T.C.
Ankara Üniversitesi
Mühendislik Fakültesi
Jeoloji Mühendisliği Bölümü

JEM 361
ÖZEL MİNERALOJİ

Dr. Öğr. Üyesi Kıymet DENİZ

4. Hafta

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Bu ders notlarının hazırlanmasında Mefail Yeniyol'un sunumlarından, Mineraloji kitabından ve Bonewitz, R. L. (2012)'nın Nature Guide Rocks and Minerals adlı kitanından yararlanılmıştır.

ENDÜSTRİYEL MİNERALLER

- ***Ekonomik değeri olan (metaller ve enerji ile ilgili mineraller hariç) doğal olarak oluşan minerallerdir (Kırıkoğlu 1990).***
- ***Çeşitli şekillerde günlük hayatımızın birer parçasını oluşturan modern endüstri ürünlerinin temel girdileri endüstriyel mineral olarak tanımlanabilir (Kırıkoğlu 1990).***
- ***Doğada yaygın olarak bulunan, kazanılmaları ve işlenmiş ürün haline getirilmeleri nispeten kolay olan yeraltı zenginlikleridir (Kırıkoğlu 1990).***

Bir mineralin endüstriyel bir mineral olabilmesi için pazarı olmalıdır

ENDÜSTRİYEL AMAÇLI KULLANILAN MİNERALLERİN SINIFLANDIRLMASI

Bu ders kapsamında minerallerin kullanım alanlarına göre olan aşağıdaki sınıflaması kullanılacaktır.

- **Süstaşı olarak kullanılan mineraller**
- **Çimento, cam ve seramik sanayinde kullanılan mineraller**
- **Kimya sanayinde kullanılan mineraller**
- **Sanayide (makine, savunma vb.) kullanılan mineraller**
- **Sağlıkta kullanılan mineraller**
- **Gıda sanayinde kullanılan mineraller**
- **Tarım sektöründe kullanılan mineraller**
- **Yapı sektöründe kullanılan mineraller**
- **Metalurjide kullanılan mineraller**
- **Dokuma, Tekstil ve deri sanayisinde kullanılan mineraller**

ENDÜSTRİYEL AMAÇLI KULLANILAN MİNERALLERİN NASIL OLMALI

Jeolojik olarak endüstriyel amaçlı kullanılacak bir mineralin

- **Yaygın olması gerekir**
- **Çok geniş/büyük bir rezerve sahip olması gerekir**
- **Kolay ulaşılabilir olması gerekir**

ENDÜSTRİYEL AMAÇLI KULLANILAN MİNERALLERİN NASIL OLMALI

Ekonomik olarak endüstriyel amaçlı kullanılacak bir mineralin

- **Geliştirilmesi daha az yatırım gerektirmelidir**
- **Pazara yakın olmalıdır**
- **Bazı mineraller metallere göre daha yüksek piyasa fiyatı gerektirir**

ENDÜSTRİYEL AMAÇLI KULLANILAN MİNERALLERİN NASIL OLMALI

Teknolojik olarak endüstriyel amaçlı kullanılacak bir mineralin

- **Daha az işlem görebilir olmalıdır**
- **Daha az enerjiye ihtiyaç duymalıdır**
- **Çevreye daha az zarar/etkisi vermelidir**
- **Olağanüstü çekici özelliklere sahip olmalıdır**

ENDÜSTRİYEL AMAÇLI KULLANILAN MİNERALLERE ÖRNEKLER

Yapı
- Kil
- Jips

Malzeme
- Kuvars
- Dolomit
- Magnezit
- Granat
- Demir oksit
- Grafit
- Asbest
- Barit
- Boksit

Kimyasal
- Barit
- Dolomit
- Boksit
- Zeolit
- Fosfatlar
- Boratlar
- Magnezit

Tarım
- Kil
- Dolomit
- Talk
- Fosfatlar
- Boratlar

Cam ve Seramik
- Kuvars
- Kil
- Feldispat
- Feldispatoyid
- Talk
- Boksit
- Boratlar

Dolgu Maddesi
- Barit
- Kil
- Jips
- Titanlı mineraller

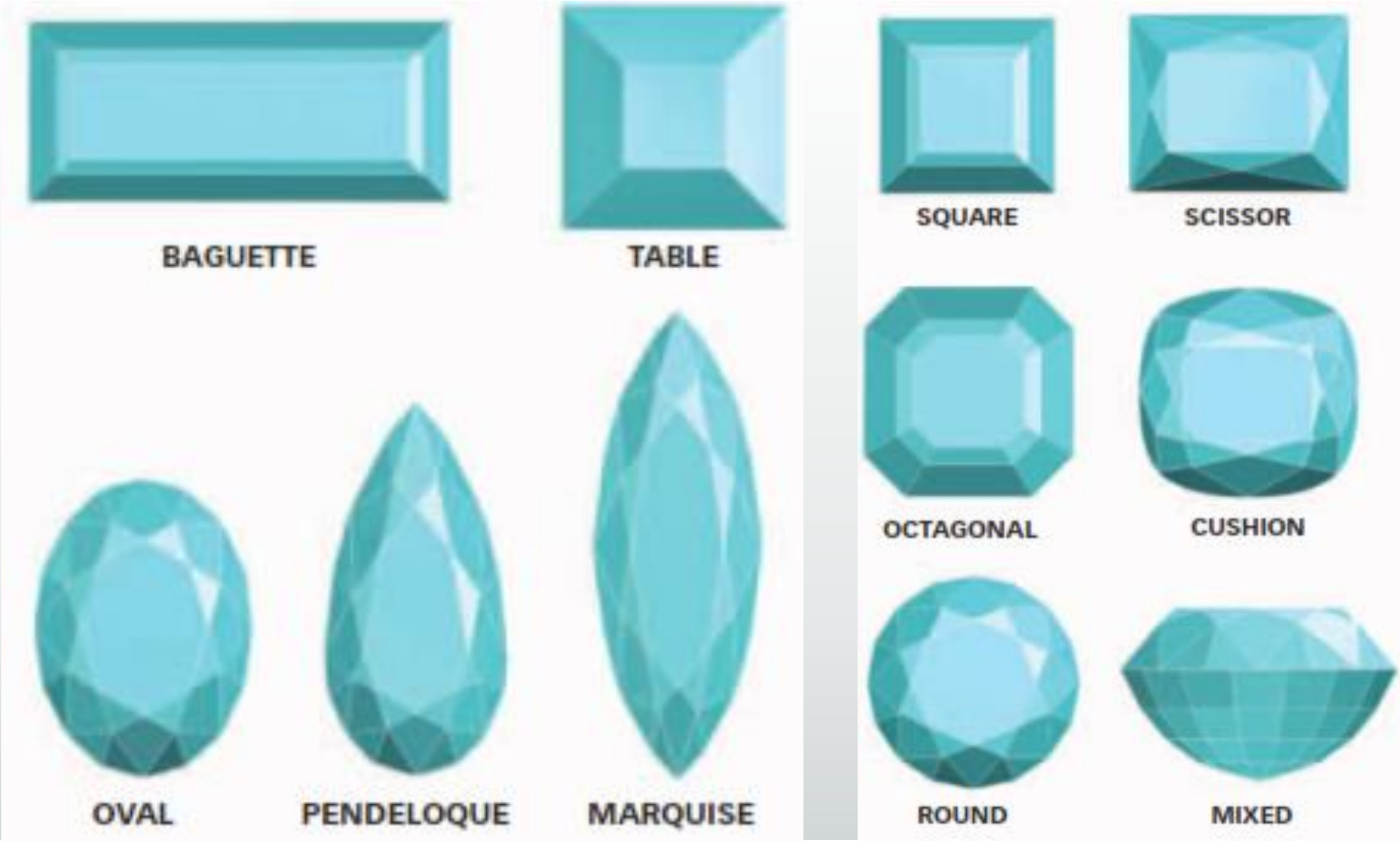
Enerji
- Kil
- Magnezit
- Lityumlu mineraller
- Grafit

Çevre
- Magnezit
- Asbest
- Zeolit
- Dolomit
- Jips
- Boksit

https://www.gninsaat.com.tr/yapi-nedir-siniflari-nelerdir, https://www.metaluzmani.com/malzeme-seciminde-goz-onunde-bulundurulmasi-gereken-ozellikler/, http://www.gunhaber.com.tr/haber/Ankara-da-hastanede-kimyasal-madde-panigi/425966, https://www.tarimdanhaber.com/tarim/tarim-surasi-temmuz-ayina-mi-alindi-h12475.html,ismek seramik ve cam, http://www.guneylihafriyat.com/kum-ve-dolgu-malzemesi, https://geturkiyeblog.com/enerji-tasarrufu-ve-verimliliginde-yeni-cozumler-i/, http://organikmuhendislik.com/hizmetlerimiz/cevre_danismanlik

SÜSTAŞI OLARAK KULLANILAN MİNERALLER

SÜSTAŞLARININ KESİM ŞEKİLLERİ



ELMAS

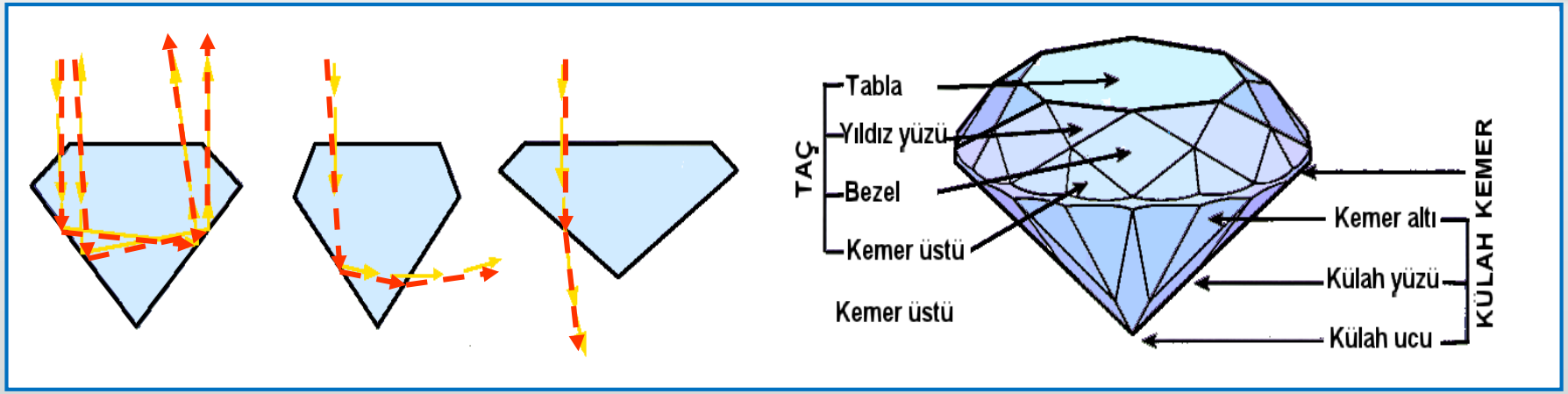
Kimyasal Formülü	C
Kristal Sistemi	Kübik
Özgül Ağırlığı	3.51
Renk	Renksiz, siyah, mavi, beyaz, gri, mor, pembe, sarı, kahverengi, kırmızı, yeşil
Sertlik	10
Çizgi Rengi	Renksiz
Parlaklık	Elmas, yağlı
Saydamlık	Saydam, yarısaydam

Bonewitz, R. L. (2012)

ELMAS

Pırlanta Kalitesi (4 C)

Kesim
Renk
Saydamlık
Karat (1 karat =0.200 gr)



KORUNDUM

Kimyasal Formülü	Al_2O_3
Kristal Sistemi	Trigonal
Özgül Ağırlığı	3.98-4.1
Renk	Renksiz, mavi, kırmızı, pembe, sari, gri, sarımsı kahverengi
Sertlik	9
Çizgi Rengi	Beyaz
Parlaklık	Elmas, camsı, inci
Saydamlık	Saydam, yarısaydam

KORUNDUM

Aluminyum Oksit (Al_2O_3)

