



PRECIOUS STONES AND METALS

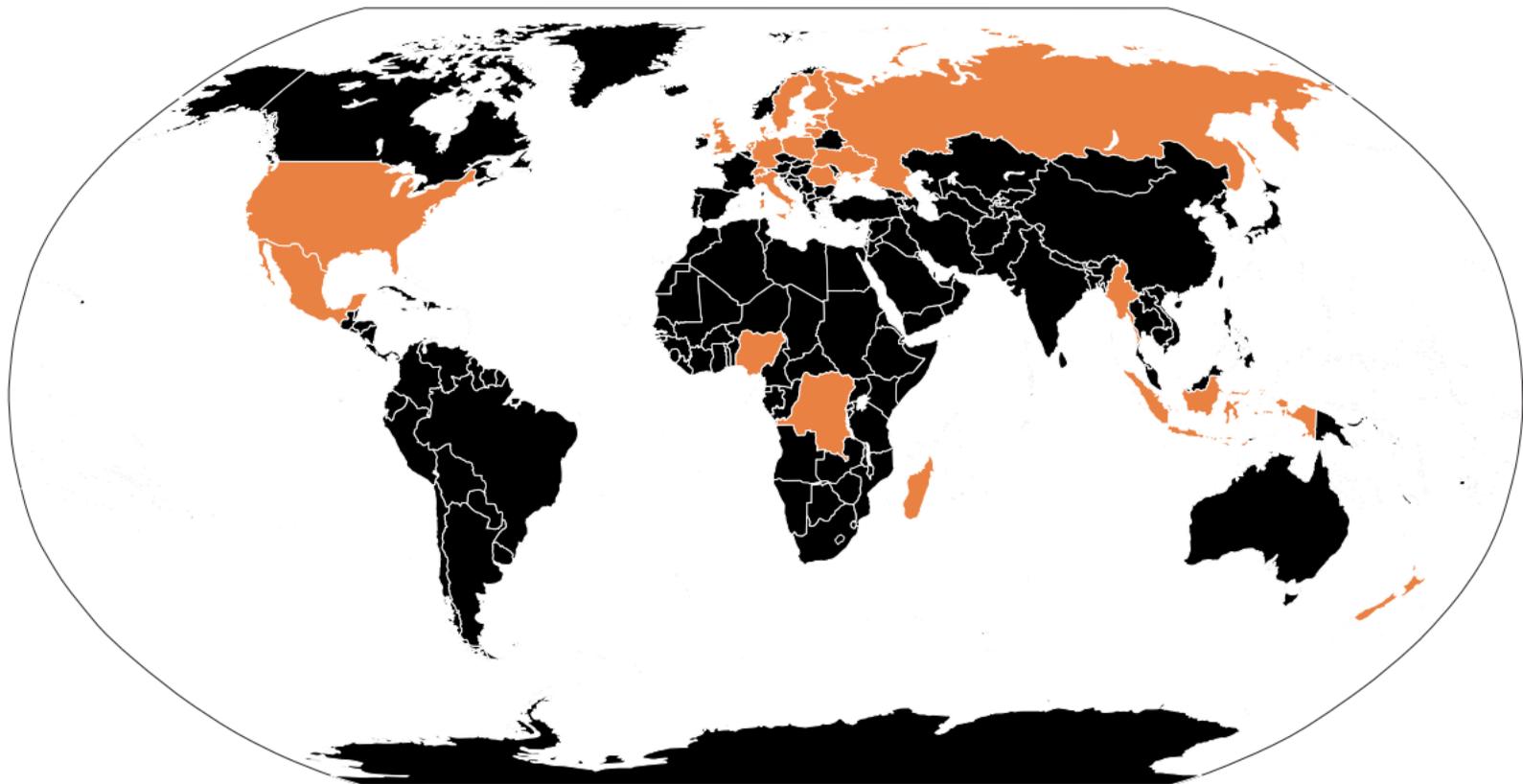
OF THE WORLD



5	Amber	21	Peridot
7	Amethyst	23	Quartz
9	Diamond	25	Ruby
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Minerals are mostly naturally occurring, inorganic, crystalline solids found in varying quantities in the Earth and beyond. Gems are usually minerals that are prized for beauty and strength; they have an eye catching color, luster or clarity coupled with a durability to make them items of lasting value. These definitions can be somewhat blurred at the edges; this has been reflected in our choice of some of the entries.



Category Gemstone

Composition Heterogeneous

Chemical Formula Fossil tree resin

Hardness 2 - 3

Color Yellow-orange-brown, pale lemon yellow, brown, almost black, red, green, or blue



