THE DRESDEN GREEN

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Fig. 1 *Hat ornament (brooch) belonging to the Diamond Suite of the Elector August III of Saxony, displayed on the original volume of the 1733 Inventory of the Green Vaults.*

Transcription of Registration No. 50 in the Inventory
(written in elderly Saxon chancery language, Pfister 1988)

«[Seite] 89. Andere Schranck Lit: B.
Sechstes Brett; pag: 202.

Eine große Brillanten Gar.
nitur.

N°. 50 Ein Orden des goldenen Vließes bestehet in einem großen und extra schönen grünen oval länglichten Brillant um und um mit kleinen Brillanten carmisiret.
Die Flammen zu beyden Seiten sind theils mit kleinen Brillanten besezt, theils roth emailliret.
Der Haken ist als ein Schnirkel façoniret und mit vielen kleinen Brillanten besezt. In der Mitten aber ein mittler viereckigter Brillant verfaßet.
Der grüne Brillant, ist von dem Juden Delles 1741. geliefert worden, und hält am Gewichte 160. green. [Engl. grain?, ca 40 ct]
Der Toison aber ist von dem Hoff-Jubelier Dinglinger geferttiget und 1742. zum grünen Gewölbe geliefert worden. [Watzdorf 1962]

Notandum

Das izo unten anhangende goldene Lamm-Fell, nebst denen drey darin versezten Brillanten gehöret zu dem mit Katzen-Augen versezten Toison, wo es bereits eingetragen zu befinden.
vide abg. und Verw. Schein vom 31. July 1743.

[Seite] 90.

N°. 50 Dieser Toison ist a°. 1745. von Praag aus nach Wien, um daselbst ganz neu gefertiget zu werden geschicket worden,
Der grüne große brillant ist wiederum im neuen Vließ Orden angewendet und [als] N°. 55 bey dieser brillanten garnitur eingetragen [reset by the Genevan A.J. Pallard, 1746].
Die Flammen und der Schnirkel [Schnörkel] aber N°. 42 und 43. zum Vorrath an Brillanten geleget worden.
Die Einfaßung um den großen grünen Brillant aber, so über und über mit kleinen brillanten, haben S. Königl. Mait. zu hohen Händen behalten.
C. Verwahr. und abg. Schein vom 31. Jan: 1748.
C.G. Gleichmann. [?]

N°. 51 Ein paar goldene Hand-Hembden-Knöpfgen mit zwey Brillanten besezt. . . .»

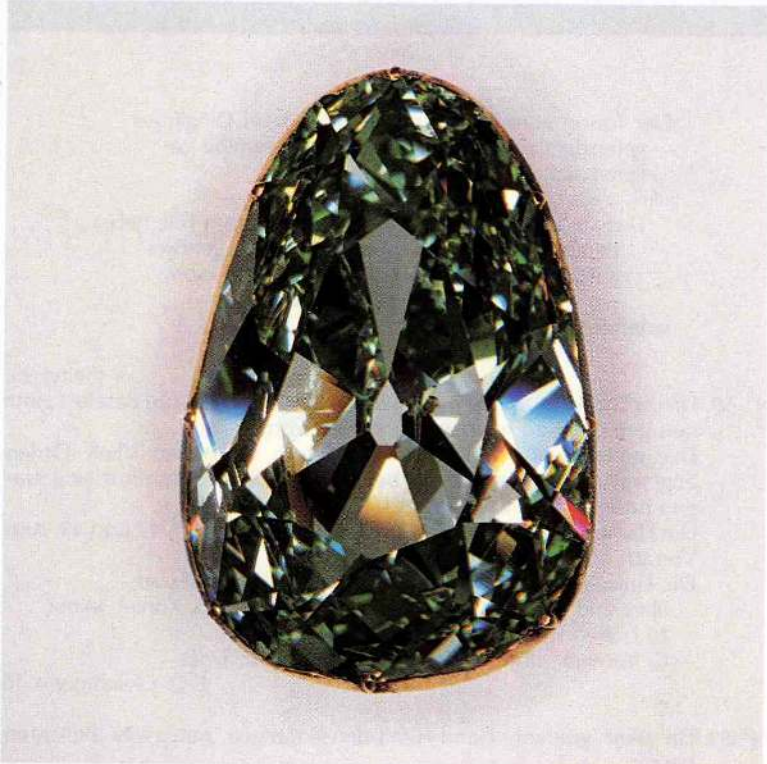
* Schweizerische Stiftung für Edelstein-Forschung (SSEF)

△

Fig. 2 *Hat ornament exhibiting the sumptuous principal stone, the Dresden Green. Original size.*

Fig. 3 *The Dresden Green set in an 18th century gold (and silver) bezel and scintillating in all spectral colours. Magnification 2½ ×. Authentic colour reproduction.*

▽



Once upon a time there lived a king. He was tall, strong, and immeasurably wealthy since his ancestors were already in possession of productive silver mines. He did not waste his treasures on foolish wars. On the contrary, he accumulated riches of such vastness in the safe vaults of his castle that his kingdom became renowned and was admired far and wide.

