The Red Emerald

Pink Portfolio

Photography by David Rozendaal

Arrangement by

Seth William Rozendaal

This work is for the enjoyment of gemstone aficionados around the world and throughout time, and dedicated to the divine muse who inspires everything.

The set of crystal forms and modified mineral habits defined in this portfolio is the direct product of beryl formation under pressure.

The resulting crystallographic and gemological similarities presented herein are a trade justification for and legitimate defense of the rightful Red Emerald name. They serve as undeniable mathematical proof of geometric equivalence between the green and red varieties.

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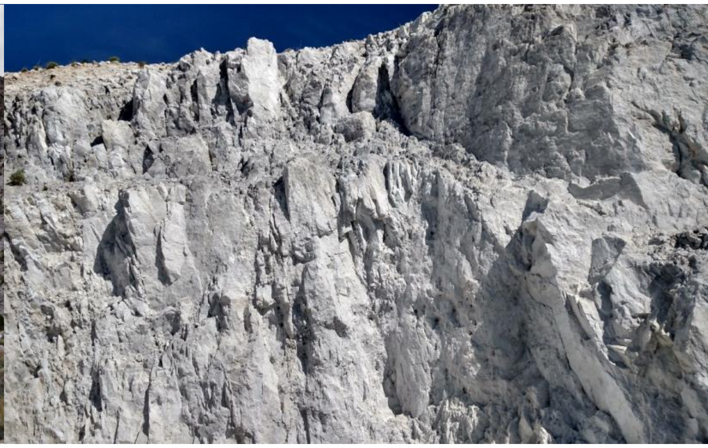
Cover Photo: “The X-Factor” by David Rozendaal - 1.81 ct Emerald Cut with Phenomenal *Jardin*
Back Cover: “The Scarlet Spectrum” by David Rozendaal - Row 1 Magenta-Purple, Row 2 Raspberry, Row 3 Orange, Row 4 Red

Table of Contents

Synthesis



At left, the red beryl zone of Topaz Valley. At right, the white cliffs of the Wah-Wah Mountains.
These two Utah localities are responsible for nearly all of the world's red beryl specimen production.

Photos by Seth William Rozendaal

Beryl varieties ordinarily synthesize in pegmatites (Type I), but in extraordinary circumstances can form in pneumatolytic environments (Type III). General Formation of red beryl is covered on Pages (1 - 4).

Pegmatites consist of coarse-grained, crystal-rich granites cooled in unconstrained, low-pressure environments. Mineral formation happens with few disturbances and little damage to fine specimens.

High-temperature magma and gas under pressure alters rock in a procedure known as **Pneumatolysis**, a rarely-occurring natural process which becomes **Hydrothermal** at lower temperatures. **Hydrothermal** processes are responsible for the crystallization of Green Emeralds constrained in a mica schist, while an underground **Pneumatolytic** lava dome birthed the Red Emerald.

One of the primary differences between pegmatitic and pneumatolytic conditions relates to the pressure present at the time of formation. Increased pressure affects crystal habits in four primary ways:

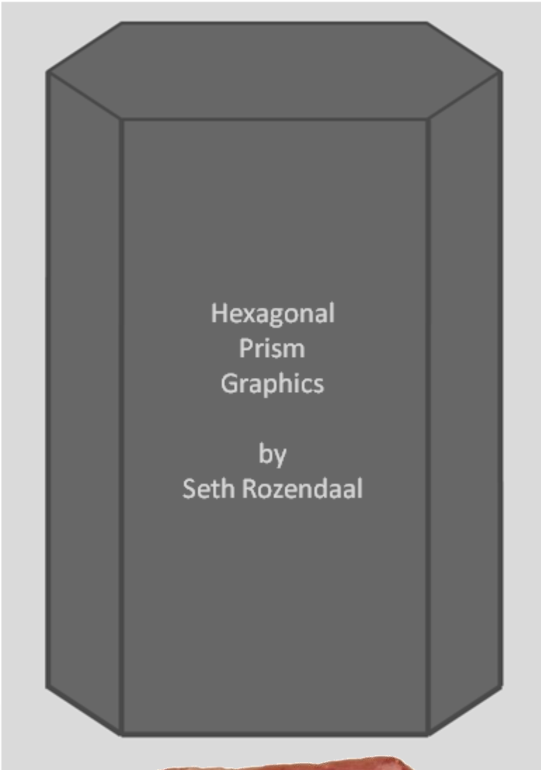
Increased Presence of Inclusions (5 - 12)
Increased Evidence of Stress (13 - 20)
Increased Pronouncement of Structural Modifications (21 - 27)
Increased Crystal Propagation (28 - 33)

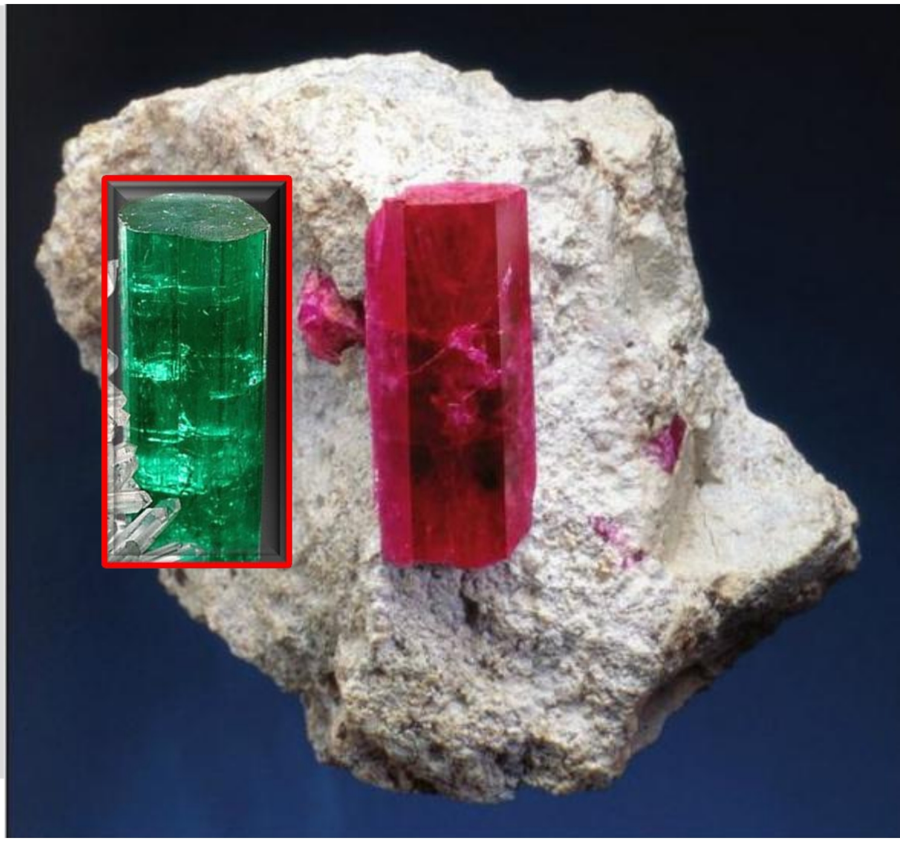
Enjoy being one of the first to witness the defined attributes of this exceedingly rare mineral variety, as observations in this **Portfolio** are catalogued here for the first time in human history!

Differences Between Beryl and Emerald

Beryl Variety by Descending Rarity	Red Emerald	Emerald	Morganite	Aquamarine	Heliodor	Green Beryl	Goshenite
Typical Synthesis	Pneumatolytic	Pneumatolytic	Pegmatitic	Pegmatitic	Pegmatitic	Pegmatitic	Pegamatitic
Hourglass Zoning	Yes	Yes	No	No	No	No	No
Saturation	***Intense***	***Intense***	*Low*	*Low*	*Low*	*Low*	*Low*
Dichroism	Moderate to **Strong**	Moderate to **Strong**	None to Weak	Weak to Moderate	Weak	None to Weak	None
Chromium Present	**Yes**	**Yes**	No	No	No	No	No
Cubic Inclusions	Yes	Yes	No	No	No	No	No
Toughness	Fair	Fair	Good	Good	Good	Good	Good
GIA Clarity	Type III	Type III	Type I	Type I	Type I	Type I	Type I
Enhancement	Liquid	Liquid	Heat	Heat	Heat / None	Heat / None	Heat / None
Value	High to Extreme	High to Extreme	Low to Moderate	Low to Moderate	Low to Moderate	Low to Moderate	Low to Moderate

The Hexagonal Crystal System





Inset: 2.5 cm Double-Terminated
Emerald Crystal
Muzo Mine, Colombia

Photo by GEMTEC, S.A.S.

