Note: This is a special corrected Table of Contents and Errata/Additions sheet, current through 27 February 2022

CONTENTS

ERRATA & ADDITIONS

PAGE 2

Spill the wine

Important pair of ruby and diamond pendent earrings, featuring untreated ~~Mozambique~~ Myanmar rubies of 11.10 and 10.41 ct respectively. These sold for HK$8,850,000 (US$1,141,223) at Tiancheng's 15 December 2015 sale. Image © Tiancheng International Auctioneer Ltd.

PAGE 46

Column 2, paragraph 8

Change Zylin Sun to Ziyin Sun.

PAGE 65

Column 2, last paragraph

Change >18 cm to >18 mm

PAGE 70

Column 2, first paragraph, second line

Change "ought to be plbut" to "ought to be placed; but"

PAGE 80

Figure 2.2, top left

One oxygen atom was accidentally omitted from the illustration.

PAGE 94

Column 1, last paragraph

Change cohesion to adhesion.

PAGE 123

Column 1, second paragraph, last sentence

Change the superscript numbers in red to read as follows:.

It is the product of the ion density per cm^3 and the path length through the stone in cm; hence the units are ions/cm^2 (in ppma).

PAGE 130 & 132

Column 1

Change 1650°C to 1750°C

PAGE 139

Figure 4.44 caption

Change Mg^{3+} to Mg^{2+}

PAGE 161

Figure 4.78:

Rays C and D were accidentally omitted. See page 2 of this Errata/Additions document for the correct figure.

PAGE 161

Column 2, add:

Chase, A.B. and Osmer, J.A. (1970) Habit changes of sapphire grown from $PbO\text{-}PbF_2$ and $MoO_3\text{-}PbF_2$ fluxes. *Journal of the American Ceramic Society*, Vol. 53, No. 6, pp. 343–345; RWHL.

PAGE 162

Column 1, add:

Harlow, George E. and Bender, W. (2013) A study of ruby (corundum) compositions from the Mogok Belt, Myanmar: Searching for chemical fingerprints. *American Mineralogist*, Vol. 98, No. 7, pp. 1120–1132.

PAGE 163

Column 1, change "Moon and Phillips (1991a) to read as follows:

Moon, A.R. and Phillips, M.R. (1991a) Iron and spinel precipitation in iron-doped sapphire. *Journal of the American Ceramic Society*, Vol. 74, No. 4, April, pp. 865–868; RWHL*.

PAGE 164

Column 1, change "Volynets and Sidorova (1971) to read as follows:

Volynets, F.K. and Sidorova, E.A. (1971) The absorption spectrum of alumina containing vanadium. *Journal of Applied Spectroscopy*, Vol. 14, No. 1, Jan., pp. 68–70; RWHL.

PAGE 186

Table 5.6, Column 1, change:

Change alanite to allanite.

PAGE 186

Table 5.2 should read as shown on page 3 of this Errata/Additions document.

PAGE 191

Column 1, change "Koivula (1980a)..." to read as follows:

Koivula, J.I. (1980a) Fluid inclusions: Hidden trouble for the jeweler and lapidary. *Gems & Gemology*, Vol. 16, No. 9, Spring, pp. 273–276; RWHL*.

PAGE 193–195

Add the following references:

Hughes, E.B. (2019) [Staurolite in Madagascar ruby]. In *Jewellery and Jadeite, Tiancheng International, Hong Kong • Spring Auction, 29 May*, p. 16; RWHL*.

Khoi, N.N., Sutthirat, C. *et al.* (2011) Ruby and sapphire from the Tan Huong-Truc Lau area, Yen Bai province, northern Vietnam. *Gems & Gemology*, Vol. 47, No. 3, Fall, pp. 182–195; RWHL*.

Notari, F., Fritsch, E. *et al.* (2018) "Boehmite needles" in corundum are Rose channels. *Gems & Gemology*, Vol. 54, No. 3, Fall, p. 257; RWHL*.