This is not the beginning of a legend but a sketch of what happened in the 17th and 18th centuries prior to and during the reign of the Saxon Elector August II, also named **August the Strong** (with the exception of the wars). His residential cities were Dresden and, after his coronation as King Frederick August I of Poland, also Warsaw. The accumulated riches of gold, silver, jewels, curiosities, and in particular gemstones were arranged and stored below his residential palace in vaults painted green. These rooms soon came to be known as the **Green Vaults** (Grünes Gewölbe). They served as strong-rooms and, in anticipation of a coming era, also as a treasury museum, fitted as an elegant French-style mirror cabinet (1723–1724). In the following years, the copper-plate engraving cabinet, the gallery of paintings, and the collection of porcelain were founded. These collections as well as the collection of natural sciences were exhibited in the pavilions of the Zwinger (stronghold of the former fortress, Menzhausen 1987a, 5–6, and 1988). For good reasons, Dresden was known as the Florence of the Elbe River.

In 1741, the son of August the Strong, **Elector August III of Saxony** (since 1733 King Frederick August II of Poland), bought one of the rarest diamonds from a Jewish dealer. Together with the Diamond Suite (Copeland 1966, 29), the green gem was registered as No. 50 in the inventory of 1733 (cf transcription below Fig. 1). From then on, the diamond was known by the name of **"Dresden Green Diamond"** or shorter "Dresden Green" and "Green Brilliant" (Tab. 1). In 1742 this brilliant-cut stone was mounted into the Order of the Golden Fleece by the Dresden court jeweller J.F. Dinglinger. However, in 1746 it was reset "à jour" by the Genevan jeweller A.J. Pallard at the court of Vienna (open-back bezel setting as in Fig. 3) and in 1768 finally mounted by Diessbach into the hat brooch known to the present day (Fig. 2).

The Dresden Green remained in the Green Vaults for over two centuries until, due to the Second World War, all Art Collections of Dresden were moved up to the Königstein (King's Rock), the imposing grey mountain fortress at the entrance to the Elbsandsteingebirge (Sandstone Sierra of the River Elbe region). From there the Soviet Trophy Organization (Copeland 1966, 25) transported the Collections into the subterranean safes of the USSR Ministry of Finance at Moscow (Menzhausen 1987a) shortly after the war. They were handed out to the German Democratic Republic in 1958. Since then the Collections have been conserved and displayed mostly at the **Albertinum** and in the Zwinger. The State Art Collections of Dresden as much in their totality as also in parts, e.g. the Saxon-Polish Crown Jewels of the Green Vaults or the Meissen Porcelain, are unique worldwide, but surprisingly little known, even in Europe.

It has come to be considered the destiny of many famous diamonds that their **histories** remain unknown or fragmentary at most. In the case of the Dresden Green this concerns its trade route before 1741 and the sojourn from 1945 till 1958. It is assumed that the stone originated in India rather than in Brazil.

The **rarity** of the Dresden Green is based not so much on its weight which is over 40 ct but rather on its green colour. In reality however, it is the coincidence of both properties that makes the diamond so exceptionally rare. Up to the present day, it has remained the largest cut diamond of natural green colour on record. Over the centuries it has not lost anything of its celebrity status. But on the contrary, it has become of increasing cultural interest and, recently, also of great scientific value.

MODERN INVESTIGATIONS OF THE DRESDEN GREEN DIAMOND and INTERPRETATION OF THE RESULTS

Motivated by the contributions of Collins (1982) and Orlov (1977) on the one side and by Bauer (1896) and further writers of the past century on the other, the author applied for permission two years ago, to investigate the Dresden Green extensively by modern, non-destructive gemmological and analytical methods. A **unique authorization** was granted from the 22nd till the 24th of November 1988 to him as well as to R.E. Kane and S.F. McClure. These colleagues of the Gemological Institute of America jointly and shortly will report on the history and gemmological properties of the diamond and will publish professional colour reproductions.

Colour Testing

In addition to the urgently needed **characterization** of such a prominent diamond individual by weight, measurements, proportions etc., the intention was to find out whether the Dresden Green belonged to the **"relatively rare, uniformly bottle-green" diamonds** (according to Orlov) or whether it possessed, as Bauer put it, a "very nice, light apple-green" colour (or even an "oil-green, yellow-green, pale, leek, asparagus, pistachio, olive, siskin, emerald, bluish or greyish-green colour"?). The question is what sort of bottles and apples were meant. According to the Identity card of the Diamond (Tab. 1), the colour hue is definitely a bluish-green.