Fe^{2+} - Ti^{4+}

(Fe, Ti, Mg), Fe -Ti

Cr^{3+}

Yakut

Safir

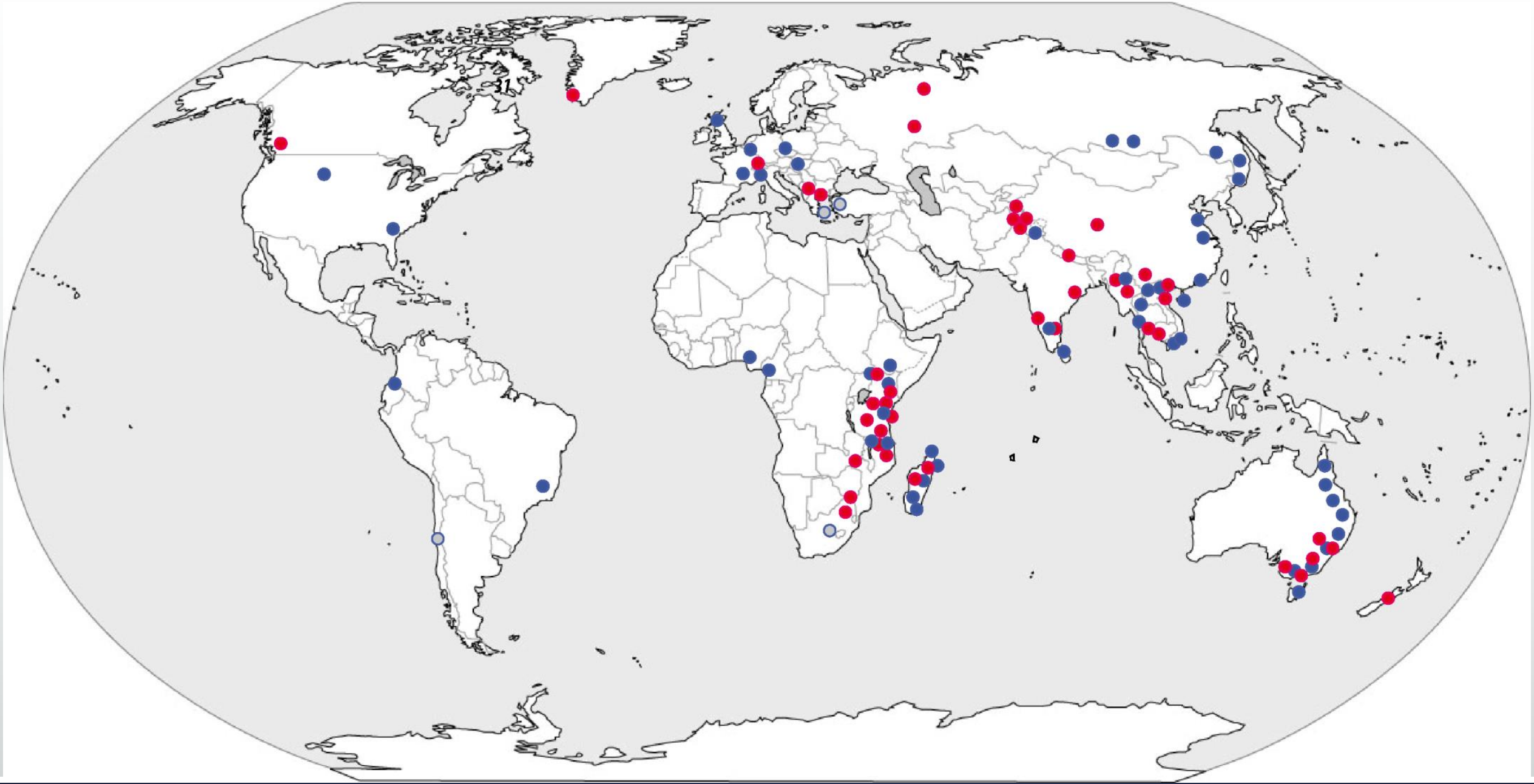
Renkli Safirler

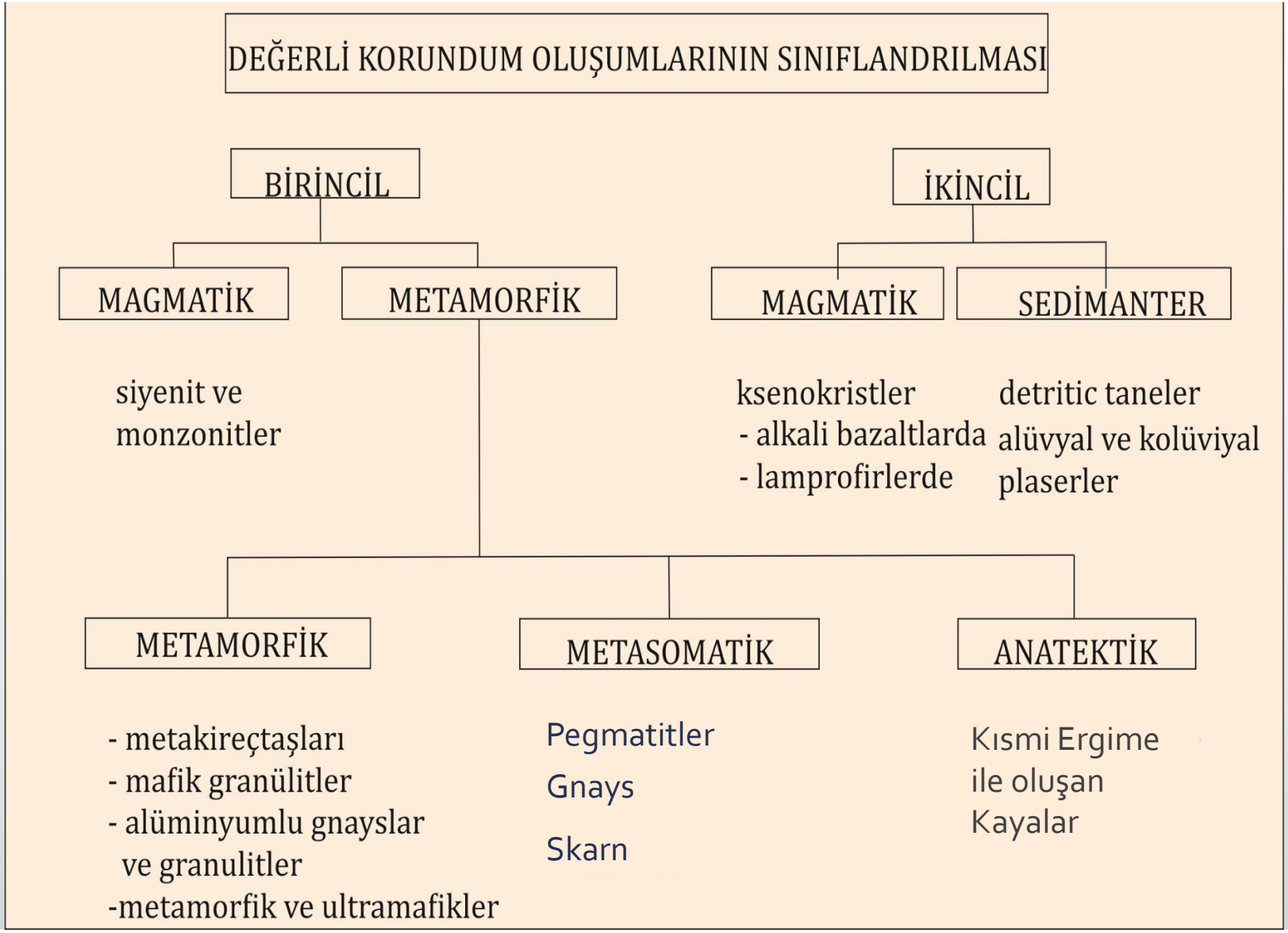
Metapiroksenit

Yakut

prx: piroksen
y: yakut

Bulunduğu Yerler





C. Simonet vd. (2007)'den değiştirilmiştir.

Metabaziklerde Yakut oluşumu

olivin + plg ⟶ ortoprx+ klinoprx + spinel reaksiyonu ile spinel oluşabilmektedir

spinel + anortit ⟶ 2 korundum + diyopsit reaksiyonunu ile korundum oluşabilmektedir

Uvarovit + anortit ⟶ Yakut + Pyx

Fluorit mineralinin bazı fiziksel özellikleri (Yeniyol 2009, Laws 2012, Deniz ve Kadıoğlu 2015)

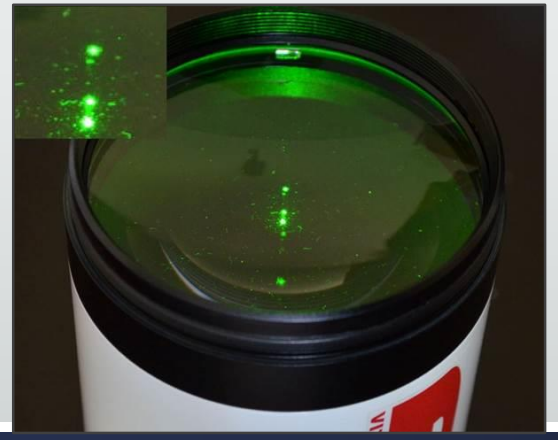
Grubu	Halit Grubu
Kimyasal Formülü	CaF_2
Kristal Sistemi	Kübik
Kristal Yapısı	Genellikle kristaller ve dilimlenebilir kütleler halinde, yumrulu, batriyoidal, nadiren iri veya ince taneli, masif, sütunsal, lifsi
Renk	Mor, yeşil, sarı, mavi (turkuaz, lacivert), pembe, beyaz, kahve, siyah, kırmızımsı turuncu
Çizgi Rengi	Beyaz
Sertlik	4
Özgül Ağırlığı	3.175-3.184 (NTE'ce zengin olanlarda 3.56)
Parlaklık	Camsı
Dilinim	Mükemmel oktahedral
Kırılma	Yarı konkoidal
Şeffaflık	Saydam ve yarısaydam
Ergime Sıcaklığı	1378°C
Kırılma İndisi	1.433-1.448
Eriyebilirlik	3
Optik Özelliği	İzotrop
Raman Shift değeri	280.9 cm^{-1} ve 322.8 cm^{-1}
FTIR Değeri	2920-2880 cm^{-1}'de absorpsiyon ve 3430-3410 cm^{-1}arasında OH piki
XRD d değeri	3.15 °A, 1.93 °A ve 1.64 °A

Alıcılık Açısından Rengin Önemi Nedir & Renk Farklılığının Nedenleri Nelerdir ?

- Hidrofluorik asit (HF) üretimi (Bileşiminde % 97'den fazla CaF_2 içeren fluoritler)
- Seramik Sanayi
- Cam Sanayi
- Emaye Yapımı
- Elektrod Sanayi

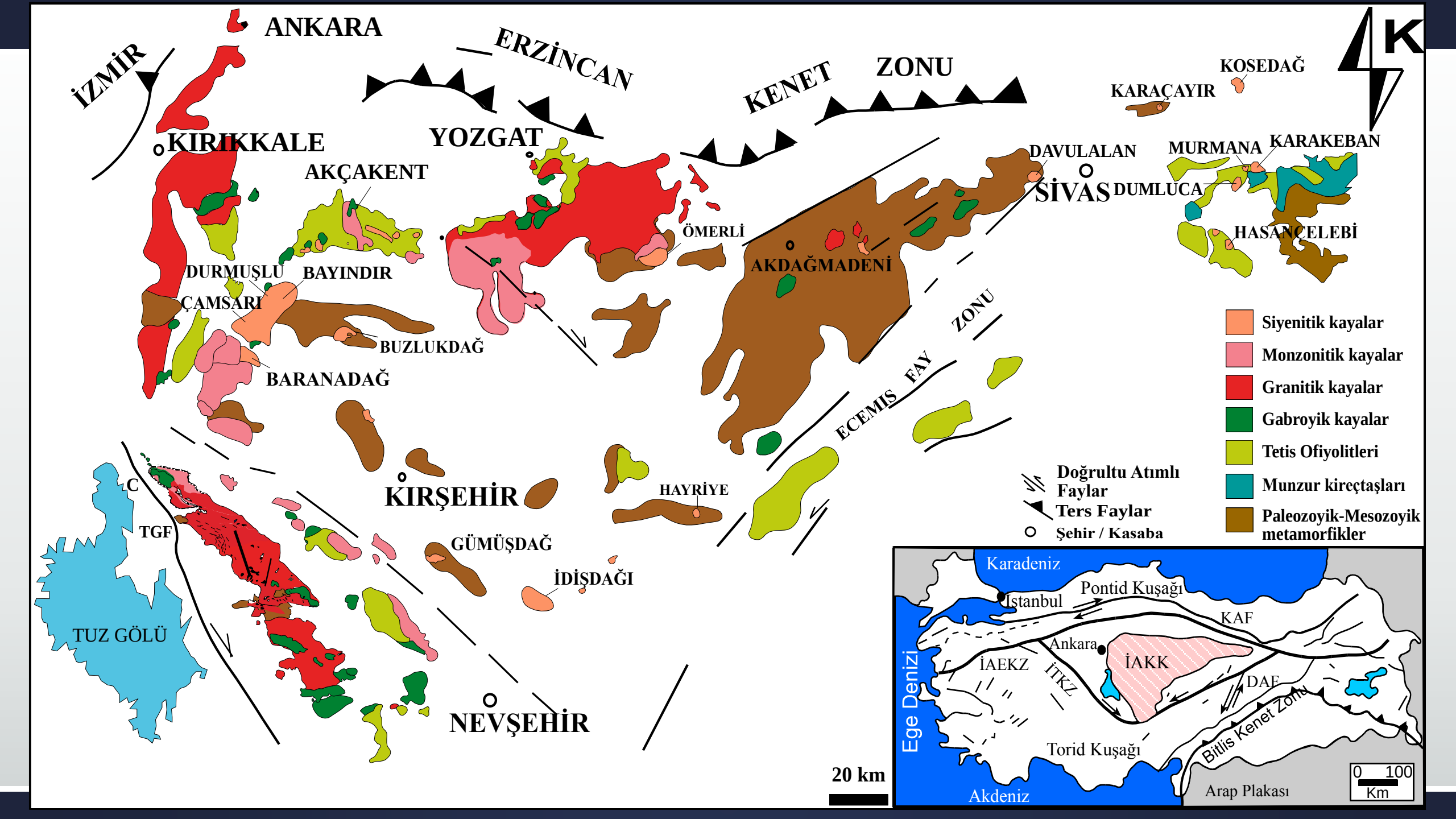
İçeriğinde % 85-96 CaF_2 olanlar

- Demir-çelik Sanayi (% 60-85 CaF_2 içerikliler)
- Optik sistemlerde mercek ve prizma yapımı



Süstaşı Olarak Fluorit

Türkiye'deki Yayılımları


ANKARA
İZMİR
ERZİNCAN
KENET
ZONU
KOSEDAĞ
KARAÇAYIR
KIRIKKALE
YOZGAT
AKÇAKENT
DAVULALAN
SİVAS
DUMLUCA
MURMANA
KARAKEBAN
HASANÇELEBİ
ÖMERLİ
AKDAĞMADENİ
DURMUŞLU
BAYINDIR
ÇAMSARI
BUZLUKDAĞ
BARANADAĞ
ZONU
ECEMIS FAY
KIRŞEHİR
HAYRİYE
GÜMÜŞDAĞ
İDİŞDAĞI
C
TGF
TUZ GÖLÜ
NEVŞEHİR
20 km
Siyenitik kayalar
Monzonitik kayalar
Granitik kayalar
Gabroyik kayalar
Tetis Ofiyolitleri
Munzur kireçtaşları
Paleozoyik-Mesozoyik metamorfikler
Doğrultu Atımlı Faylar
Ters Faylar
Şehir / Kasaba
Karadeniz
Pontid Kuşağı
İstanbul
KAF
Ankara
İAEKZ
İTKZ
İAKK
DAF
Ege Denizi
Bitlis Kenet Zonu
Torid Kuşağı
Akdeniz
Arap Plakası
0 100
Km

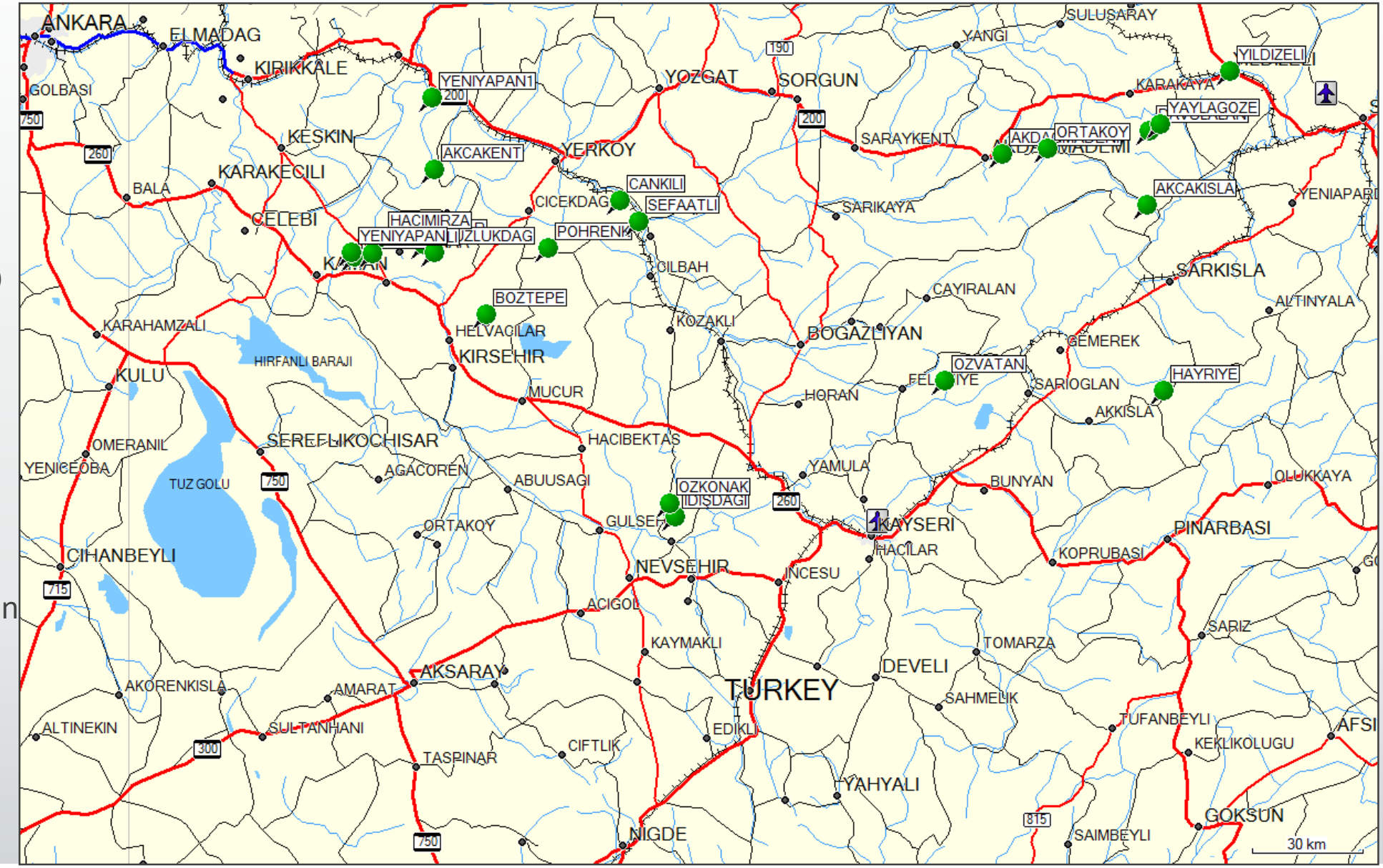
ORTA ANADOLU FLUORİTLERİ (OAF)