Schneider, V. and Smith, T. (2018) G&G Microworld: Sillimanite in ruby. *Gems & Gemology*, Vol. 54, No. 4, Winter, pp. 448–449; RWHL.

Soonthorntantikul & Khowpong *et al.*, (2019) Observations on the heat treatment of basalt-related blue sapphires. *GIA: News from Research*, 60 pp.; RWHL*.

Zwaan, J.C., Buter, E. *et al.* (2015) Alluvial sapphires from Montana: Inclusions, geochemistry, and indications of a metamorphic origin. *Gems & Gemology*, Vol. 51, No. 4, Winter, pp. 370–391; RWHL*.

PAGE 215

Column 1, second to last paragraph

Change "(left)" and "(right)" to "(top)" and "(bottom)".

PAGE 238

Figure 6.65, change "Heat for 1 Hour (0°C)" to "Heat for 1 Hour (°C)"

PAGE 247

Column 1, add the following reference:

Soonthorntantikul & Khowpong *et al.*, (2019) Observations on the heat treatment of basalt-related blue sapphires. *GIA: News from Research*, 60 pp.; RWHL*.

PAGE 258

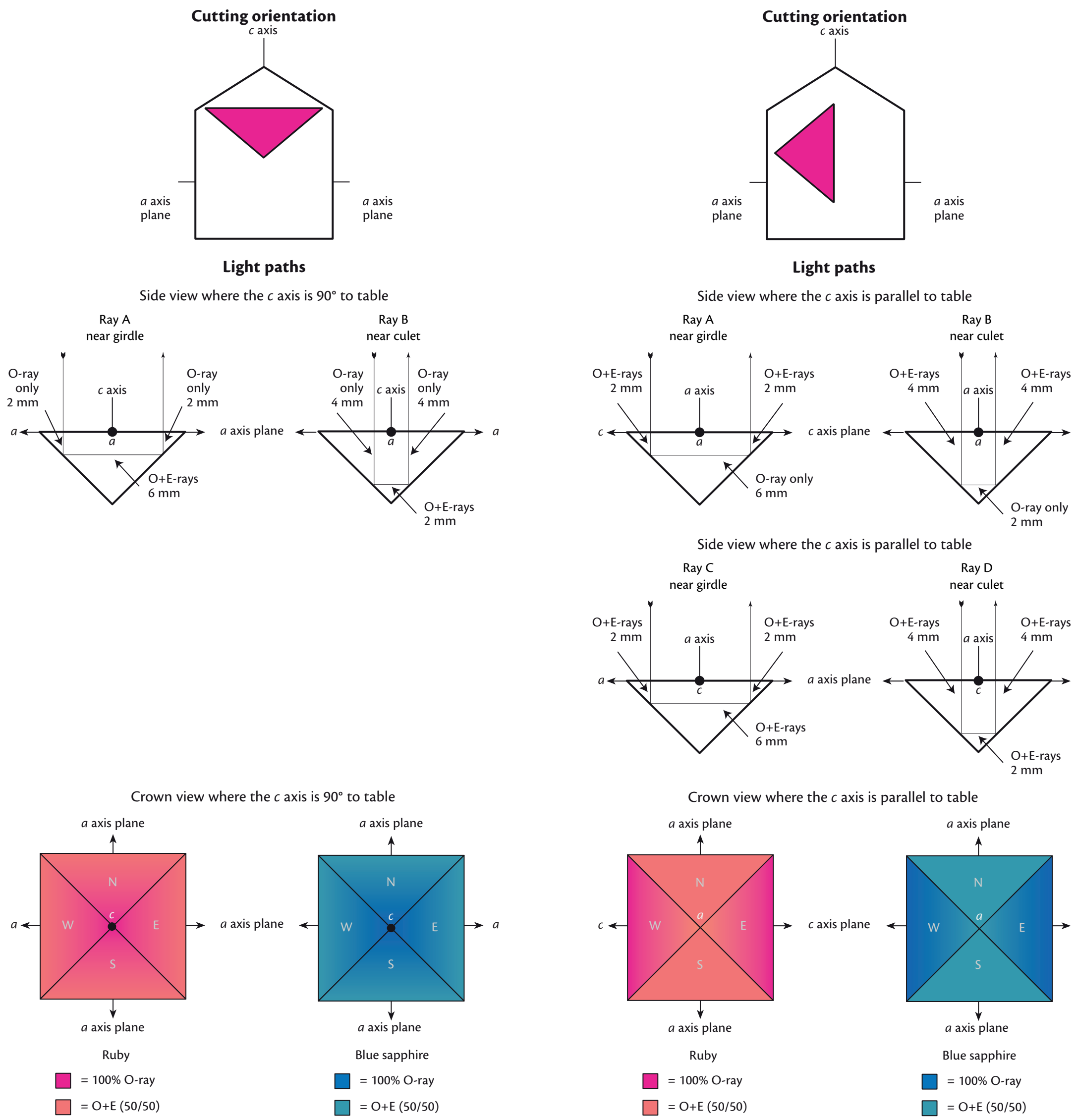

Figure 4.78 The visual effects of pleochroism on the appearance of corundum

The stone above left is cut with the *c* axis 90° to the table facet.

