Diamond Risk Evaluation

#DDL_DRE_XXXXXX

Assessment of potential damage during polishing

For XX.XX Carat Rough Diamond

Prepared by:

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Diamond Durability Laboratory

XXXXXX XX, 2015

DIAMOND INFORMATION

Owner: XXXXXX

Address: XXX XXXXXX XXXX

DETAILS OF THE STONE:-

Country and mine of origin: XXXXXXX

Examiner's valuation of unprocessed stone: $X,XXX,XXX

Weight in carats: XX.XX

Dimensions: XX.XX x XX.XX x X.XX mm

General shape: Rough

Color: XXXXX

Imperfections: Fractures, graining, crystals

Stress: High

Fluorescence: None

SKETCH OF THE STONE

SEE ATTACHED IMAGES

Overall Assessment

This diamond has one factor that could raise the potential damage from polishing, the three fractures documented above. This factor indicates that there is some potential for damage from polishing this stone. The laser sawing will remove the danger from the large fracture, but the remaining two fractures will have to be handled with great care so as not to extend. They appear to be along cleavage planes and thus at the weakest part on the diamond. The one area of stress in the stone resulting from plastic deformation is not deemed as a significant risk. This diamond is categorised as **moderate-to-high** risk for damage to occur during re-polishing.

DIAMOND RISK EVALUATION

Introduction

This report has been created at the request of XXXXX XXXXXX of XXXXX XXXXX, corp. to determine the likelihood of damage occurring from the polishing of a XX.XX carat rough diamond. Damage to diamonds through re-polishing can be affected by many factors, which are outlined below. Please note that many of these factors only increase risk when occurring in conjunction with others, and that the summary below incorporates all of the factors to provide a complete judgement.

Diamonds have a cubic crystal system, meaning they have isotropic optical properties (i.e. equal in all directions). This means that when viewed between crossed-polarized lenses diamonds should appear black, as interference colors (i.e. birefringence) are the result of anisotropy (i.e. the optical properties not being equal in all directions). However, this is very rarely the case in diamonds as internal stresses and strains within the stone can result in anisotropy, which in turn creates birefringence. There are several main causes of this stress, but they fall into two main categories; those generated during growth (termed here as primary), and those produced by external forces at some point in the diamond's lifetime after its formation (termed here as secondary). In general higher levels of strain indicate a higher likelihood of damage, but their locations, sizes and causes are vital to understanding diamond processing risk.

Primary Stresses:

Growth Stratigraphy

Diamonds grow in a concentric, layer-by-layer fashion. As it grows, the amount of impurities (mainly nitrogen) incorporated into the diamond may vary. The diamond may also change its fundamental growth mechanism to something different than its iconic octahedral growth. If there are significant differences in the amount of nitrogen contained in two consecutive layers, this will create a localized stress at this boundary, which is visible as birefringence. It may also create an optically identifiable feature, generally referred to as graining in the gem trade.

The XX.XX carat rough diamond showed some stress related to its growth stratigraphy. Images 1 and 2 below are two views of the same area of the diamond with different light intensities to show the growth stratigraphy related stain. Image 1 displays first order interference colors indicative of low to moderate levels of strain, image 2 more accurately shows the growth layers (see arrow).


