For Further Reading

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These references include source material for many of the course assignments and suggestions for your own research. You will not be tested on the information in any of the references provided below.

**Assignment 1: Introduction**

*Gems & Gemology* current issue:
https://www.gia.edu/gems-gemology

News and Articles:
https://www.gia.edu/gia-news-research

GIA Gem Project:
https://www.gia.edu/gia-gem-database

GIA Library recommended reading & bibliographies for gems and historical localities:
https://www.gia.edu/library

**Assignment 2: Gemstone Formation and Mining**

**Gems from volcanic rocks**

https://www.gia.edu/gems-gemology/fall-2016-peridot-central-highlands-vietnam-properties-origin-formation


https://www.gia.edu/gems-gemology/winter-1994-corundum-occurence-levinson

**Gems from pegmatites**

https://www.gia.edu/gems-gemology/summer-1985-tourmaline-brazil-proctor

https://www.gia.edu/gems-gemology/summer-1984-pegmatite-shigley

**Gems from hydrothermal deposits**

https://www.gia.edu/gems-gemology/spring-1983-topaz-brazil-keller

Scan the QR code above or go to https://www.gia.edu/library to access articles for further reading.
Gems from metamorphic rocks


Gems from sedimentary rocks


Mining and Recovery

https://www.gia.edu/gems-gemology/fall-2016-gemnews-update-colored-gemstone-mining-tanzania

Visit Two of Mogok’s Most Important Mines with GIA (2016) GIA Research & News
https://www.gia.edu/gia-news-research/field-gemologist-mogok-mines-dattaw-ruby-baw-mar-sapphire

https://www.gia.edu/gia-news-research/ruby-sapphire-spinel-mogok-myanmar-field-expedition

https://www.gia.edu/gia-news-research/trail-africa-hidden-gems-field-gemologists

https://www.gia.edu/gia-news-research/gems-luc-yen-vietnam-field-expedition

https://www.gia.edu/gia-news-research/overview-of-2014-gia-brazil-expedition

Long P.V. et al. (2013) Update on Gemstone Mining in Luc Yen, Vietnam. Gems & Gemology, Vol. 49, No. 4
https://www.gia.edu/gems-gemology/WN13-Long-Gemstone-Mining-Vietnam

https://www.gia.edu/gems-gemology/fall-2010-diamond-pearl-colored-stones-shigley

https://www.gia.edu/gems-gemology/winter-2004-gem-news-international

https://www.gia.edu/gems-gemology/fall-2002-gem-news-international

https://www.gia.edu/gems-gemology/spring-1997-geology-techniques-cook

https://www.gia.edu/gems-gemology/summer-1992-tanzania-gems-dirlam

Assignment 3: Gems and Their Physical Properties

https://www.gia.edu/gems-gemology/fall-2016-microworld-etch-marks-negative-crystals-tubes-spinel-madagascar
https://www.gia.edu/gems-gemology/fall-2016-microworld-tourmaline-termination

https://www.gia.edu/gems-gemology/fall-2016-gemnews-large-aqueous-primary-fluid-inclusion-amethyst

https://www.gia.edu/gems-gemology/fall-2016-microworld-mobile-fluorite-quartz

https://www.gia.edu/gems-gemology/fall-2016-microworld-unusual-growth-zoning-beryl

https://www.gia.edu/gems-gemology/spring-2016-microworld-fantastic-display-phase-changes-sapphires-fluid-inclusion

https://www.gia.edu/gems-gemology/summer-2015-microworld-introduction-gems

https://www.gia.edu/gems-gemology/micro-world-gallery

https://www.gia.edu/gems-gemology/lab-notes-Unusual-Curved-Color-Zoning-In-Emerald

The Hidden Beauty of Gemstones (2013) GIA Research & News
https://www.gia.edu/photomicrography

https://www.gia.edu/gems-gemology/spring-2009-tourmalines-mozambique-koivula

https://www.gia.edu/gems-gemology/summer-1987-gemstone-durability-martin

**Assignment 4: Gems and Light**

**Color-causing mechanisms**

https://www.gia.edu/gems-gemology/spring-2013-labnotes-yellow-synthetic-sapphire

https://www.gia.edu/gems-gemology/spring-2011-gem-news-international

https://www.gia.edu/gems-gemology/summer-2009-tourmalines-copper-merkel

https://www.gia.edu/gems-gemology/summer-1988-color-gems-fritsch
https://www.gia.edu/gems-gemology/spring-1988-gem-color-fritsch

https://www.gia.edu/gems-gemology/fall-1987-color-gems-fritsch

**Other optical properties**

https://www.gia.edu/gems-gemology/fall-2014-introduction-pleochroism-faceted-gems

https://www.gia.edu/gems-gemology/winter-1984-calcite-hurlbut

**Phenomena**

https://www.gia.edu/gia-news-research/optical-effects-phenomenal-cabochons


https://www.gia.edu/gems-gemology/winter-1982-alexandrite-effect-gubelin

**Assignment 5: Synthetics and Imitations**

**Synthetic Corundum**

https://www.gia.edu/gia-news-research/synthetic-ruby-overgrowth-corundum-analysis

https://www.gia.edu/gia-news-research-Sapphire-Series-Introduction-to-Sapphire-and-Synthetic-Sapphire

https://www.gia.edu/gia-news-research-Sapphire-Series-Next-Generation-Growth-Techniques

https://www.gia.edu/gia-news-research-Sapphire-Series-Modern-Applications

https://www.gia.edu/gia-news-research-Sapphire-Series-Treated-Synthetics
For Further Reading

https://www.gia.edu/gems-gemology/fall-1997-hydrotherma-synthetic-sapphires-thomas

https://www.gia.edu/gems-gemology/winter-1988-ruby-inamori-koivula

https://www.gia.edu/gems-gemology/fall-1985-synthetic-ruby-sapphire-kane

https://www.gia.edu/gems-gemology/fall-1983-synthetic-ruby-kane

https://www.gia.edu/gems-gemology/fall-1982-synthetic-sapphire-kane

https://www.gia.edu/gems-gemology/fall-1982-synthetic-ruby-gubelin

**Synthetic Beryl**

https://www.gia.edu/gems-gemology/winter-2016-synthetic-emeralds-richard-nacken-1920s

https://www.gia.edu/gems-gemology/winter-2007-gem-news-international

https://www.gia.edu/gems-gemology/spring-1996-hydrothermal-synthetic-emerald-koivula