Luster Resinous, greasy

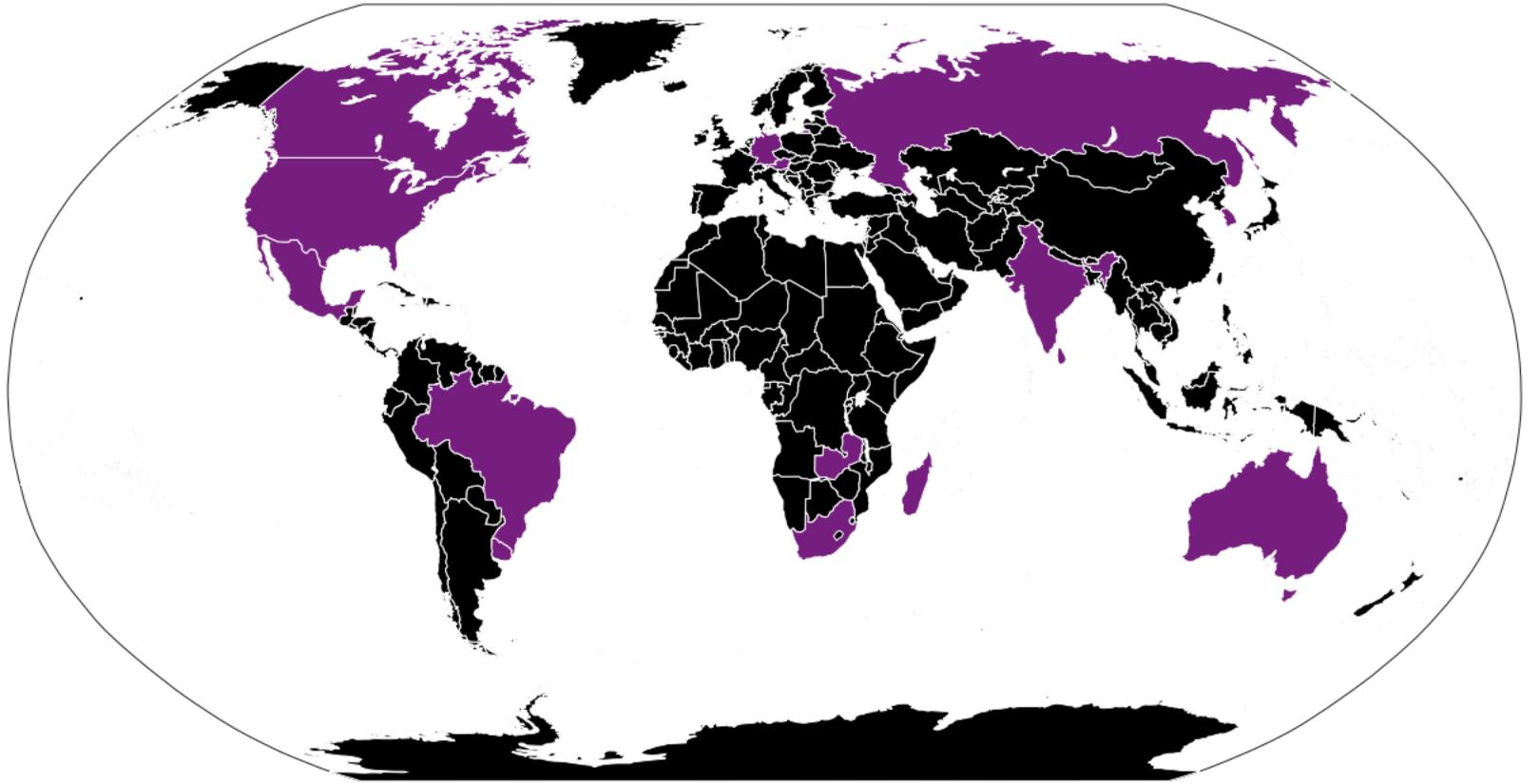
Cleavage None

Fracture Conchoidal



AMBER

Amber's name comes from the old Arabic word *anbargris* and refers to an oily, perfumed substance secreted by the sperm whale. This was translated into Middle English *ambre*, then Old French *ambre*, then Medieval Latin *ambra*. The meaning was lost in translation and is now associated with fossil tree resin. The Greek name for Amber is *electron* which was connected with their Sun God.



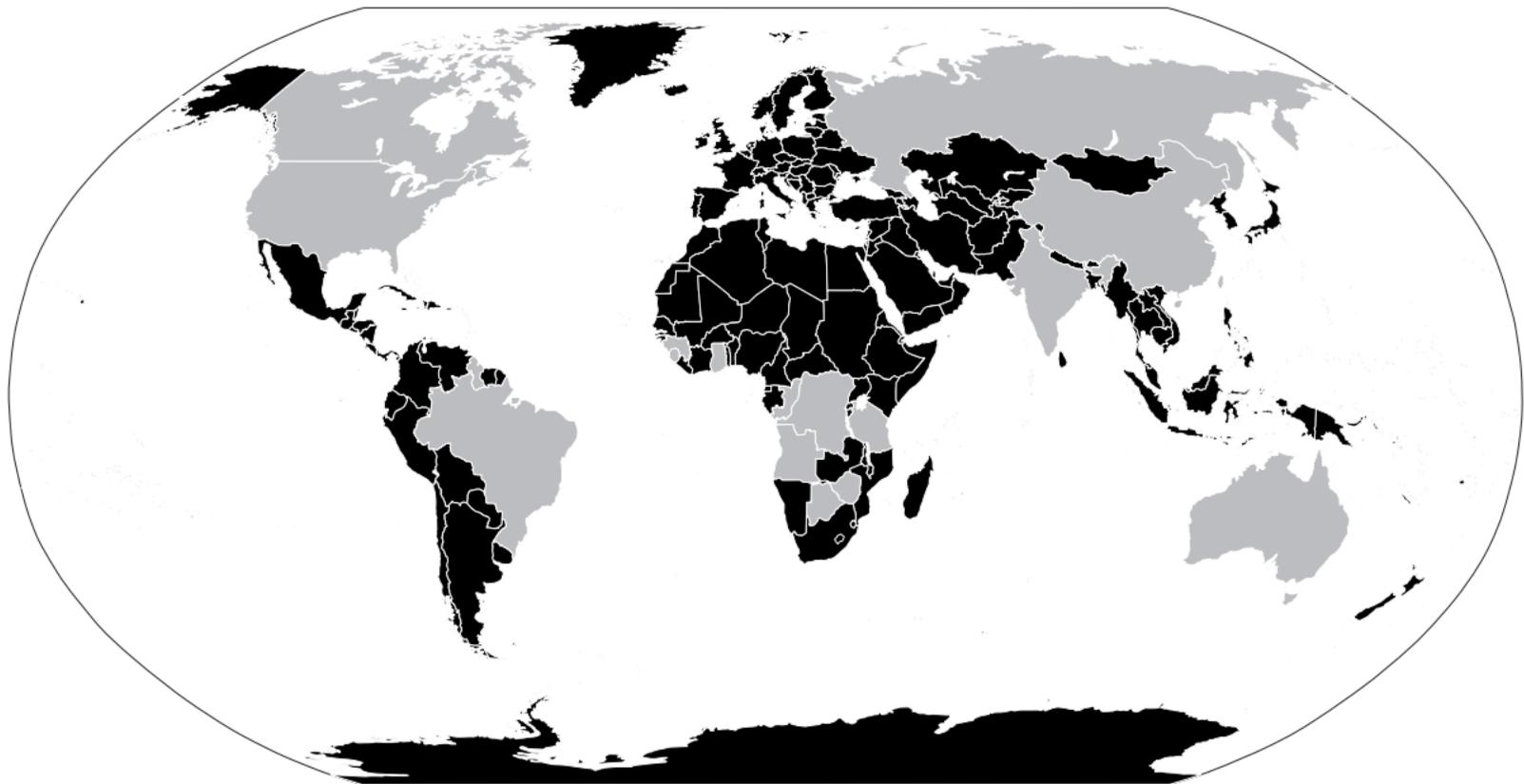
Category Mineral Variety
Crystal System Rhombohedral
Chemical Formula Silica
Hardness 7
Color Violet

Luster Vitreous, glossy
Streak White
Cleavage None
Fracture Conchoidal
Melting Point 1650° C

AMETHYST

Amethyst's name comes from the Ancient Greek a- ("not") and methustos ("intoxicated"), a reference to the belief that the stone protected its owner from drunkenness; the ancient Greeks and Romans wore amethyst and made drinking vessels of it in the belief that it would prevent intoxication. Amethyst is the birthstone for February. The most valuable amethyst is called the "Deep Russian."





Category Native Mineral

Crystal System Isometric-hexoctahedra

Chemical Formula Carbon

Hardness 10

Color Yellow, brown, gray, colorless, blue, green, black, translucent, white, pink, violet, orange, purple, or red



Luster Adamantine

Streak White

Cleavage 111 Perfect in four directions

Fracture Conchoidal, shell-like

Melting Point 3550°C



DIAMOND

Diamond's name comes from the Greek word *adamas* which means unbreakable or untamed. Diamond is the hardest known mineral and is the second most stable form of carbon. Today diamonds are associated with marriage as a symbol of love and forever. They are also used as abrasives because few substances can scratch them. It is also the birthstone for April.

Category Beryl Variety
Crystal System Hexagonal
Chemical Formula Beryllium
aluminium silicate with chromium
Hardness 7.5 - 8
Color Green



Luster Vitreous
Streak White
Cleavage Poor basal
cleavage seldom visible
Fracture Conchoidal
Melting Point Difficult
or impossible to find



EMERALD

Emerald's name comes from the Latin word *smaragdus*, which came from the Greek word *smaragdōs*, which came from the Semitic word *izmagad* meaning green. Emerald is the birthstone for May. It is also the traditional gift for the 55th wedding anniversary, but is also used as a 20th and 35th wedding anniversary stone. Ireland is often called "Emerald Isle."

