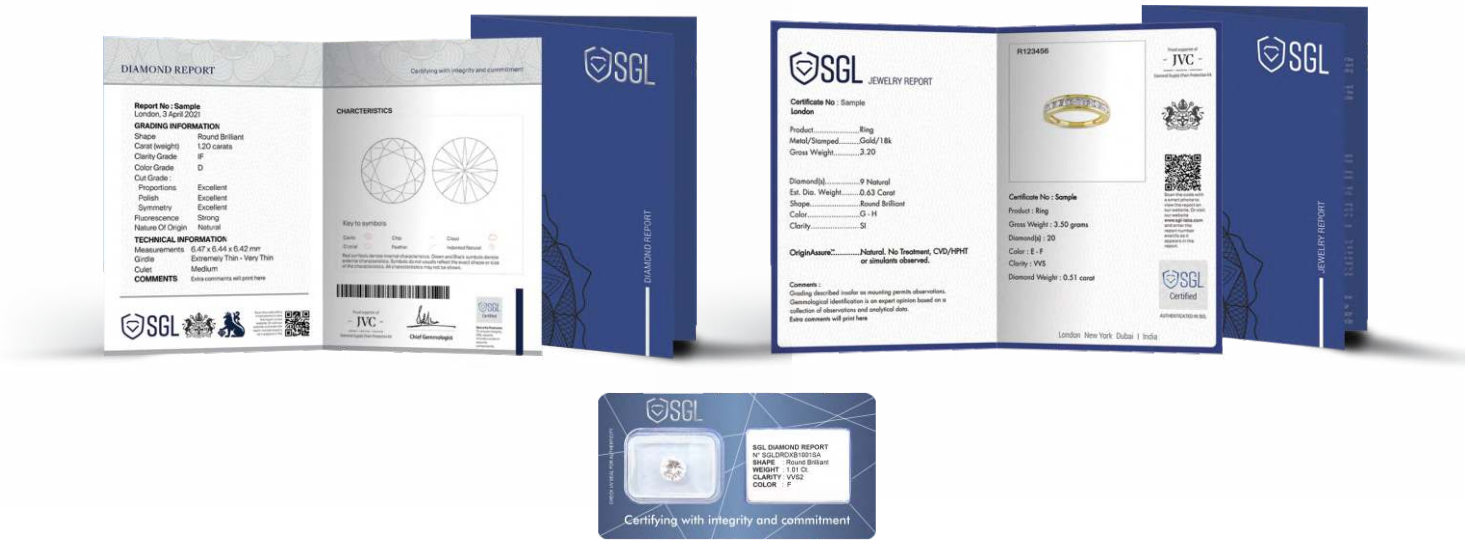
The final shape and cut of the gemstone is the result of a highly complex decision taken by the cutter, and mainly defined by the shape and the quality of the rough crystal. The cutter tries to find a balance between enhancing the color, brilliance and transparency, while retaining as much weight of the crystal as possible. A diamond cut constitutes a more or less symmetrical arrangement of facets, which together modify the shape and appearance of a diamond crystal. Diamond cutters must consider several factors, such as the shape and size of the crystal when choosing a cut. The practical history of diamond cuts can be traced back to the Middle Ages, while their theoretical basis was not developed until the turn of the 20th century. Design, creation and innovation continue to the present day: new technology notably laser cutting and computer-aided design has enabled the development of cuts whose complexity, optical performance, and waste reduction were hitherto unthinkable. The round brilliant is the dominant cut in the market.Although many cutters seek to combine artistic flair with the optical properties of a diamond to retain more weight from the rough. Today laboratories use an international cut grading system that can help detect the quality of the cut.