Collins (1982) confirmed that uniformly green (by this he did not mean surface-coloured but body-coloured green) diamonds are so rare that up to now no corresponding absorption spectra existed in literature. According to Collins, however, these spectra would be **of scientific importance to solid state physicists** for the clarification of the natural causes of green colouration (e.g. irradiation), as a possible precursor of yellow and brown colourations (annealing during or subsequent to irradiation).

In addition it would be a **breakthrough of commercial significance** if specialized gemmological laboratories henceforth would be in a position **to differentiate between diamonds of natural and artificially caused green colour.** At present few laboratories succeed in reliably identifying these colourations and then only in exceptional cases. For these reasons the author has pursued his goal for over three years now (outside the daily routine analysis of gemstones) to trace cut diamonds of guaranteed naturally green colour – this proved to be unusually difficult – and to measure them accurately. The research work will come to a close soon and will then be published (Bosshart 1989).

Absorption analysis

In some of the recognized gemmological laboratories it has been standard practice for more than ten years now to record the absorption spectra of coloured diamonds applying **refrigeration by liquid nitrogen** (boiling temperature of LN_2 at atmospheric pressure: –196 °C/77 K, where Kelvin (K) = Celsius (°C) + 273.16). The advantages of this procedure are absorption diagrams which give much increased evidence compared to the spectra registered at ambient temperature (Collins 1982), as is proved by Fig. 4:

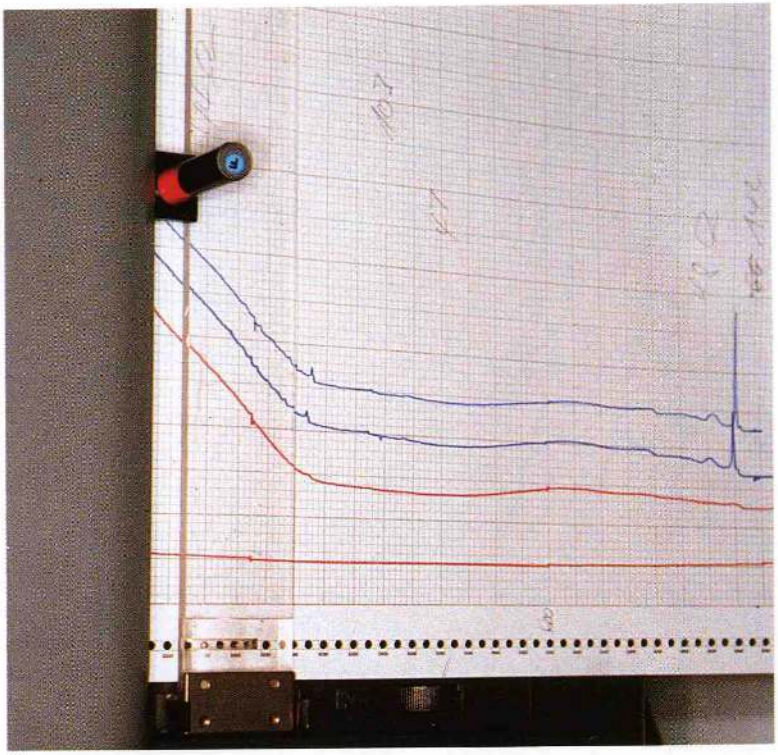
Survey spectra	upper blue curve	medium refrigeration
	lower blue curve	weak refrigeration
	red curve	ambient temperature

(horizontal red line: baseline of spectrophotometer and cryogenic cell)

Figure 5 presents the well established **cooling cell of the bath type** (cryostat) developed by the author. In variation to the cryogenic flow-type devices of other laboratories cooling the diamond with nitrogen gas crossing the spectrometer sample beam at right angles (Scarratt 1979 and Hofer & Manson 1981), the Dresden Green was mounted in the N_2-vapour atmosphere of the illustrated highly-transparent cooling cell (i.e. above the liquid nitrogen bath) in such a manner that the diamond could be traversed by the light beam on a linear optical path.

With regard to spectral analysis, it was a favourable and rather unusual circumstance that the Dresden Green, still mounted in its open-back bezel setting, possesses a large culet parallel to the table facet. The optical path length between table and culet, however, was the absolutely shortest of the stone, corresponding to the weakest possible absorbance (cf Figures 3 and 6). On the other hand, the light traverse in the long or diagonal directions of the diamond was rendered practically impossible by the silver bezel hiding the pavilion of the diamond just below the girdle.

The **"Dresden Green Project"** was consented to only after the author's party had furnished physical evidence that the necessary refrigeration (and subsequent warming up) could cause damage neither to the diamond nor its green colouration nor the bezel setting (Rosenfeld & Bosshart 1987 etc.). Despite the author's many years of experience in refrigerating large and small, mounted and loose diamonds, there remained a **residual risk** which needed a little courage to overcome since doubts about the innocuousness of the project for the famous big diamond had been expressed in some gemmological circles. Although the present investigation has been completed successfully and without detriment to the diamond and its setting, this shall still not be interpreted as an encouragement to deep-freeze gemstones unscrupulously as certain significant conditions have to be fulfilled.