Image 1

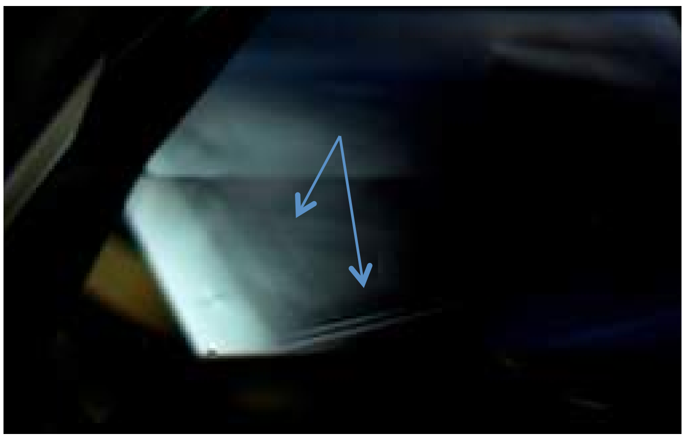
Image 2

Inclusions

Sometimes a diamond may encapsulate other crystals that were present where it grew, or even that were growing at the same time as the diamond. These may be a variety of minerals, with certain ones being more common as they are abundant in the rocks that the diamond forms within. These inclusions can sometimes create very localized stresses within the diamond once they have come to the surface. This is because the mineral may want to expand more than the diamond will let it; therefore the diamond retains that stress. If this stress is too high for the diamond to withstand, it can result in fracturing to relieve some of the stress.

The XX.XX carat rough diamond contains a few small dark inclusions. One of them in particular has a significant level of stress surrounding it (see images 3 and 4). There are high second order colors associated with this inclusion, which is likely a coesite. The strain extends 0.65mm from the inclusion.

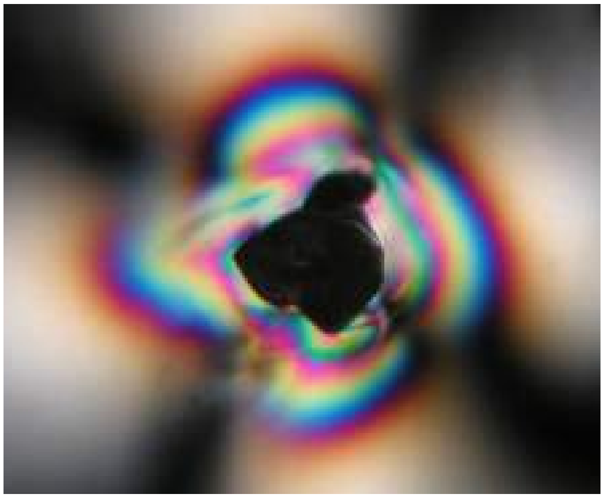
Image 3


Image 4

Grown-in Dislocations

Sometimes, when the diamond encapsulates an inclusion, an error occurs in the way the diamond grows afterwards. This is termed a grown-in dislocation. It can create a very small level of stress but it can extend for quite someway through a crystal. This is common when a diamond encapsulates another diamond (almost like a seed). This grown-in dislocation can create an optical feature referred to as graining by gemologists.

The XX.XX carat rough diamond contains one grown-in dislocation that begin deep in the diamond and extends a good way towards the surface of the diamond (Image 5 below). When viewed through cross-polarizers high first order colors are visible, indicating moderate levels of strain. This strain extends along the entire length of the grown-in dislocation and beyond.