2.1 cm Double-Terminated
Red Emerald Crystal
Ex. Rex Harris Collection

Photo by Jeff Scovil

The mineral name for Emerald is beryl, which forms under the **Hexagonal Crystal System**. Beryllium atoms bond to six oxygen each -- the same electrical charge in every oxygen keeps the half-dozen atoms evenly spaced in a stable six-sided ring called the Cyclosilicate.

Like sugar water condenses on a wooden stick to form rock candy, microscopic plates of beryl attach themselves to bixbyite nucleation points floating in a rhyolite magma solution rich in topaz, fluorine and beryllium.

Molecules group repeatedly in a highly-ordered structure, “stacking“ one upon another, on top of and around each other, coating with layer after layer of crystal. The geometry of a hexagon limits the physical ways beryl molecules may fit together, causing similar architectural patterns to emerge within each mineral variety. The tiny shapes coalesce to combine into larger versions of themselves until an almost imperceptible mineral wafer materializes.

Viewing the C-Axis

A **Wafer** describes the tabular habit of red beryl, easily-distinguishable by its unmistakable hexagonal shape.

This hexagon can be located on nearly every red beryl specimen, and finding it is fundamentally important, as this is the same act as looking down the C-Axis.

Identifying the C-Axis allows gemologists, mineralogists, students and fans to accurately describe a specimen to others. For Emerald lapidaries, orienting a gemstone's table perpendicular to the C-Axis often produces the best color and brilliance.

High-temperature environments cool quickly, producing small wafers, while low-temperatures can be sustained for longer periods, allowing plates to stack until a mineral begins preferential growth in the direction of the C-Axis. When enough beryl has grouped together to grow longer than a specimen is wide, the crystal habit has become a mineral tower known as a **Prism**.

Above: C-Axis of Beryl Prism

Top Left: C-Axis on Matrix

Top Right: C-Axis of Beryl Wafer

Photos by David Rozendaal

OPPOSITE PAGE

Middle Left: Profile of an American Beryl Prism
Photo by David Rozendaal

Bottom Left: Profile of a Colombian Beryl Prism
Photo by Seth William Rozendaal

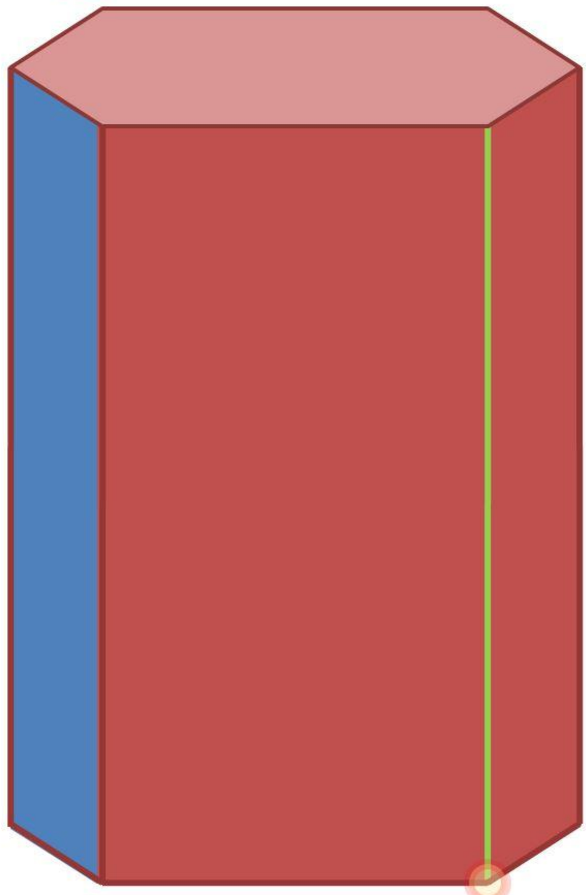
The Anatomy of a Prism

A Termination occurs at the beginning and end (top and bottom) of the Hexagonal Tower.

A Crystal **Termination** on the end of a **Prism** has an outline in the shape of a Hexagon -- Two **Terminations** exist on a **red** beryl **Prism** in the unmodified **General Form**.

A Face is one side of the Hexagonal Tower.

A Crystal **Face** on the side of a **Prism** has an outline in the shape of a rectangle -- Six **Faces** exist on a red beryl **Prism** in the unmodified **General Form**.



An Edge is the boundary line where two planes meet in a crystal.

A Point is where three or more edges meet in a crystal.

Below: Six "floater" or off-matrix **Prisms** from the Wah-Wah Range
equal or greater in size to the largest crystal found after the first 25 years of mining.

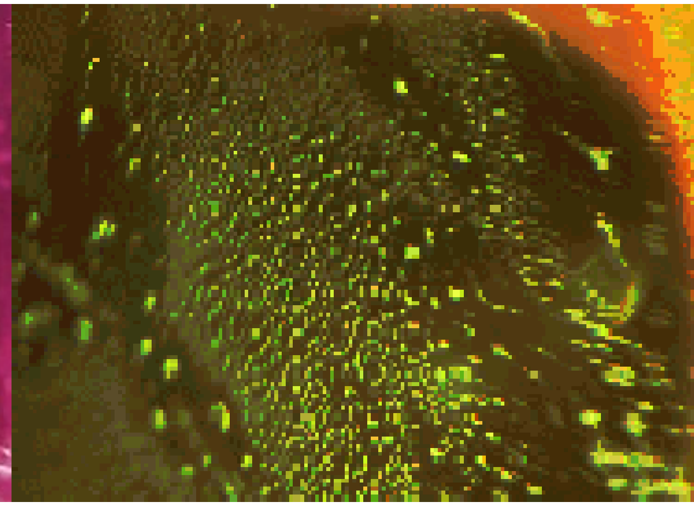
Photos by David Rozendaal

Lantern Twin	Ironcliff Towers	Ten-Tabular Pi	Fat Red Vein	Red Cross	Mickey
30.45 ct	**30.83 ct**	**31.415 ct**	**36.70 ct**	**40.9 ct**	**44.79 ct**
21.48 x 15.42 x 13.34	25.03 x 13.52 x 10.64	20.02 x 16.61 x 12.60	18.12 x 16.07 x 15.78	27.94 x 17.4 x 14.5	26.1 x 18.11 x 12.82

Inclusion Patterns and Effects

Red Emerald Fingerprint Inclusion Field
Gems and Gemology, Winter 1984

Photo by Robert Kane



Emerald Fingerprint Inclusion Field
Early Online Photogallery of Emerald Inclusions

Photo by GEMTEC, S.A.S.

Gem minerals with similar clarity properties should be expected to produce gemstones of a similar optical nature. The characteristics of an inclusion have a critical impact on the appearance of a host mineral. The red and green varieties of beryl regularly display similar inclusion types (*eg - next page*), arranged in similar patterns (*eg - above*) with similar effects on crystal form (*eg - below*).