Category Nesosilicates

Crystal System Cubic

Chemical Formula Calcium, iron, manganese, magnesium, with aluminum, chromium, silicon, and oxygen

Hardness 6 - 7.5

Color Virtually all colors

Luster Vitreous to resinous

Streak White

Cleavage None

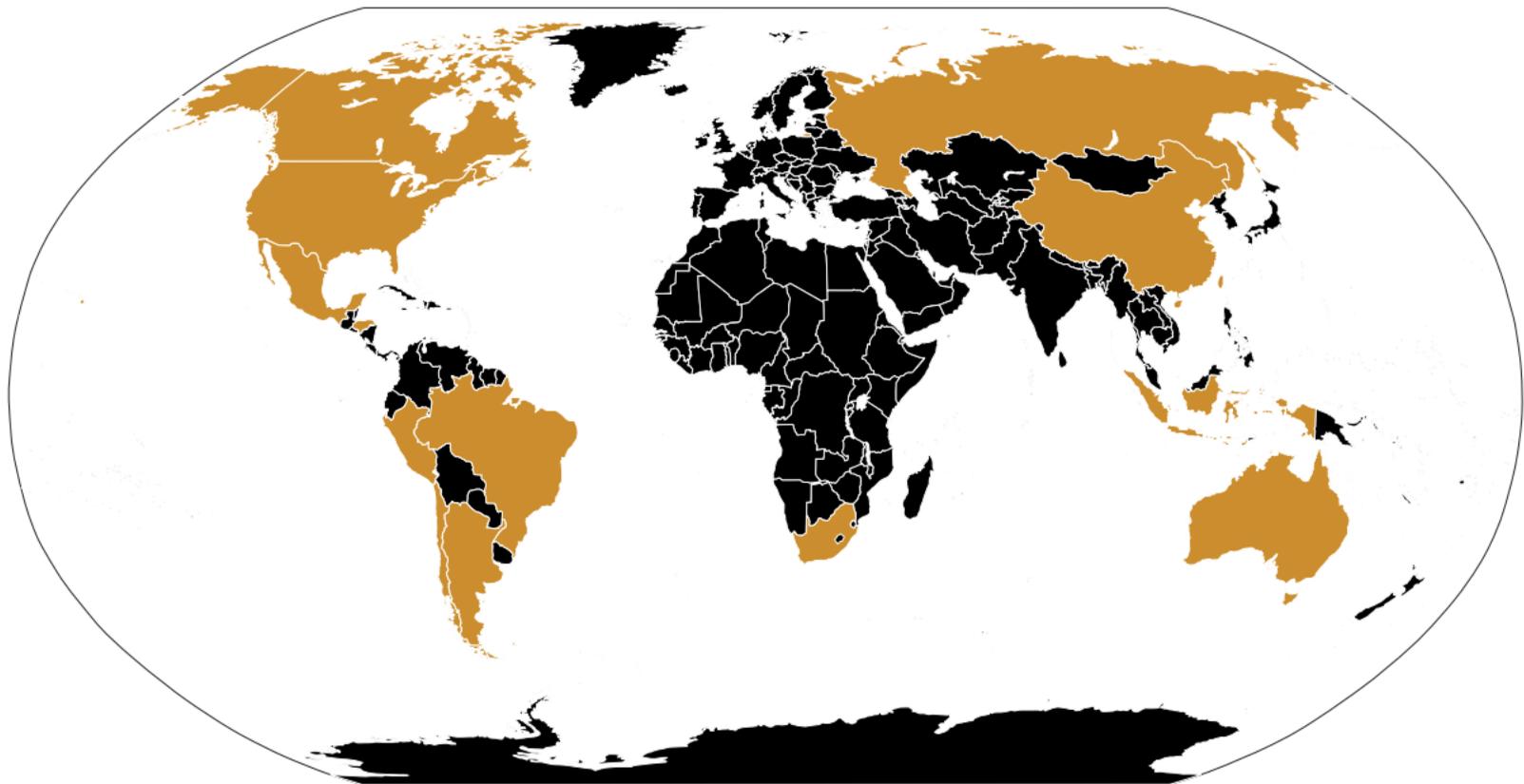
Fracture Uneven or conchoidal

Melting Point 1250° C

GARNET

Garnet's name comes from either the Middle English word meaning dark red or the Latin word granatus meaning grain, possibly referring to the pomegranate. Garnet is the birthstone for January. It is also used as a replacement for silica in sand blasting and used for water filtration media.





GOLD

Category Transition metal

Crystal System Cubic face centered

Chemical Formula Gold, Au

Hardness 2.5

Color Metallic yellow

Luster Metallic

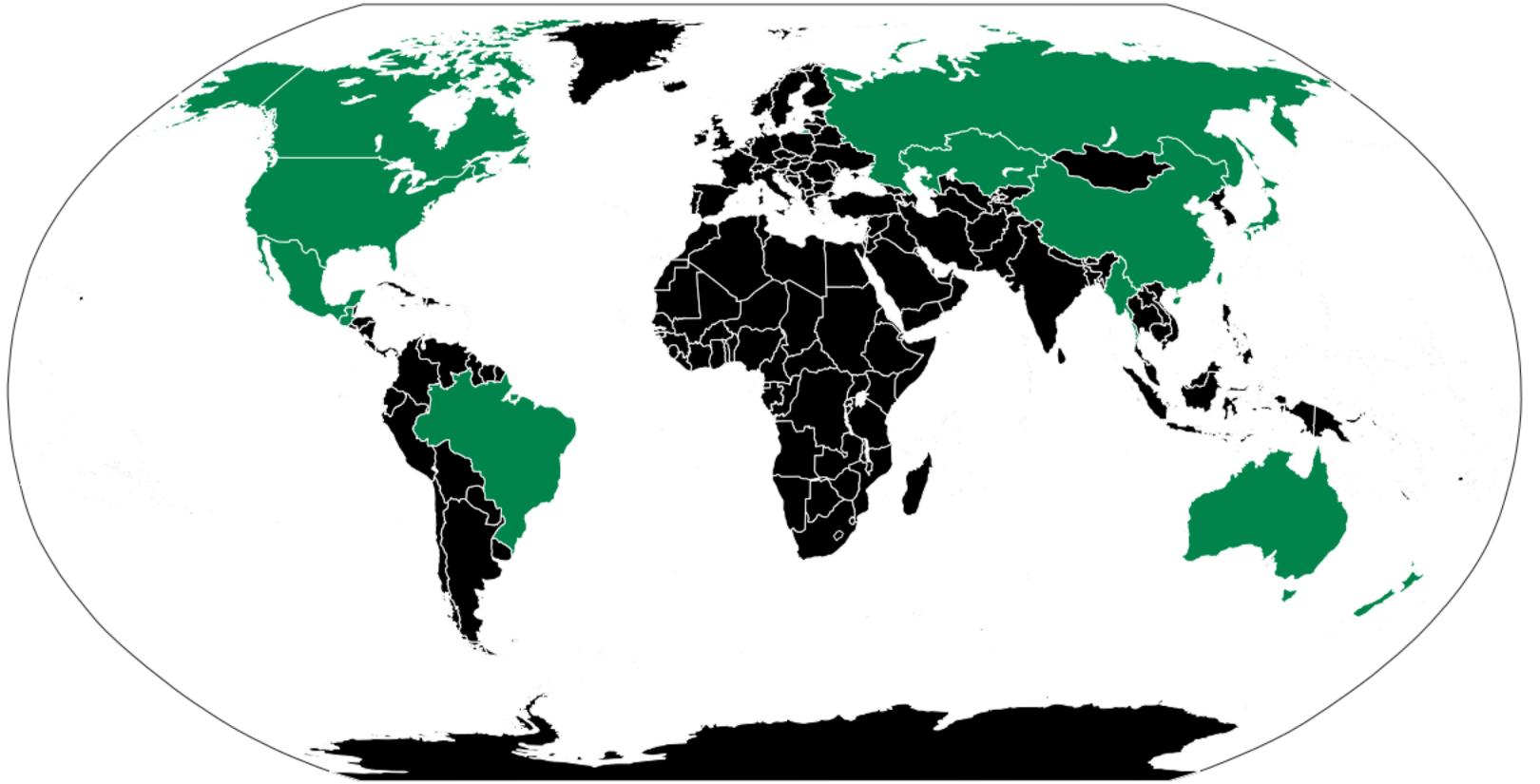
Cleavage None

Fracture Hackly

Melting Point 1064.18°C

Gold was used as a standard for monetary exchange. It is also used in jewelry, sculpture, and ornamentation. In medicine injectable gold can help reduce the pain and swelling of rheumatoid arthritis and tuberculosis. Gold leaf is used in gourmet foods. Gold is also used in electrical wiring. Gold has always been associated with the extremities of utmost evil and great sanctity throughout history.