CLARITY

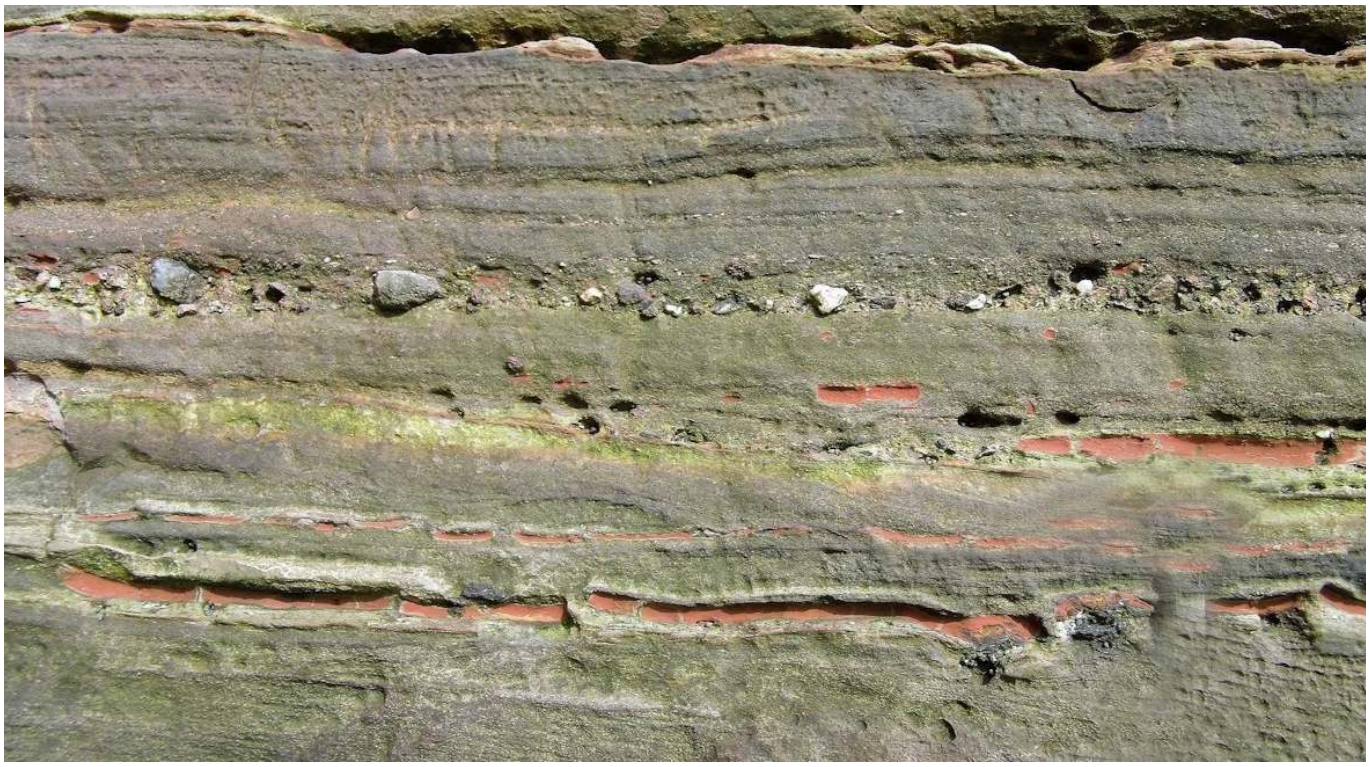
Defining clarity in terms of diamonds is how free a diamond is from external and internal characteristics (blemishes and inclusions). Inclusions are internal features and blemishes are marks confined to the surface of a diamond. Inclusions have a big effect on light transmission, so in turn it has an influence on the clarity grade. Inclusions and blemishes act as a fingerprint to identify a diamond and make each diamond unique. No two diamonds have the exact same clarity features. A diamond's clarity helps identify a diamond from simulants. Before deciding the clarity of a diamond, certain factors are considered such as size, location, numbers, relief & nature. Common clarity characteristics of a diamond are needle, crystals, feathers, knot, cloud etc