Red Emerald Gem Prism with Well-Defined Geometric Form

Photo by David Rozendaal

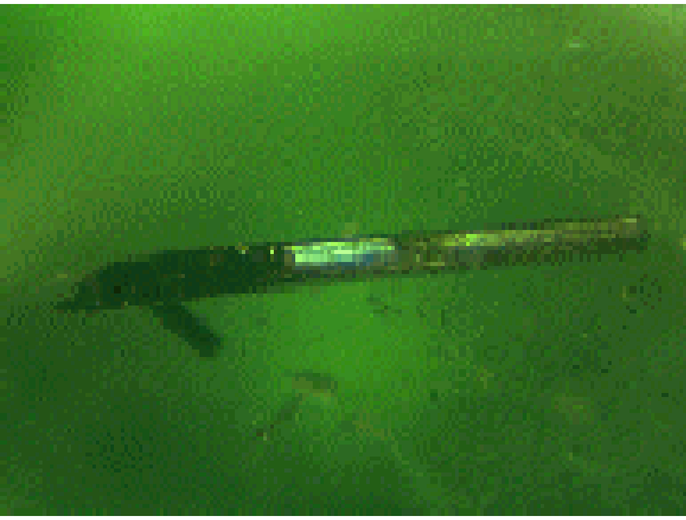
Emerald Rough with Inclusions, Surface Discoloration and Pitting

Photo by Lapidaries Finest Gemstones

Red Emerald Rough with Inclusions, Surface Discoloration and Pitting

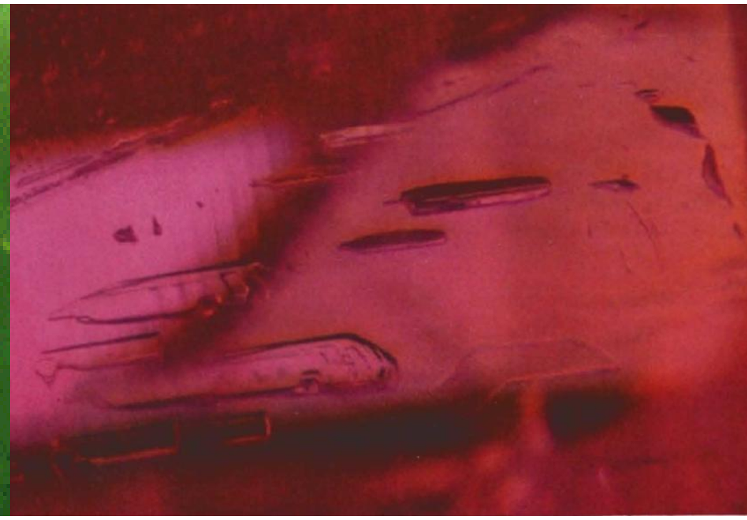
Photo by David Rozendaal

Inclusion Types



Two-Phase Tubular Inclusion in Chivor Emerald Rough
Early Online Photogallery of Emerald Inclusions

Photo by GEMTEC, S.A.S.



Directionally-Oriented Two-Phase Inclusions in Red Emerald
Gems and Gemology, Winter 1984

Photo by Robert Kane

Uniformly-Oriented Tubular Inclusions Produce a Weak Catseye Effect in this Gem Cabochon Pear.

Photo by Stephen Kotlowski

All colors of beryl may contain two-phase inclusions, but the red and green carry a significantly higher concentration of inclusions, dramatically contributing to an Emerald's signature appearance. The Gemological Institute of America designated the two varieties as Type III under their Clarity Classification System, which affects the gemological appraisal methodologies applied.

The Red and Green Emerald both display a very specific type of two-phase inclusion: The tubular, fibrous or needle-like inclusion which is directionally-oriented and capable of transmitting light.

When an army of these inclusions face the same direction, a stone can be shaped into a rounded dome which arranges their collected light into a line. This effect is known as the **Catseye** Phenomenon.

Green Emerald Catseye stones are incredibly rare, and only a handful of Red Emerald examples exist.

Cubic Inclusions

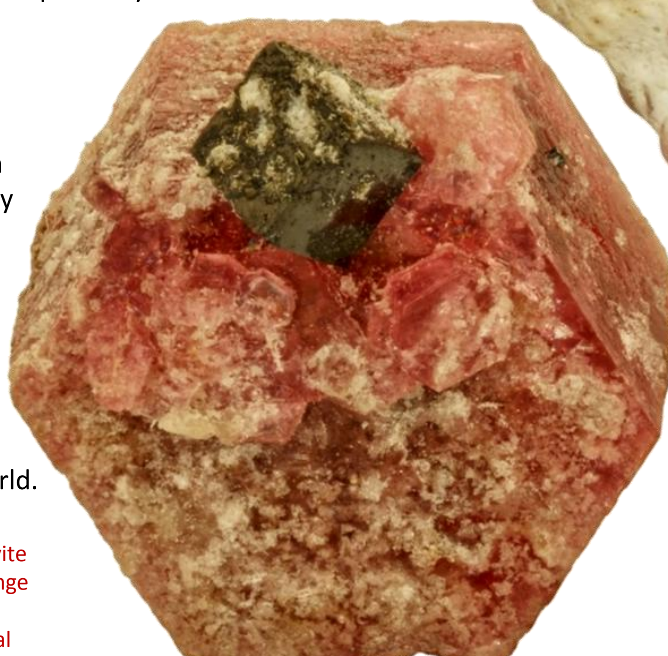
Left: Pyrite in Cubic Form on Matrix
Photo by Barbara Smigel

Inset: Cubic Pyrite in Chivor Emerald
Photo by Vienna Gem Center

The location where a red beryl crystal originates on a **Bixbyite** is known as the nucleation point. The large bixbyite at right is worn away by time, but the crisp angles of its former glory can still be imagined in parallel orientation with the other cubes on this page. Note the square crystal negative at the bottom of the black material; this void suggests another bixbyite cube may have once been attached and lost.

Colombian Emeralds are found regularly included by **Pyrite**, also known as Fools Gold. The Emerald and Red Emerald both have cubic inclusions with a metallic luster in pyrite and bixbyite, respectively. These two minerals are similar inclusions.

The Red and Green Emerald also possess unique inclusions which can be used to positively identify origin. When discovered as minerals, the parisite in Muzo material and the bixbyite in Utah rough were both believed to exist nowhere else in the world.



Right: Red Beryl and Bixbyite Cube from the Thomas Range

Photo by David Rozendaal

Above: Red Beryl and Bixbyite Cube from the Wah Wah Mountains

Photo by David Rozendaal

Cubic System Modification in Emerald

3 bixbyite nucleation points spaced symmetrically on termination
Gems and Gemology, Winter 1984

Photo by Ted Harris

While only a single bixbyite nucleation is needed for red beryl growth, a single beryl will often contact multiple bixbyite in the vicinity as it forms (*Left*).

When red beryl interacts with any other mineral, growth modifications are used to "adapt" to the foreign crystal. The **General Form** of bixbyite may be unaffected as an inclusion, but red beryl also appears capable of modifying, restructuring or consuming bixbyite during crystallization.

OPPOSITE PAGE

Hexagonal Houglass Color Zoning in Emerald

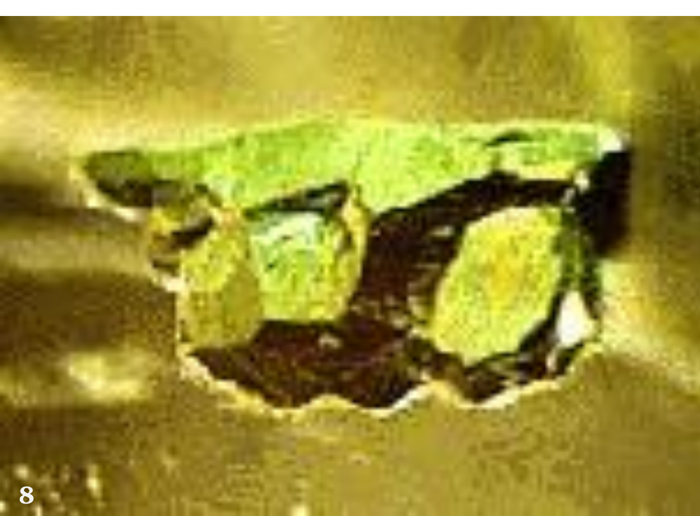
Sketch from the Mineralogical Record
Volume 47 Number 1

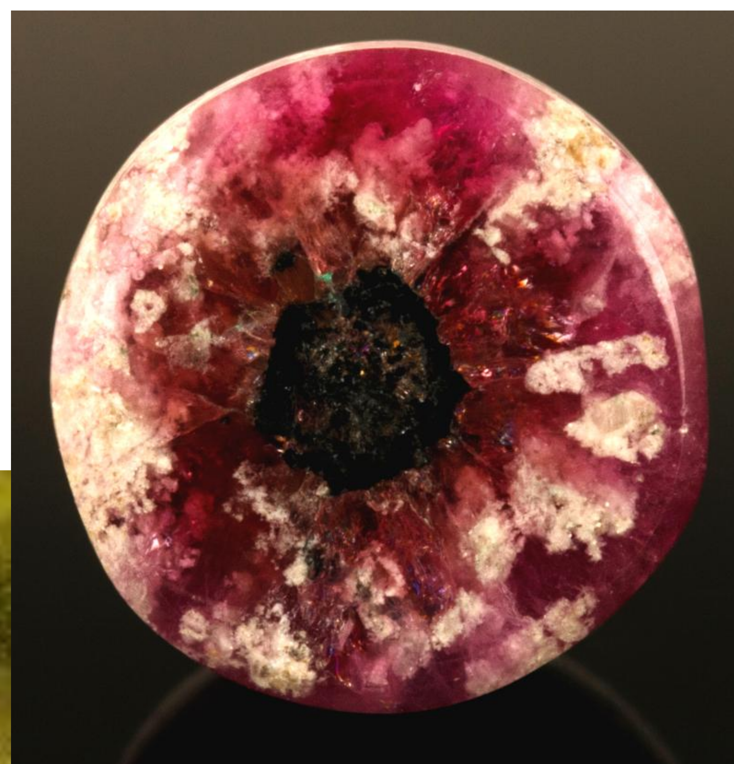
Pyrite mineral habits appear in many shapes, and crystals trapped within Colombian Emeralds have been documented in forms modified (*Below*) from their typical block-like cubic structures.