△

Fig. 4 *The first three absorption spectra of the Dresden Green Diamond showing lesser spectral information in the red curve registered at ambient temperature than the spectra run at freezing temperatures (blue curves). Baseline of spectrophotometer and cryogenic cell (horizontal, red) and absorption curves vertically displaced for better clarity.*

▷

Fig. 5 *The Dresden Green mounted in the N_2 vapour atmosphere of the highly transparent cooling cell and adjusted in the sample beam of the Pye Unicam SP8-100 UV/VIS spectrophotometer prior to the first absorption measurement in refrigeration.*

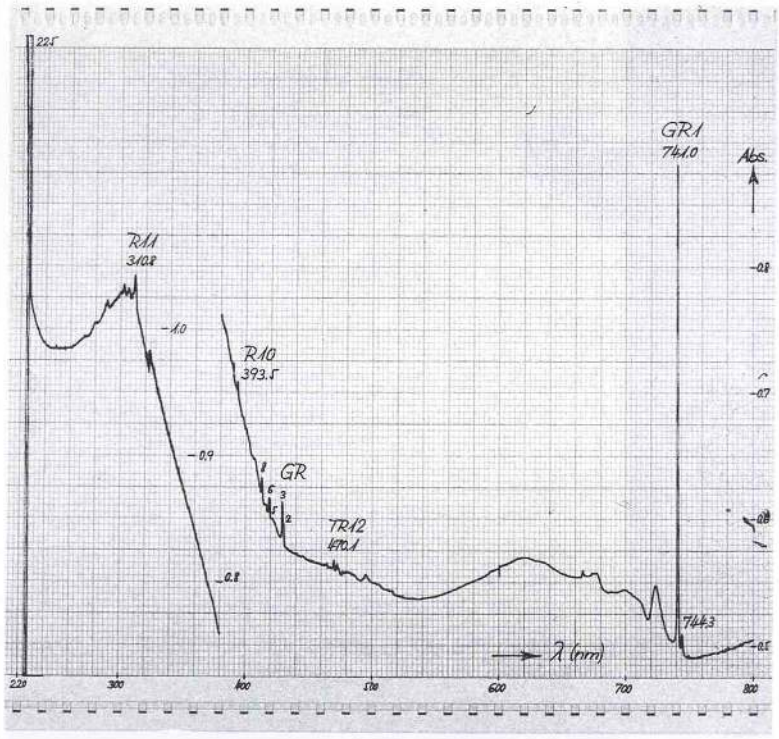


Fig. 6 *High-resolution absorption spectrum of the Dresden Green Diamond recorded on a Pye Unicam SP8-100 UV/VIS spectrometer at very low temperature, four-fold gain and slow wavelength scanning and chart advance speed. Optical path length from table to culet 10.288 (± 0.005) mm. Classical absorption behaviour of an irradiated type IIa diamond.*
***Main spectral characteristics** are the bands of the GR 1 absorption system (750 to 530 nm, present in all irradiated diamonds) and the GR 2–8 system. The wide absorption band between 440 and 250 nm is characteristic of irradiated type IIa diamonds, the chemically nearly pure form of natural and synthetic diamond. The absorption line R 11 occurs only in type IIa diamonds (Davies 1977). The exceptionally steep and high absorption edge of the Dresden Green is situated immediately below 225 nm in the short-wave ultraviolet spectral region.*
*The absolutely lowest absorbance of the Dresden Green Diamond in the region of the spectral colours (visible electromagnetic waves between 700 and 400 nm) is found at 534 (± 2) nm. A green hue corresponds to this wavelength (after DIN 6164 hue no. 22½). The human eye, however, senses the hue no. 21½, i.e. a **slightly bluish-green** because the absorption in the blue is even lower than in the orange portion. Due to the fairly weak GR 1 absorption in the red and orange regions (right half of Fig. 4), the colour saturation of the Dresden Green is relatively moderate. As a result of this, virtually no body colour is visible through the culet (Fig. 3). This observation was confirmed by comparison with the DIN Colour Atlas charts (Tab. 1: degree of saturation of the body colour K only about 0.5 units, i.e. very pale).*
Fortunately numerous vividly green internal reflections are created by the interaction of the exceptional old-cut and the GR 1 absorption (Tab. 1: degree of saturation of the reflection colour R around 3 units, i.e. a green of medium saturation).
This reflection colour has made the Dresden Green into the famous diamond admired for centuries (Fig. 3).