https://www.gia.edu/gems-gemology/fall-1987-lennix-synthetic-emerald-graziani

https://www.gia.edu/gems-gemology/fall-1985-synthetic-emerald-australia-kane

https://www.gia.edu/gems-gemology/summer-1985-russia-synthetic-emerald-koivula

https://www.gia.edu/gems-gemology/fall-1984-synthetics-emerald-stockton

**Synthetic Quartz**

https://www.gia.edu/gems-gemology/summer-1999-russian-synthetic-ametrine-balitsky

https://www.gia.edu/gems-gemology/fall-1986-amethyst-twinning-crowningshield

**Synthetic Opal**

https://www.gia.edu/gems-gemology/spring-2012-gem-news-international

https://www.gia.edu/gems-gemology/fall-2008-synthetic-fire-opal-choudhary

https://www.gia.edu/gems-gemology/fall-1987-synthetic-opal-kyocera-schmetzer

**Other**

https://www.gia.edu/gems-gemology/winter-2010-synthetic-diamonds-renfro

https://www.gia.edu/gems-gemology/summer-1997-gem-news-international

https://www.gia.edu/gems-gemology/fall-1987-malachite-russia-balitsky

https://www.gia.edu/gems-gemology/fall-1987-alexandrite-inamori-created-kane

https://www.gia.edu/gems-gemology/spring-1987-synthetic-jadeite-nassau

**Imitations**

https://www.gia.edu/gems-gemology/winter-2016-labnotes-synthetic-sapphire-synthetic-spinel-doublets

https://www.gia.edu/gems-gemology/winter-2016-gemnews-imitation-rubellite-boulders


https://www.gia.edu/gems-gemology/winter-2014-gemnews-unusual-composite-ruby-rough


https://www.gia.edu/gems-gemology/summer-2014-labnotes-shell-pearl
For Further Reading

Altobelli M. et al. (2013) Lab Notes: Spinel Submitted as Diamond. Gems & Gemology, Vol. 49, No. 4

https://www.gia.edu/gems-gemology/WN13-GNI-composite-amber

https://www.gia.edu/gems-gemology/FA13-LN-imitation-moonstone-assemblage

https://www.gia.edu/gems-gemology/spring-2012-gem-news-international

https://www.gia.edu/gems-gemology/spring-2011-gem-news-international

https://www.gia.edu/gems-gemology/summer-2008-gem-news-international

https://www.gia.edu/gems-gemology/summer-2008-gem-news-international

https://www.gia.edu/gems-gemology/fall-2007-gem-news-international

https://www.gia.edu/gems-gemology/summer-2006-lab-notes

https://www.gia.edu/gems-gemology/winter-2003-gem-news-international

https://www.gia.edu/gems-gemology/winter-2003-gem-news-international

https://www.gia.edu/gems-gemology/summer-2001-lab-notes

https://www.gia.edu/gems-gemology/summer-2001-lab-notes

https://www.gia.edu/gems-gemology/summer-2001-imitating-asterism-mcclure

https://www.gia.edu/gems-gemology/spring-2001-lab-notes

https://www.gia.edu/gems-gemology/spring-1999-lab-notes

https://www.gia.edu/gems-gemology/summer-1997-gem-news-international
https://www.gia.edu/gems-gemology/winter-1996-synthetic-tanzanite-kiefert

https://www.gia.edu/gems-gemology/fall-1995-lab-notes

https://www.gia.edu/gems-gemology/fall-1995-lab-notes


https://www.gia.edu/gems-gemology/fall-1990-imitation-pearls-hanano

https://www.gia.edu/gems-gemology/spring-1989-plastic-opal-koivula

https://www.gia.edu/gems-gemology/fall-1987-synthetic-opal-kyocera-schmetzer

https://www.gia.edu/gems-gemology/winter-1983-cobalt-lapis-bosshart

Assignment 6: Treatments

Heat treatment

https://www.gia.edu/gia-news-research-low-temperature-heat-treatment-mozambique-ruby


https://www.gia.edu/gems-gemology/FA13-koivula-corundum-heat-treatment

https://www.gia.edu/ongoing-research/distinguishing-heated-unheated-spinel

https://www.gia.edu/gems-gemology/summer-2007-gem-news-international

https://www.gia.edu/gems-gemology/winter-1993-montana-sapphires-emmett

https://www.gia.edu/gems-gemology/summer-1982-corundum-bangkok-abraham

**Diffusion treatment**

Saeseaw S. et al. (2015) GIA Lab Reports on a New Cobalt Diffusion Treatment of Natural Spinel. GIA Research & News  


https://www.gia.edu/gems-gemology/spring-2002-gem-news-international


https://www.gia.edu/gems-gemology/summer-1990-diffusion-treated-sapphire-kane

**Other corundum treatments and multiple treatment combinations**


https://www.gia.edu/gems-gemology/winter-1984-ruby-glass-kane

https://www.gia.edu/gems-gemology/winter-1983-inclusions-koivula

**Clarity enhancement**

https://www.gia.edu/gems-gemology/spring-2016-labnotes-hydrophane-opal-treatment

https://www.gia.edu/gems-gemology/FA13-LN-green-glass-filled-sapphire

https://www.gia.edu/ongoing-research/lead-glass-filled-star-rubies-reportedly-from-madagascar


https://www.gia.edu/gems-gemology/summer-2007-durability-testing-of-filled-emeralds
McClure S.F. et al. (1999) Classifying Emerald Clarity Enhancement at the GIA Gem Trade Laboratory. Gems & Gemology, Vol. 35, No. 4
https://www.gia.edu/gems-gemology/winter-1999-classifying-emerald-clarity-mcclure

https://www.gia.edu/gems-gemology/fall-1983-emerald-oiled-ringsrud

Irradiation
https://www.gia.edu/gems-gemology/spring-1985-topaz-color-nassau

https://www.gia.edu/gems-gemology/summer-1982-irradiated-spodumene-rossman

https://www.gia.edu/gems-gemology/winter-1981-radioactivity-topaz-crowningshield

Coating
https://www.gia.edu/gia-news-research-titanium-coated-tanzanite-cooper

https://www.gia.edu/gems-gemology/gemological-characteristics-coated-jadeite-jade

https://www.gia.edu/gems-gemology/summer-2008-coated-tanzanite-mcclure


https://www.gia.edu/gems-gemology/fall-1995-lab-notes

Dyeing


https://www.gia.edu/gems-gemology/winter-2012-lavender-jadeite-lu

https://www.gia.edu/gems-gemology/winter-2011-hydrophane-opal-renfro


https://www.gia.edu/gems-gemology/spring-1982-jadeite-color-koivula
Bleaching and polymer impregnation