IDENTITY & AUTHENTICITY

One most fundamental information any gem lab report has to provide is the identity of the stone. Diamond is identified by viewing the color, clarity, carat(weight) and cut of the stone. Color of the diamond is graded by comparing the stone with the master stones using a white background and daylight equivalent light. A master stone helps you trace the depth of color in diamonds within the normal color range.
Diamonds in the normal color range are graded against a colorless to light yellow master stones set. The same master stone is used to grade the color for brown and grey diamonds in the normal color range. Subtle differences in color are more visible from the pavilion; because of this, diamonds are compared and graded against a master stone face down. Each stone in a master stone set represents the least amount of color in its color range. For diamonds exhibiting color between two ranges, compare each master stone next to both sides of the diamond if you find one side gives a lighter color, go with the color grade higher. For e.g., a diamond in a face-down view with less color than a diamond face-down H master stone is considered, G. Clarity of a diamond must be graded using a microscope as well as loupe. Look at the stone in all directions and all facets. You can use the wedge technique: divide your stone in eight wedges, so you can assess each section one by one from crown, girdle and pavilion view. Switch to a loupe to assess the final grade. You can also only use a loupe instead of a microscope. The loupe must be a triplet corrected for color distortion (chromatic aberration) and linear distortion (spherical aberration). When you focus on a point, the area around that is clear is called depth of field. The more you increase the magnification, the more shallow the depth of field becomes. Use this to understand the location of a characteristic: focus on the table, if you can see a characteristic clear it is probably right under the surface or a blemish. The weight of a diamond has a big effect on the price. Digital scales are quick, easy and a widely used device for weighing diamonds. The most accurate and reliable digital scales are electronic scales, they can measure the weight of individual stones or large parcels. After weighing the stone on the digital scale, it must be then mentioned on the certificate. The cut is an overall estimation of various proportions of a diamond. The cut is the overall assessment of proportions such as table percentage, crown angle, crown height, total depth, pavilion angle, girdle thickness etc.



After measuring all the proportions based on the table percentage, crown height percentage and pavilion depth percentage a final cut grade is given to the stone. Thus cut is an important aspect to measure the quality of a diamond. All the factors affecting cut are considered & the final cut grade is mentioned on the certificate. Different materials might be used to fake a diamond, acting as so-called simulants. Clearly, the value of a simulant is a fraction only of the true diamond. As diamonds can also be grown synthetically, the authenticity needs be addressed; is the diamond indeed of natural provenance, i.e. grown millions of years ago in the depth of the earth, or if it is a synthetic diamond, i.e. a man-made crystal? Synthetic diamonds are known since the late 1950s, and possess chemical and physical properties almost identical to natural diamonds. But the production and hence the supply of synthetic diamond is virtually unlimited, which reduces their value dramatically compared to a naturally grown diamond.



ORIGIN

Throughout history, diamonds have been associated with specific countries and mining localities by virtue of their outstanding beauty and quality. However, the outward splendour of a diamond is not all that contributes to the prominence of a particular source. The history and notoriety – often tumultuous – with which many exceptional diamonds are associated, have contributed greatly to the reputation of a few specific deposits.

HISTORY OF DIAMOND MINES

Although the world's first diamond deposits are believed to have formed 900 million years ago, the first stones were found in India in the fourth century BC. But now the mine production has changed and the largest diamond producing mines are located in Russia. Home to arguably the richest and largest diamond resources in the world, Russia tops the list with more than 12 open-pit mines.With mining starting in 1947, Russia now tops the world's diamond production hierarchy. It is also the world's largest exporter of rough diamonds by volume. The country's major miner is a group of companies called ALROSA, which produces the majority of Russia's diamond output. Aikhal located in Sakha (Yakutia), Republic of Russia, is the world's biggest diamond mine. It comprises various deposits, including the Jubilee Pipe, Aikhal Pipe, Komsomolskaya Pipe, and Zaria Pipe. The Jubilee and Komsomolskaya pipes are mined through open-pit methods. The Jubilee pipe is currently operating at a depth of 390m and planned to reach an ultimate depth of 720m.