Kırşehir

- Bayındır
- Yeniyapan
- İsahocalı
- Alişar-Tatarilyas (Buzlukdağ)
- Çökelik
- Akçakent
- Pöhrenk

Yozgat

- Akdağmadeni
- Cankılı
- Tad Dere
- Ortaköy
- Akçakışla



Sivas

Yaylagözü

Kayseri

Özvatan

Nevşehir

Genezin-İdişdağ

ORTA ANADOLU FLUORİTLERİ (OAF)

City	*Deposit*	*Deposit Type*	*Host Rock*	*Minor Minerals*	*Homogeneous Temperature (oC)*	*Salinity (NaCl %)*	*Colour*	*Direction*	*Genesis*	*Average NTE (ppm)*	*References*
Kırşehir	Pöhrenk	Space filling	Carbonate rocks	Kaolinite, barite, calcite, quartz, illite,smectite	78.1-363°C	1.05-24.08 %	Yellow	NE	Hydrothermal	0.08-5.8	Uras, 2007
Kırşehir	Bayındır	Vein	Gabbro, syenite, alkalen syenite	Kaolinite, quartz, calcite, hematite, sulphur minerals	I. 190°C II. 80°C 126°C 125-354°C	0-8.8 %	Violet, green, colourless, yellow	NE-SW	Hydrothermal Epithermal	43.67-140.31, 0.3-33.1	Yaman, 1984, 1985; Ulu, 1995; Karakurt, 2008; Özmen and Koç, 2006
Kırşehir	Akçakent (Çiçekdağ)	Vein	Gabbro, syenite, syenite porphry	Quartz, manyetite, hematite, rutile	I. Kumlutepe: 140-150°C II. Değirmensırtı: 140-150°C III. Yoncalıöz: 130°C 112-350°C and 110-370°C	0-6.5, 0.4-5.3 %	Violet, green	NW-SE, NE-SW	Hydrothermal	75.68-235.67	Yaman, 1985; Karakurt, 2008
Kırşehir	Yeniyapan	Joint, fracture, vein	Alkaline Syenite	Quartz	130.3°C 117-392°C	0-4.5 %	Violet, green		Epithermal, Hydrothermal	22.40-27.76, 0.2-34.6	Ulu, 1995; Karakurt, 2008; Özmen and Koç, 2006
Kırşehir	İsahocalı	Joint, fracture, vein	Alkaline Syenite, syenite, gabbro, quartzite	Quartz, clay	147.3°C 140-386°C	0-7.3 %	Violet, green, colourless	NE-SW, NW-SE	Epithermal Hydrothermal	110.27-182.61, 0.4-50.3, 0.2-174.1	Ulu, 1995; Uras et al., 2004; Karakurt, 2008; Özmen and Koç, 2006
Kırşehir	Alişar	Joint, fracture, vein	Alkaline Syenite	Quartz			Violet, green		Epithermal	0.2-1320.1	Ulu, 1995; Özmen and Koç, 2006
Kırşehir	Çökelik			Quartz	112-350°C and 110-370°C	0-6.5, 0.4-5.3 %	Violet, green		Hydrothermal	70.46-122.66	Karakurt, 2008
Kırşehir	Buzlukdağ	Joint, fracture, vein, lens shaped	Syenite	Quartz, molibdenite, titanite, pyrite, chalcopyrite	147.5-390°C	1.2-9.1 %	Violet, green, yellow	NW-SE	Hydrothermal	60.25-192.88	Karakurt, 2008; Deniz, 2010
Sivas	Yaylaözü (Yıldızeli)	Skarn, vein	Syenite	Quartz, calcite	161-243°C	3-8 %	Light violet, nearly black	N-S E-W	Pegmatitic, High Hydrothermal	68-5288	Şaşmaz and Yavuz, 2007
Yozgat	Tad Dere	Vein	Metamorphic, granite	Galena, sphalerite, pyrite, chalcopyrite, fahlore group minerals	156-185°C	12-23 %	Violet, green	E-W	Hydrothermal	20.6-48.5	Şaşmaz et al., 2005
Yozgat	Büyükçal Tepe	Vein	Skarn	Scheelite	390-430°C	8-12 %	Violet, green	N-S, NSW	Hydrothermal, Pegmatitic	61.3-149.3	Şaşmaz et al., 2005
Yozgat	Akçakışla (Akdağmadeni)	Fracture, lumps	Alkaline granitoid	Sphalerite, chalcopyrite, galena, pyrite	390-430°C	8-12 %	Violet, green	NW-SE	Pegmatitic	279.2-4222.4	Şaşmaz et al., 2005; Sağıroğlu, 1982, 1984

Sonuçlar

- Değişik renklere ve floresan özelliğine sahip olması nedeniyle süstaşı olarak da dikkat çekmekte ve kullanılabilmektedir.
- Süstaşı olarak kullanılan fluoritlerin mükemmel saydamlığa buna karşın endüstriyel ve ticari amaçlı kullanılacakların ise yarı saydam veya opak olması gerekmektedir.
- Süstaşı olarak kullanılan fluoritler genellikle oval, yuvarlak, çok renkli ve bantlı olanlar ise kabason kesilmektedir.
- Sertliğinin düşük olması nedeniyle kesilirken kırılma eğilimi vardır. Oldukça düşük sertliğe ve mükemmel dilinimlere sahip olması nedeniyle hakim süstaşı olarak kuyumculukta kullanılmamaktadır. Yumuşak bir süstaşı olmasına rağmen broş, küpe, kolye gibi kısmen korunabilen takı yapımında ve vazo kaplaması olarak kullanılabilmektedir. Çok renkli ve bantlı olan fluoritler ise bazen bilezik yapımında kullanılmaktadır.
- Fluoritlerin oluşum koşularını göz önüne alarak kırılmaması için özenle işlenmesi gerekmektedir.
- OAF mercek, çatlak, kırık, boşluk ve damar dolgusu şeklinde bulunması ve saydam olmaması nedeniyle süstaşı olarak kullanıma çok uygun olmadığı düşünülmektedir.

SPİNEL

Kimyasal Formülü	$MgAl_2O_4$

PROFILE

Cubic

7 ½–8

3.6–4.1

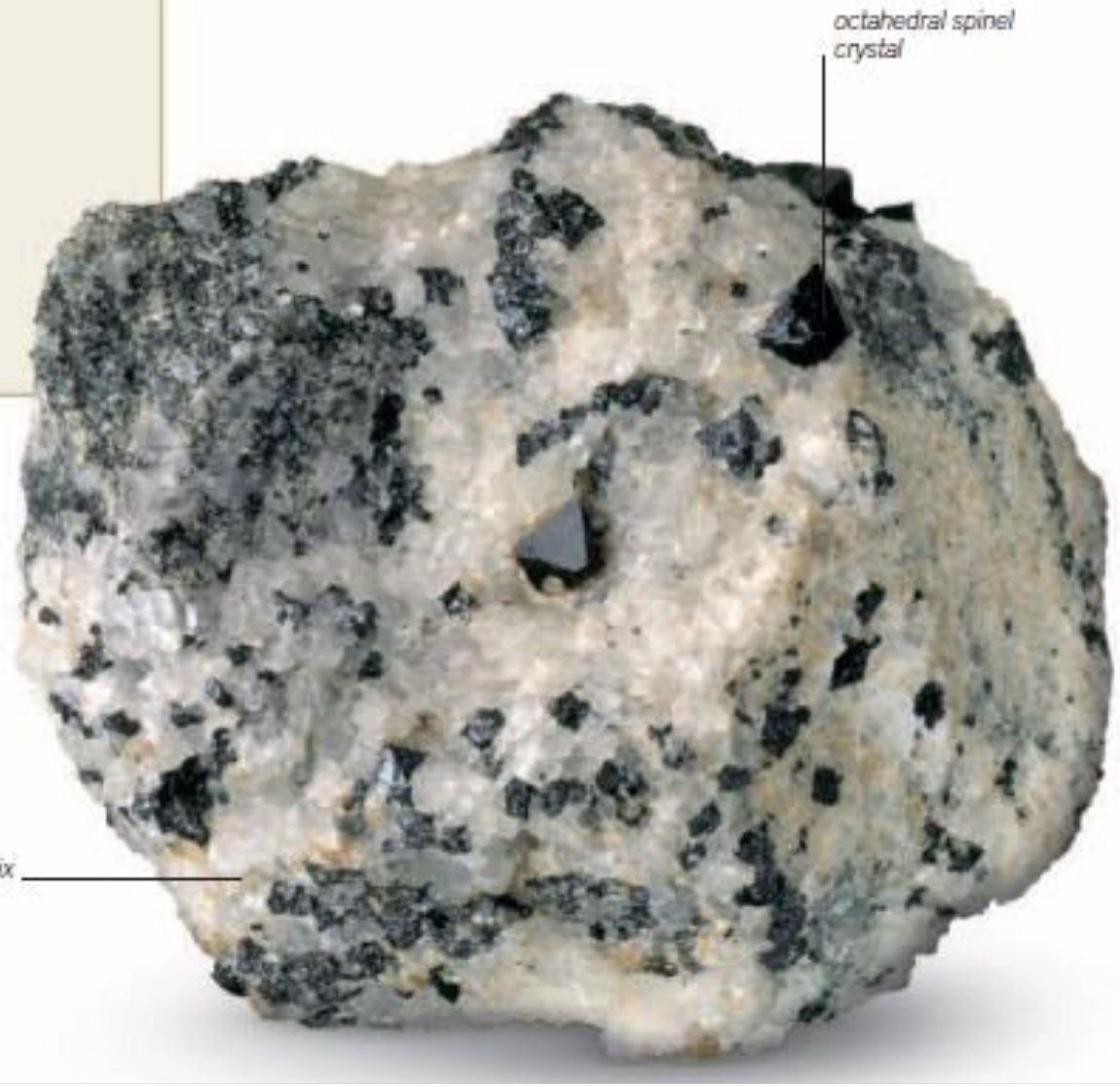
None

Conchoidal to uneven

White

Vitreous

Spinel octahedrons
In this specimen, octahedral crystals of pleonaste, or black spinel, are set in a quartz matrix.



Spinel gemstone
This superb faceted spinel shows excellent red-lavender color and good clarity.

Bonewitz, R. L. (2012)

DİYASPOR

Kimyasal Formülü	AlO(OH)

PROFILE

Orthorhombic

6½–7

3.4

Perfect, Imperfect

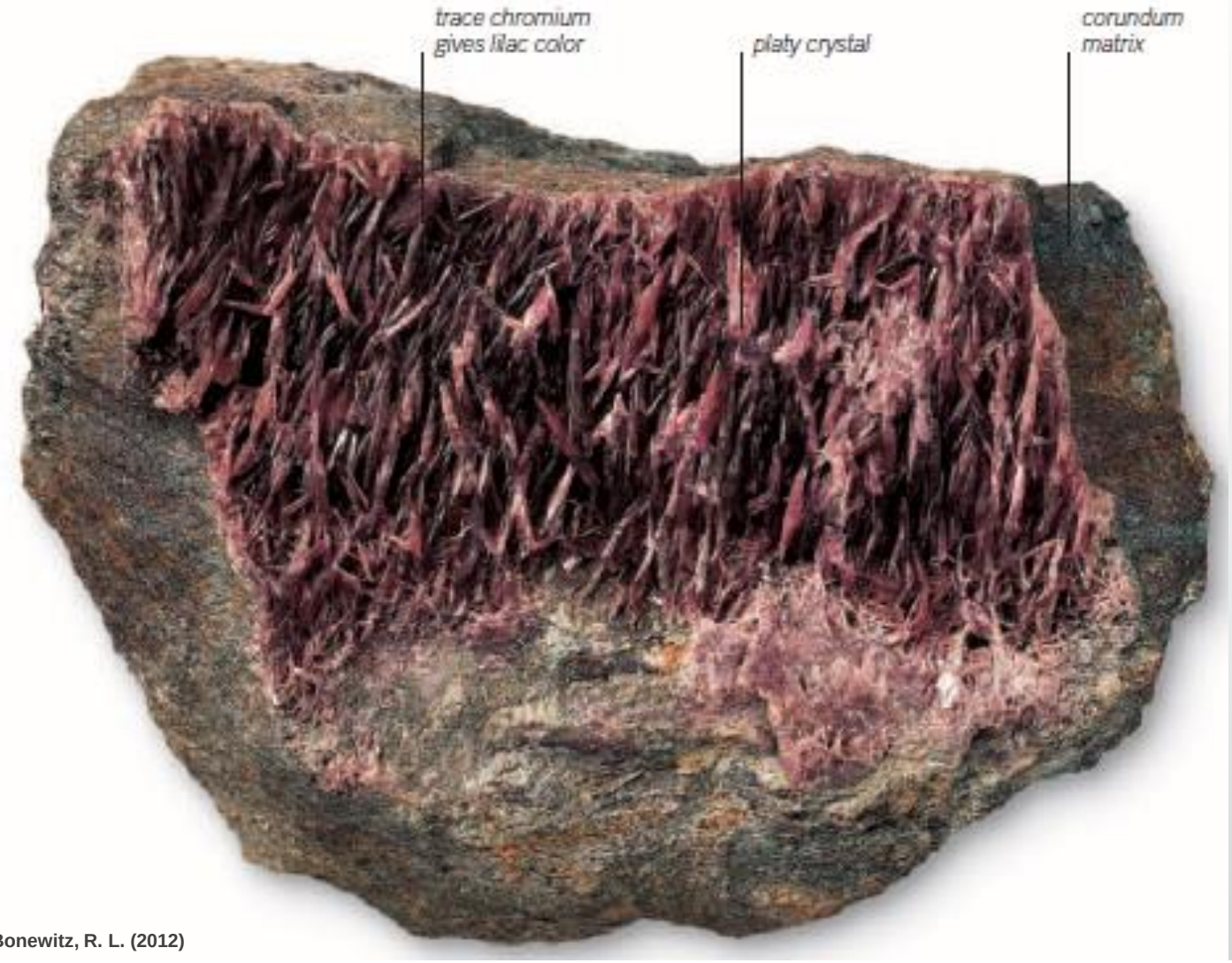
Conchoidal, brittle

White

Vitreous

Faceted gem
Zultanite, which is a rare, transparent type of diaspore crystal from Turkey, is a collector's gem.

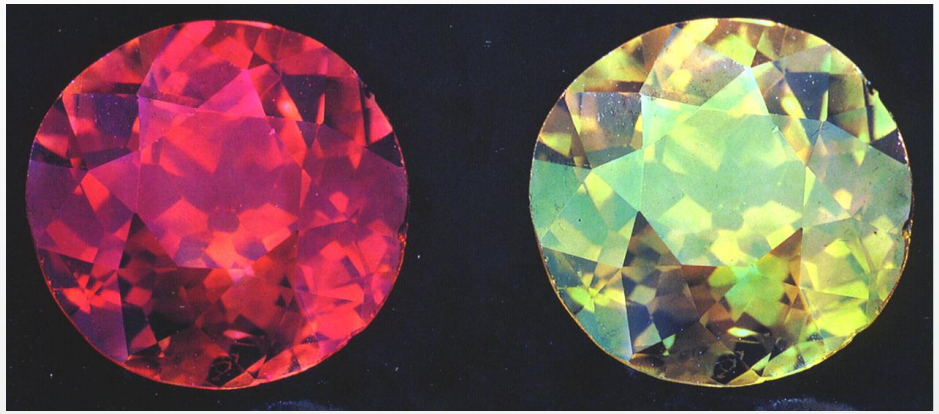
Dark red diaspore
In this specimen, a mass of dark red, thin, platy diaspore crystals rests in a matrix of corundum.