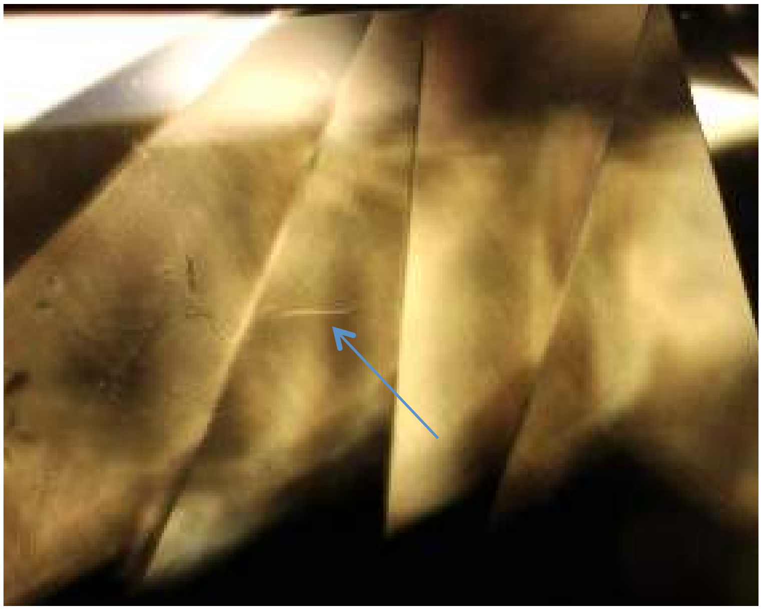

Image 5

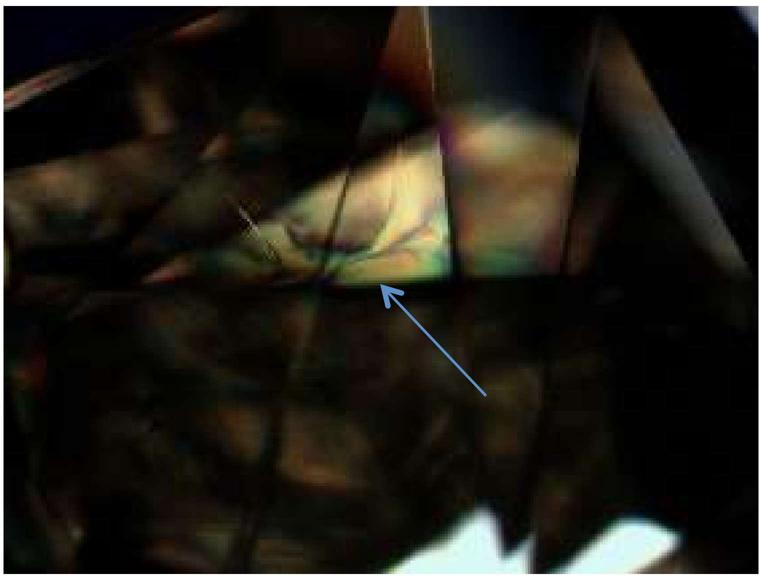

Image 6

Secondary Stresses:

Plastic Deformation

Once a diamond has grown, it may reside in the Earth for a very long period of time, under very high temperatures and pressures. Despite diamond's hardness, it can be subjected to external pressures that cause permanent plastic deformation of the crystal lattice. This type of crystal deformation is actually inherent to creating certain colors in diamond (namely brown and pink), although colorless diamonds may exhibit this as well. This deformation often appears as parallel banding related to the octahedral crystal face. Sometimes the deformation can occur on multiple sets of octahedral faces, creating cross-cutting bands. Deformation occurs on this crystal surface because it is the weakest within the diamond structure; this is the surface upon which diamonds cleave (i.e. split apart).

The XX.XX carat rough diamond exhibits brown color parallel banding related to plastic deformation (see image 7 below) When viewed through cross-polarizers high second order colors are visible (green to red see image 8 below). The stress related to the deformation seems pervasive through the diamond and nears the surface in many areas.