Sugar treatment
https://www.gia.edu/gems-gemology/summer-1991-andamooka-matrix-opal-brown

General
https://www.gia.edu/gems-gemology/fall-2010-detection-disclosure-heating-mcclure
https://www.gia.edu/gems-gemology/winter-2002-commercially-available-gem-treatments-smith
https://www.gia.edu/gems-gemology/spring-1984-gem-treatment-nassau
For Further Reading

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Assignment 7: The Colored Stone Market

https://www.gia.edu/gems-gemology/summer-2016-color-responsibility-ethical-issues-solutions-colored-gemstones

https://www.gia.edu/gems-gemology/winter-2016-jaipur-india

https://www.gia.edu/gia-news-research/jaipur-creation-business-beads

https://www.gia.edu/gia-news-research/jaipur-india-emerald-cutting-trading-powerhouse


https://www.gia.edu/gia-news-research/great-potential-diopside-china-market

https://www.gia.edu/gia-news-research-Gem-TV-China-Overview-Shanghai

https://www.gia.edu/gia-news-research/panyu-legendary-manufacturing-hub-global-gem-jewelry-industry

https://www.gia.edu/gia-news-research/belmont-mine-emeralds-journey-mine-to-market

https://www.gia.edu/gia-news-research-gemfields-bets-gemstone-markets-growth

https://www.gia.edu/gems-gemology/spring-2014-lucas-chinese-gem-industry

https://www.gia.edu/gia-news-research-expedition-to-the-valley-of-rubies-part-1

https://www.gia.edu/gia-news-research-expedition-to-the-valley-of-rubies-part-3

https://www.gia.edu/gia-news-research-gemfields-ruby-auction-singapore

https://www.gia.edu/gia-news-research-sept-2014-industry-analysis-gemfields-ruby

Long P.V. et al. (2013) Update on Gemstone Mining in Luc Yen, Vietnam. Gems & Gemology, Vol. 49, No. 4
https://www.gia.edu/gems-gemology/WN13-Long-Gemstone-Mining-Vietnam

https://www.gia.edu/gia-news-research-Rise-of-the-Brazilian-Jewelry-Industry

https://www.gia.edu/gems-gemology/Spring-2013-shor-auction

https://www.gia.edu/gems-gemology/FA13-cheapside-hoard-weldon

https://www.gia.edu/gems-gemology/fall-2010-diamond-pearl-colored-stones-shigley

https://www.gia.edu/gems-gemology/fall-2010-diamond-pearl-shor

https://www.gia.edu/gems-gemology/fall-2007-global-free-market-pearl-industry-shor

Assignment 8: Color

https://www.gia.edu/gia-news-research-pantone-spring-colors-2015

https://www.gia.edu/gems-gemology/fall-2014-introduction-pleochroism-faceted-gems

https://www.gia.edu/gems-gemology/spring-2003-gem-news-international

Assignment 9: Cut

https://www.gia.edu/gems-gemology/summer-2016-challenges-cutting-large-gem-opal-rough

https://www.gia.edu/gems-gemology/summer-2016-gemnews-robotic-colored-stone-cutting-machines

Pay D. (2016) Cutting the “Imperial Flame” Topaz. GIA Research & News
https://www.gia.edu/gia-news-research/cutting-imperial-flame-topaz
And Then Came the Fantasy Cut (2014) GIA Research & News
https://www.gia.edu/munsteiner-gem-cut

https://www.gia.edu/gems-gemology/Optimizing-Face-Up-Appearance-in-Colored-Gemstone-Faceting


Secrets of a Master Gem Cutter: Interview with Michael M. Dyber (2013) GIA Research & News
https://www.gia.edu/tucson2013-michael-dyber


https://www.gia.edu/gems-gemology/winter-2001-transcending-traditional-lapidary-arts-thompson


https://www.gia.edu/gems-gemology/winter-1983-history-gems-gray

https://www.gia.edu/gems-gemology/winter-1981-kunzite-ramsey

**Assignment 10: Clarity**

https://www.gia.edu/gems-gemology/winter-2016-inclusions-natural-synthetic-treated-emerald

https://www.gia.edu/gems-gemology/micro-world-gallery


https://www.gia.edu/gems-gemology/summer-2015-microworld-introduction-gems

Insights from Inclusions (2014) GIA Research & News
https://www.gia.edu/gem-inclusion-insight

The Hidden Beauty of Gemstones (2013) GIA Research & News
https://www.gia.edu/photomicrography

Assignment 11: Carat Weight and the Gem Business

An Inside Look at the 2016 Tucson Shows (2016) GIA Research & News
https://www.gia.edu/2016-tucson-show-inside-look

https://www.gia.edu/gems-gemology/spring-2016-gemnews-tucson-overview


https://www.gia.edu/tucson-2015-show


An Inside Look at the 2014 Tucson Shows (2014) GIA Research & News
https://www.gia.edu/tucson2014-show

An Inside Look at the 2013 Tucson Shows (2013) GIA Research & News
https://www.gia.edu/tucson2013-show

https://www.gia.edu/gems-gemology/spring-2012-gem-news-international

https://www.gia.edu/gems-gemology/spring-2011-gem-news-international

https://www.gia.edu/gems-gemology/spring-2010-gem-news-international

For Further Reading

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**Assignment 12: Ruby**

**Africa**

[https://www.gia.edu/gems-gemology/fall-2016-gemnews-preliminary-study-rubies-reportedly-pokot-kenya](https://www.gia.edu/gems-gemology/fall-2016-gemnews-preliminary-study-rubies-reportedly-pokot-kenya)


[https://www.gia.edu/gia-news-research/field-gemologist-documents-madagascar-ruby-rush](https://www.gia.edu/gia-news-research/field-gemologist-documents-madagascar-ruby-rush)


GIA Field Gemologists Visit Chimwadzulu Ruby Mine, Malawi (2015) GIA Research & News,
[https://www.gia.edu/gia-news-research/chimwadzulu-ruby-mine-malawi-field-gemologists](https://www.gia.edu/gia-news-research/chimwadzulu-ruby-mine-malawi-field-gemologists)