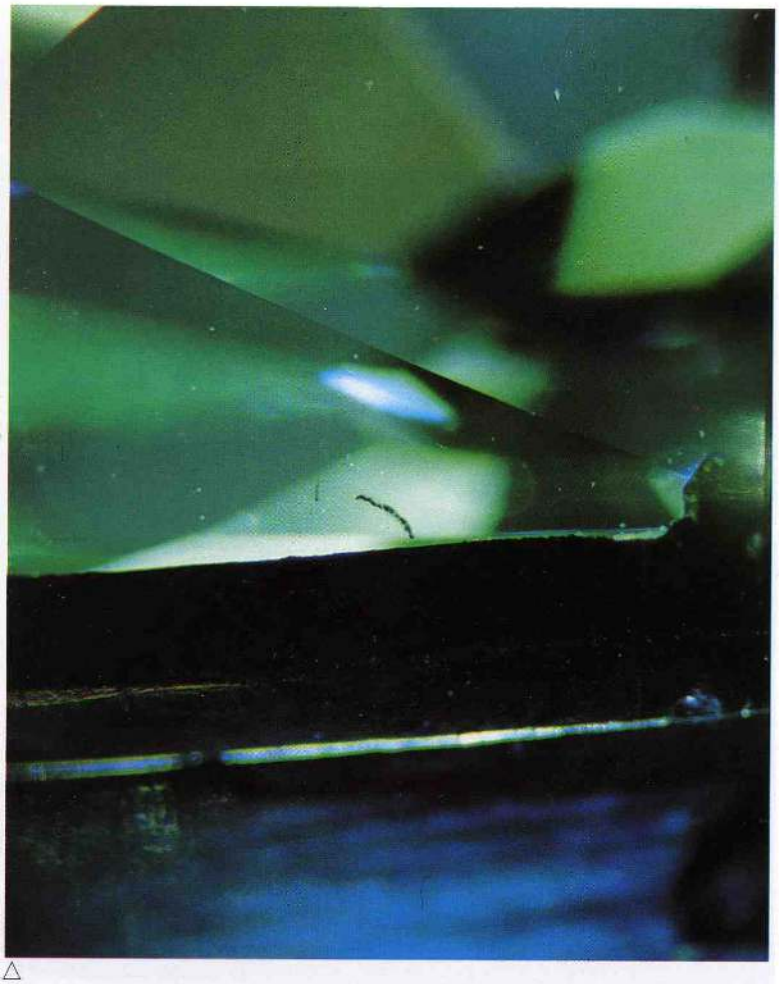


Fig. 7 *Shallow fissure in one of the upper girdle facets showing diffuse green spots on the fissure walls, very probably generated by radioactive ground-waters having circulated on the diamond deposit. Gold bezel (top) and silver bezel (bottom) visible below the fissure. Dark-field illumination. Length of fissure approximately 0.4 mm.*

The absorption diagram of the Green Diamond of Dresden in the ultraviolet and visible portions (Fig. 6) now represents one of the first if not **the first published absorption spectrum** for a naturally green, cut diamond (thus being body-coloured) which had been missed by Orlov (1977) and Collins (1982) so far. After the author had already measured other bluish-green old-cut brilliants of natural colouration identified as type IaA diamonds (containing considerable amounts of nitrogen, mainly as pairs named A), it came as a great surprise in the Green Vaults when it became evident that the Dresden Green unambiguously belonged to the rarer, almost nitrogen-free type IIa. This observation was clearly confirmed by the absence of absorption bands below 1600 cm^{-1} and above 2650 cm^{-1} in the recorded mid-infrared transmission diagram. Although artificially coloured diamonds of type IIa hitherto encountered displayed a blue and not a green colour, their absorption spectra are almost identical to that of the Green Diamond.
Virtually all diamonds showing a non-fluorescent green colour component owe this to the influence of natural or artificial high-energy **radiation.** In both cases it generates **defects in the carbon lattice** of diamond, the so-called vacancies, themselves causing the same kind of selective light absorption in all four known types of diamond (Ia, Ib, IIa, IIb), i.e. in the first place the **GR 1 (General Radiation) absorption system** presented in Fig. 6.
At the beginning of this century, W. Crookes executed the first intentional irradiations of diamond applying radium salts. The **green colouration** of diamonds can therefore only be accepted, for the intended research study, as guaranteed natural if they spent the last one hundred years under credible supervision (e.g. in a museum) as stones known to always having been green. Considering that industrial routine irradiation of diamonds began approximately in 1950, it must be attributed to fortunate circumstances that this guarantee of natural colouration can be maintained by independent proofs even for the absence of the Green Diamond from Dresden:

- Firstly the colour of the diamond had been described as pale green (Bauer 1896) long before the stone was stored away on the Königstein, a colour it still shows.
- Secondly the diamond retained several small and shallow fissures with diffuse green specks (Fig. 7 and Tab. 1) encountered so far only as products of natural radiation which has emanated from radioactive ground-waters.

Undoubtedly however, these few irradiation spots do not account for the homogeneous green colouration of the Dresden Green. A body colour must be present.

Weight Estimation

The author pointed out in the early stages of negotiation with the director of the Green Vaults, Dr. J. Menzhausen, that the Dresden Green Diamond should be removed from its mounting and weighed precisely for the

literature (Bauer 1896, De Beers 1983 etc.) up until now contains the most incredible weight figures (cf Tab. 1). Regrettably no permission could be procured for taking the diamond out of its setting. At that point, the author unfortunately did not know that the girdle projects over the top edge of the bezel on almost half of its circumference.