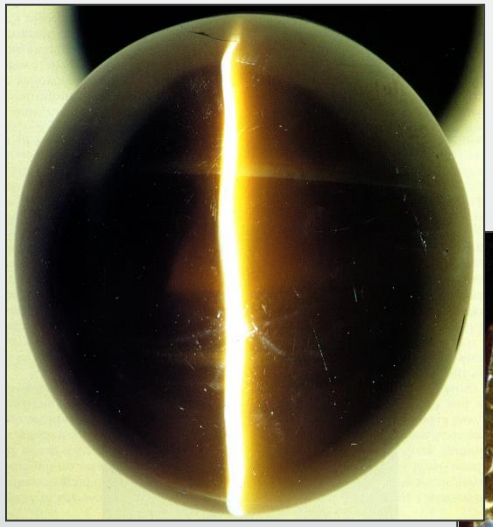


Bonewitz, R. L. (2012)

KRİZOBERİL

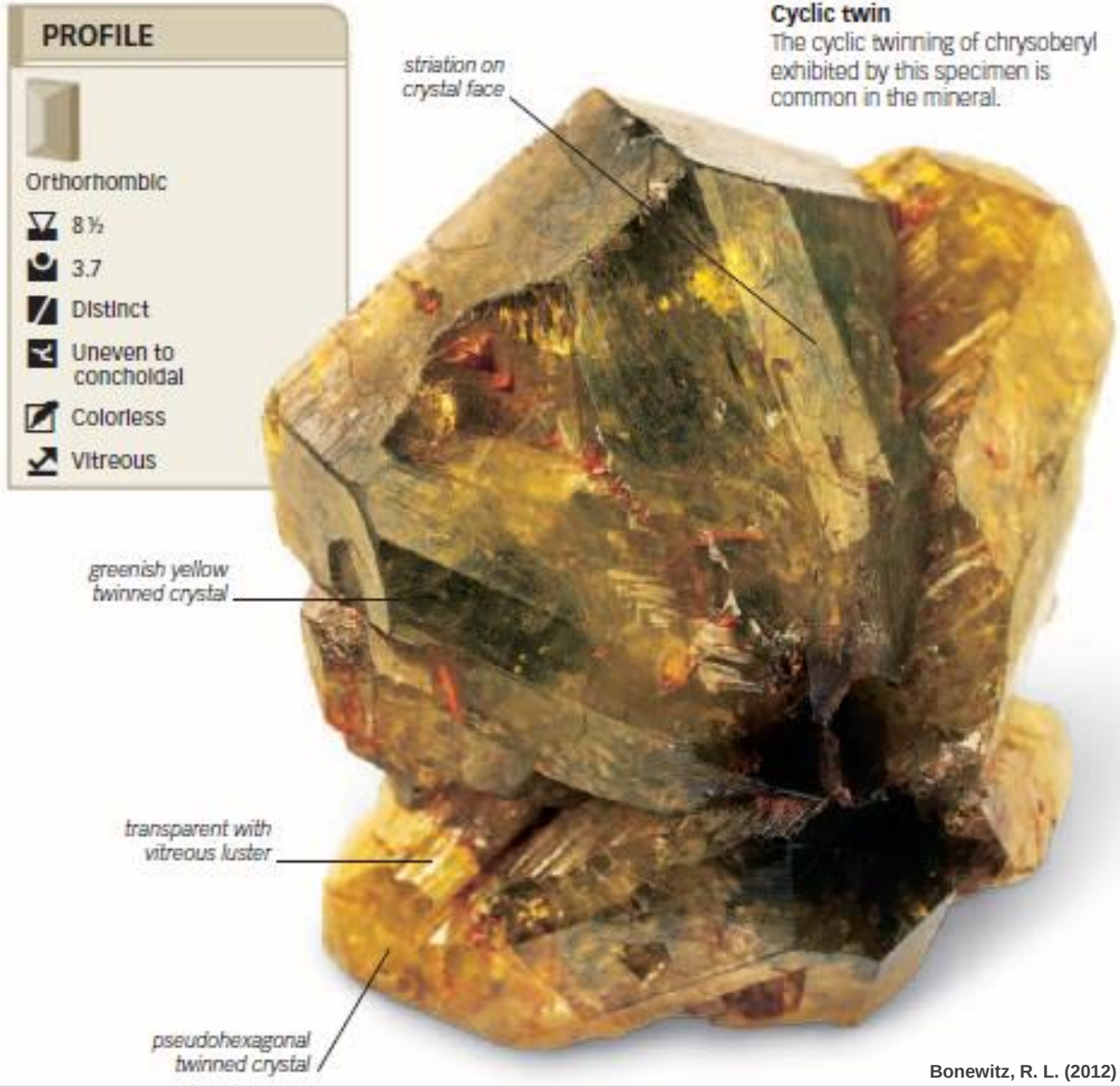
Kimyasal Formülü	$BeAl_2O_4$





Yellow gemstone Cat's eye chrysoberyl in the most desirable honey-yellow color

Color change
Alexandrite exhibits color change—from brilliant green in daylight to cherry-red under tungsten light.



Bonewitz, R. L. (2012)

SFALERİT

Kimyasal Formülü	ZnS

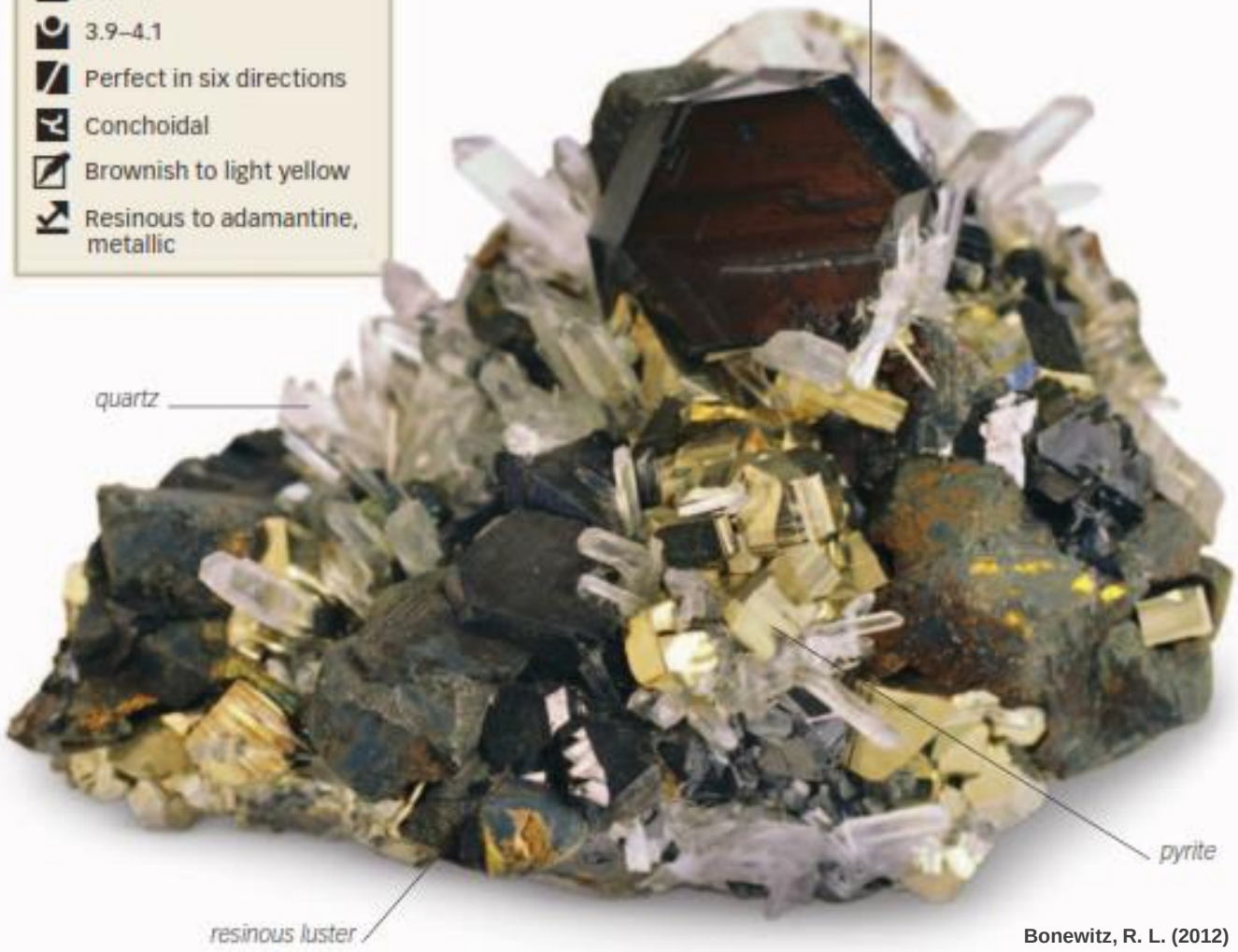
Oval cut
This oval cut shows off the golden brown color of sphalerite. Such stones are cut for collectors.

PROFILE

Cubic

- 3½–4
- 3.9–4.1
- Perfect in six directions
- Conchoidal
- Brownish to light yellow
- Resinous to adamantine, metallic

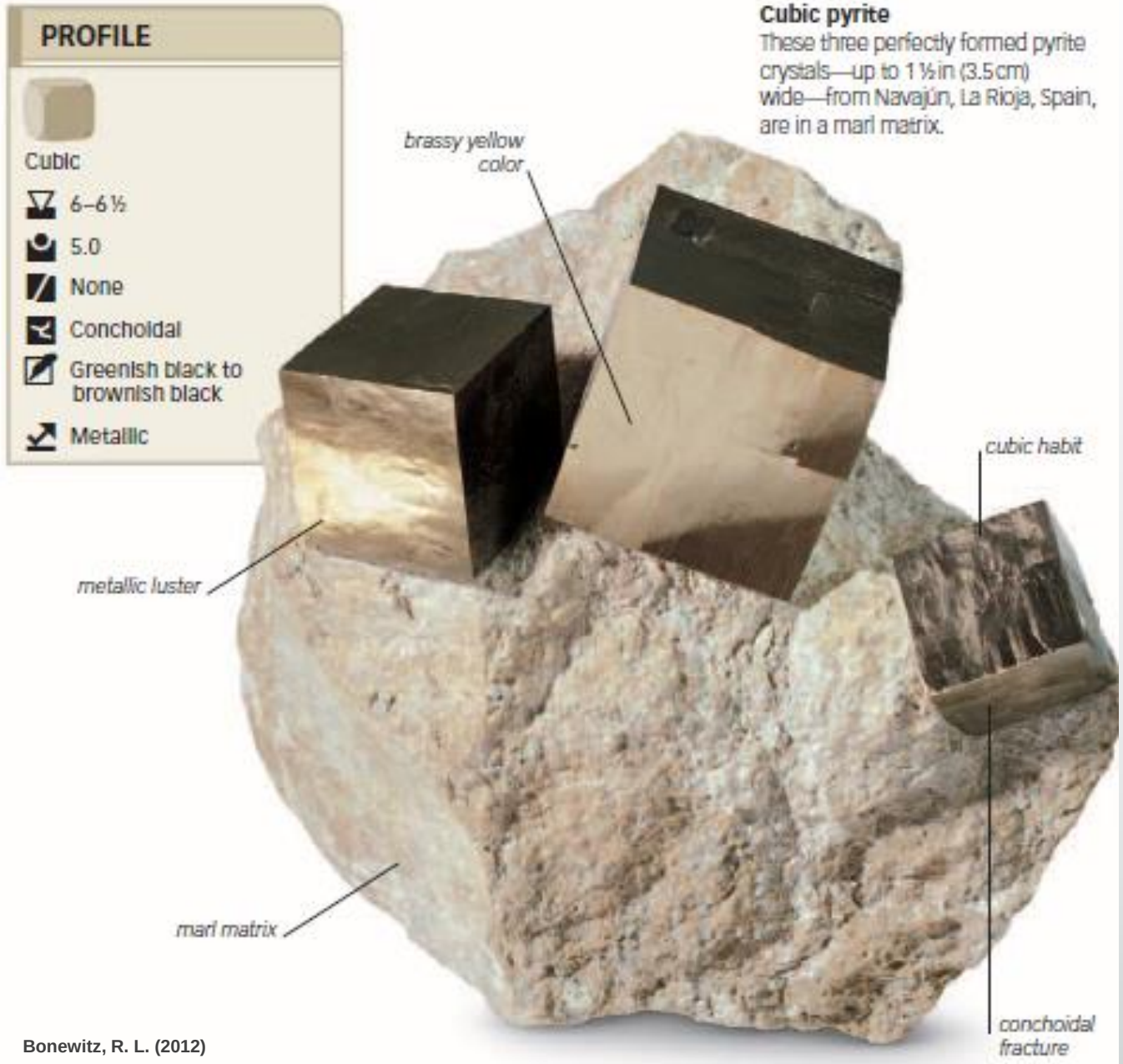
Sphalerite crystals
These superbly formed sphalerite crystals occur with well-crystallized pyrite and quartz. They are from Casapalca, Lima, Peru.



Bonewitz, R. L. (2012)

PİRİT

Kimyasal Formülü	FeS_2



Pyrite beads
With care, brittle pyrite can be ground into beads, such as those strung together in this necklace.