[https://www.gia.edu/gia-news-research-gemfields-ruby-auction-singapore](https://www.gia.edu/gia-news-research-gemfields-ruby-auction-singapore)

Series of Articles on Rubies from Mozambique (2014) GIA Research & News
[https://www.gia.edu/gia-news-research-mozambique-montepuez-rubies](https://www.gia.edu/gia-news-research-mozambique-montepuez-rubies)

[https://www.gia.edu/gems-gemology/summer-2012-gem-news-international](https://www.gia.edu/gems-gemology/summer-2012-gem-news-international)

[https://www.gia.edu/gia-news-research-nr101512](https://www.gia.edu/gia-news-research-nr101512)

[https://www.gia.edu/gems-gemology/fall-2009-gem-news-international](https://www.gia.edu/gems-gemology/fall-2009-gem-news-international)

Central Asia and Russia


https://www.gia.edu/gems-gemology/winter-2011-gem-news-international

https://www.gia.edu/gems-gemology/winter-2010-gem-news-international

https://www.gia.edu/gems-gemology/fall-2007-gem-news-international


Southeast Asia

https://www.gia.edu/gems-gemology/spring-2016-gemnews-ruby-sapphire-muling-china

GIA Field Gemologists Seek Ruby in Mogok, Myanmar (2015) GIA Research & News
https://www.gia.edu/gia-news-research/seek-ruby-mogok-myanmar-field-expedition

https://www.gia.edu/gia-news-research/expedition-to-the-valley-of-rubies-part-1


https://www.gia.edu/gia-news-research/expedition-to-the-valley-of-rubies-part-3
For Further Reading

https://www.gia.edu/gems-gemology/fall-2012-vietnam-huong

https://www.gia.edu/gems-gemology/fall-2011-ruby-sapphire-khol

https://www.gia.edu/gems-gemology/spring-1995-ruby-mong-hsu-peretti


https://www.gia.edu/gems-gemology/winter-1983-ruby-mogok-keller

https://www.gia.edu/gems-gemology/winter-1982-chanthaburi-trat-gem-keller

Other

https://www.gia.edu/gems-gemology/winter-2009-ruby-sapphire-shor

https://www.gia.edu/gia-news-research-nr32309


Assignment 13: Blue Sapphire

Southeast Asia

https://www.gia.edu/gia-news-research/sapphire-chanthaburi-thailand-gemological-characteristics

https://www.gia.edu/gia-news-research/blue-sapphires-baw-mar-mine-mogok-myanmar

https://www.gia.edu/gems-gemology/spring-2016-gemnews-ruby-sapphire-muling-china
Venture into Chanthaburi’s Sapphire Mines and Markets with GIA’s Field Gemologists (2015) GIA Research & News
https://www.gia.edu/gia-news-research/chanthaburi-sapphire-mines-markets-field-gemology


https://www.gia.edu/gia-news-research-sri-lanka-mining-part1

https://www.gia.edu/gia-news-research-sri-lanka-mining-part2

https://www.gia.edu/gems-gemology/WN13-Karampelas-Blue-Sapphires-Mogok

Pardieu V. (2013) Video Feature: Gem Mining in Cambodia. GIA Research & News
https://www.gia.edu/news-research-cambodia-mining-pardieu

https://www.gia.edu/gems-gemology/summer-2012-sapphires-thammannawa-dharmaratne

https://www.gia.edu/gems-gemology/fall-2012-vietnam-huong

https://www.gia.edu/gems-gemology/summer-2012-gem-news-international

https://www.gia.edu/gia-news-research-nr50212

https://www.gia.edu/gems-gemology/fall-2011-gem-news-international

https://www.gia.edu/gia-news-research-nr51409

https://www.gia.edu/gems-gemology/fall-1995-sapphires-southern-vietnam-smith

Guo J. et al. (1992) Sapphires from Changle in Shandong Province, China. Gems & Gemology, Vol. 28, No. 4


https://www.gia.edu/gems-gemology/fall-1989-gem-news-international

https://www.gia.edu/gems-gemology/fall-1988-china-sapphire-furui

https://www.gia.edu/gems-gemology/spring-1986-sapphire-china-keller
Africa

https://www.gia.edu/gia-news-research/sapphires-gem-rush-bemainty-ambatondrazaka-madagascar

https://www.gia.edu/gems-gemology/winter-2016-gemnews-sapphire-rush-near-ambatondrazaka-madagascar

https://www.gia.edu/gems-gemology/spring-2016-gemnews-blue-sapphires-new-deposit-andranondambo-madagascar

https://www.gia.edu/gia-news-research/sapphire-mines-ilakaka-madagascar-field-expedition

https://www.gia.edu/gia-news-research-nigerian-source-blue-sapphire

https://www.gia.edu/gia-news-research-nr101512

https://www.gia.edu/gems-gemology/summer-2012-gem-news-international

https://www.gia.edu/gems-gemology/winter-2010-gem-news-international

https://www.gia.edu/gems-gemology/fall-2000-sapphires-antsiranana-province-madagascar-schwarz

https://www.gia.edu/gems-gemology/summer-1996-gem-sapphire-madagascar-schwarz

Central Asia and Russia

https://www.gia.edu/gems-gemology/fall-2016-gemnews-blue-sapphire-badakhshan-afghanistan

Pardieu V. et al. (2009) Sapphires Reportedly from the Batakundi/Basil Area. GIA Research & News
https://www.gia.edu/ongoing-research/sapphires-reportedly-from-the-batakundi-basil-area

https://www.gia.edu/gems-gemology/winter-2004-gem-news-international


https://www.gia.edu/gems-gemology/winter-1990-kashmir-sapphire-schwieger


https://www.gia.edu/gems-gemology/summer-1983-sapphire-atkinson

**North America**


https://www.gia.edu/gems-gemology/fall-2009-gem-news-international

https://www.gia.edu/gems-gemology/spring-1995-yogo-sapphire-deposit-mychaluk

**Australia**

https://www.gia.edu/gia-news-research/seeking-legacy-australian-sapphire

https://www.gia.edu/gems-gemology/fall-1985-sapphire-australia-coldham

**Other**

https://www.gia.edu/ongoing-research/beryllium-treated-blue-sapphire

https://www.gia.edu/gems-gemology/winter-2009-ruby-sapphire-shor

https://www.gia.edu/gems-gemology/winter-1994-corundum-occurence-levinson

**Assignment 14: Fancy Sapphire and Phenomenal Corundum**

**North America**

https://www.gia.edu/gia-news-research/rock-creek-montana-sapphires-new-age-mining-begins