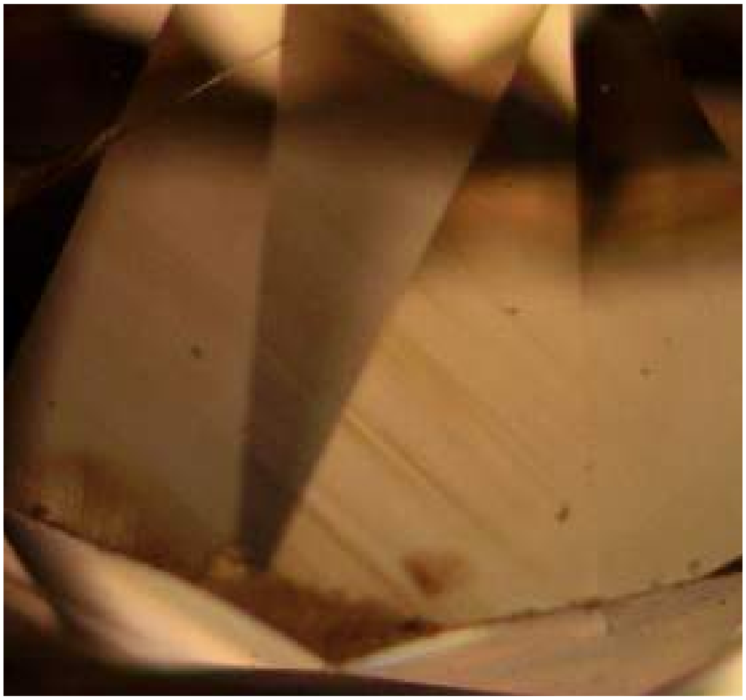
Image 7

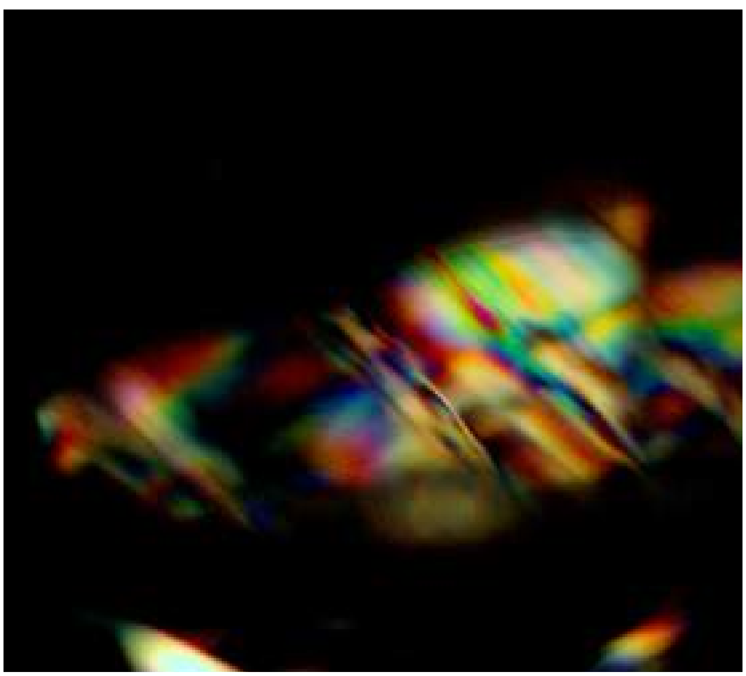
Image 8

The XX.XX carat rough diamond exhibits numerous visible parallel lines that are commonly referred to as internal grain lines by gemologists. Grain lines are the visual manifestation of some plastic deformation slip planes.

Fractures

Fractures that are unrelated to inclusions can occur at any stage of the diamonds processing e.g. from recovery at the mine, to cutting and polishing to turn it into a gem. Pre-existing fractures in a diamond can extend during the cutting process. This is most likely to occur with large fractures, those that occur along growth planes (cleavage directions), or those that are within close proximity to the girdle. New fractures are more likely to form along growth planes previously weakened by stress.

Three fractures are observed in the XX.XX carat rough diamond. The largest one (image 9 below) is quite dangerous given its size and location in the diamond. The cutting plan is to have this section of the diamond removed via laser sawing, resulting in two remaining pieces, one much larger than the other. The other two fractures are much smaller (images 10 and 11 below) and will be in the larger of the two diamonds after sawing. Both are quite straight and are seemingly along growth planes. One appears to be near where the girdle of the finished diamond will be, the other would be in the table.


image 9


image 10

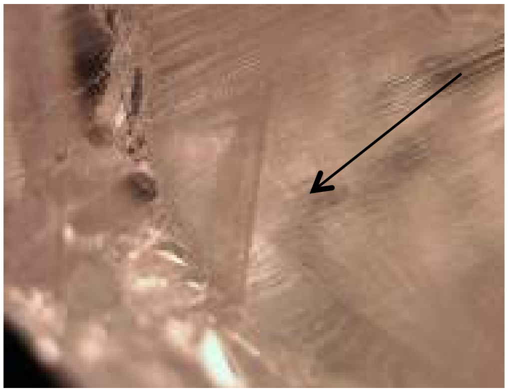
image 11

Other Comments

There are no features that fall outside of the above categories observed within this diamond that will affect durability during polishing.