JADE

Category Mineral Variety

Crystal System Monoclinic

Chemical Formula Sodium
aluminum silicate

Hardness 6.5 - 7

Color Shades of green, white, gray,
yellow, orange, and violet

Luster Vitreous

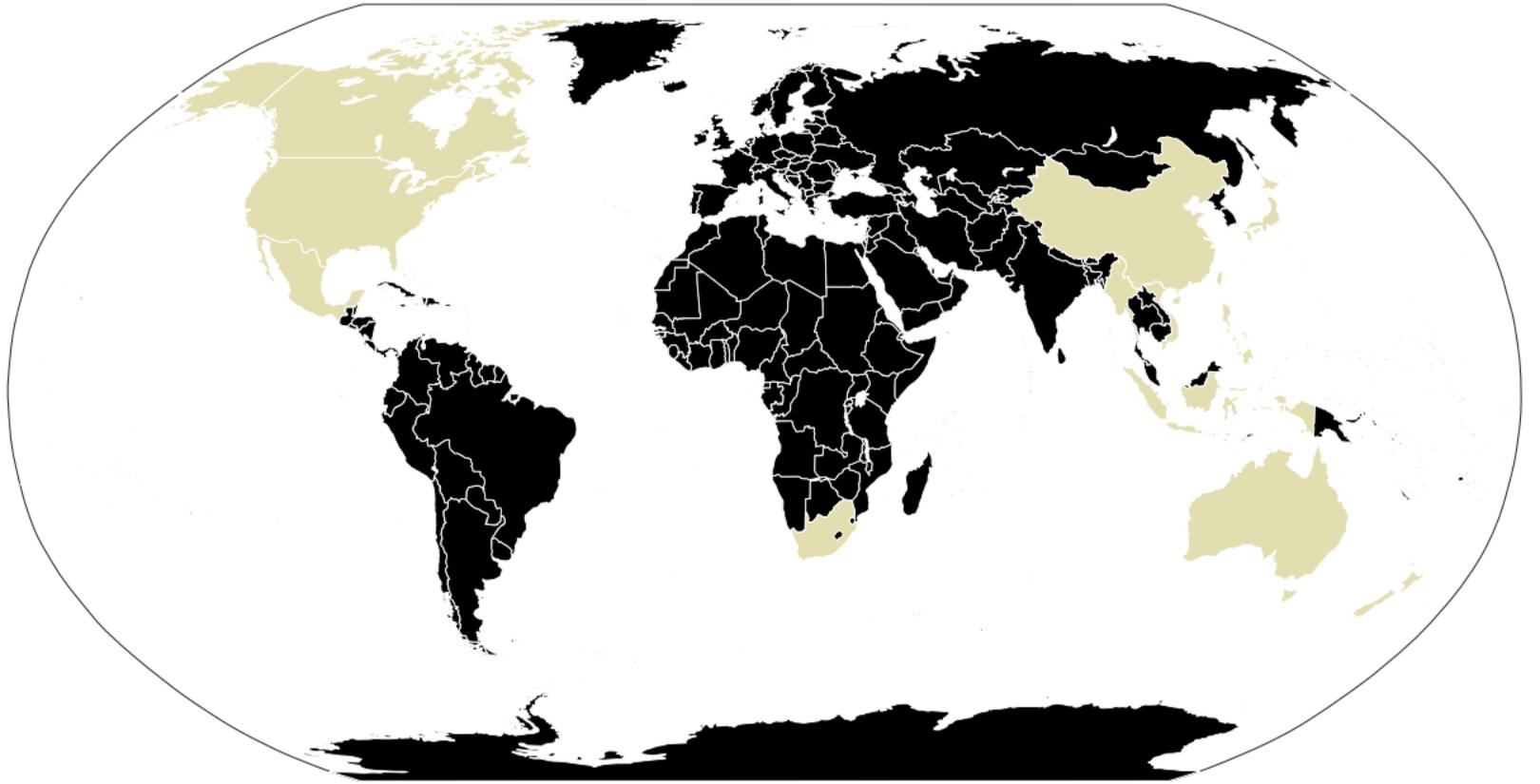
Streak White

Cleavage Poor in two
directions

Fracture Splintery to
uneven



Jade's name comes from the Spanish phrase *piedra de ijada* meaning stone of the side. It was named this because they believed that jade could cure kidney and hip problems. Jade is stronger than steel and was used for many weapons in early civilizations. Jade is considered the stone of fidelity. It is a symbol of calm and serenity, balance and healing. It is also believed to bring good luck and health.