The Aikhal pipe was also mined through open-pit methods until 1997 before it switched to underground mining using the cut-and-fill mining method. The Zaria pipe is currently under development and will be mined through open-pit methods using selective mining. Commercial production from the open-pit is expected to commence in 2021.

Africa's top diamond producer, Botswana sits second in this global list. Since the 1870s, most gem-quality stones have been mined in Africa and, in 2017, the value of diamond exports from African countries in the global market was valued at $9.65bn.

Diamond exploration started in Botswana in the 1950s, with mining officially launching in 1971. Some of the world's highest-yielding mines were unearthed in Botswana by the mid-1980s. The African country's diamonds are generally larger than those mined in Russia and boast a better quality. Botswana houses seven top-class mines, out of which Orapa and Jwaneng, are the world's two most productive diamond mines. Jwaneng alone produces an average of 10 million carats per annum. The other diamond producing countries are Republic of Congo, Australia , Canada etc.

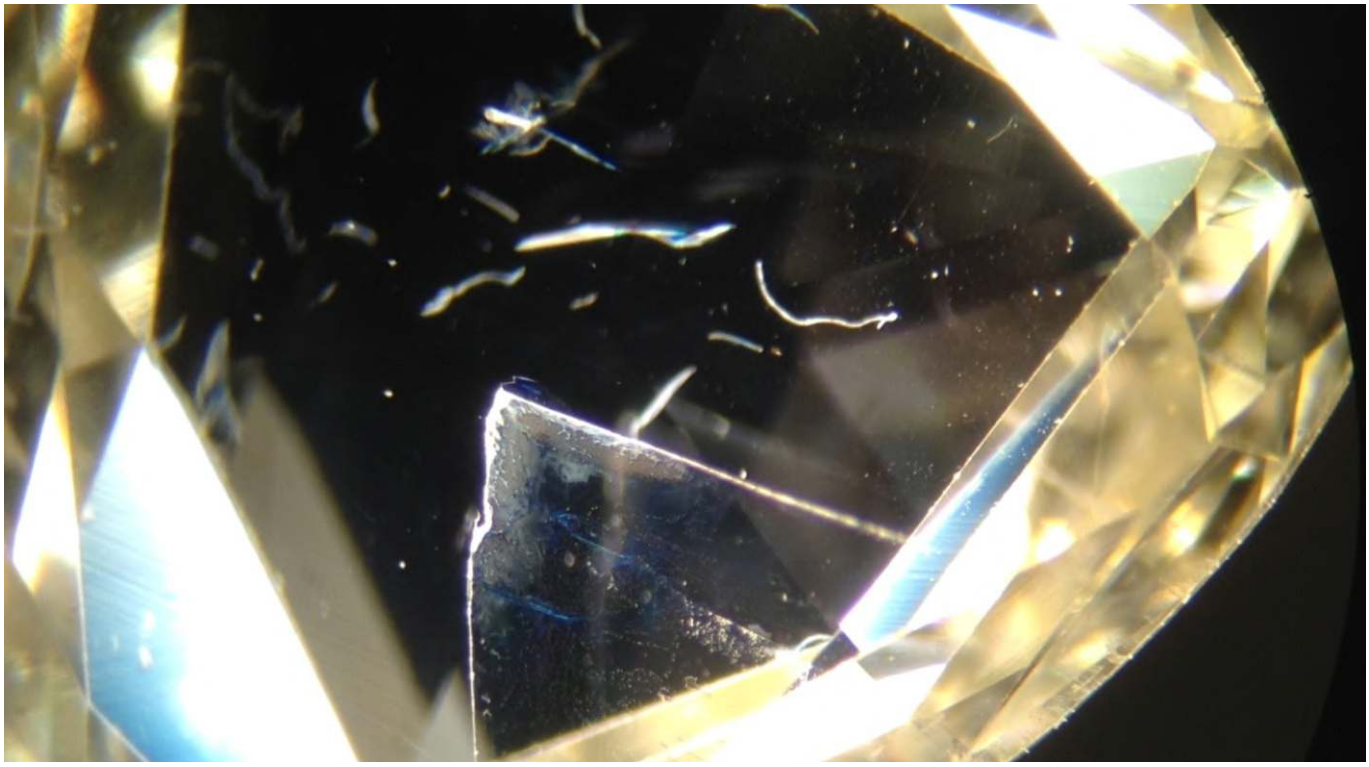
DETERMINATION OF ORIGIN

GEOLOGY & AGE

Diamonds form in two different igneous rocks: Peridotite and Eclogite. They are present in different geological conditions and have different compositions; the presence of carbon that they supply in different conditions is what they have in common. When two of the Earth's crustal plates collide, subduction takes place: one plate is forced under the other. The lower plates, going downwards, heat up and its components release carbon. If the temperature and the pressure are favourable, diamonds are formed. When diamonds are formed, it is still between