Bixbyite is ordinarily seen as cubic, but can appear slightly altered (*Right*) with a hexagonal profile. Utah beryl has a **red** color with a strong **orange** **Secondary Hue** in the center where the gem is in contact with bixbyite. This red graduates into a **purple** secondary hue around the edge or the "rind".

Pyrite Inclusion in Green Emerald,
Modified from Cubic Form

Photo by GEMTEC, S.A.S.

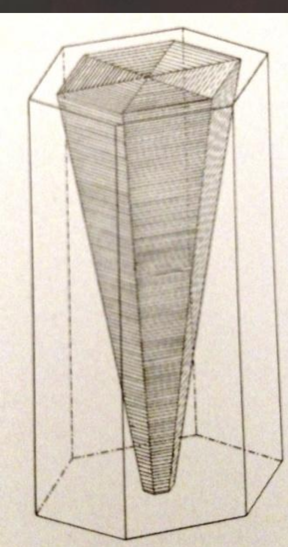


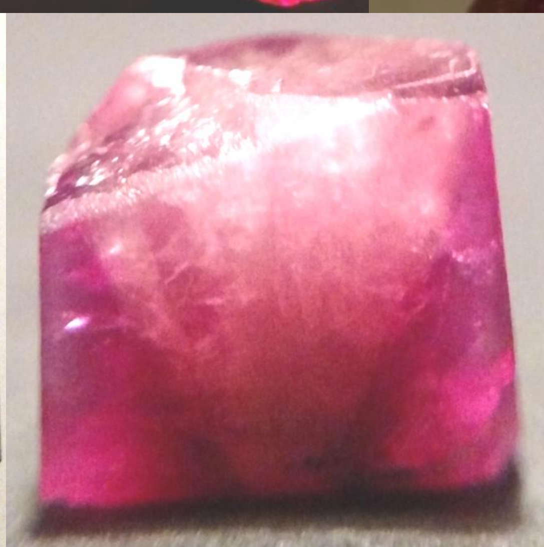


Bixbyite Inclusion in Red Emerald,
Modified from Cubic Form into Hexagon

Photo by David Rozendaal

The Hexagonal Eyes of the Hourglass





Top Left: Termination Base of Hourglass
Top Right: Termination End of Hourglass

Photos by David Rozendaal

Where the bixbyite attachment ends, gem quality red beryl begins (*Top Left*). The orange core of a red beryl grows wider as a prism lengthens, typically covering more than half of the termination end when present (*Top Right*).

This size difference creates a tapered color zone which looks similar to the funnel on the top of an **Hourglass** (*Left*).

Above: Profile of Hourglass
Photo by Seth William Rozendaal

Right: Pale Core Wafer on Bixbyite
Photo by David Rozendaal

In 1958 when this red variety was finally discovered in gem quality, **Hourglass Color Zoning** (Page 12) was regarded a defining characteristic of Emeralds from the Muzo Mine.

Left: Hexagonal Core in a Colombian Emerald Cabochon

Photo by Gems Shoppe

The Trapiche Phenomenon

Right: Fine Emerald Trapiche with Well-Defined Trapiche Lines from Hexagon Center

Photo by Tino Hammid

The classic Emerald **Trapiche** (*Right*) arranges inclusions in angular lines radiating outward from the hexagonal center of a green beryl crystal along the rotational axes.

While catseyes can often be found in the gem segments of a green trapiche, the chatoyant portions of Red Emerald trapiche are in the fibrous lines of inclusions! (*Below*)

Light reflects off the surface of six horsetail-like groups to create the appearance of a catseye on each trapiche line spraying outward, making an extraordinary gemological curiosity.

Below: 0.39 carat Red Emerald with Well-Defined Trapiche Lines from Bixbyite Center

Photo by David Rozendaal

Below: 4.52 carat Red Emerald Trapiche with Hexagonal Zoning

Photo by David Rozendaal

Radial Formations

Above: Preferential Breakage on Radiating Fracture Lines
Photo by David Rozendaal

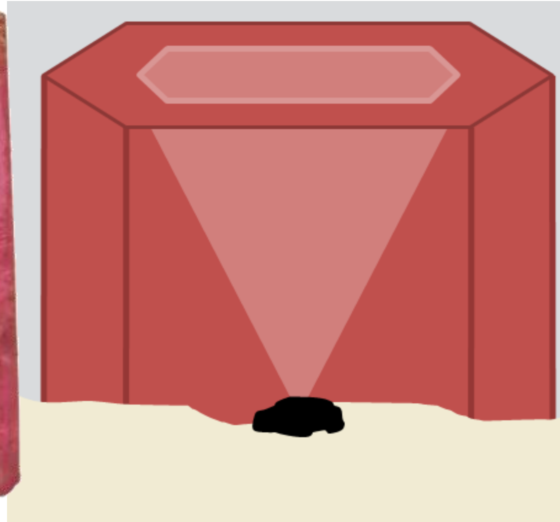
Left: Radial Emerald Group from Bahia, Brazil
Photo by Marin Minerals

Red beryl grows from a single origin and forms a prism with an hourglass that sprays from the central nucleation point. Instead of crisp, sharp trapiche lines, Red Emeralds orient similar materials much more loosely along the axes. More-included reverse trapiche or "poker chip" patterns seen in green emeralds are comparable to small specimens noted in the red.

Above: Radiating Lines of Inclusions Along the Rotational Axes
Photo by David Rozendaal

Right: Type II / Reverse Trapiche Emerald Prism
Photo by Diego Rodriguez Acuña

Hourglass Color Zoning



Hourglass Color Zoning shown through the profile of a red beryl prism

Photo by David Rozendaal

Cross-Section with Hourglass Color Zoning
Gems and Gemology, Winter 1984

Photo by John Koivula

The **Red-Orange** gem material inside the hourglass zone is slightly more-included, with different chemical and gemological properties than the **Red-Purple** rind which surrounds the hourglass border.

The contrast between these two **Secondary Hues** is ordinarily observed as dichroism, but the red-orange and red-purple colors can be seen simultaneously when examining an hourglass prism perpendicular to the C-Axis.

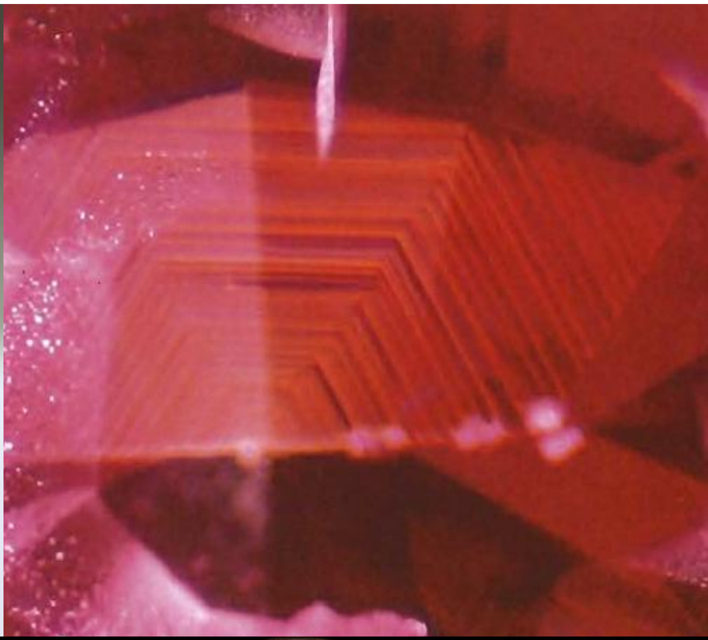
The profile of an Hourglass appears smooth like a cone, but the shape is actually flat with corners, echoing the hexagonal form of the greater crystal structure.