- Ray A enters near the girdle, traveling 4 mm parallel to the *c* axis (O-ray only) and 6 mm parallel to the *a* axis (3 mm of O-ray and 3 mm of E-ray). The color of Ray A therefore consists of 70% O-ray and 30% E-ray.
- Ray B strikes the pavilion much closer to the culet. Ray A and Ray B have identical path lengths, each traveling 10 mm through the gem. But Ray B's light path consists of 8 mm parallel to the *c* axis (8 mm of O-ray only) and just 2 mm parallel to the *a* axis (1 mm of O-ray and 1 mm of E-ray). Thus, the color of Ray B is 90% O-ray and only 10% E-ray.

The stone above right is cut with the *c* axis 90° to the table facet.

- Ray A has 6 mm of O-ray only, and 4 mm of equally mixed O- and E-rays, giving a total of 80% O-ray and 20% E-ray.
- Ray B consists of 2 mm of O-ray only, and 8 mm of equally mixed O- and E-rays, giving a total of 40% O-ray and 60% E-ray. As a result, the color on these facets will show more of the O-ray near the girdle and less at the culet.
- Rays C and D are equal mixtures of O- and E-rays, because their entire journey takes place perpendicular to the *c* axis. Those facets will display a uniform 50%–50% split.

Table 5.2. Inclusions of corundum

Solids: The following solids have been identified in corundum:

- Allanite Group (Hänni, 1990a)
- Aluminite Group (Zwaan & Buter *et al.*, 2015)
- Amphibole Group: Pargasite (Gübelin, 1973)
- Anatase (Zwaan & Buter *et al.*, 2015)
- Anhydrite (Smith & Dunaigre, 2001)
- Apatite Group: Fluorapatite (Gübelin, 1969)
- Baddeleyite Group: Baddeleyite (Gübelin & Peretti, 1997)
- Baryte (Barite) Group: Baryte (Zwaan & Buter *et al.*, 2015)
- Boehmite (Böhmite) (Sahama & Lehtinen *et al.*, 1973)
- Brookite (Gübelin & Koivula, 1986)
- Calcite Group: Calcite: Gübelin (1940b); Magnesite (Thirangoon, 2009)
- Carbon (Amorphous) (Zwaan & Buter *et al.*, 2015)
- Catapleiite (Thirangoon, 2009)
- Chalcopyrite Group: Chalcopyrite (Gübelin, 1973)
- Chlorite Group (Gübelin, 1982a)
- Columbite Group: Columbite-(Fe), a.k.a. Niobite: Tantalite-(Fe); Gübelin, 1973; Pardieu & Sangsawong *et al.*, 2014)
- Cordierite (a.k.a. Iolite) (Thirangoon, 2009)
- Cosalite (Thirangoon, 2009)
- Cristobalite (Zwaan & Buter *et al.*, 2015)
- Diaspore Group: Diaspore, Goethite (Gübelin, 1982a; Smith, 1995)
- Dolomite Group: Dolomite (Brückl, 1937)
- Epidote Group: Clinozoisite, Epidote (Gübelin & Koivula, 2008)
- Euxenite Group: Fersmite (Guo & O'Reilly *et al.*, 1996)
- Feldspar Group: Alkali, Plagioclase (Gübelin, 1971)
- Feldspathoid Group: Nepheline (Khoi & Sutthirat *et al.*, 2011)
- Fergusonite (Gübelin, 1973)
- Fluorite Group: Fluorite (Peretti & Schmetzer *et al.*, 1995)
- Garnet Group: Almandine, Pyrope, Spessartine (Gübelin, 1948; Du Toit & Charoensrithanakul *et al.*, 1995b)
- Gibbsite (Zwaan & Buter *et al.*, 2015)
- Glass (Gübelin & Koivula, 1986)
- Grandidierite (Hain & Hughes, 2019)
- Graphite (Brückl, 1937)
- Halite Group: Halite; Khoi & Sutthirat *et al.*, 2011)
- Hematite Group: Corundum, Hematite (Gübelin, 1940b; Gübelin, 1953)
- Humite Group: Chondrodite, Humite (Barthoux, 1933)
- Ilmenite Group: Ilmenite (Moon & Phillips, 1984)
- Kyanite (Pardieu & Sangsawong *et al.*, 2013)
- Marcasite Group: Marcasite (Bowersox & Foord *et al.*, 2000)
- Mica Group: Biotite, Fuchsite, Margarite, Muscovite, Phlogopite (Gübelin, 1940b; Gübelin, 1982a)
- Molybdenite Group: Molybdenite (Saeseaw & Sangsawong *et al.*, 2017)
- Monazite Group: Monazite (Gübelin, 1973)
- Nahcolite (Zwaan & Buter *et al.*, 2015)
- Nordstrandite (Kane & McClure *et al.*, 1991)
- Olivine Group: Forsterite (Gübelin & Koivula, 1986)
- Pentlandite Group: Pentlandite (Coenraads, 1992a)
- Pyrite Group: Pyrite (Gübelin & Koivula, 1986)
- Pyrochlore Group: Uranopyrochlore, Betafite (Gübelin, 1973; Guo & O'Reilly, 1996)
- Pyroxene Group: Augite–Fassaite, Diopside, Hedenbergite (Gübelin, 1971, 1973; Gübelin & Peretti, 1997)
- Pyrrhotite Group: Pyrrhotite (Gübelin, 1971)
- Rhabdophane Group: Brockite (Guo & O'Reilly, 1996)
- Rutile Group: Rutile (Tschermak, 1878; Gübelin, 1953)
- Samarskite Group: Samarskite (Guo & O'Reilly, 1996)
- Sapphirine Group: Sapphirine (Koivula & Fryer, 1987)
- Scapolite Group: Marialite (Kammerling & Scarratt *et al.*, 1994)
- Sillimanite (Thirangoon, K., 2009)
- Smectite Group: Vermiculite (Zwaan, 1974)
- Sodalite Group: Lazurite (Renfro & Pardieu, 2012)
- Sphalerite Group: Sphalerite (Gübelin & Koivula, 1986)
- Spinel Group: Chromite, Gahnospinel, Gahnite, Hercynite, Magnetite, Pleonaste, Spinel (Gübelin, 1953)
- Staurolite Group: Stauroite (Hughes, E.B., 2019)
- Sulfur Group: Sulfur (Fritsch & Rossman, 1990)
- Tialite (Panjikar & Panjikar, 2016)
- Titanite (Sphene) Group: Titanite (Barthoux, 1933)
- Topaz (Zwaan & Buter *et al.*, 2015)
- Tourmaline Group (Gübelin & Koivula, 1986)
- Uraninite Group: Uraninite, Thorianite: (Gübelin, 1973; Gübelin & Peretti, 1997)
- Vesuvianite Group: Vesuvianite (Idocrase): (Renfro & Koivula, 2017)
- Wollastonite Group: Wollastonite (Gübelin & Koivula, 2008)
- Xenotime Group: Xenotime (Gübelin & Koivula, 2008)
- Zeolite Group: Analcime (Gübelin & Koivula, 1986)
- Zircon Group: Zircon (Gübelin, 1953); Thorite: (Coenraads, 1992a)
- Zirconolite (Peretti & Peretti *et al.*, 2008)
- Zirkelite (Gübelin & Koivula, 2008)
- Zoisite (Zwaan & Buter *et al.*, 2015)