Category Organic

Crystal System Orthorhombic

Chemical Formula Calcium carbonate and conchiolin

Hardness 3

Color White, bluish gray, pink, or black

Luster Pearly, iridescent, translucent to opaque

Streak White

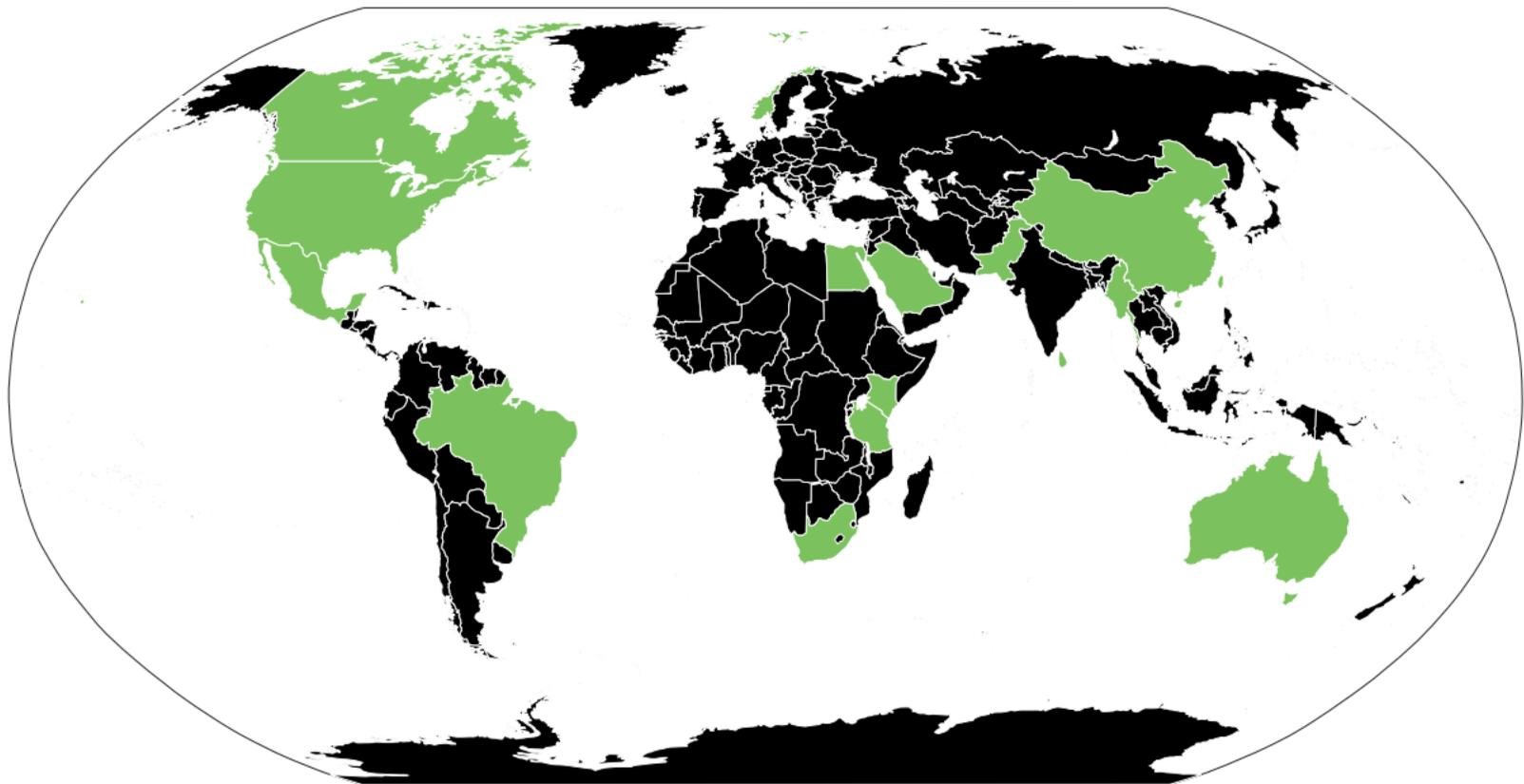
Cleavage None

Fracture Uneven or conchoidal

PEARL

Pearl is the birthstone for June. Pearls are formed when foreign matter like a grain of sand invades a mollusk. The mollusk then envelopes it within a soft body-part such as the mantle which secretes nacre. A sac surrounds the irritant, and pearl building takes place within it. More nacre builds up a spherical or near-spherical cyst pearl, a pear-shaped pearl often taking about seven years.





PERIDOT

Category Mineral

Crystal System Orthorhombic

Chemical Formula Magnesium iron silicate

Hardness 6.5 - 7

Color Yellow, yellow-green, olive-green, or brownish

Luster Vitreous, glassy

Streak White

Cleavage Poor

Fracture Conchoidal

Melting Point Very high

Peridot's name comes from the French word peridot meaning gold. This was because peridot can be a gold color. Peridot is the birthstone for August. It is also supposed to bring the owner of the stone success, peace, and good luck. Peridot is the gemstone of the 16th wedding anniversary. Ancient Egyptian considered peridot the gem of the sun. Peridot was once ground and used to treat asthma.



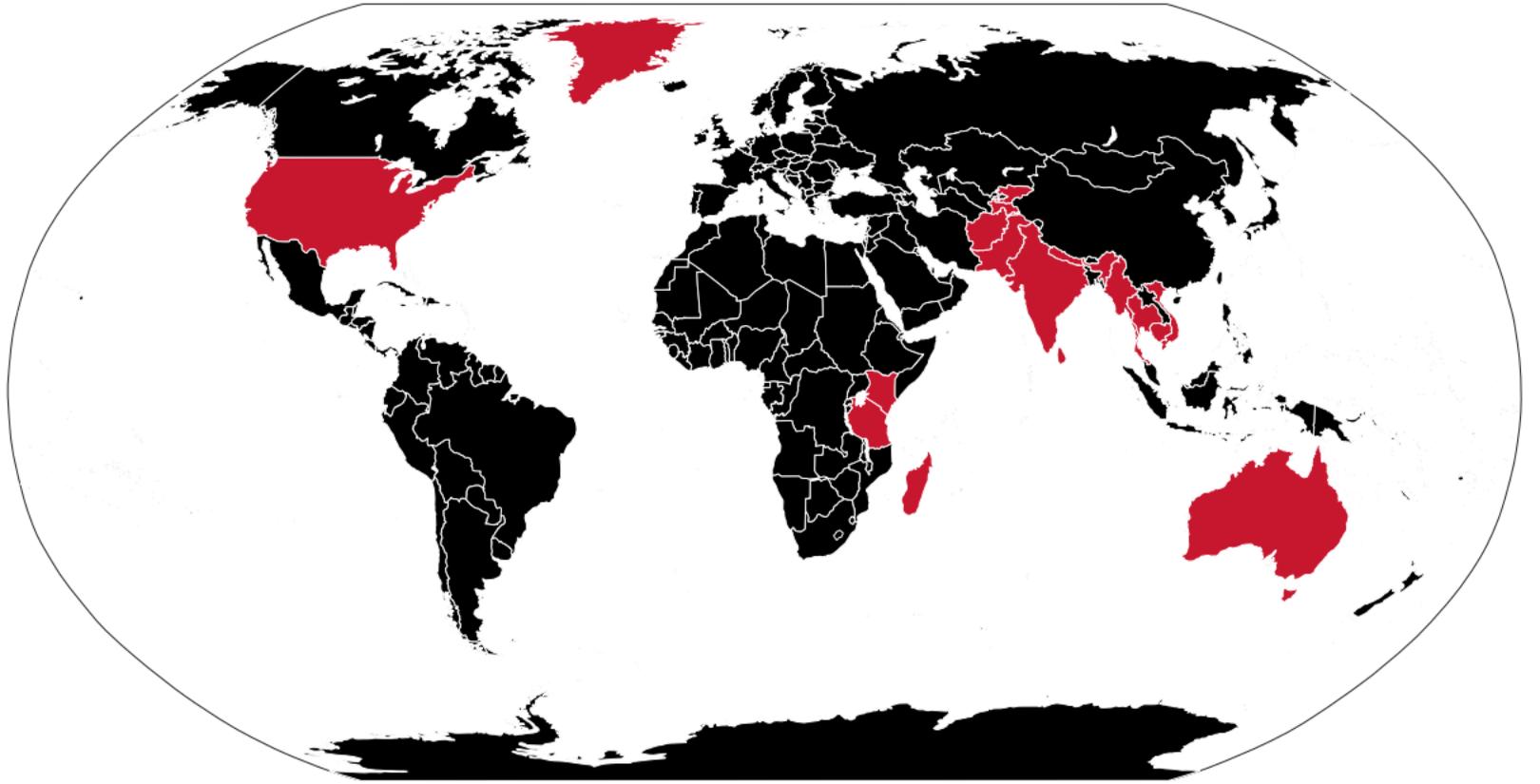
QUARTZ

Category Oxide mineral
Crystal System Rhombohedral
Chemical Formula Silica
Hardness 7
Color Clear or white

Luster Vitreous, glossy
Streak White
Cleavage None
Fracture Conchoidal
Melting Point 1650° C



Quartz's name comes from the German word *quarz* meaning cross-vein ore. Quartz is the second most abundant mineral in Earth's crust. The Irish refer to it as the stone of the sun. Until the 1600s it was believed that quartz was ice permanently frozen after great lengths of time. Quartz also has the ability to split light into a spectrum.