https://www.gia.edu/gia-news-research/monotana-gem-mountain-sapphire-mine

260
For Further Reading


https://www.gia.edu/gems-gemology/fall-2009-gem-news-international

**Australia**

https://www.gia.edu/gia-news-research/seeking-legacy-australian-sapphire

https://www.gia.edu/gems-gemology/fall-1985-sapphire-australia-coldham

**Africa**

Pardieu V. (2013) Update on Sapphire Mining in Ilakaka-Sakaraha, Madagascar. GIA Research & News  
https://www.gia.edu/gia-news-research-Sapphire-Mining-Ilakaka-Madagascar

https://www.gia.edu/gia-news-research-nr50212

https://www.gia.edu/gia-news-research-nr101512

https://www.gia.edu/gems-gemology/summer-1999-sapphire-garnet-kalalani-seifert

**Southeast Asia**

https://www.gia.edu/gems-gemology/fall-2011-ruby-sapphire-khol


https://www.gia.edu/gems-gemology/fall-1988-china-sapphire-furui

https://www.gia.edu/gems-gemology/spring-1983-sapphire-crowningshield

**Central Asia**

Pardieu V. et al. (2009) Sapphires Reportedly from the Batakundi/Basil Area. GIA Research & News  
https://www.gia.edu/ongoing-research/sapphires-reportedly-from-the-batakundi-basil-area

Other

https://www.gia.edu/gems-gemology/winter-2009-ruby-sapphire-shor

https://www.gia.edu/gia-news-research-nr32309


Assignment 15: Emerald

Africa


https://www.gia.edu/gia-news-research/visit-zambia-emerald-mines-field-gemology

Hsu T. et al. (2014) A Visit to the Kagem Open-pit Emerald Mine in Zambia. GIA Research & News
https://www.gia.edu/gia-news-research-kagem-emerald-mine-zambia

https://www.gia.edu/gems-gemology/spring-2011-gem-news-international

https://www.gia.edu/gems-gemology/summer-1997-sandawana-mines-emerald-zwaan

https://www.gia.edu/gems-gemology/summer-1993-emerald-beryl-egypt-jennings

Colombia

https://www.gia.edu/gems-gemology/summer-2016-rainier-footsteps-journey-chivor-emerald-mine

https://www.gia.edu/gems-gemology/fall-2015-colombian-trapiche-emeralds-recent-advances-understanding-formation

https://www.gia.edu/gems-gemology/fall-2008-finest-colombian-emeralds-ringsrud
For Further Reading

https://www.gia.edu/gems-gemology/fall-2002-gem-news-international

https://www.gia.edu/gems-gemology/winter-1989-treasures-spanish-galleon-kane

https://www.gia.edu/gems-gemology/summer-1986-colombia-emeralds-ringsrud


Brazil


https://www.gia.edu/gia-news-research/belmont-mine-emeralds-journey-mine-to-market

https://www.gia.edu/gems-gemology/spring-2012-brazil-emerald-lucas

https://www.gia.edu/research-news-brazil-emerald-sources-lucas

https://www.gia.edu/gems-gemology/spring-2012-gem-news-international

https://www.gia.edu/gems-gemology/spring-2012-emeralds-brazil-zwaan

https://www.gia.edu/gems-gemology/fall-1989-brazil-emeralds-epstein

https://www.gia.edu/gems-gemology/spring-1984-emerald-cassedanne

Central Asia

Searching for Emeralds in Afghanistan (2014) GIA Research & News
https://www.gia.edu/afghanistan-emerald

https://www.gia.edu/gems-gemology/fall-2011-gem-news-international

https://www.gia.edu/gems-gemology/spring-2005-gem-news-international

North America

https://www.gia.edu/gems-gemology/winter-2010-gem-news-international

https://www.gia.edu/gems-gemology/spring-2008-gem-news-international

Russia


Schmetzer K. et al. (1991) Emeralds from the Ural Mountains, USSR. Gems & Gemology, Vol. 27, No. 2

Cutting Centers

https://www.gia.edu/gems-gemology/winter-2016-jaipur-india

https://www.gia.edu/gia-news-research/jaipur-india-emerald-cutting-trading-powerhouse

Other

Saeseaw S. et al. (2014) Three-Phase Inclusions in Emerald and Their Impact on Origin Determination. Gems & Gemology, Vol. 50, No. 2
https://www.gia.edu/gems-gemology/summer-2014-saeseaw-three-phase-inclusions-emerald

For Further Reading

GIA's course content comes from field research at gem mining, processing, and marketing centers, carried out by GIA subject matter experts and research scientists, as well as from publications on the GIA website and in GIA's peer-reviewed professional journal, *Gems & Gemology*, authored by GIA experts and worldwide contributors.

These references include source material for many of the course assignments and suggestions for your own research. You will not be tested on the information in any of the references provided below.

Assignment 16: Pearl formation, Types, and Market

Natural pearls

https://www.gia.edu/gems-gemology/winter-2012-pearls-scarratt

Non-nacreous pearls


https://www.gia.edu/gems-gemology/fall-2014-observations-pinnidae-family-pen-pearls

https://www.gia.edu/gia-news-research-NR61509A

https://www.gia.edu/gems-gemology/winter-1987-queen-conch-pearls-fritsch

Chinese freshwater cultured pearls


https://www.gia.edu/gems-gemology/spring-2010-gem-news-international

North American natural and cultured freshwater pearls

https://www.gia.edu/gia-news-research/freshwater-pearling-tennessee

https://www.gia.edu/gems-gemology/fall-1984-pearls-sweaney

South Sea cultured pearls

https://www.gia.edu/gems-gemology/fall-2016-bead-cultured-pearls-lombok-indonesia

https://www.gia.edu/gia-news-research/pearl-farms-mergui-myanmar-field-expedition