the upper mantle and the crust, it could stay there for millions of years unless a geological process, called emplacement that delivers material to the surface, takes place. The material carried to the surface is an igneous rock (kimberlite or lamproite) and sometimes they carry diamonds. The first emplacements took place 2.5 billion years ago and the latest known was approximately 20 million years ago. Therefore diamonds we see now are at least 20 million years old. The most common deposits where diamonds are mined are kimberlite deposits, like the sources in South Africa. The most famous lamproite deposit is the Argyle mine in Australia. While the kimberlite is pushed to the surface, it creates a deep vertical tunnel, wider at the top called a pipe. Depending on the kind of deposit, they might look different: kimberlite pipes look similar to carrots and lamproite pipes more like mushrooms.

A diamond in a kimberlite rock

TREATMENT



A diamond Inclusion

Induced by the tectonic conditions during their growth, diamonds are prone to fracturing. The brittleness of the crystal structure of diamond, is even furthering the formation of fractures and fissures. Despite skilful cutting a few fissures remain in some diamonds. Depending on the number, size, position and orientation of the fissures, they might lower the transparency of the diamond, or even affect its stability. By filling these fissures and fractures with a foreign substance such as oil, resin or wax, their presence can be masked, and the clarity of the diamond can be enhanced. Such a procedure is referred to as fracture-filling treatment, which is done to enhance the clarity of a diamond and to make the diamond appear more beautiful. Another treatment done for diamonds is laser-drilled diamonds.