In order to be able to check the weight figure of 41 ct cited in most instances, two approaches of weight estimation were chosen:

– The weight determination of the diamond in the bezel setting did not permit a satisfactory approximation in spite of the precise measurement of the metal parts because their fineness was not known.
– Calculation by means of the **factor for the conversion of dimensions into weight** of a loose pear-shaped old-cut brilliant of no less than 13 ct proved unsuccessful for the proportions deviated too strongly from those of the Dresden Green.

Based on data gathered in the Laboratory the author reached the conclusion that a conversion factor of 0.0065 would be the most supportable.

Table 1. Physical Properties of the Dresden Green Diamond

CUT	Pear-shape with rounded tip (almond-shape), historic brilliant-cut style (pear-shaped old-cut brilliant)		
Measurements of diamond	Length × Width × Height		approx. 30.30 × 20.35 × 10.288 mm (TESA dial calipers and micrometre)
	Table T		approx. 16.30 × 10.15 mm
	Culet C		approx. 3.25 × 1.65 mm (SSEF table gauge)
Proportions	Table width/Width		49.9%
	Culet width/Width		8.1%
	Height/Width		50.6%
	Crown height/Width		approx. 17% (estimated)
	Pavilion height/Width		approx. 33% (estimated)
	Girdle width/Width		approx. 0.5% (where visible), i.e. very thin to sharp-edged
		L / W	approx. 3 / 2
		H / W	approx. 1 / 2
		TW / W	approx. 1 / 2
		TW / TL	approx. 1 / 1.6
		CW / CL	approx. 1 / 2
		Cr / Pv	approx. 1 / 2
Symmetry	Good to very good: no large remnants of crystal faces ("naturals") or extra facets present, very sharp facet corners; bezel and pavilion (upper and lower main) facets in part slightly distorted, girdle slightly wavy.		
Polish	Good to very good: table facet perfectly plane; some light wheelmarks.		
Measurements of bezel	Gold bezel	L × W	approx. 30.90 × 20.60 mm
		Height	1.90 to 2.40 mm (without prongs)
	Silver bezel (pavilion)	Height	3.30 to 3.80 mm
		Thickness	0.48 to 0.51 mm
	Four drillholes for "lacing" the silver bezel into the hat ornament (brooch) using silver wire (Arnold 1988), drillhole diametres from 0.7 to 1.3 mm.		
Condition	Girdle of diamond mediocre: displaying numerous small breakages, projecting over the gold bezel on almost half of the circumference (from right to top) and extremely thin. Bezel setting good: excepting a fine-grained layer on the gold bezel at top right, on right side and bottom left (Fig. 3, remainders of tin solder rather than oxidized silver solder; no patina).		
WEIGHTS	A1		**approximately 41.1 ct** (author's calculation by means of similarly proportioned pear-shaped old-cut brilliants as length × width × height × 0.0065)
of the Dresden Green	A2		approximately 43 ct (too high; calculation on the basis of the conversion factor 0.00678 for a loose pear-shaped old-cut of 13.24 ct of the Green Vaults)
	B1		41 ct (Green Brilliant, Menzhausen 1987a)
	B2		**Dresden Green, identical with Green Brilliant,** i.e. 41 ct (Menzhausen 1987b)
	C1		41.00 ct (Dresden Green, De Beers 1983, 60)
	C2		40.00 ct (Green Brilliant, De Beers 1983, 60), citation of erroneous indications in the Anglo-Saxon literature (Copeland etc.)
	D1		48½ ct (Bauer 1896, 157), contradiction to D2
	D2		40 ct (Bauer 1896, 287: "not 31¼ or 48 carat")
	E		160 green (Inventory volume 1733), [green = engl. grain (?), between 40 and 41 ct]
Weight including bezel setting	11.182 g (55.91 ct) (Owa laboratory balance 160 g max., e = 0.01 g)		
PURITY			
External characteristics	One small extra facet at the tip of the pavilion, one very small natural near the girdle on the right of the crown side.		
Blemishes	Numerous small to tiny breakages along the girdle on the crown and pavilion side, one short curved scratch on the left in the table, some slightly abraded facet edges on the crown and pavilion side (Hänni & Bosshart 1987).		
Internal characteristics	One small, concentrically ribbed tension fissure of a whitish appearance and similar to a healing crack and one shallow and short fissure with green specks (Fig. 7), both on the left of crown near the girdle; very short tension fissures with green spots on the right of crown at the girdle, one group of tiny, brown reflecting opaque crystal inclusions (chromian spinels?) near a lower girdle facet on the right (approx. 0.15 mm deep).		
Growth characteristics	Weak to distinctive, lamellar zoning in triangular octahedral arrangement (three-point diamond).		
Strain birefringence	Fine, cross-hatched and pronounced, lamellar extinction pattern in cross-polarized light ("Tatami" type, Orlov 1977, 116), no interference colours.		
Damages	One small tension fissure emanating from a girdle chip on the right crown side, one tiny percussion mark in the bezel at the tip.		
Purity grade	SI		(small inclusions, CIBJO Rules 1986), theoretical possibility of improvement of the purity and girdle by a professional repolishing operation.