Otter L.M. et al. (2014) A Look Inside a Remarkably Large Beaded South Sea Cultured Pearl. Gems & Gemology, Vol. 50, No. 1

https://www.gia.edu/gems-gemology/summer-2012-pearl-micronesia-cartier

https://www.gia.edu/gems-gemology/fall-1989-black-pearls-goebel

Akoya cultured pearls


https://www.gia.edu/gems-gemology/summer-2007-gem-news-international

Abalone pearls


Cultured blister pearls

https://www.gia.edu/gems-gemology/spring-1982-pearls-cultivation-crowningshield
**Pearls from the Gulf of California**


https://www.gia.edu/gems-gemology/summer-1995-pearling-baja-california

**Market updates**

https://www.gia.edu/gems-gemology/summer-2015-gemnews-baroque-pearls

https://www.gia.edu/gems-gemology/spring-2015-gemnews-cultured-pearl-market-update

https://www.gia.edu/gems-gemology/spring-2014-gemnews-cultured-pearl-tucson

https://www.gia.edu/gia-2012-paspaley-pearl-auction-hong-kong-shor

*Gems & Gemology*, Vol. 43, No. 3  
https://www.gia.edu/gems-gemology/fall-2007-global-free-market-pearl-industry-shor

**Assignment 17: Pearl Value Factors, Processing, and Treatments**

*Gems & Gemology*, Vol. 48, No. 4  
https://www.gia.edu/gems-gemology/winter-2012-cultured-pearls-zhou

Karampelas S. et al. (2011) UV-Vis-NIR Reflectance Spectroscopy of Natural-Color Saltwater Cultured Pearls from Pinctada Margaritifera.  
*Gems & Gemology*, Vol. 47, No. 1  
https://www.gia.edu/gems-gemology/spring-2011-saltwater-pearls-karampelas

*Gems & Gemology*, Vol. 46, No. 2  
https://www.gia.edu/gems-gemology/summer-2010-pearls-microtomography-karampelas

*Gems & Gemology*, Vol. 46, No. 2  
https://www.gia.edu/gems-gemology/summer-2010-pearls-microtomography-krzemnicki

https://www.gia.edu/ongoing-research/microradiographic-structures-of-non-bead-cultured-pearls

*Gems & Gemology*, Vol. 42, No. 4  

*Gems & Gemology*, Vol. 38, No. 2  

*Gems & Gemology*, Vol. 38, No. 1  
https://www.gia.edu/gems-gemology/spring-2002-yellow-cultured-pearls-pinctada-margaritifera-elen


**Assignment 18: Jade**

**Jadeite**


https://www.gia.edu/gems-gemology/spring-1982-jadeite-color-koivula

**Nephrite**


https://www.gia.edu/gia-news-research/nephrite-jade-road-evolution-green-nephrite-market


https://www.gia.edu/gems-gemology/fall-2014-nephrite-jade-guangxi-province-china

https://www.gia.edu/gems-gemology/summer-2013-adamo-nephrite-italy

**Other**


https://www.gia.edu/gems-gemology/fall-2001-lab-notes

https://www.gia.edu/gems-gemology/spring-1998-gem-news-international

**Assignment 19: Opal**

https://www.gia.edu/gia-news-research/queensland-opal-fields-precious-unique-australian-boulder

https://www.gia.edu/gems-gemology/summer-2016-challenges-cutting-large-gem-opal-rough

https://www.gia.edu/gia-news-research/australia-opal-fields-expedition


Assignment 20: Quartz and Chalcedony

Quartz


For Further Reading

https://www.gia.edu/gems-gemology/fall-2011-amethyst-crystals-karampelas

https://www.gia.edu/gems-gemology/spring-2009-gem-news-international


https://www.gia.edu/gems-gemology/spring-2009-anahi-ametrine-mine

https://www.gia.edu/gems-gemology/fall-2004-amethyst-four-peaks-arizona-lowell


https://www.gia.edu/gems-gemology/fall-1989-synthetic-quartz-koivula


https://www.gia.edu/gems-gemology/fall-1986-amethyst-twinning-crowningshield

https://www.gia.edu/gems-gemology/spring-1981-artificial-color-nassau

Chalcedony

https://www.gia.edu/gia-news-research/gem-cutters-reveal-beauty-chalcedony


https://www.gia.edu/gems-gemology/spring-2014-gemnews-tucson-australian-chrysoprase

Weldon R. (2013) From the Andes to the Pantanál: In Search of Ametrine. GIA Research & News
https://www.gia.edu/gia-news-research-In-Search-of-Ametrine

https://www.gia.edu/gems-gemology/FA13-dumanska-agate-sidi-rahal

https://www.gia.edu/gems-gemology/winter-2009-chrysoprase-prase-opal-shigley

335
Assignment 21: Tanzanite, Iolite, Chrysoberyl, and Andalusite


https://www.gia.edu/gems-gemology/spring-2014-gemnews-tucson-tanzanite-yellow-sapphire

https://www.gia.edu/gems-gemology/summer-2009-andalusite-brazil-fernandes

https://www.gia.edu/gems-gemology/spring-2005-gem-news-international

https://www.gia.edu/gems-gemology/spring-2005-gem-news-international

https://www.gia.edu/gems-gemology/summer-2004-lab-notes

https://www.gia.edu/gems-gemology/winter-2003-gem-news-international

https://www.gia.edu/gems-gemology/fall-2002-gem-news-international

https://www.gia.edu/gems-gemology/spring-1981-green-zoisite-barot

For Further Reading

GIA’s course content comes from field research at gem mining, processing, and marketing centers, carried out by GIA subject matter experts and research scientists, as well as from publications on the GIA website and in GIA’s peer-reviewed professional journal, Gems & Gemology, authored by GIA experts and worldwide contributors.

These references include source material for many of the course assignments and suggestions for your own research. You will not be tested on the information in any of the references provided below.