Cabochon showcasing cubic crystal negatives, a bixbyite nucleation point and full hourglass

Photo by David Rozendaal

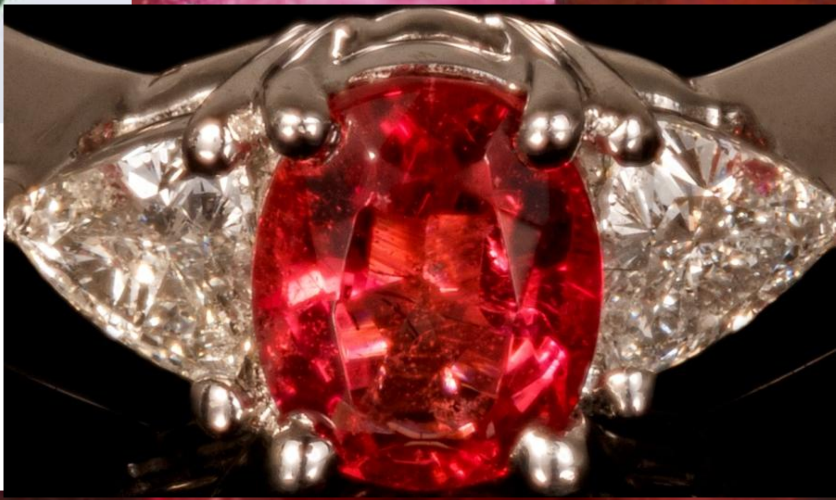
Symmetrical Angular Growth

If one looks down the C-Axis into the funnel of the Hourglass, angular growth features can sometimes be observed. These cascading chevrons mark the passage of time like rings on a tree, continuously recording the fluctuating availability of component minerals throughout the prolonged period of growth.



Angular Growth Features in a Colombian Cross-Section

Photo by Luciana Barbosa



Top Right: Angular Growth Features in a Red Beryl Crystal *Gems and Gemology*, Winter 1984 Photo by Robert Kane

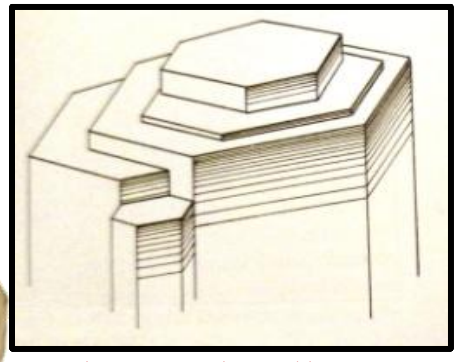
Middle Right: Red Emerald Oval Ring with Orange Coloration Photo by David Rozendaal

Bottom Right: Magnified view of Growth Lines in the Crimson Jardin Photo by David Rozendaal

Crystal Growth in Parallel

Below: Multiple Red Hexagonal Plateaus
Rise in Parallel

Photo by David Rozendaal



Above: Layered Emerald
Growth in Parallel

Sketch from the Mineralogical Record
Volume 47 Number 1

Right: Multiple Green Hexagonal
Plateaus Rise in Parallel

Photo by Fabre Minerals

On the surface of a beryl termination, hexagons not only stack outwardly in rings, but they stack up, around and upon one another.

The higher pressure of pneumatolytic growth forces multiple prismatic specimens to form separately in parallel, similar to the architectures of Emeralds from the Otero Muñoz mine in Colombia.

Competition between these hexagonal groups may end when one finds a direction of growth which outperforms the rest. New gem layers forming faster along a preferential growth vector will envelop previously-fragmented efforts and merge into fewer terminations.

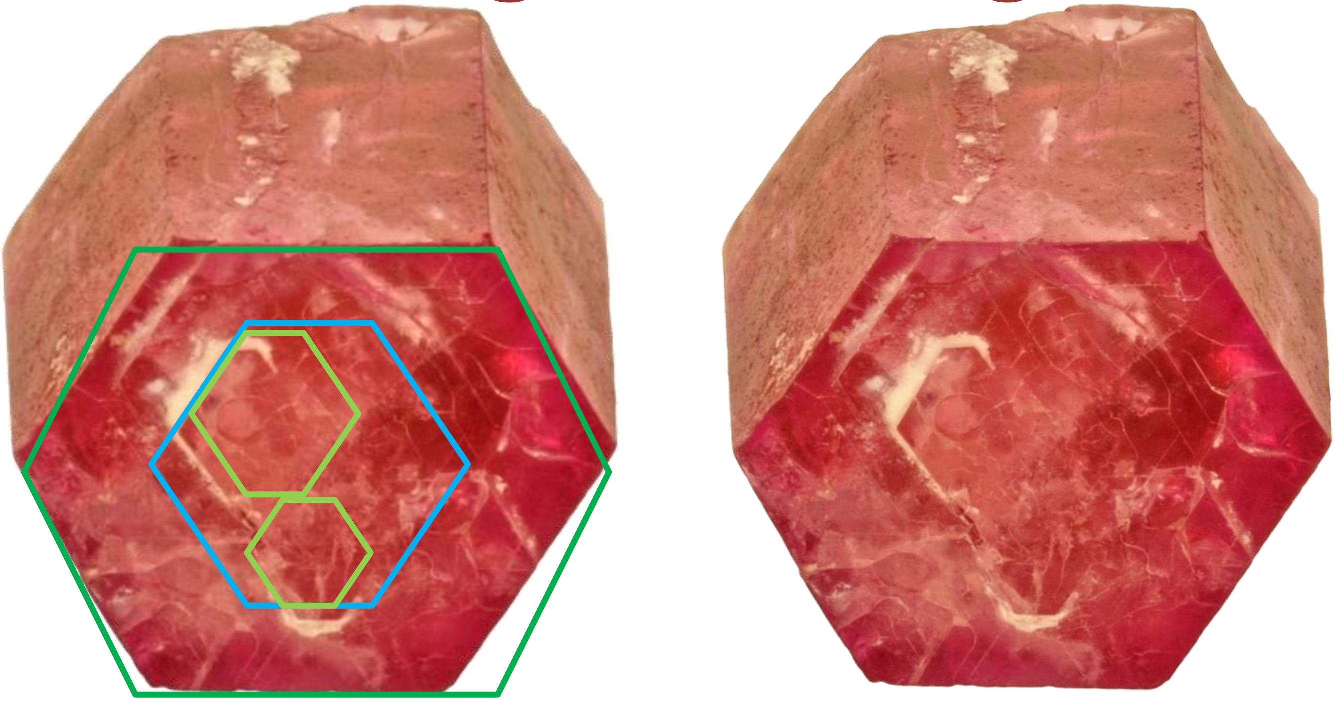
Alternatively, if synthesis fails to centralize, the number of disturbances may increase, existing disruptions may become more pronounced or new crystals may even propagate.

Left: Multiple Termination Faces in Parallel

Right: Alternate Version of a Similar
Crystal with Merged Terminations

Photos by David Rozendaal

Hexagonal Stacking



Smaller Hexagon Plates Form a Larger Hexagonal Plate Group

Photos by David Rozendaal

Emerald formation should not be imagined as a single hexagon prism coming into existence. Creation occurs as the result of thousands of tiny plates stacking together to form larger hexagonal groups, slowly adding to crystal size over time (*Above*). Tiny plates latch onto bigger wafers to help a Red Emerald grow.

The process begins along the outer edge of a hexagon, with smaller plates corkscrewing inward. Hexagons are arranged in staggered spirals winding into the slightly depressed center of the termination end, creating the vortex of the hourglass color zone. Uneven crystal growth during the end of the crystallization period allows hexagonal stacking to be observed on a termination.