Continued

Table 1. Physical Properties of the Dresden Green Diamond

COLOUR						
Description	Transparent, non-fluorescent, slightly bluish green of weak saturation.					
Colour grade	Fancy colour.					
Classification	After the Colour Atlas DIN 6164 (Biesalski 1957) as colour index triplet					
			"hue	: saturation	: greyness"	
	Body colour K	(in transmitted light)	≈ 21	: ½	: 1	
	Reflection colour R	(in reflected light)	≈ 21½	: 3 ± 2	: 3	
	Reflection colour R	(Rösch 1969)	≈ 22	: 2–3	: 3	
Colour distribution	Apparently homogeneous body colouration (no colour zoning, mottled or surface colour).					
Colour type	Natural colouration (Menzhausen 1987b).					
Cause of colouration	Light absorption (GR 1–8) at a limited number of crystal lattice defects, generated by a continued natural radioactive irradiation in the diamond deposit; annealing in the parent rock at a maximum of 350° C.					
Colour stability	Possibility of fading of the green colouration by thermal healing of the GR 1–8 lattice defects starting at about 500° C (Woods & Collins 1986).					
UV Fluorescence	Impure yellowish-green, weak, homogenenous (VEB Quarzlampen Markkleeberg UA 150.1, 365 nm/140 W/10 cm).					
ABSORPTION	UV/VIS **Fig. 6**	GR 1	very weak absorption band from 750 to 530 nm, with medium strong zero-phonon doublet (Collins 1982) at 741.0 and 744.3 nm			
		667	very weak line at 666.6 nm (after Davies 1977 stable below 700 K/430° C)			
		594	extremely weak band at 594 nm (appears above 275° C only, Woods & Collins 1986)			
		495	very weak band at 495 nm			
		473	very weak band at 473 nm			
		TR 12	very weak line at 470.1 nm			
		GR 2–8	weak to extremely weak lines at 430.4, 429.5, 419.1, 413.2 nm etc.			
		R 10	very weak line at 393.5 nm			
		R 11	weak line at 310.8 nm			
		306	very weak line at 306 nm			
		303	very weak line at 303 nm			
		289	very weak line at 289 nm			
		279	extremely weak band at 279 nm			
		225	steep and high absorption edge at 225 nm			
	MIR	no specific absorption bands in the middle infrared region (4000 to 400 cm^{-1} / 2.5 to 25 µm) except the strong lattice absorption present in all diamonds between 2650 and 1400 cm^{-1} (Davies 1977) → **TYPE IIa**				
Radioactivity	No residual β/γ-activity observed (natural background radiation 0.2 counts/sec on Geiger counter EMA GZ25/VA-Z125).					
Conductivity	Thermal conductor (EICKHORST Thermolyzer II), electrical insulator (voltmeter).					
DIAMOND-TYPE	*IIa*					

Calculation with this factor resulted in a weight of 41.1 ct and thus confirmed Menzhausen's value (1987a). If the accurate weight differed, it would be slightly inferior (using the factor of 0.0064, near 40.5 ct).
Diamonds of type IIa reveal a clear tendency to be sizeable as well as nearly to completely colourless (Collins 1982, translator's footnote on page 164) if not irradiated like the Dresden Green.

Examination of the Cut

The Green Diamond of Dresden was cut more than 240 years ago. Whoever examines this historic cut will be astonished by the **quality** of its symmetry, polish and proportions:
According to prevailing grading regulations (CIBJO Rules 1986), the quality would have to be classified as good or even very good. The table facet of a diamond of 41 ct although being expansive is optically plane. The common corners of joining neighbour facets are perfectly pointed. Facets of one kind have an identical size and are not distorted. Table and culet are exactly concentric. The outline is pleasingly rounded and symmetrical. The quality of this cut cannot easily be rivalled by more recent old-cuts. And to beat it all, this remarkably cut diamond exhibits a unique series of ratios of length to width etc. in whole numbers (cf Tab. 1).
The question shall be admissible whether such a **perfection of cut** was conceivable already **in the early 18th century.** Tillander (1988) considers this possible if the diamond had been cut in London, and Guichon (1988) as well if a top cutter executed the opus. In those times already a lap (scaife) of porous cast iron was employed. Yet it did not turn at 3000 but at less than 1000 rpm. The diamond was almost completely coated with lead, and the lead dop was mounted on a thin and flexible copper stick for easy adjustment of the facet angles in relation to the grinding wheel. Because also less oil than boart was applied the cut remained "cold" but took months for a large facet to be completed (Guichon 1988).