Assignment 22: Topaz and Beryl

Topaz

Cairncross B. et al. (1998) Topaz, Aquamarine, and Other Beryls from Klein Spitzkoppe, Namibia. Gems & Gemology, Vol. 34, No. 2

Sauer D.A. et al. (1996) An Update on Imperial Topaz from the Capão Mine, Minas Gerais, Brazil. Gems & Gemology, Vol. 32, No. 4
https://www.gia.edu/gems-gemology/winter-1996-imperial-topaz-brazil-sauer

Gübelin E. et al. (1986) Pink Topaz from Pakistan. Gems & Gemology, Vol. 22, No. 3
https://www.gia.edu/gems-gemology/fall-1986-pink-topaz-gubelin

https://www.gia.edu/gems-gemology/spring-1983-topaz-brazil-keller

Beryl

https://www.gia.edu/gems-gemology/summer-2012-gem-news-international

Huong L. et al. (2011) Aquamarine from the Thuong Xuan District, Thanh Hoa Province, Vietnam. Gems & Gemology, Vol. 47, No. 1
https://www.gia.edu/gems-gemology/spring-2011-aquamarine-topaz-huong

https://www.gia.edu/gems-gemology/winter-2010-gem-news-international

https://www.gia.edu/gems-gemology/winter-2010-gem-news-international

https://www.gia.edu/gems-gemology/fall-2009-aquamarine-masino-bregaglia-bocchio

https://www.gia.edu/gems-gemology/summer-2007-gem-news-international

https://www.gia.edu/gems-gemology/spring-2003-gem-news-international

https://www.gia.edu/gems-gemology/fall-2002-gem-news-international

https://www.gia.edu/gems-gemology/spring-1993-finland-beryl-lahti

https://www.gia.edu/gems-gemology/spring-1989-beryl-brazil-kampf

https://www.gia.edu/gems-gemology/winter-1984-beryl-utah-shigley

https://www.gia.edu/gems-gemology/summer-1984-pegmatites-brazil-proctor

GIA Gem Project: Beryl
https://www.gia.edu/gia-gem-project-beryl

Assignment 23: Tourmaline, Peridot, and Zircon

Tourmaline

https://www.gia.edu/gia-news-research/cuprian-liddicoatite-tourmaline

https://www.gia.edu/gia-news-research-miranda-journey-of-rubellite-tourmaline

Lucas A. et al. (2015) Expedition to the Cruzeiro Tourmaline Mine in Minas Gerais, Brazil. GIA Research & News
https://www.gia.edu/gia-news-research-cruzeiro-tourmaline-mine-expedition

https://www.gia.edu/gia-news-research-an-overview-of-2014-gia-brazil-expedition

https://www.gia.edu/gems-gemology/spring-2011-gem-news-international

https://www.gia.edu/gems-gemology/fall-2009-gem-news-international

https://www.gia.edu/gems-gemology/fall-2009-gem-news-international

https://www.gia.edu/gems-gemology/spring-2009-tourmalines-mozambique-koivula
For Further Reading

https://www.gia.edu/gems-gemology/spring-2008-copper-bearing-tourmaline-mozambique-laurs

https://www.gia.edu/gems-gemology/winter-2007-gem-news-international

Laurs B.M. et al. (2007) Yellow Mn-Rich Tourmaline from the Canary Mining Area, Zambia. Gems & Gemology, Vol. 43, No. 4

https://www.gia.edu/gems-gemology/winter-2007-gem-news-international

https://www.gia.edu/gems-gemology/winter-2007-gem-news-international

Furuya M. (2007) Copper-Bearing Tourmalines from New Deposits in Paraíba State, Brazil. Gems & Gemology, Vol. 43, No. 3

https://www.gia.edu/gems-gemology/spring-2006-paraiba-tourmaline-chemical-fingerprinting-abduriyum

https://www.gia.edu/gems-gemology/winter-2005-gem-news-international

https://www.gia.edu/gems-gemology/summer-2005-maine-tourmaline-production-simmons

https://www.gia.edu/gems-gemology/spring-2002-liddicoatite-tourmaline-madagascar

Shigley J.E. et al. (2001) An Update on “Paraíba” Tourmaline from Brazil. Gems & Gemology, Vol. 37, No. 4
https://www.gia.edu/gems-gemology/winter-2001-paraiba-tourmaline-brazil-shigley

https://www.gia.edu/gems-gemology/fall-1997-multicolored-tourmaline-zambia-johnson

Fritsch E. et al. (1990) Gem-Quality Cuprian-Elbaite Tourmalines from São José Da Batalha, Paraíba, Brazil. Gems & Gemology, Vol. 26, No. 3
https://www.gia.edu/gems-gemology/fall-1990-tourmaline-brazil-fritsch

https://www.gia.edu/gems-gemology/summer-1985-tourmaline-brazil-proctor

GIA Gem Project: Tourmaline
https://www.gia.edu/gia-gem-project-tourmaline
Peridot

https://www.gia.edu/gems-gemology/fall-2016-peridot-central-highlands-vietnam-properties-origin-formation

https://www.gia.edu/gems-gemology/fall-2011-peridot-meteorite-shen

https://www.gia.edu/gems-gemology/summer-2009-peridot-sardinia-italy-adamo


https://www.gia.edu/gems-gemology/spring-1986-china-peridot-koivula

https://www.gia.edu/gems-gemology/summer-1983-peridot-tanzania-stockton


Zircon

https://www.gia.edu/gems-gemology/fall-2016-reversible-color-modification-blue-zircon-long-wave-ultraviolet-radiation

https://www.gia.edu/gems-gemology/summer-2015-labnotes-chemical-analysis-zircon

https://www.gia.edu/gems-gemology/spring-2011-red-zircon-muling-chen

https://www.gia.edu/gems-gemology/winter-1989-zircon-australia-faulkner

GIA Gem Project: Zircon
https://www.gia.edu/gia-gem-project-zircon
Assignment 24: Garnet and Spinel

Andradite garnet


https://www.gia.edu/gems-gemology/winter-2014-gemnews-demantoid-baluchistan-province-pakistan

Interview with Stephan Reif (2013) Demantoid from the Green Dragon Mine. GIA Research & News
https://www.gia.edu/tucson2013-sephan-reif

https://www.gia.edu/gems-gemology/spring-2011-demantoid-topazolite-antetezambato-pezzotta

https://www.gia.edu/gems-gemology/spring-2010-gem-news-international

https://www.gia.edu/gems-gemology/winter-2009-demantoid-italy-adamo

https://www.gia.edu/gems-gemology/fall-2009-gem-news-international


https://www.gia.edu/gems-gemology/spring-2003-gem-news-international

https://www.gia.edu/gems-gemology/summer-1996-green-andradite-garnet-phillips

https://www.gia.edu/gems-gemology/fall-1995-garnet-mali-johnson

https://www.gia.edu/gems-gemology/winter-1983-garnet-stockton

https://www.gia.edu/gems-gemology/fall-1981-andradites-payne

Pyrope, almandine, and pyrope-almandine garnet

https://www.gia.edu/gems-gemology/fall-2016-gemnews-purple-pyrope-almandine-garnet-mozambique