Category Mineral Variety

Crystal System Trigonal

Chemical Formula Aluminum Oxide with Chromium

Hardness 9

Color Red, may be brownish, purplish, or pinkish

Luster Vitreous

Streak White

Cleavage None

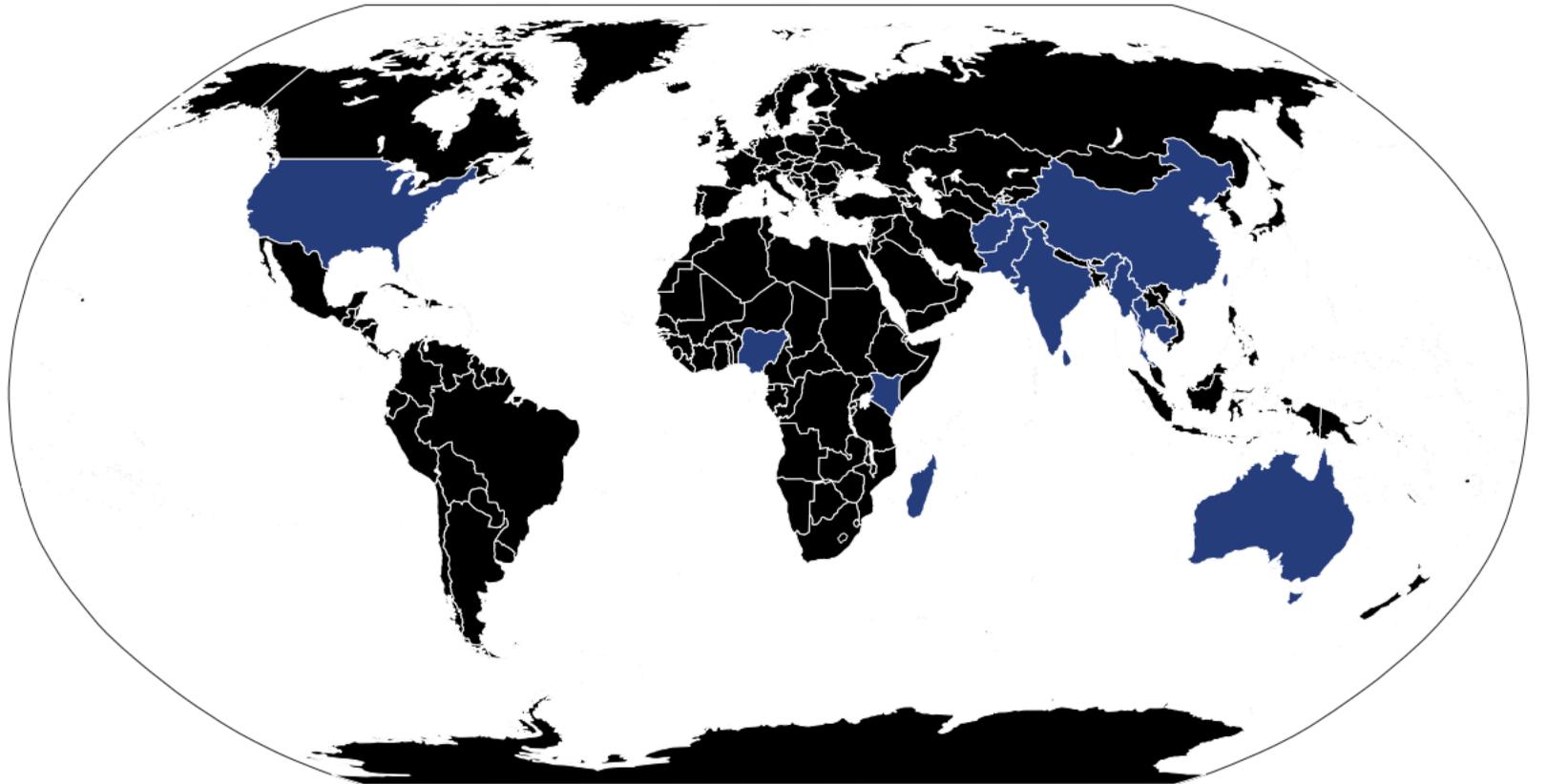
Fracture Uneven or conchoidal

Melting Point 2044° C

RUBY

Ruby's name comes from the Latin word ruber meaning red. Ruby is the birthstone for July and is associated with the 40th wedding anniversary. It is also associated with fire and blood, passion and power implying warmth and life. In China and India rubies were laid beneath the foundation of buildings to secure good fortune to the structure. They were also used to ornament armor and harnesses.





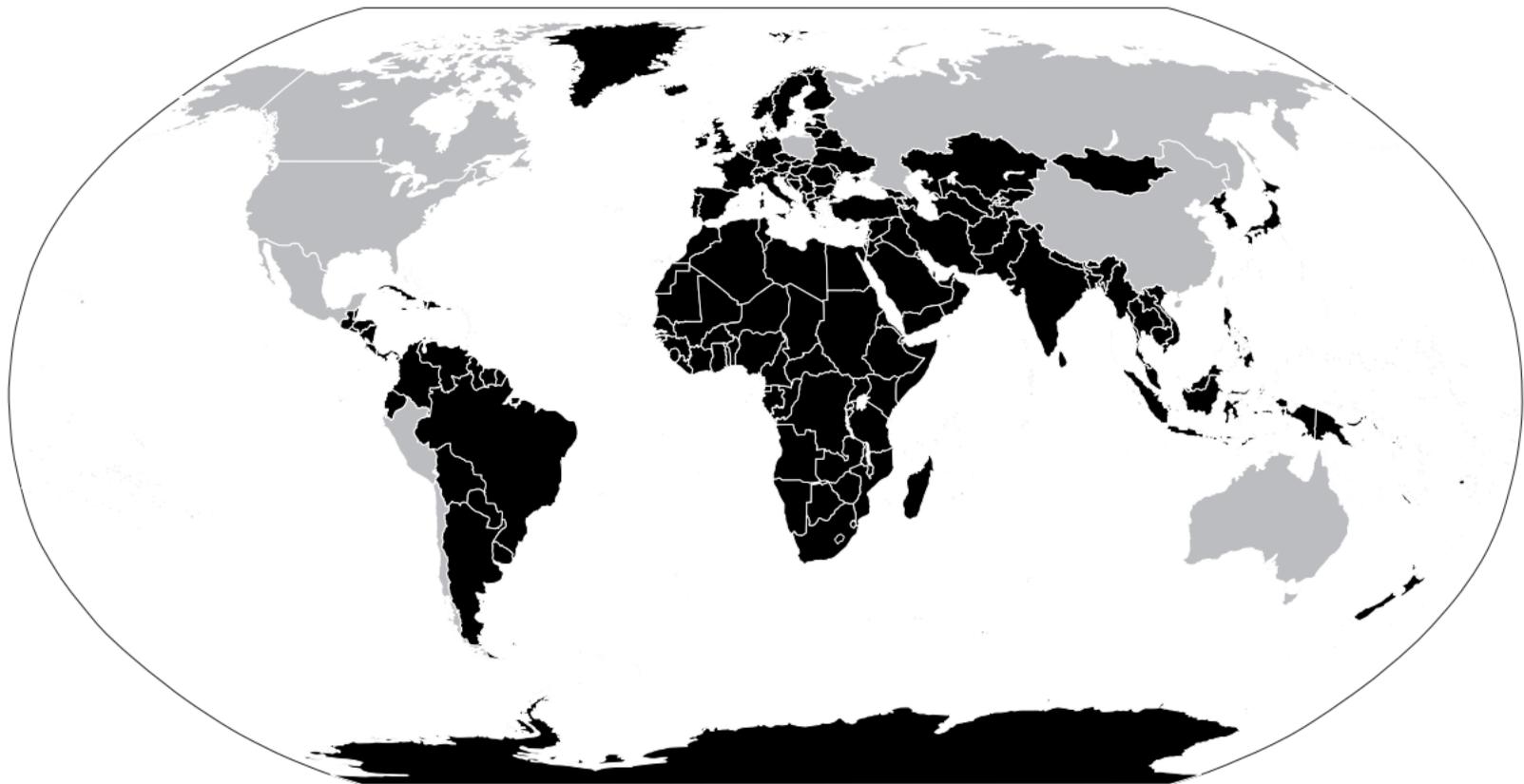
Category Mineral Variety
Crystal System Trigonal
Chemical Formula Aluminum Oxide
Hardness 9
Color Every color except red or pinkish orange

Luster Vitreous
Streak White
Cleavage None
Fracture Conchoidal splintery
Melting Point 2030° C

SAPPHIRE

Sapphire comes from the Greek word sapphiros referring to blue gems in general. Sapphire is the birthstone for September and is associated with the 45th wedding anniversary. It symbolizes loyalty, love, and longing. Because of this many women desire a sapphire engagement ring. Sapphire is liked so much because blue is the favorite color of about 50% of all people and blue is associated with sapphire.