Exsolved solids

- Rutile needles ('silk), form parallel to the second-order hexagonal prism $\{11\bar{2}0\}$ (3 directions, intersecting at 60/120° in the basal plane). Rutile often forms knife-shaped twins with tiny re-entrants and daughter crystals at the broad end, flattened in the basal plane. Sizes and lengths vary, some appearing as mere dots, some broad, some narrow. Overhead fiber optic illumination is often best, looking down the *c* axis. Exsolved particles are often best seen with the fiber optic light guide from below or to the side of the stone. Often iridescent under fiber optic illumination.
- Hematite-ilmenite silk/plates; parallel to the faces of the first-order hexagonal prism $\{10\bar{2}0\}$; often iridescent under fiber optic illumination.
- Diaspore in the same directions as rutile, but often with a more "cottony" appearance; common in Mong Hsu ruby.

Cavities (liquids/gases/solids)

- Primary fluid-filled cavities of various configurations (1-, 2- or 3-phase). CO_2 is a common filling, in both liquid and gaseous forms.
- Secondary fluid inclusions in patterns of infinite variety and thickness; often referred to as fingerprints or feathers. CO_2 is a common filling, in both liquid and gaseous forms. Produced by the healing of fractures, their patterns may often be "wispy" or "veil-like," and so are easily confused with flux inclusions in synthetic corundums. Their surfaces should be examined under high magnification with fiber-optic lighting to determine if fluid (natural) or flux (synthetic) fills the small channels. As natural stones healed over a much longer period of time, their healing patterns are often far more detailed. The higher viscosity of a flux also contributes to coarser and less detailed healing in flux-grown synthetics.
- Long white secondary "Rose channels" at the junctions of intersecting rhombohedral twinning planes $\{10\bar{1}1\}$. Directions and angles are the same as that described for rhombohedral twinning above. The *combination* of rhombohedral twinning with rose channels has yet to be seen in flux-grown synthetic corundums and so is important for identification. Rose channels were formerly thought to be boehmite (Notari *et al.*, 2018).
- Epigenetic kaolinite, boehmite and/or iron oxide stains are common in surface-reaching fissures; they may be eliminated/altered during heat treatment.

Growth zoning

Straight angular growth lines following various crystal faces, often in a hexagonal pattern and often featuring associated minute exsolved needles or particles following these growth lines. These growth zones and exsolution products often produce phantom growth outlines of the crystal's shape as it formed. The lines vary in thickness and spacing, are never curved if examined parallel to the face along which they grew, and always lie inside the stone. They are associated with crystal faces, not with cut facets. Sharp lines are seen well with dark-field illumination, or better, immersion with light-field shadowing. Broad bands or hazy clouds are best seen with immersion and diffused light-field illumination.

Twin development

True twinning planes will show interference fringes and appear light against a dark background when the gem is examined between crossed polars.

- Polysynthetic twinning along the rhombohedron $\{10\bar{1}1\}$, in 3 directions, but only 2 in any one plane) meeting at 86.1 & 93.9°. These planes meet the *c* axis at angles of 32.4/57.6°.
- Growth twins may also be seen along other faces. Immersion between crossed polars will separate true twinning from sharp color zoning.

Other features

Rhombohedral parting (due to Rose channels and/or exsolved boehmite) and basal parting (due to exsolved hematite).