Hexagonal Stacking of more than half a dozen wafers

Photo by Treasure Mountain Mining

Phenomenal Hexagonal Stacking

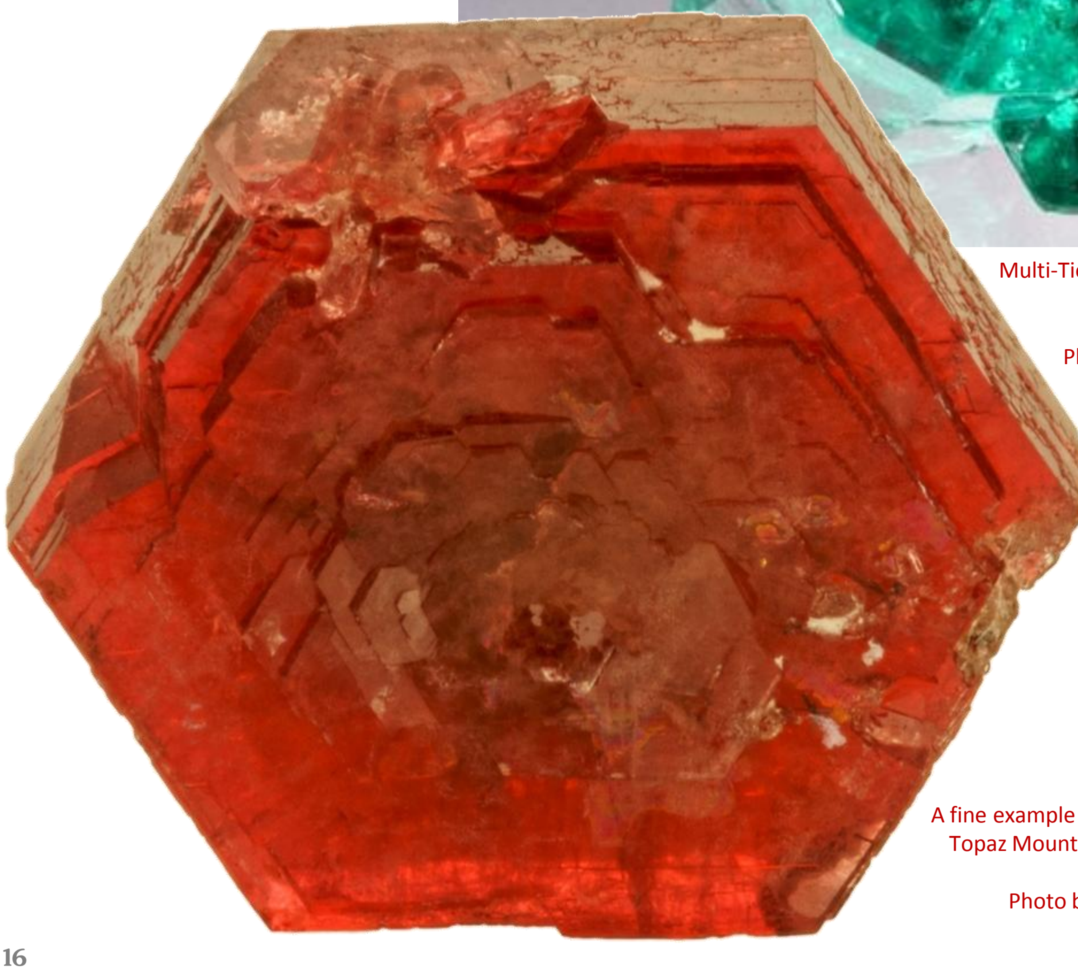
The hundreds of tiny hexagon plates which stack in a synchronized fashion occasionally do so with astonishing visual results.

The green and red specimens on this page are rarely seen, world-class examples of hexagonal plating.

Note the many layers of hexagons on different geometric planes in each piece. The number of layered "stacks" can be counted in the reflection off the upper crystal face below.

Multi-Tiered Green Hexagon Wafers
Stacked in Parallel

Photo by Dan Weinrich



A fine example of the rosette crystal habit
Topaz Mountain, Thomas Range, Utah

Photo by David Rozendaal

Hexagonal Grouping and Plateau

Very fine Emerald Heart with Hexagonal Plates grouped at Various Elevations

Photo by Rob Lavinsky

Very fine beveled Red Emerald Prism with raised Hexagonal Plates grouped on the Termination End

Photo by David Rozendaal

A termination may be completely flat and glassy or have hexagonal groups which are marginally elevated over the surface of an end (*Above*).

A wafer group which significantly outperforms peers in growth leads to the staggered rise of a smaller hexagon within the larger perimeter of a termination.

A **Partial Plateau** (*Right*) is formed by two or more hexagonal groups rising simultaneously in competitive growth, with no group completely surrounded by any other(s). A Partial Plateau is a **Platform** (19) on a Termination End.

Severe disturbances reveal the hexagonal stacking and grouping which form a Plateau

Photo by David Rozendaal

Full Plateau and Scepter

Left: Wafers band together and elevate their Hexagonal Group

Photo by John Betts

A **Full Plateau** forms when a crystal shows preferential growth towards a specific group of wafers enclosed in the center of a termination end, allowing that hexagon to rise in obvious contrast with the mineral's surrounding architecture.

When a crystal becomes prominently larger at a termination end, the habit is referred to as a **Scepter**.

A **Reverse Scepter** occurs when the larger portion of a crystal is at the bottom termination of a specimen (beginning of growth) like the spectacular examples pictured at *Left*.

Bottom Left: Emerald Reverse Scepter Prism

Bottom Right: Red Emerald Reverse Scepter Prism

Video Stills from Treasure Mountain Mining

Facial Separation and Platform

To form a crystal, identical molecules are placed in the repeated sequence of a highly-ordered structure. The organization of these molecules occurs on an imaginary grid called a **Lattice**.

Damage to a crystal's surface may result in errors to the orientation of a lattice, leading to growth along a new Axis. **Facial Separation** occurs when a secondary layer of crystallization begins in this new direction, partially crossing the surface of an existing crystal face (*Right*).

Above: Facial Separation on top and center faces
Ex. Steve Dowell Collection

Photo by The Crystal Cave

A thick, gem block Platform on the bottom right face

Photo by John Betts

When a partial layer of crystallization rises more prominently against a crystal than a Facial Separation, that block of gem material has become a **Platform**.

Right: The 632 ct Patricia Emerald has a famous gem platform attached at a slightly-canted angle

Photo by the American Museum of Natural History

Surface Etching

Striations are a by-product of formation similar to the natural appearance of growth lines in fingernails.

Striations are etched furrows on the surface of a crystal face. Striations form from repeated gaps in the development sequence, causing their orientation to follow the direction of growth and remain roughly parallel to the C-Axis.

Striations follow the direction of growth
in both the primary crystal and sidecar

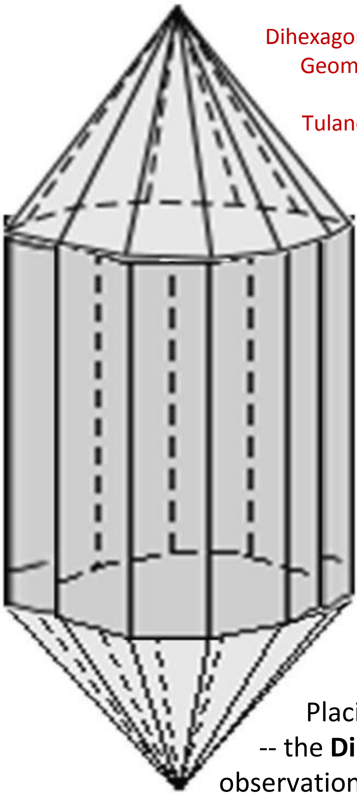
Photo by Seth William Rozendaal

Etching refers to a noticeable variation in the surface topography of a crystal face, which may be caused by early-phase external modifications, mirror-plane pressures, unseen structures overlapping within the internal lattice or another source of stress at the time of formation.