Bonewitz, R. L. (2012)

MARKASİT

Kimyasal Formülü	FeS_2

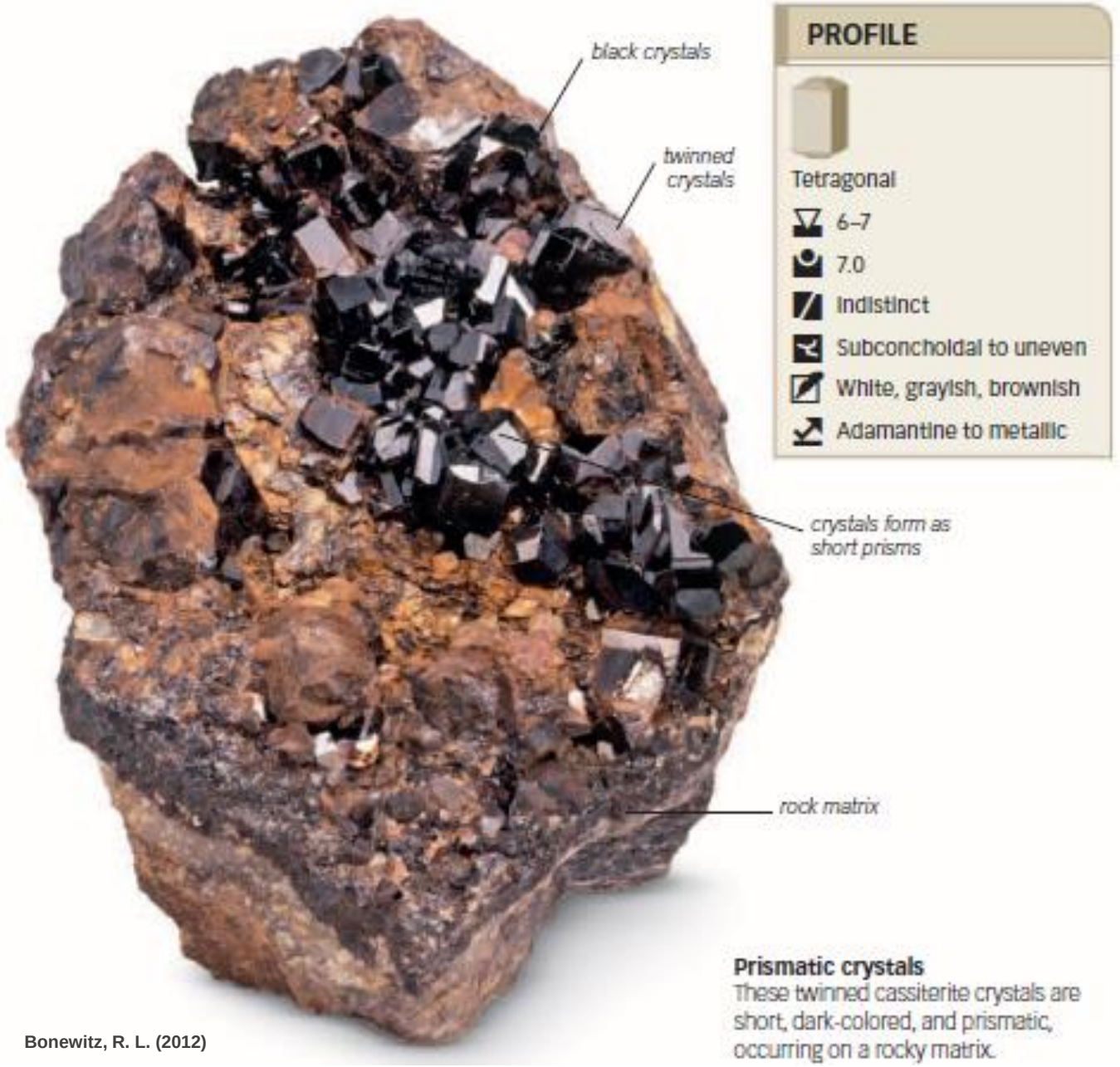
Art Deco jewelry
Marcasite was a popular choice for Victorian and Art Deco jewelry, although most of the material used was actually pyrite.

Marcasite crystals
This striking group of marcasite crystals is on a matrix of chalk. It formed in Cap Blanc-Nez, Pas-de Calais, France.

Bonewitz, R. L. (2012)

KASİTERİT

Kimyasal Formülü	SnO_2



Prismatic crystals
These twinned cassiterite crystals are short, dark-colored, and prismatic, occurring on a rocky matrix.

Brilliant gemstone
This faceted, golden orange cassiterite gem is transparent with a resinous luster.

Bonewitz, R. L. (2012)

KUPRİT

Kimyasal Formülü	Cu_2O

PROFILE

Cubic

3½–4

6.1

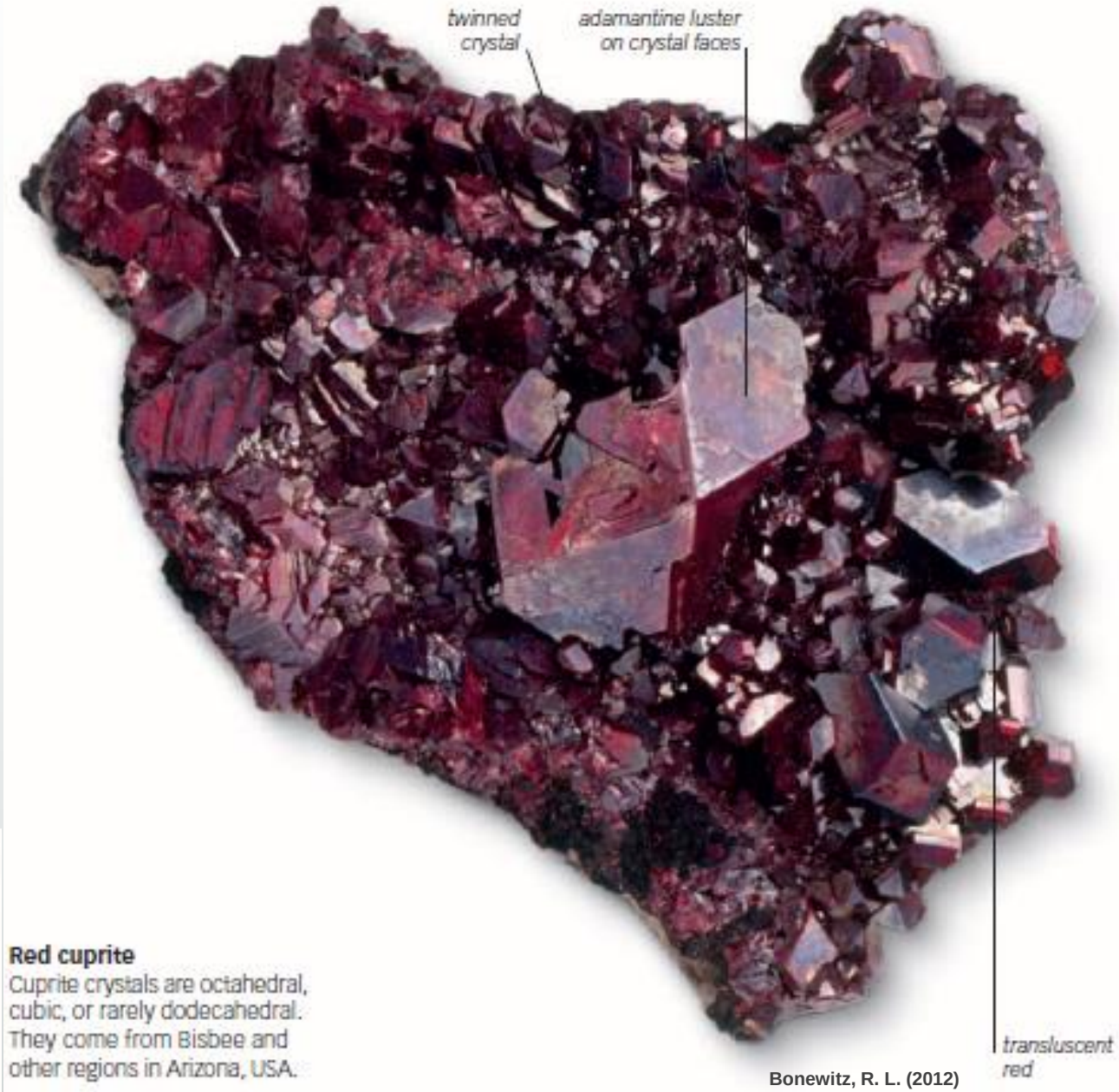
Distinct

Conchoidal, brittle

Brownish red, shining

Adamantine, submetallic

Step cut
Rare transparent cuprite is sometimes cut for collectors, as in this rectangular step cut.

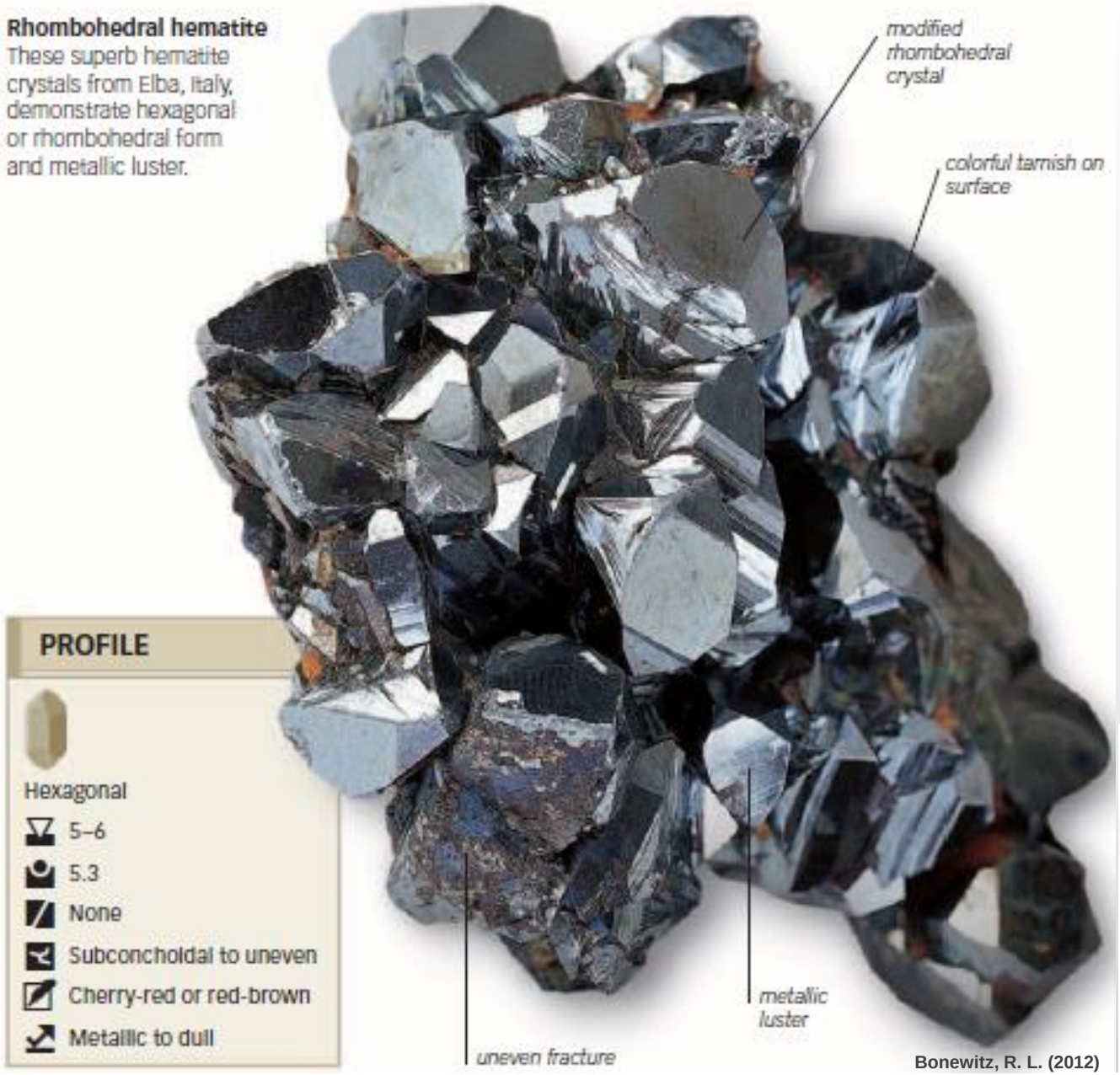


Red cuprite
Cuprite crystals are octahedral, cubic, or rarely dodecahedral. They come from Bisbee and other regions in Arizona, USA.

Bonewitz, R. L. (2012)

KUPRİT

Kimyasal Formülü	Fe_2O_3

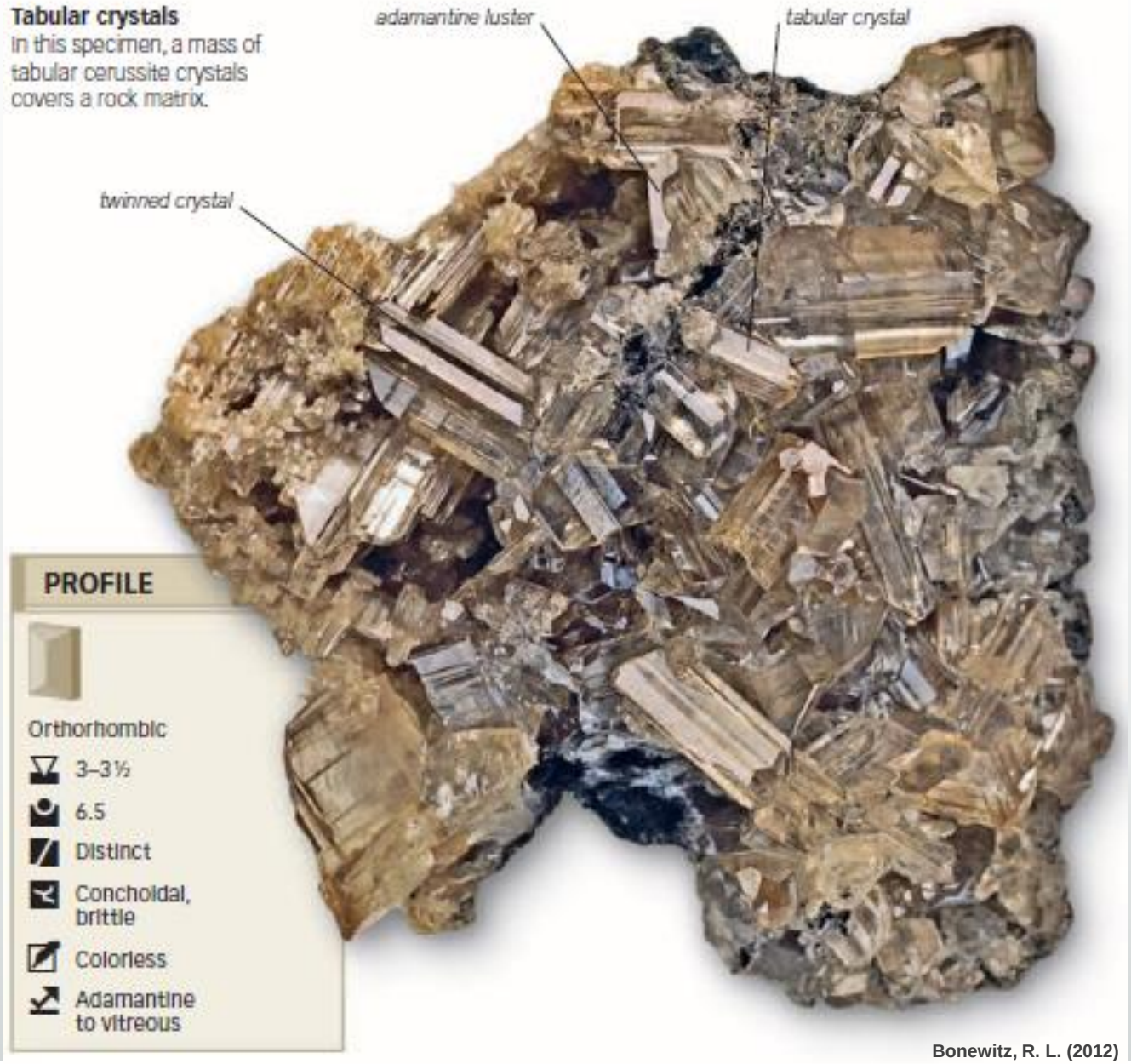


Bonewitz, R. L. (2012)

Oval cabochon
This oval cabochon of black hematite is faceted on top. Hematite cabochons have been sold as "marcasites."

SERUZİT

Kimyasal Formülü	$PbCO_3$



Bonewitz, R. L. (2012)

Collector's gem
Faceted cerussite stones, such as this rare gem, are brilliant but too soft to be worn.

AZURİT

PROFILE

Monoclinic

3½–4

3.8

Perfect

Conchoidal, brittle

Blue

Vitreous to dull earthy

Large crystals
In this specimen of azurite, large, well-formed crystals rest on a goethite matrix.