Category Transition metal

Crystal System Face-centered cubic

Chemical Formula Silver, Ag

Hardness 2.5

Color Silver

Luster Metallic

Cleavage None

Fracture Hackly

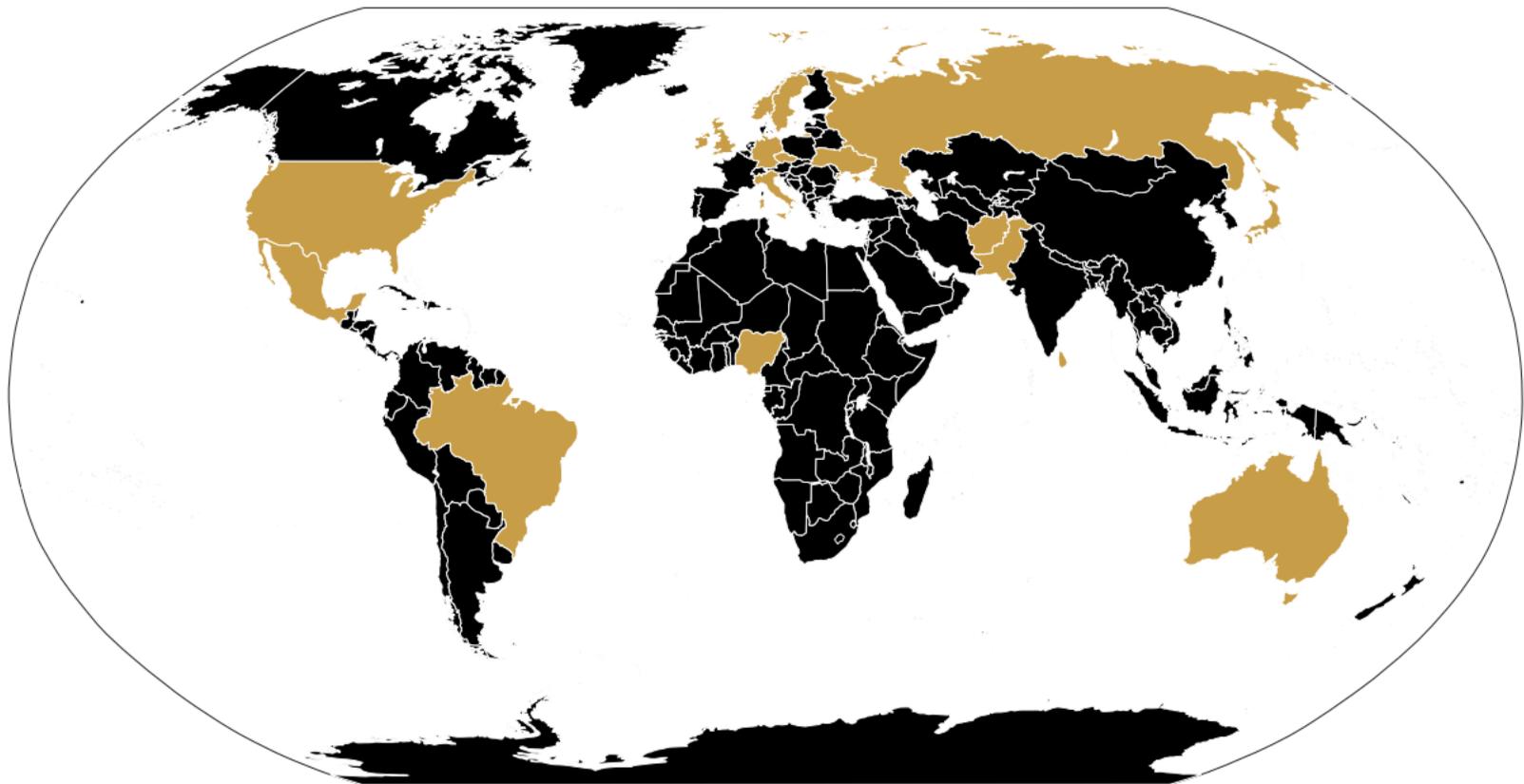
Melting Point 961.78° C

SILVER

Silver's name comes from the Greek word *argēntos* which means white shining. Silver is used to make ornaments, jewelry, high-value tableware, utensils, and currency coins. It is also used in electrical contacts and conductors, mirrors, and catalysis of chemical reactions.

Silver inhibits the growth of bacteria and fungi and keeps odor to a minimum and reduces the risk of bacterial infection.