Column 2, Figure 7.13, line 2

Change "In natural stones (right)…" to "In natural stones (left)…".

PAGE 264

Column 2, Table 7.2, Verneuil Syn. Corundum, Red, Pink

change "C^{3+}" to "Cr^{3+}".

PAGE 307

Column 1, change "Plato (1952)…" to read as follows:

Plato, W. (1952) Oriented lines in synthetic corundum. *Gems & Gemology*, Vol. 7, No. 7, Fall, pp. 223–224; RWHL*.

PAGE 326

Figure 9.10

change "γ" to "°".

PAGE 326

Column 1, in Meen, V.B. (1969) change "Vol. 8" to "Vol. 13".

Meen, V.B. (1969) The largest gems in the crown jewels of Iran. *Gems & Gemology*, Vol. 13, No. 1, Spring, pp. 2–14; RWHL.

PAGE 329

Column 2, Star Stones, line 3

Change "perpendicular to the cabochon girdle" to "parallel to the cabochon girdle plane"

PAGE 362

Column 2, last paragraph

Change "Avincourt" to "Agincourt"

PAGE 367

Column 3, third paragraph

Change "Henry Bentinck" to "Henry Benedict"

PAGE 384

Column 3, under "Current Location"

Change "Myanna" to "Myanma"

PAGE 376–377

In Figure 10.41, change the price of the 15.04 ct Myanmar ruby from $1,222,233 to $1,266,901 and in Figure 10.43, change $1.22k to $1.26k.

PAGE 453

Figure 12.17. Map. Change shading on "TAIWAN" to match "CHINA".

PAGE 477

Table 12.6, add the following under solids:

- Hematite (Bui & Fritsch *et al.*, 2013)
- Spinel (Bui & Fritsch *et al.*, 2013)
- Remove the sentence beginning "Uraninite crystals are distinctive…" but keep the reference (Hänni, 1990a)

PAGE 479

Add the following reference:

Bui, H.N., Fritsch, E. *et al.* (2013) Kashmir sapphires: Geographical origin determination of top-quality blue sapphires versus science. *International Gemmological Conference Proceedings*, Hanoi, Vietnam, pp. 59–60; RWHL*.

PAGE 481

Column 2, add the following reference

Muyal, J. (2018) G&G Lab Notes: Large pargasite inclusion in Kashmir sapphire. *Gems & Gemology*, Vol. 54, No. 4, Winter, pp. 435–436; RWHL.

PAGES 498–499

Add the following references

Hain, M. and Hughes, E.B. (2019) MicroWorld: Grandidierite inclusions in sapphires. *Gems & Gemology*, Vol. 55, No. 1, Spring, pp. 111–112; RWHL.

Hughes, E.B. (2019) [Staurolite in Madagascar ruby]. In *Jewellery and Jadeite, Tiancheng International, Hong Kong • Spring Auction, 29 May*, p. 16.

PAGE 505

Box: Change "Sapphires, many supposed, made their way from Madagascar to Bangkok, and then on to America were…" to "Sapphires, many supposed, made their way from Madagascar to Bangkok, and then on to America where…"

PAGE 517

Figure 12.69.

Change F. to read: These mixed crystals contain a combination of pargasite (transparent) and chromite (black). EBH

PAGE 549

Figure 12.45. Map.

Change "Andrandondambo" to "Andranondambo".

PAGE 549

Figure 12.99. Superb example of a 15 ct untreated ~~Möng Hsu~~ Mogok ruby. Photo: Wimon Manorotkul; ring: Veerasak Gems

PAGE 574

Column 1 change "Scott (1936a)…" to read as follows:

Scott, W.H. (1936a) The ruby mines of Burma. *Gems & Gemology*, Vol. 2, No. 1, Spring, pp. 3–6; No. 2, Summer, pp. 31–34; RWHL.