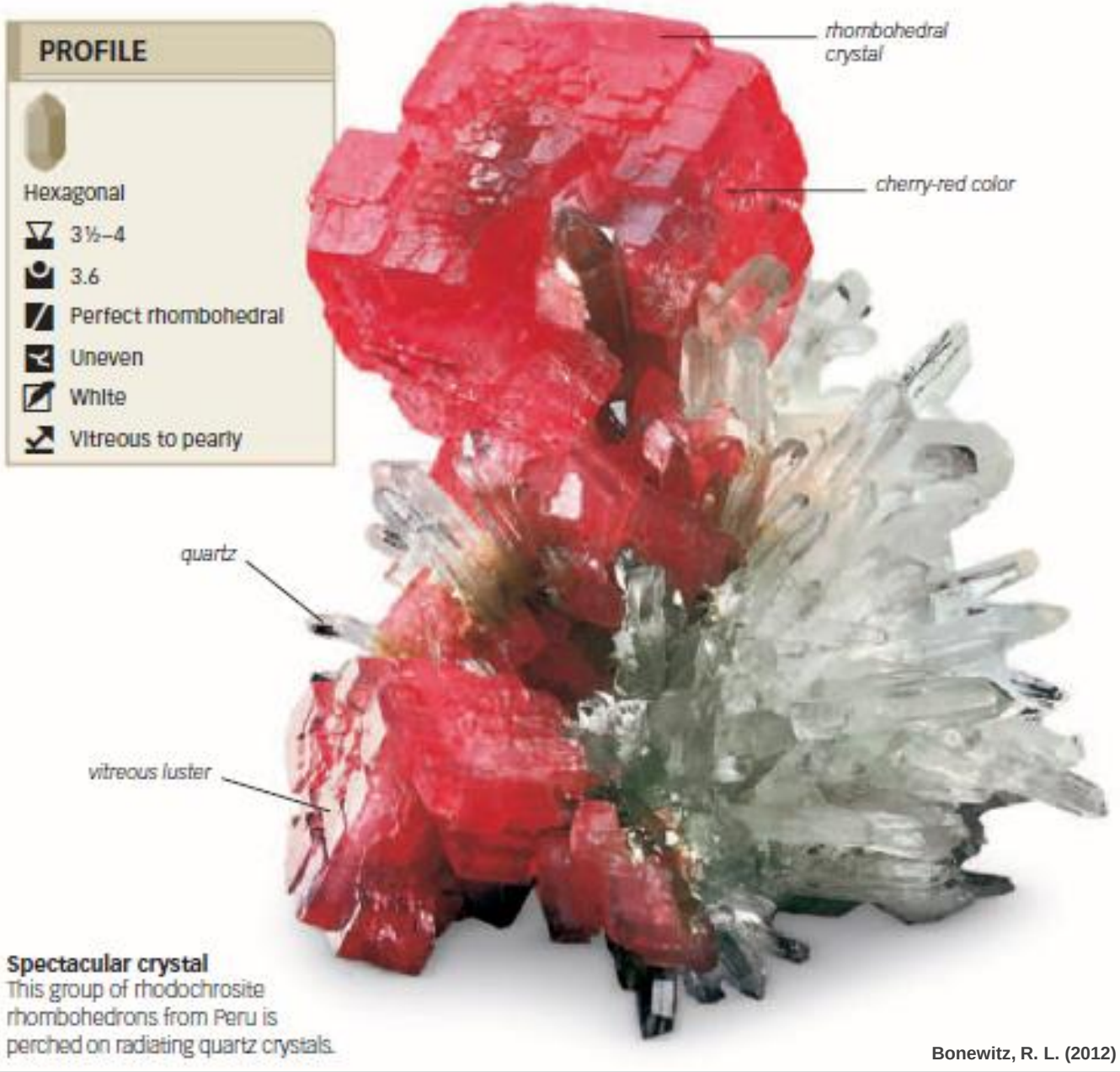
Kimyasal Formülü	$Cu_3(CO_3)_2(OH)_2$

Cabochon gemstone
This cabochon exhibits the vivid blue color of azurite and the green color of malachite.

Bonewitz, R. L. (2012)

RODOKROZİT

Kimyasal Formülü	$MnCO_3$



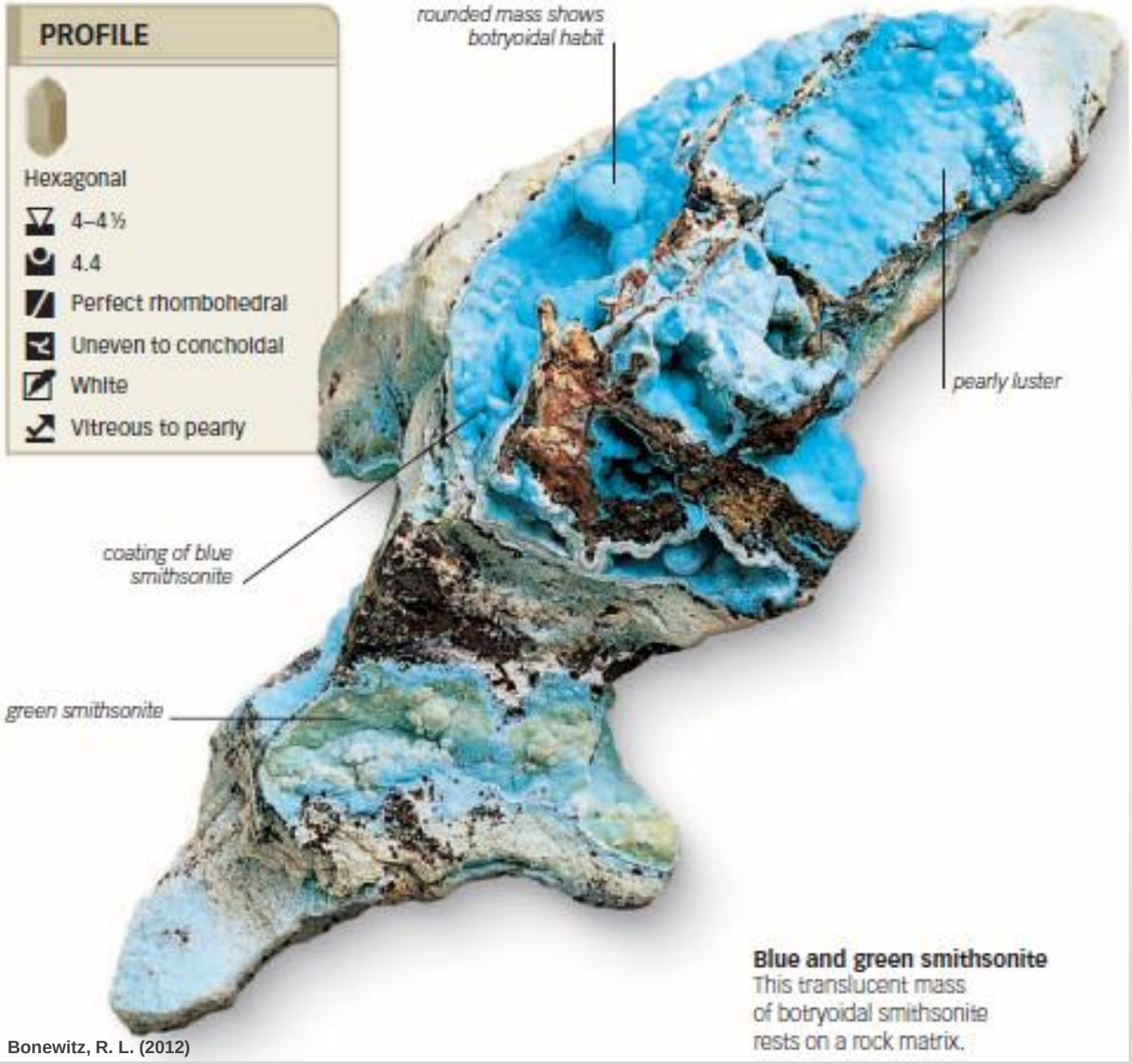
Spectacular crystal
This group of rhodochrosite rhombohedrons from Peru is perched on radiating quartz crystals.

Bonewitz, R. L. (2012)

Rhodochrosite carvings
These two decorative ducks were carved from banded rhodochrosite and white calcite.

SİMİTSONİT

Kimyasal Formülü	$ZnCO_3$



Blue and green smithsonite
This translucent mass of botryoidal smithsonite rests on a rock matrix.

Bonewitz, R. L. (2012)

Cabochon
Soft smithsonite is occasionally cut into cabochon gemstones for collectors.

MALAKİT

Kimyasal Formülü	$CuCO_3(OH)_2$

Bonewitz, R. L. (2012)

Polished malachite
This specimen of the mineral malachite has been polished to show dark and light color bands.

HOVLİT

Kimyasal Formülü	$Ca_2B_5SiO_9(OH)_5$

PROFILE

Monoclinic

3½

2.6

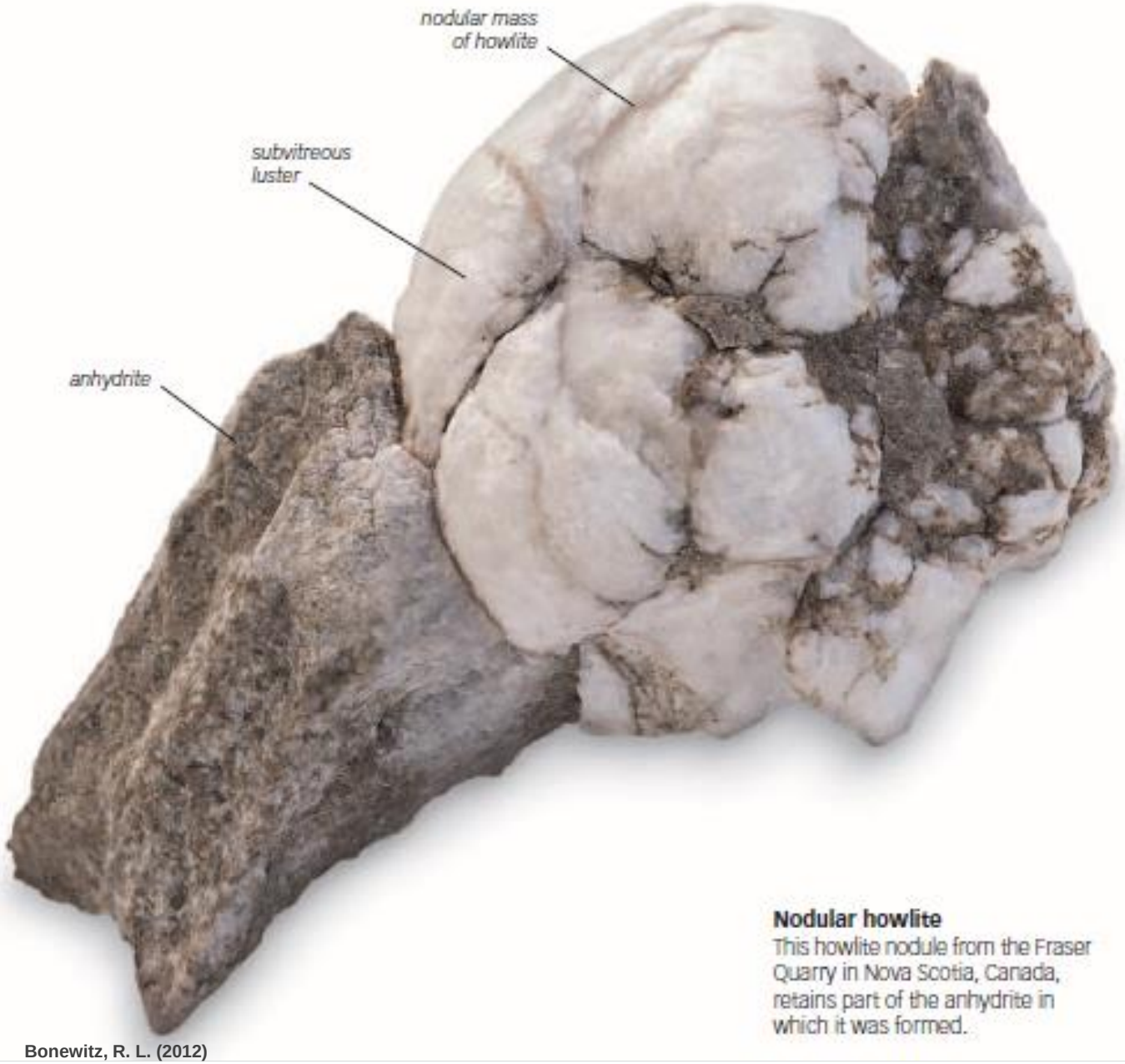
None

Conchoidal to uneven

White

Subvitreous

Stained howlite
This tumble-polished and dyed or stained piece of howlite looks similar to turquoise.



Nodular howlite
This howlite nodule from the Fraser Quarry in Nova Scotia, Canada, retains part of the anhydrite in which it was formed.

Bonewitz, R. L. (2012)

ANGLEZİT

PROFILE

Orthorhombic

2½–3

6.4

Good, distinct

Conchoidal, brittle

Colorless

Adamantine to resinous, vitreous

Anglesite crystals
These striated prismatic crystals of anglesite are on a rock matrix with galena.

Kimyasal Formülü	$PbSO_4$

Oval-cut anglesite
Anglesite is soft and easily cleaved. It is one of the stones used to test the skills of master gem cutters.

Bonewitz, R. L. (2012)

BARİT

PROFILE

Orthorhombic

3–3½

4.5

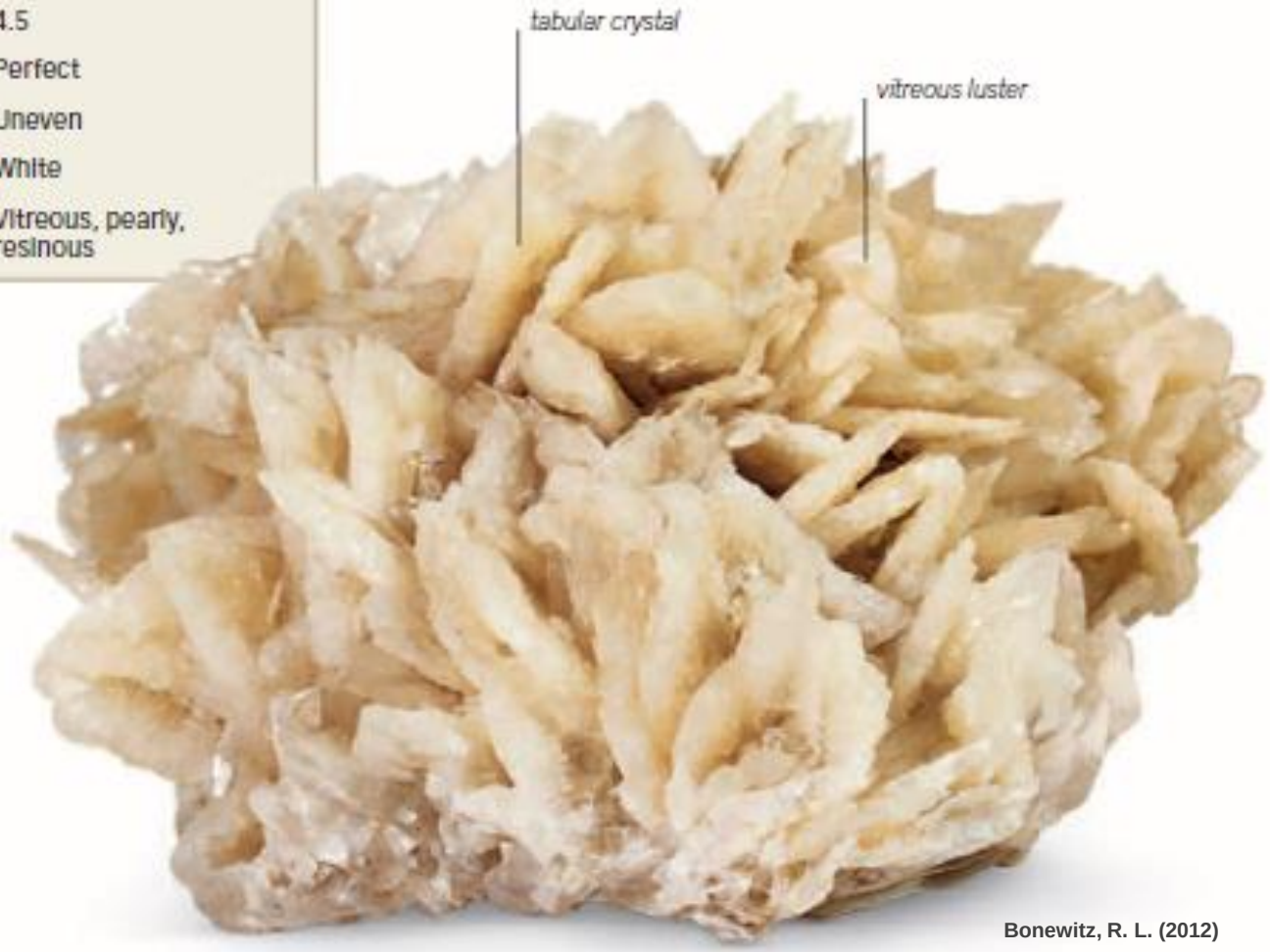
Perfect

Uneven

White

Vitreous, pearly, resinous

Barite crystals
This large group of tabular barite crystals is from the Wet Grooves Mine in Yorkshire, England.