Stair-Steps are **Etched** into the bottom of the left face
on this specimen, which exhibits slight sceptering

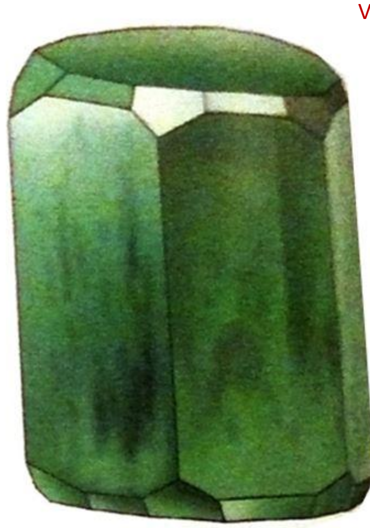
Photo by David Rozendaal

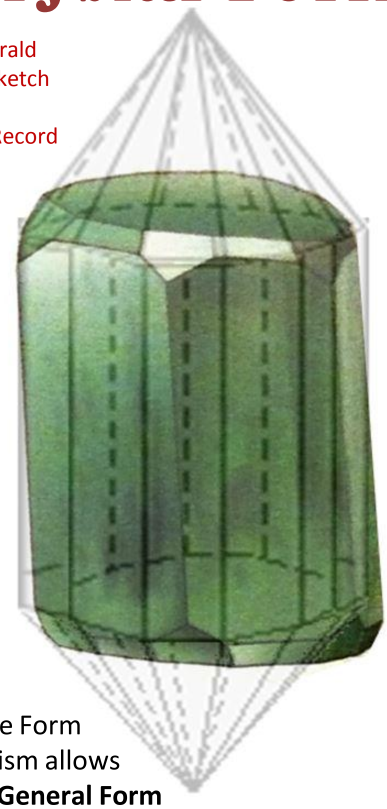
Mirror-Modifications to Crystal Form



Dihexagonal Dipyramidal
Geometric Sketch

Tulane University





Beveled Emerald
Termination Sketch

Mineralogical Record
V41 N1

Placing the planar boundaries of beryl's Ultimate Form -- the **Dihexagonal Dipyramid** -- around a crystal Prism allows observation of the **Mirror Plane**. Beryl may modify its **General Form** along these unseen planes and still maintain symmetrical (efficient) formation.

Pyramidal adjustments demonstrate how a General Form adapted to stress -- meaning Mirror-Modifications may be caused by crystal perfection OR crystallization disruption. Mirror-Modifications are permanent structural changes which result in Complex Terminations. Any red beryl specimen with even slight modification is an unusual and outstanding prize for a collection.

Modified Coscuez Prism

Photo by Jeff Scovil

A **Pyramidal Bevel** is one of the rarest structural modifications

Photo by Guy Russo

Pyramidal Point

Imagine a generic, square plastic container easily found in a grocery store. Push in a corner until the plastic is dented. How surprising would it be to see the corner pushed in absolutely flat at precise and perfect angles?! Pneumatolytic pressure "restrains" or "pushes in" the growth of a crystal, causing points and edges to "dent". These indentations do not appear randomly, but geometrically.

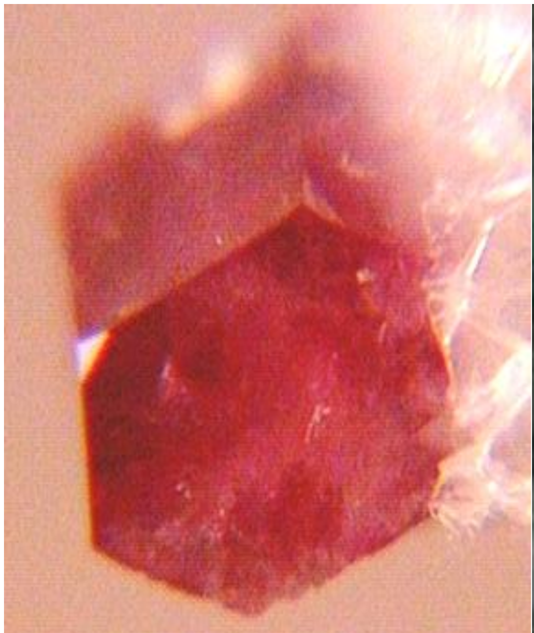
A **Pyramidal Point** is a blunted alteration at the point where two termination edges and a facial edge meet.

Top Left: Indented Point on Red Beryl Prism
Photo by Tom & Vicki Loomis

Top Right: Indented Point on Green Beryl Prism
Photo by Rob Lavinsky

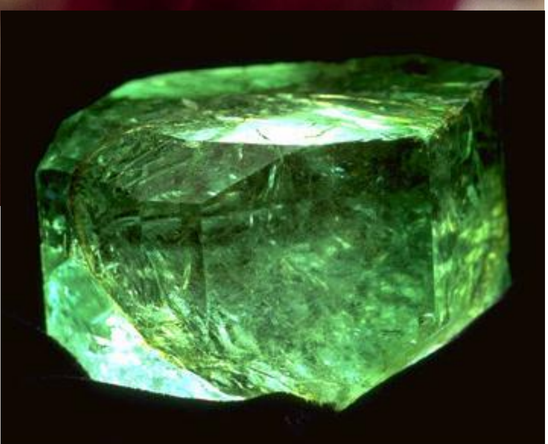
Bottom Left: Pyramidal Points on Stepped Red Beryl Prism
Photo by Mike Petrov

Bottom Right: Pyramidal Points on Stepped Green Beryl Prism
Photo by Fabre Minerals



The point where the termination end meets two faces appears shaved off, with the ordinarily sharp crystal point blunted into a flat triangle shape. Extending this triangular plane forms one of the extra phantom faces in a **Dipyramid**.

Pyramidal Edge



El Perfecto, a fine Beveled Emerald specimen from Coscuez

Photo by Jeff Scovil

Above: Beveled Prism
Photo by David Rozendaal

Left: The 858 ct *Galacha* Emerald
Photo by the Smithsonian Institution

Above Left: Beveled Heart
Photo by Seth William Rozendaal

A blunted alteration along the edge of a single crystal face with the termination end is a **Bevel** or a **Dome**. Beveling occurs when an edge shared by the termination end and one crystal face is bent over, presenting a shaved appearance similar to the tapered edge along a countertop.

Shield-shaped termination caused by Beveling

Photo by David Rozendaal

A Bevel along the longer edge of two crystal faces forms a **Facial Dome**. This rarely-observed additional crystal face would serve as one of the extra phantom sides in a **Dihexagon**.

Discover additional examples of red beryl crystal modifications by searching for ones hidden in the photos on other pages of this book.

1.86 ct Beveled Prism

Photo by Seth William Rozendaal

Inverted Pyramidal Edge

Imagine the plastic container from the grocery store again, with an indented, beveled edge. Imagine applying more pressure until the bevel snaps inward, the geometric reflection of an unmodified edge...these "opposite-formations" embody the very meaning of "Mirror Modification"!

A sliver of the upper right face is unformed, creating the slightly-staggered appearance of **Stair-Steps**

Photo by Wayne Schrimp

A Bevel pushed further inward along the edge of one crystal face with the termination end forms an **Inverted Edge** with the appearance of a **Stair-Step** (*Above*).

While pyramidal modifications are relatively common in other beryl varieties, inverted modifications are another feature of Emeralds forming under pressure.

An Indented Bevel which ceases development while a crystal continues to lengthen is referred to as a **Ledge**. This **Terminated Inverted Edge** causes a secondary layer of crystal growth with a more interrupted appearance than a Stair-Step (*Right*).

Top Right: **Stair-Steps** on Green Emerald Prism

Right: A **Ledge** grows wider but not longer, creating a Platform crossing an entire face

Photos by John Betts

Inversion through Multiple Axes and Planes

Any combination of two or more Stair-Step modifications on different rotational axes of the same geometric plane classifies as **Pyramidal Stairs**, or **Sequentially-Inverted Bevels**.

Pyramidal Stairs have the appearance of a wrap-around porch. If those stairs circle all SIX sides of a termination end, that habit is a **Full Plateau** (18). Steps numbering fewer than six result in a **Partial Plateau** (*Left*).

Inverted Bevels which occur in Series, with Stair-Steps passing through multiple geometric planes and terminating on progressive levels, creates a **Stairwell**.

A combined set of Platforms, Plateaus and Stair-Steps which pass through progressive levels forms a **Staircase**.

Top Left: **Pyramidal Stair-Steps** wrap around Multiple Axes
Photo by David Rozendaal

Bottom Left: Progressive **Stairwell** to Termination
Photo by Seth William Rozendaal

Bottom Right: **Staircase** through Multiple Planes and Axes
Photo by David Rozendaal

Corner and Groove

Imagine the plastic container from the grocery store again, with an indented, triangular point. Imagine applying more pressure until the triangle snaps inward, geometrically reversed with an unmodified point.