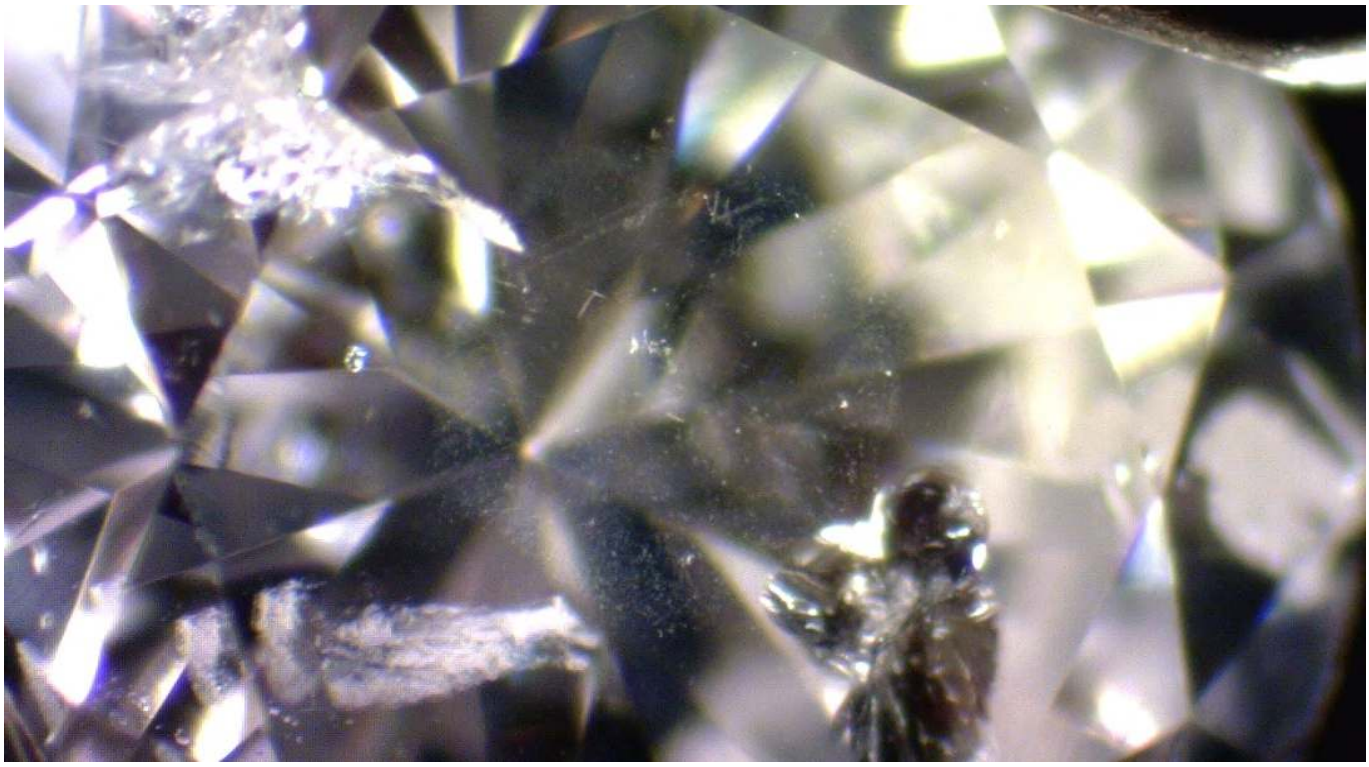
.In such a diamond a very tiny laser hole is drilled to access an unsightly inclusion. Once a passageway has been opened up, the diamond is boiled in acid or other chemicals to bleach the inclusion. Sometimes the inclusion is removed by burning it away with the laser. This treatment is done to enhance the clarity and such a treatment is a permanent treatment, unlike fracture-filling. If any such treatment is done then the lab needs to disclose about the treatment. Clarity enhancement of diamond by fracture-filling is a reversible and repeatable process and fissures may be filled and cleaned multiple times during their life. This is especially true when oil is used as a filling agent because oil dries out over time and it can leak out when heated or when surrounding air pressure is changed. But generally, all types of filling material, including epoxy and resins, can be removed. The reversibility and repeatability of this process implies a possible change of appearance of the stone.

WITHIN DIAMOND

Careful study of the internal features and properties gives valuable insights into the identity, authenticity and sometimes the origin of a diamond. All these characteristics are the result of the individual history of this specific diamond, providing a patchy and fragmented - but very personal - diary from its growth in the inner of the earth, its uplift to the surface, to the mining process and finally the processing by man.
The growth of the crystal is controlled by the geological setting in which the mineral formed, the pressure and temperature conditions and the specific chemical environment prevailing at that time.

MICROSCOPIC FEATURES

In combination with the magnifying aid of a microscope, the experienced human eye provides an extremely sensitive, powerful and versatile analytical tool. The determination and description of the microscopic characteristics found in a diamond - ranging from tiny crystals, feathers, cloud, needles, to growth features and minute fissures - provide a comprehensive qualitative survey indispensable for any gemological conclusion.