PAGE 600

Table 12.21, Column 2, add the following under "Solids":

- Xenotime (Gübelin & Koivula, 2008)

PAGE 606

Column 2 add this reference:

Gübelin, E.J. and Koivula, J.I. (2008) *Photoatlas of Inclusions in Gemstones, Volume 3*. Basel, Switzerland, Opinio Publishers, 672 pp.; RWHL*.

PAGE 675

Column 1, "Schubnel (1975)…" change "No. 43" to "No. 45":

Schubnel, H.-J. (1975) Excursion à la mine de saphirs de Bò-Phloï (Thaïlande). *Revue de Gemmologie A.F.G.*, No. 45, December, pp. 8–10; seen.

PAGE 680

Figure 12.197, capton:

Change "Vertex" to "Vortex"

PAGE 690

Table 12.35, add the following under "Solids":

- Anatase (Zwaan, J.C., Buter, E. *et al.*, 2015)
- Anhydrite (Gübelin & Koivula, 2008)
- Barite (Zwaan, J.C., Buter, E. *et al.*, 2015)
- Epidote (Gübelin & Koivula, 2008)
- Ferro-columbite (Zwaan, J.C., Buter, E. *et al.*, 2015)
- Gibbsite (Zwaan, J.C., Buter, E. *et al.*, 2015)
- Mica (biotite) (Gübelin & Koivula, 2008)
- Nahcolite (Zwaan, J.C., Buter, E. *et al.*, 2015)
- Pyrite (Gübelin & Koivula, 2008)
- Pyroxene (Gübelin & Koivula, 2008)
- Topaz (Zwaan, J.C., Buter, E. *et al.*, 2015)
- Zoisite (Zwaan, J.C., Buter, E. *et al.*, 2015)

PAGE 693–695

Add the following references:

Palke, A.C., Renfro, N.D. *et al.* (2016) Origin of sapphires from a lamprophyre dike at Yogo Gulch, Montana, USA: Clues from their melt inclusions. *Lithos*, Vol. 260, pp. 339–344; RWHL.

Zwaan, J.C., Buter, E. *et al.* (2015) Alluvial sapphires from Montana: Inclusions, geochemistry, and indications of a metamorphic origin. *Gems & Gemology*, Vol. 51, No. 4, Winter, pp. 370–391; RWHL*.

PAGE 700

Table 12.37, add the following under "Solids":

- Anhydrite (Khoi & Sutthirat, C. *et al.*, 2011)
- Boehmite (Khoi & Sutthirat, C. *et al.*, 2011)
- Chlorite (Khoi & Sutthirat, C. *et al.*, 2011)
- Diaspore (Khoi & Sutthirat, C. *et al.*, 2011)
- Dolomite (Khoi & Sutthirat, C. *et al.*, 2011)
- Feldspar (plagioclase) (Khoi & Sutthirat, C. *et al.*, 2011)
- Graphite (Khoi & Sutthirat, C. *et al.*, 2011)
- Halite (Khoi & Sutthirat, C. *et al.*, 2011)
- Hematite (Khoi & Sutthirat, C. *et al.*, 2011)
- Ilmenite (Khoi & Sutthirat, C. *et al.*, 2011)
- Mica (biotite, margarite, muscovite, phlogopite), brownish orange (Kane & McClure *et al*., 1991)
- Monazite (Khoi & Sutthirat, C. *et al.*, 2011)
- Nepheline (Khoi & Sutthirat, C. *et al.*, 2011)
- Pyrite (Khoi & Sutthirat, C. *et al.*, 2011)
- Spinel (hercynite, magnetite, spinel) (Khoi & Sutthirat, C. *et al.*, 2011)
- Titanite (sphene) (Khoi & Sutthirat, C. *et al.*, 2011)
- Tourmaline (Khoi & Sutthirat, C. *et al.*, 2011)
- Zircon (Khoi & Sutthirat, C. *et al.*, 2011)

PAGE 725

Column 2

Add: Galibert, Olivier 45, 389, 454–456, 527–528, 571, 656

PAGE 726

Column 1

Add: epidote 186, 690

PAGE 726

Column 3

Add: xenotime 186, 487, 600, 631, 634