TOPAZ

Category Silicate mineral

Crystal System Orthorhombic

Chemical Formula Aluminum silicate with fluorine

Hardness 8

Color Clear, blue, brown, orange, gray, yellow, green, pink, or reddish pink



Luster Glassy

Streak White

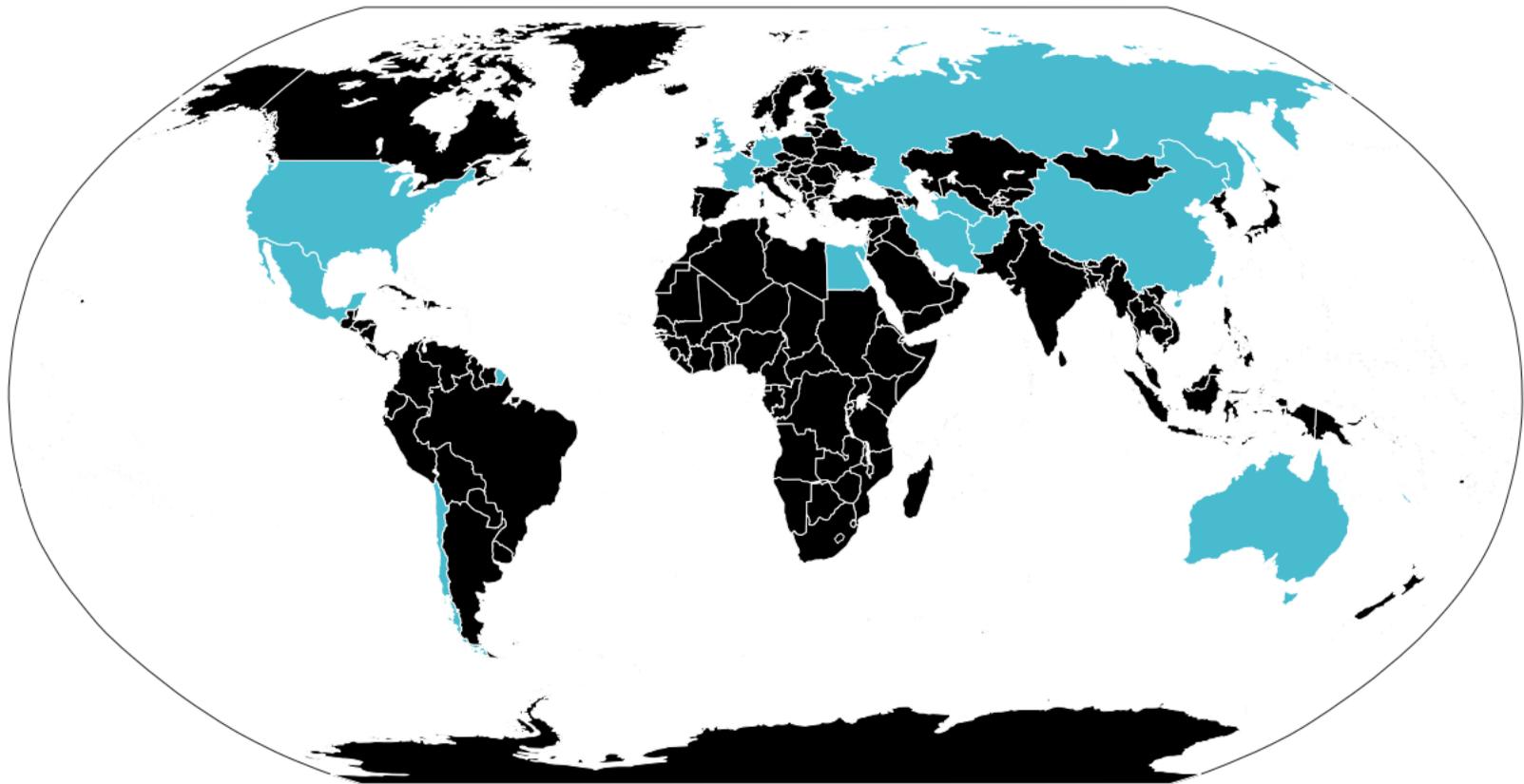
Cleavage 001 Perfect

Fracture Conchoidal

Melting Point 1376° C



Topaz's name comes from the Greek word topazion meaning fire. Topaz produces some of the largest crystals in the world. Some weigh up to 660 pounds. It is the birthstone for November. Topaz is said to dispel sadness, and anger and protect their owner from death. One of the stones set in the Portuguese royal crown was thought to be a diamond but actually is Topaz.



Category Phosphate mineral

Crystal System Triclinic

Chemical Formula Hyrous phosphate of copper and aluminum

Hardness 5 - 6

Color Blue, blue-green, or green

Luster Waxy to subvitreous

Streak Bluish white

Cleavage Good to perfect, but usually none

Fracture Conchoidal

Melting Point 2044° C

TURQUOISE

Turquoise's name comes from the French word turquoise meaning Turkish, since it arrived in Europe through Turkey but actually it isn't found there.

Turquoise was one of the first gemstones ever mined. Ancient Egyptians used turquoise to adorn their pharaohs. The Navajo believed that they were pieces that had fallen from the sky. Some early cultures used this stone as protection.





Color The most immediately noticeable property, color is only occasionally useful if the mineral has a distinctive, inherent color such as yellow sulphur or blue azurite. For minerals whose color varies with impurity content, it is much less useful. For example pure quartz is colorless, but may be of almost any hue through to black.

Category The minerals in this book are divided into groups following a conventional system based on their chemical composition. Classification is firstly on minerals in the same chemical grouping or those having similar properties. The silicates, being the largest group are further subdivided according to structure. All silicates are based on the 'silicate tetrahedron' - a silicon atom bonded to four oxygen atoms which are arranged as if at the corners of a tetrahedron. They are then classified according to how these tetrahedra are joined and arranged. Native elements comprise single elements which occur uncombined in nature. Sulfides contain the S^{2-} group and are classed with arsenides, antimonides and tellurides. Oxides contain the O^{2-} group. Carbonates, nitrates and borates. Sulphates. Phosphates. Nesosilicates contain isolated SiO_4^{4-} tetrahedra. Sorosilicates have two tetrahedra joined as $Si_2O_7^{6-}$ groups. Cyclosilicates contain three, four or six tetrahedra joined as a ring. Inosilicates have the tetrahedra joined into indefinite chains, usually as single or double chains. Phyllosilicates comprise indefinite two-dimensional arrays of tetrahedra joined at three corners in hexagonal arrangements. Tectosilicates are joined at all four corners into indefinite three-dimensional frameworks containing voids or 'cages'.

Cleavage Cleavage is the tendency of a crystal to break cleanly along distinct planes. Since most gemstones are crystals, cleavage is an issue that gem buyers as well as jewelers and gem cutters need to take into account. Minerals can have from one to five cleavage planes, and each cleavage plane has a grade or rating, indicating the relative ease with which the crystal

can be cleaved. Cleavage is graded as perfect, good, indistinct or “none” (in the case where a gemstone has no cleavage at all).

Crystal System Crystals are made up of atoms or molecules arranged in a regular three-dimensional repeated pattern. Each unit which can be seen to repeat in order to build this structure is called a unit cell. Crystallography is governed by geometric possibilities (for example a cube can be repeated but a sphere or dodecahedron cannot), rather like the equivalent two-dimensional property of tessellation. Only seven possible patterns are recognized in unit cells. These are referred to as the crystal system adopted by that particular mineral. Each crystal system constrains the shape that crystals can adopt. Some crystal shapes can be characteristic of a crystal system such as the cube and the octahedron in the cubic system, but many require specialized knowledge and measurement to be diagnostic.

Fracture The surface of a mineral obtained when it breaks in directions other than cleavages or parting is known as fracture. Fracture occurs in random directions mostly due to a sharp impact. Conchoidal (shell like) as a smooth break with concentric rings. This is the most common form of fracture, particularly well seen in glass, quartz and garnet. Splintery - has a fibrous appearance similar to a break on wood with the grain. E.g. nephrite, jadeite and ivory. Granular - Sugary appearance common to crystalline aggregates. Even - smooth break, but does not show the stepped structure as in cleavage e.g. diamond. Uneven - a rough and irregular fracture. Any rock or mineral can exhibit this. Fracture surfaces and the lustre observed on them are important from the point of identification. E.g. Rough moonstone can be identified from rough chalcedony of the same quality by the lustre on the fracture surfaces. Moonstone will have a pearly lustre while chalcedony will exhibit a waxy to dull luster.

GLOSSARY

Hardness The hardness of a mineral has been defined as its resistance to abrasion or scratching. A practical system for measurement was devised by the Austrian mineralogist Friedrich Mohs in 1812. A set of ten common minerals was chosen of different hardnesses such that each one will scratch the surface of all softer minerals. These were then numbered 1 to 10 in increasing order of hardness. Most literature gives hardness to the nearest half unit, for example as 3.5, as a working approximation.

Luster Describes the nature of the light from the surface of a mineral. A metallic luster is shown by opaque minerals such as metals and many sulphides; if imperfect, it is called submetallic. A non-metallic luster is a catch-all term for all the rest and is shown by transparent and translucent minerals. It includes Adamantine - highly reflective like diamond, Vitreous - glassy, as in quartz, Resinous - like resin, as in amber and opal, Pearly - like a pearl, due to alignment of platy minerals under the surface, as in talc and mother-of-pearl, Silky - like silk, due to an underlying fibrous structure, as in satin spar, a variety of gypsum, Greasy - produced by an irregular surface, Earthy or dull - matt surface shown by minerals having no luster.

Streak The color of a mineral in a finely powdered form. This is usually demonstrated by scratching across unglazed porcelain, crushing a sample or scratching the surface with a knife. The streak tends to remain the same for minerals which appear to be colored differently in larger masses. It is therefore a more consistent indicator of a mineral. Streak is not useful for most silicate minerals as they are usually white and often too hard to powder easily.

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PRECIOUS STONES AND METALS

With beautiful color photographs, *Precious Stones and Metals* provides invaluable information for gemologists and jewelers alike on the world's most commonly occurring gemstones.