**Grossular garnet (including tsavorite)**

https://www.gia.edu/gems-gemology/spring-2016-gemnews-update-scorpion-tsavorite-mine


https://www.gia.edu/gems-gemology/spring-2010-gem-news-international

https://www.gia.edu/gems-gemology/spring-2004-gem-news-international

https://www.gia.edu/gems-gemology/spring-2004-gem-news-international

https://www.gia.edu/gems-gemology/summer-1990-tsavorite-tanzania-kane

https://www.gia.edu/gems-gemology/winter-1982-grossular-garnet-manson

**Spessartine garnet**

https://www.gia.edu/gems-gemology/spring-2008-gem-news-international

https://www.gia.edu/gems-gemology/winter-2001-spessartine-garnet-california-laurs

**Other**


[https://www.gia.edu/gems-gemology/winter-1985-garnet-classification-stockton](https://www.gia.edu/gems-gemology/winter-1985-garnet-classification-stockton)

GIA Gem Project: Garnet
[https://www.gia.edu/gia-gem-project-garnet](https://www.gia.edu/gia-gem-project-garnet)

Spinel

Seek the World’s Most Vivid Blue Spinel with GIA Field Gemologists (2016) GIA Research & News
[https://www.gia.edu/gia-news-research/field-gemologist-vivid-blue-spinel-vietnam](https://www.gia.edu/gia-news-research/field-gemologist-vivid-blue-spinel-vietnam)


[https://www.gia.edu/ongoing-research/distinguishing-heated-unheated-spinel](https://www.gia.edu/ongoing-research/distinguishing-heated-unheated-spinel)


GIA Gem Project: Spinel
[https://www.gia.edu/gia-gem-project-spinel](https://www.gia.edu/gia-gem-project-spinel)

**Assignment 25: Lapis Lazuli, Turquoise, and Other Opaque Gems**

**Lapis**

https://www.gia.edu/gems-gemology/winter-1985-gemstones-afghanistan-bowersox

https://www.gia.edu/gems-gemology/winter-1983-cobalt-lapis-bosshart

https://www.gia.edu/gems-gemology/winter-1981-lapis-afghanistan-wyart

Turquoise

Chen Q. et al. (2012) Turquoise from Zhushan County, Hubei Province, China. Gems & Gemology, Vol. 48, No. 3
https://www.gia.edu/gems-gemology/fall-2012-turquoise-chen

https://www.gia.edu/gems-gemology/summer-2010-turquoise-composite-choudhary

https://www.gia.edu/gems-gemology/summer-2008-gem-news-international


https://www.gia.edu/gems-gemology/spring-1986-turquoise-spectroscopy-fuquan

https://www.gia.edu/gems-gemology/fall-1983-turquoise-spectroscopy-lind

Other materials

https://www.gia.edu/gems-gemology/fall-2011-gem-news-international

https://www.gia.edu/gems-gemology/spring-2009-gem-news-international

https://www.gia.edu/gems-gemology/summer-1997-rhodochrosite-colorado-knox

https://www.gia.edu/gems-gemology/winter-1989-blue-pectolite-woodruff

https://www.gia.edu/gems-gemology/summer-1987-sugilite-wessels-shigley

https://www.gia.edu/gems-gemology/winter-1986-medvedev-gem-inlay-elliott
Assignment 26: Feldspar, Spodumene, and Diopside

Feldspar


https://www.gia.edu/gems-gemology/FA13-oregon-sunstone-pay

https://www.gia.edu/gia-news-research-ponderosa-sunstone-pay

https://www.gia.edu/gia-news-research-dustdevil-sunstone-pay

https://www.gia.edu/gia-news-research-butte-sunstone

https://www.gia.edu/gems-gemology/summer-2012-gem-news-international

https://www.gia.edu/gems-gemology/summer-2011-feldspar-shigatse-tibet-abduriyim


https://www.gia.edu/ongoing-research/special-report-on-red-felspar

https://www.gia.edu/gems-gemology/winter-2010-gem-news-international

https://www.gia.edu/gia-news-research-nr33009A

https://www.gia.edu/gems-gemology/winter-2008-gem-news-international

https://www.gia.edu/gems-gemology/winter-2008-gem-news-international

https://www.gia.edu/gems-gemology/summer-2008-gem-news-international

https://www.gia.edu/gems-gemology/spring-2008-gem-news-international
https://www.gia.edu/gems-gemology/summer-2007-gem-news-international

https://www.gia.edu/gems-gemology/winter-2006-gem-news-international

https://www.gia.edu/gems-gemology/winter-2005-gem-news-international

https://www.gia.edu/gems-gemology/winter-2005-gem-news-international

https://www.gia.edu/gems-gemology/spring-2005-gem-news-international

https://www.gia.edu/gems-gemology/fall-2003-gem-news-international

https://www.gia.edu/gems-gemology/summer-2002-gem-news-international

https://www.gia.edu/gems-gemology/spring-2002-gem-news-international

https://www.gia.edu/gems-gemology/summer-1997-gem-news-international

https://www.gia.edu/gems-gemology/summer-1997-gem-news-international


**Spodumene**

https://www.gia.edu/gems-gemology/summer-2010-gem-news-international

https://www.gia.edu/gems-gemology/winter-2008-gem-news-international

https://www.gia.edu/gems-gemology/fall-2007-gem-news-international

https://www.gia.edu/gems-gemology/fall-2003-gem-news-international


Diopside


Assignment 27: Organics and Collectors Stones


https://www.gia.edu/gems-gemology/summer-2012-gem-news-international

https://www.gia.edu/gems-gemology/fall-2009-green-amber-abduriyim

https://www.gia.edu/gems-gemology/fall-2009-ammolite-fossil-mychaluk

https://www.gia.edu/gems-gemology/fall-2009-hauyne-tanzania-zaitsev


https://www.gia.edu/gems-gemology/spring-2005-gem-news-international

https://www.gia.edu/gems-gemology/winter-2004-gem-news-international

https://www.gia.edu/gems-gemology/summer-2002-gem-news-international

https://www.gia.edu/gems-gemology/spring-2001-fossilized-ammonite-canada-mychaluk

https://www.gia.edu/gems-gemology/fall-2000-hauyne-germany-kiefert

https://www.gia.edu/gems-gemology/fall-1997-benitoite-california-laurs

https://www.gia.edu/gems-gemology/summer-1981-ivory-kane