CHEMICAL FEATURES

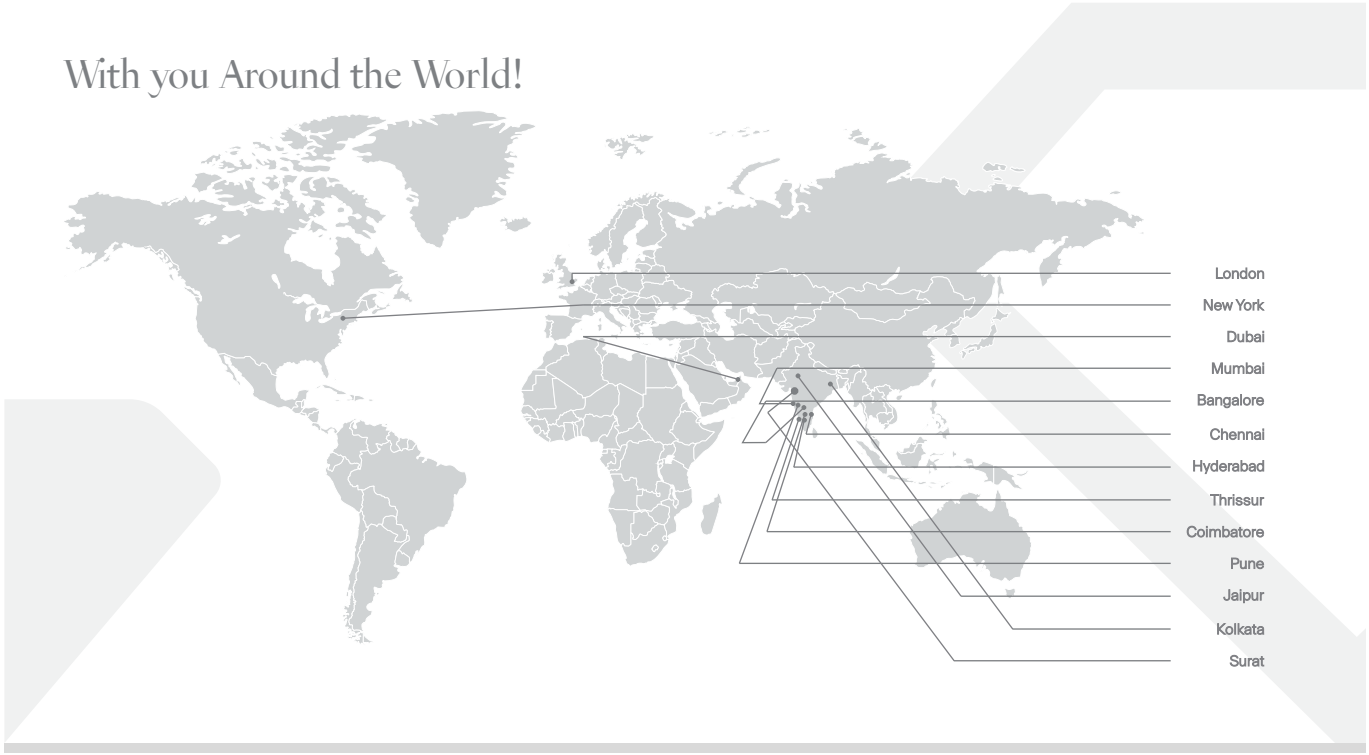
In addition to microscopic features, a number of technologically advanced analytical methods are deployed to contribute to a secure determination of a diamond's authenticity and origin. These more sophisticated methods can be grouped into spectroscopic and chemical methods. Both types give hints to the type of rock in which the gem formed, and might also reflect alterations imposed by a possible treatment process.

Sophisticated analytical techniques measure the concentration of chemical elements in diamond. Aside from the main and minor elements, diamonds also contain other elements present in even smaller concentrations of a few parts per million. These trace elements typically do not have any significant influence on the appearance of the diamond, but they shed light on the environment in which it grew thousands, millions or even billions of years ago. The type and amount of these elements in a diamond are often indicative of a specific location and are used by gem labs to determine its country of origin.

Cutting-edge chemical analysis: 193 nm Laser-Ablation ICPMS unit, operated at the Gübelin Gem Lab in Lucerne

SPECTROSCOPIC FEATURES

Different methods of spectrometry are applied to help determine the origin and possible treatments of a diamond. These analytical techniques apply electromagnetic radiation that interacts with the diamond, providing information about its chemical and structural constituents (i.e. elements, molecules, crystallographic properties) through the characteristic absorbance of visible, infrared and/or ultraviolet light.



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