Bonewitz, R. L. (2012)

Kimyasal Formülü	$BaSO_4$

Barite gemstone
Although transparent barite is soft and difficult to cut, it is sometimes faceted for collectors.

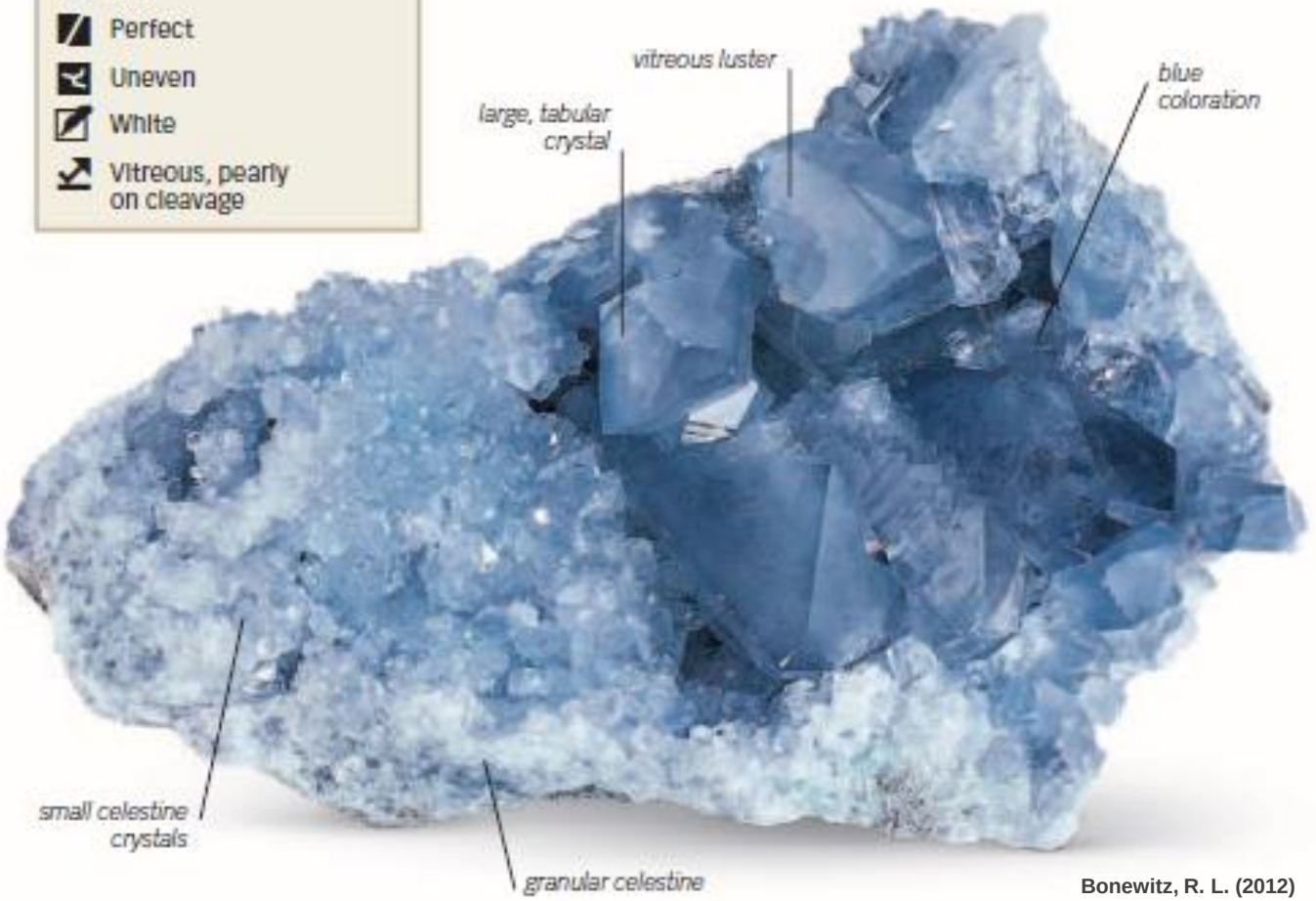
SELESTİN

PROFILE

Orthorhombic

- 3–3½
- 4.0
- Perfect
- Uneven
- White
- Vitreous, pearly on cleavage

Celestine crystals
This superbly crystallized specimen of blue celestine crystals is from Madagascar. The largest crystal is more than 1 ½ in (3.5 cm) long.



Bonewitz, R. L. (2012)

Kimyasal Formülü	$SrSO_4$

Collector's gem
Celestine is too soft to wear. Faceted celestine demonstrates the skills of master cutters.

Kimyasal Formülü	$CaSO_4 2H_2O$

Selentine gypsum crystal
This single transparent, prismatic crystal of selenite comes from the Cave of Swords in Mexico.

Cat's eye sheen
Satin spar, a fibrous variety of gypsum, can be cut into a cabochon gem with a cat's eye sheen.

Bonewitz, R. L. (2012)

ŞEELİT

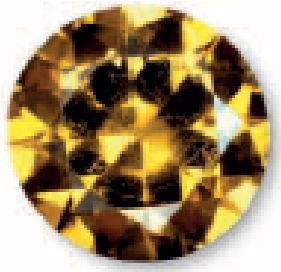
Bipyramidal scheelite
This group of orange-yellow scheelite crystals clearly shows a tetragonal bipyramidal habit.

Bonewitz, R. L. (2012)

Kimyasal Formülü	$CaWO_4$

PROFILE

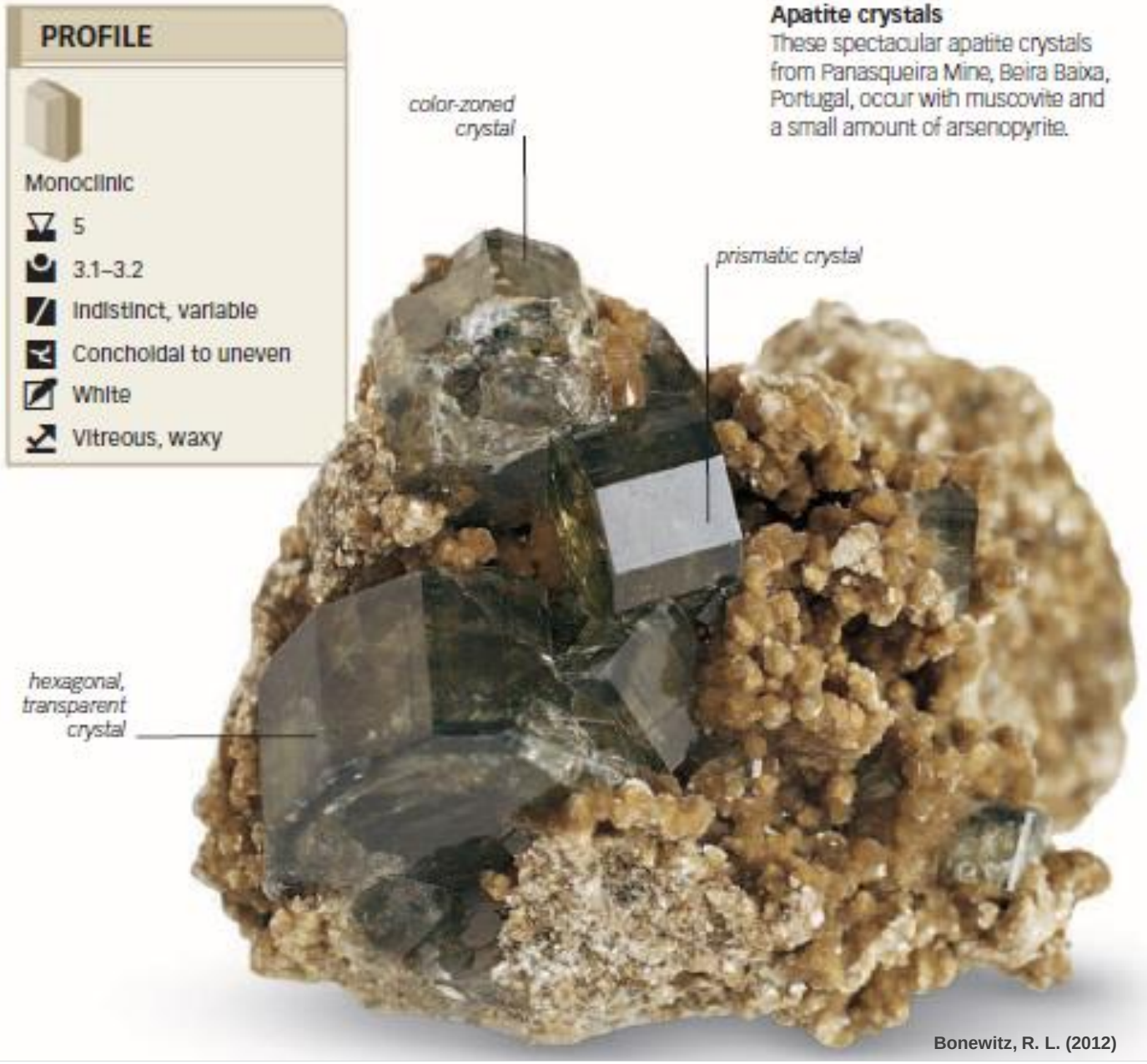
Tetragonal
4½–5
6.1
Distinct
Uneven to subconcholdal
White
Vitreous to greasy



Brilliant cut scheelite
Transparent scheelite is relatively rare. Stones faceted from it are only for gem collectors.

APATİT

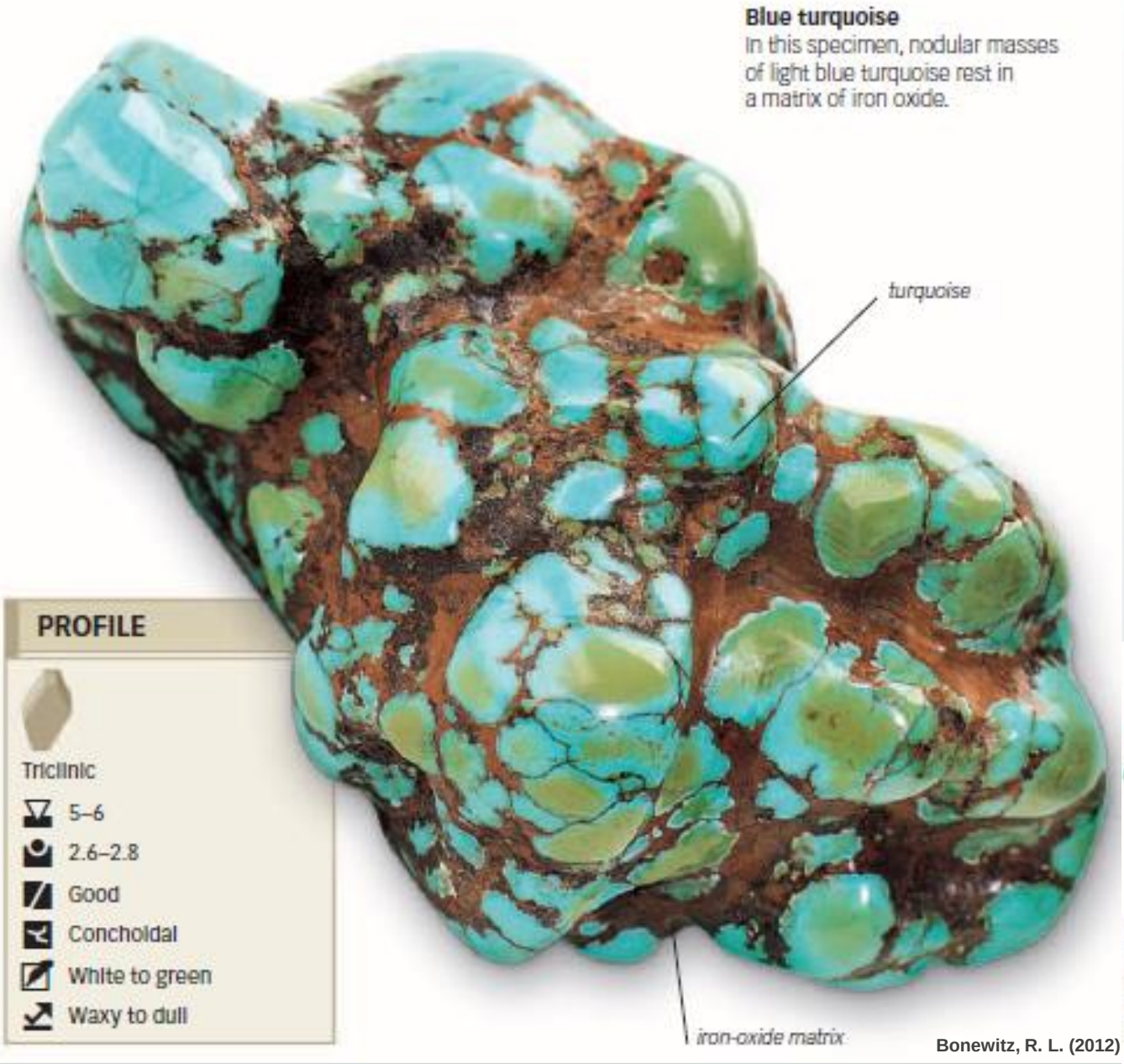
Kimyasal Formülü	$Ca_5(PO_4)_3(F, OH, Cl)$



Step-cut gemstone
Owing to the brittleness of apatite, an edge of one facet of this blue gemstone has become chipped.