Summary of Stresses within the Diamond

This diamond exhibits one area of low level stress, which is seemingly related to plastic deformation of the diamond. By itself, this is not thought to be a considerable risk to the stone for polishing. The diamond does have an additional factor that raises the risk of potential damage through polishing, its three fractures..

Plans for Reprocessing

The owner's plan for this diamond is to be polished by the diamond cutting firm XXXXX XXXXX. It will involve laser sawing the diamond into two pieces. This will effectively remove the danger from the large fracture (image 4). The remaining large piece will still contain the two smaller fractures. This larger piece will be polished to create a pink cushion shaped diamond. It is estimated the resulting polished diamond will finish at around XX.XX carats in weight.

The plan for polishing the smaller piece will be determined after the sawing is complete. The large fracture will pose little risk in this smaller piece due to its location.

Overall Assessment

This diamond has one factor that could raise the potential damage from polishing, the three fractures documented above. This factor indicates that there is some potential for damage from polishing this stone. The laser sawing will remove the danger from the large fracture, but the remaining two fractures will have to be handled with great care so as not to extend. They appear to be along cleavage planes and thus at the weakest part on the diamond. The one area of stress in the stone resulting from plastic deformation is not deemed as a significant risk. This diamond is categorised as **moderate-to-high** risk for damage to occur during re-polishing.

I certify that I have examined the above mentioned and described stone.

Thomas Gelb

Wolf Gluck

Daniel Howell

Dated: XXXX XX, 20XX

Please note that the above represents our best opinion as of the date listed. We cannot guarantee that a diamond will not be damaged during processing even if it has a low chance of damage. Additionally, a rough diamond’s surface can obscure parts of the interior of the diamond, making a thorough analysis very difficult.

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Explanation of scales used in this report:

We feel it necessary to further elaborate the definitions for our scale that ranges from low to high risk. The scale is in no way linear. A low risk diamond ranges for less than 1% to 2%. A low to moderate risk ranges from 2%-5%. A moderate risk is 5-10%. A moderate to high risk is 10-20%. A high risk diamond is anything greater than 20% chance of damage.

Thomas Gelb Biography

- Graduate Gemologist GIA – 1996
- MBA Columbia Business School
- Approx. 15 years at the GIA Lab. Managed New York colored diamond department
    - One of only two people who wrote the GIA's damage reports (the other is current lab head Tom Moses)
    - Co-wrote numerous articles about diamonds, focusing on fancy colors and unusual features
- Managed Harry Winston grading department
- For the past 6 years has been consulting to various firms on quality, improvability and financing
- Educational Director, Natural Color Diamond Association (NCDIA)

Wolf Gluck Biography

- Master Diamond cutter
- More than 20 years' experience on the wheel
- Works with many large and important diamond manufacturers including:
    - "The Orange" – Largest Fancy Vivid Orange ever polished, held world record price per carat for any diamond sold at auction.
    - Largest D IF Briolette shape
    - Largest orangy Red

Dr Daniel Howell Biography

- Geoscience MSci degree (1st Class) Royal Holloway University 2004
- Ph.D. University College London 2009:
    - Thesis title "Quantifying stress & strain in diamond"
- Post-doctoral work at Macquarie University, Sydney 2009-2014
- Currently research fellow at Goethe University (Germany) and the University of Bristol (UK)
- >10 years' experience researching various aspects of diamond science