CONCLUSIONS

The **secret** why a diamond of this size possesses such an outstanding cut and still displays its original colouration is that it was **cut slowly and with little pressure.** In this manner neither the diamond nor the lead could heat up over a certain critical temperature.
Without cutters of the past centuries having realized it, green diamonds were protected by the **"thermostat effect" of the lead/tin alloy.** Pb/Sn solders melt at **low temperatures,** varying with composition (CRC 1978):

Pb70/Sn30 at 255° C	maximum
Pb60/Sn40 at 238° C	**standard**
Pb40/Sn60 at 190° C	minimum

The green radiation colours of diamonds are **sensitive to heat,** without exception. Hänni (1987 and 1988) checked this fact on an experimental basis on a naturally green-skinned diamond crystal and on an artificially greened brilliant. Many a diamond cutter of today involuntarily made this experience with his own cutting goods (and many a diamond setter also during his jewellery work).
The **discolouration of green diamonds** resulting from overheating is a continuous process of healing up the GR 1–8 radiation damage in the crystal lattice. This fading process starts already at 500° C, e.g. when diamonds are brought to red-heat which is performed easily on a modern 3000 rpm lap. In type Ia diamonds the discolouration of green comes to an end at about 800° C (Woods & Collins 1986), in type IIa at higher temperatures (Davies 1977). The process runs down the quicker the higher the effective heat is. In general, uncontrolled annealing leads to unpleasant brown colour changes of incorrectable stability.
Thanks to the thermostat reaction of the lead dop after the ancient cutting technique, the discolouration of the Dresden Green could therefore not start at all. Thus, if a larger number of historical green cut diamonds is unknown world-wide, this can only mean that these body-coloured diamonds are

extremely rare, much rarer than the relatively abundant green-skinned rough diamond crystals. The latter lose their surface and sub-surface colouration entirely during cutting most of the time. Occasionally however, individual green specks survive the cutting process, more frequently on remnants of crystal faces ("naturals") than in natural fissures, e.g. like those in the Dresden Green (Fig. 7). The causes of this rarity of green body colouration will be pursued in the planned study.

Two further consequences of the low melting point of the lead dop are noteworthy:

- **No burn marks** can be observed on old-cuts after the lead dop technique was applied. As the author pointed out earlier, surface corrosion marks develop only at 600° C (Hänni & Bosshart 1987). This temperature can be surpassed easily with modern cutting techniques. According to what has been said so far, the heat which produces the burn marks under the prongs of the mechanical dop of today forcibly incurrs the destruction of green body and skin-colours of diamond too.
- The Green Diamond of Dresden cannot have exceeded the temperature of 260° C when it was cut more than 240 years ago. This means that the **absorption band at 594 nm** (in Fig. 6 present in extremely weak intensity) cannot be an artefact caused by elevated cutting temperatures but represents a natural property of the Dresden Green. The absorption band at 594 nm only develops above 275° C (Woods & Collins 1986) while the line at 667 nm is destroyed above 430° C (Davies 1977). Hence it follows that the Dresden Green experienced a temperature of not more than 350 (±80)° C in the earth's crust.

SUMMARY

It can be stated that the Dresden Green Diamond:

1) belongs to the rare and chemically pure type IIa and as such is typically big and free of macroscopic inclusions;
2) possesses internal strain of normal strength ("Tatami" type);
3) as an historical old-cut brilliant exhibits an extraordinarily good cutting quality and noteworthy proportions;
4) was cut at slow speed, with little pressure and, mounted in a lead dop, at less than 260° C and then was carefully set;
5) is damaged along the girdle (its purity and girdle theoretically being improvable by a professional repolish);
6) very nearly weighs 41 ct;
7) should be weighed at least to the hundredth of the carat and be set anew;
8) experienced a moderate irradiation by radioactive ground-waters;
9) does not show residual radioactivity;
10) reveals a non-fluorescent bluish-green colour hue and a weak saturation (due to 8);
11) evinces an extremely rare, heat-sensitive body colour (due to 1 and 8);
12) displays a brilliant reflection colour (thanks to 3 and 8);
13) was heated in the earth's crust to about 350° C;
14) has retained its green colouration (owing to 4 and 13) but could lose it on the occasion of a repolishing operation on a rapid lap;
15) however, endured multiple deep-freezing in a nitrogen gas atmosphere without any problems;
16) differs little in absorption behaviour from type IIa diamonds artificially coloured blue;
17) will not reveal its place of origin in the near future, based on the inclusions present and on the criteria enumerated above.

APPRECIATION

The author wishes to express his satisfaction about the availability of such a unique gemstone as the Dresden Green for investigation, across all borders. The successful outcome of the "Dresden Green Project" creates the hope that **in future an increasing number of projects of particular scientific or cultural significance could be realized between East and West.**

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