An **Inverted Point** has the appearance of a single square-ish Stair-Step, and looks exactly like the **Corner** of any ceiling.

An uncorrected Corner will continue from a termination end to invert an edge segment as a crystal lengthens. When this is no longer the reflection of a point, but mirrors an **Inverted Edge Segment** instead, the modification has become a **Groove**.

A crystal may attempt to correct disturbances caused by a Groove through further adjustments to form; with penetrating planes (*Right*), stepped modifications (*Below*) or other alterations.

Above: **Corners** on top and bottom of the edge right-of-center

Stepped and **Grooved** 17.1 ct Green Emerald

Photo by Rameen Minerals

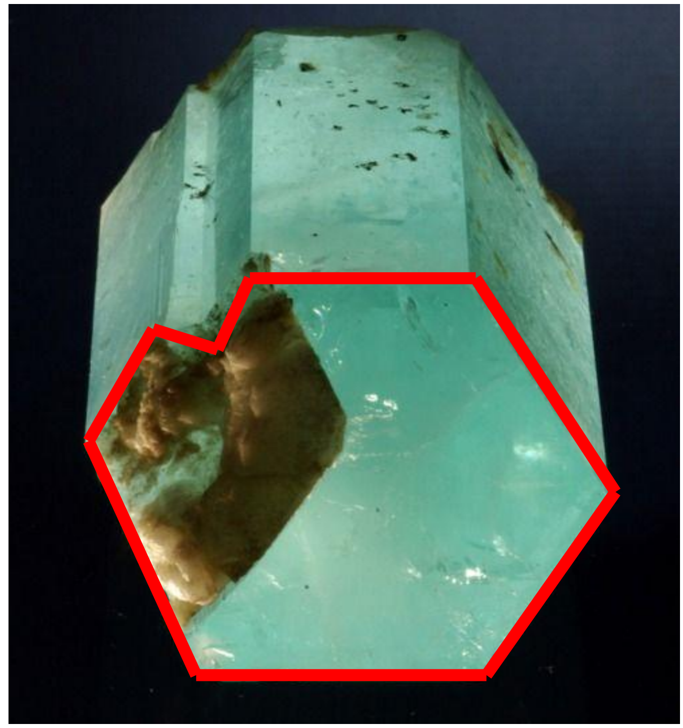
Below: Stepped and **Grooved** 16.96 ct Red Emerald

Photos by David Rozendaal

Trench and Heart

A **Trench** runs through the Facial Edge of a Red Emerald Specimen

Photo by Treasure Mountain Mining



A Trench runs through the Facial Edge of an Emerald Specimen to Reveal the **Heart**

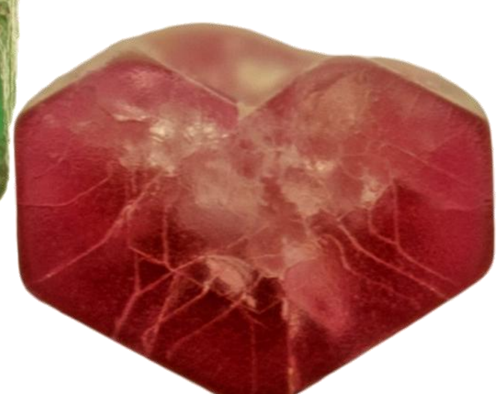
Photo by Fiona Glenn

If a **Groove** is not rectified by the greater hexagonal structure and instead runs uncorrected for the full length of a crystal, it becomes a **Trench**. A Trench is an **Inverted Facial Edge**, or a Stair-Step along a complete facial edge.

If a Trench maintains a modest degree of reflective symmetry along the C-Axis, that **Symmetrical Inverted Edge** creates a hexagonal prism with the appearance of an eight-sided geometric **Heart**.

Orange-Core Heart

A Colombian Heart



Symmetrical Heart Prism

Photos by David Rozendaal

Complex Red Crystal Structures

Intersecting Red Emerald Prisms Turns the Bottom Termination into a Composite of Small Faces

Photo by David Rozendaal

Emeralds are prone to crystal propagation and clustering. The genesis of new prisms can be encouraged from a variety of sources but each beryl has at least eight sides and six rotational axes from which even more crystals may begin to grow. Together their forms combine to create some of the most complex and impressive mineral specimens in the collectible world.

Two Intersecting Prisms from Beaver County, Utah

Photo by David Rozendaal

Genesis of Multiple Red Prisms, with Dihexagonal Facial Modification

Photo by David Rozendaal

Multiple Red Prisms from a single nucleation

Photo by David Rozendaal

Complex Green Crystal Structures

Intersecting Emerald Prisms Turns the Bottom
Termination into a Composite of Small Faces

Photo by Stan Celestian

Two Intersecting Prisms
from Hiddenite, North Carolina

Photo by the Smithsonian Institution

Genesis of Multiple Green Prisms, with
Dihexagonal Facial Modification

Photo by Exceptional Minerals

Multiple Green Prisms from a single nucleation

Free License Photo

Phenomenal Green Crystal Structures

Right: This Cluster of Emerald Prisms Sold at Tucson in 2017

Photo by Seth William Rozendaal

Green Prism Spray

Photo by James Rath

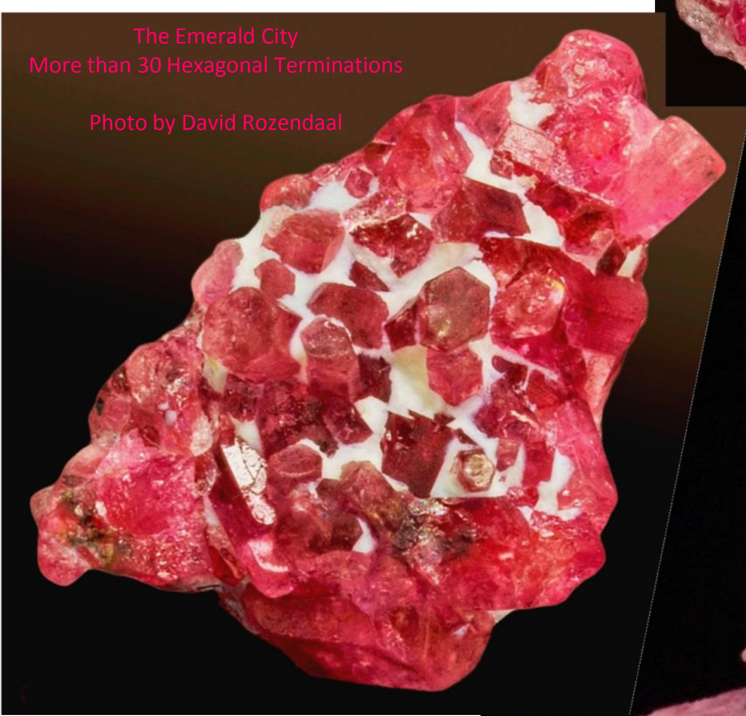
Right: Chatham Laboratory-Produced Fine Emerald Crystal

Photo by John Betts

Phenomenal Red Crystal Structures

Right: An apparent flex fracture runs through the center of this massive 39 ct Cluster of Prisms, likely caused by movement of the matrix during crystallization

Photo by David Rozendaal



The Emerald City
More than 30 Hexagonal Terminations

Photo by David Rozendaal

Right: A mammoth 87.65 ct Cluster specimen demonstrates the difference in quality of crystal production inside and outside of fractures in the rhyolite

Photo by Jasun McAvoy

The Color of a Ruby…
The Body of an Emerald

W. E. Wilson, author for the Mineralogical Record, while describing Red Beryl specimens at the 1991 Denver show, claimed that “to see these in the bright Colorado sunlight is almost a religious experience.” My goal is to provide that same exhilarating feeling by presenting breathtaking Red Emerald jewelry in unprecedented sizes and quality never achieved by the whole of humanity before, demonstrating the full glory of this precious gemstone.

Constraints of supply blessed me as the one of the few designers who will ever have complete access to the rarest color palette on Earth. By creating art from this jewel, I am obligated by a sacred responsibility to be good. I strive to accomplish my very best for everyone on this planet today and those yet to come. I am motivated by a duty to honor you and this irreplaceable Red Emerald material, an undeniable gift from God.

My sincerest hope is that you enjoy it, love it and **MARVEL** at one of the wonders of the modern world.

Your friend,

Seth William Rozendaal

www.TheRedEmerald.com