TURKUAZ

Kimyasal Formülü	$CuAl_6(PO_4)_4(OH)_8 4H_2O$



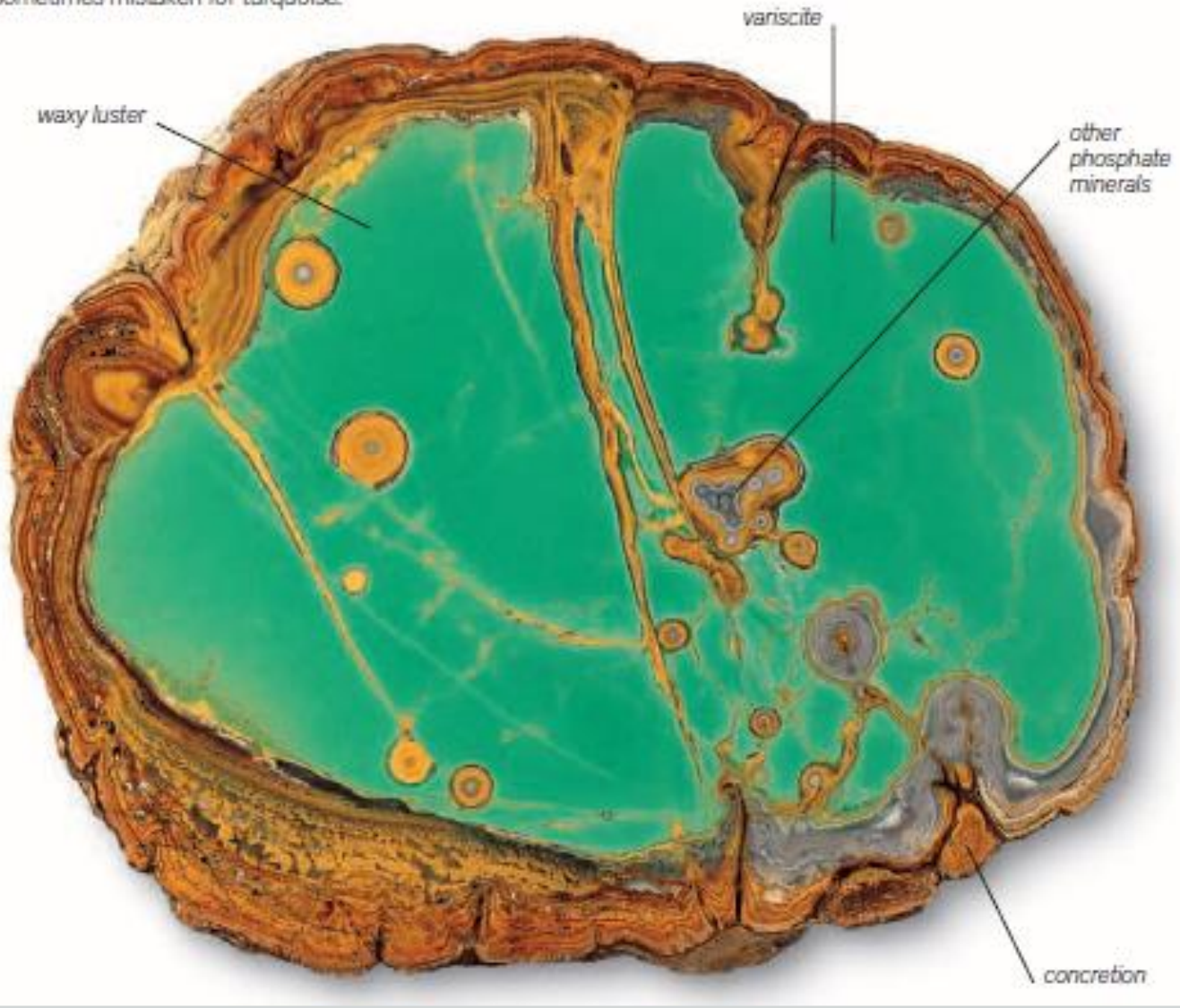
Blue turquoise
In this specimen, nodular masses of light blue turquoise rest in a matrix of iron oxide.

Carved elephant
Turquoise is a favorite of Chinese stone carvers, who produced this turquoise elephant.

Bonewitz, R. L. (2012)

VARİSİT

Concretionary variscite
Variscite is often found in nodules and concretions like the sliced specimen shown here. It can be sometimes mistaken for turquoise.



Kimyasal Formülü	$AlPO_4 2H_2O$

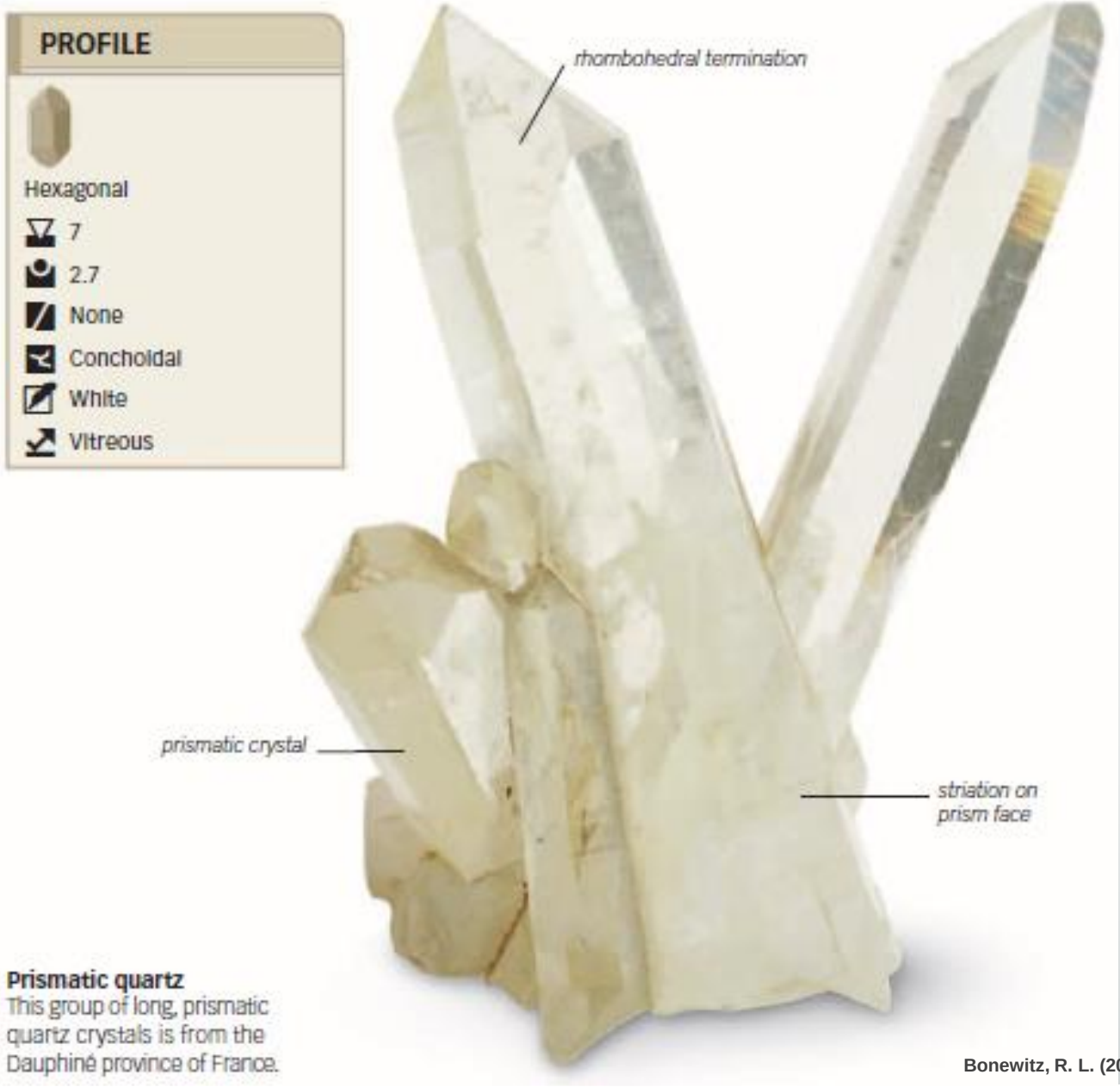
PROFILE

Orthorhombic
4½
2.6
Good but rarely visible
Splintery in massive
White
Vitreous to waxy

Cabochon
Variscite can be polished into inexpensive gems, but their softness makes them vulnerable to wear.

KUVARS

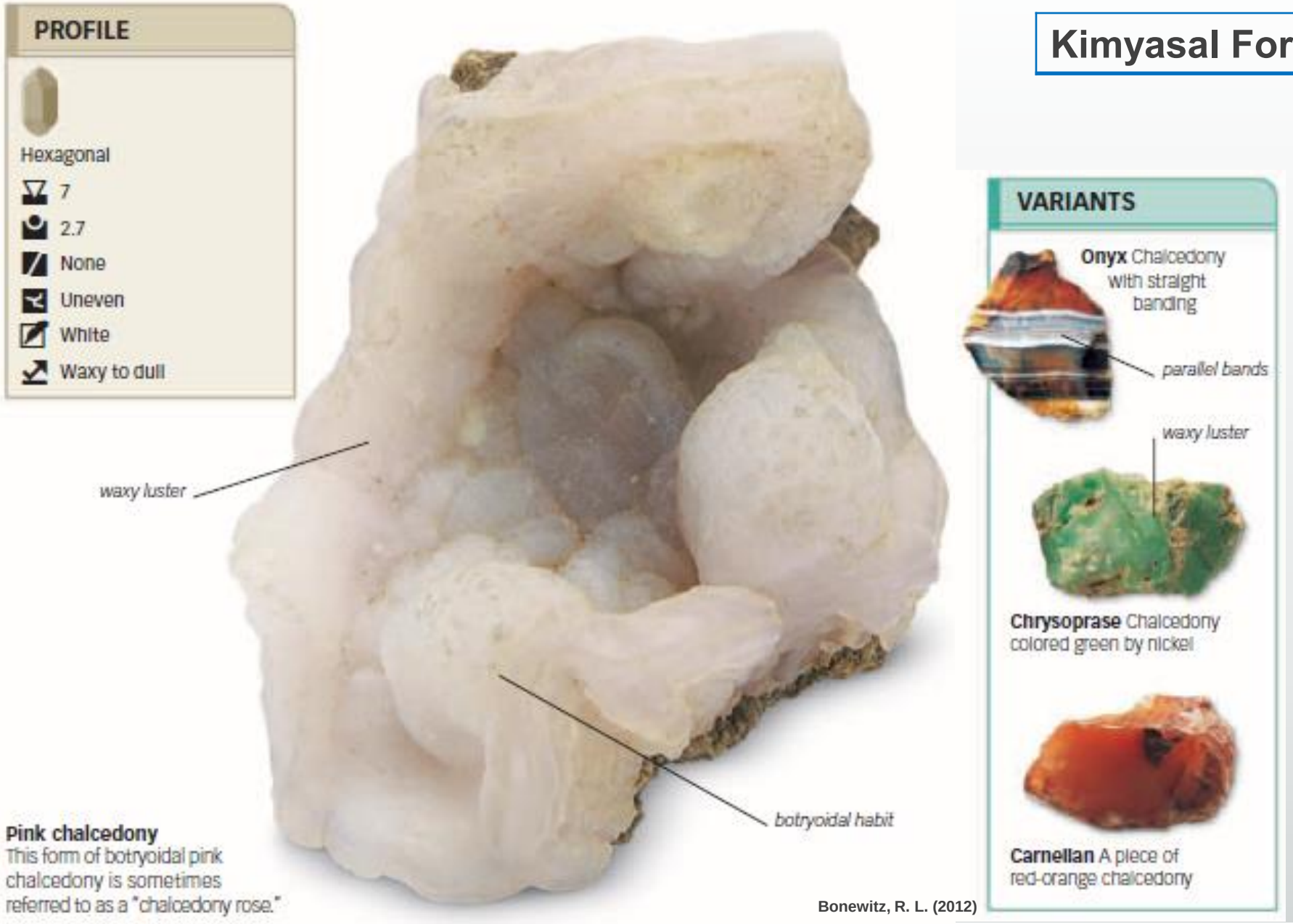
Kimyasal Formülü	SiO_2



Bonewitz, R. L. (2012)

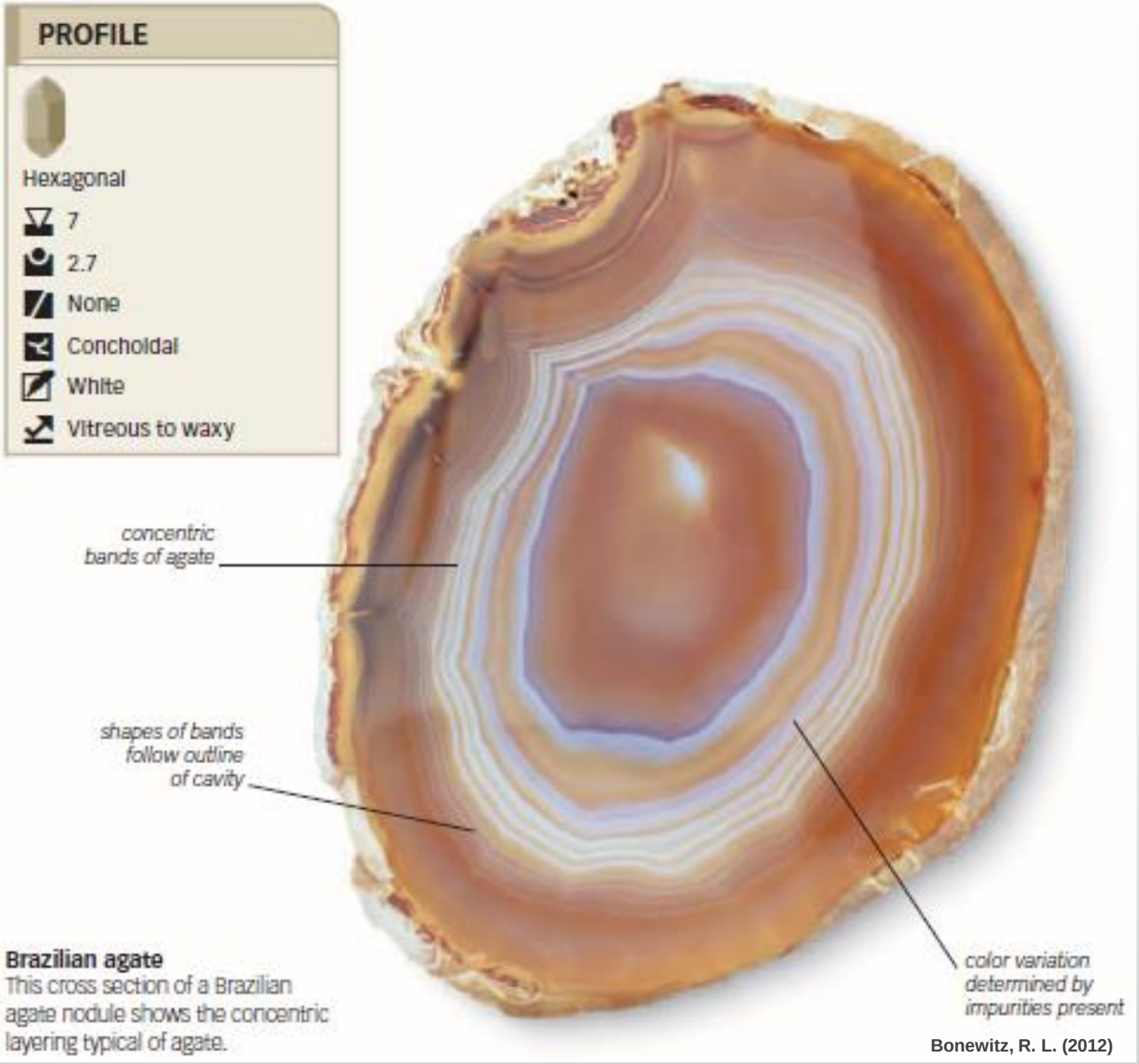
KALSEDON

Kimyasal Formülü	SiO_2



Bonewitz, R. L. (2012)

AGAT

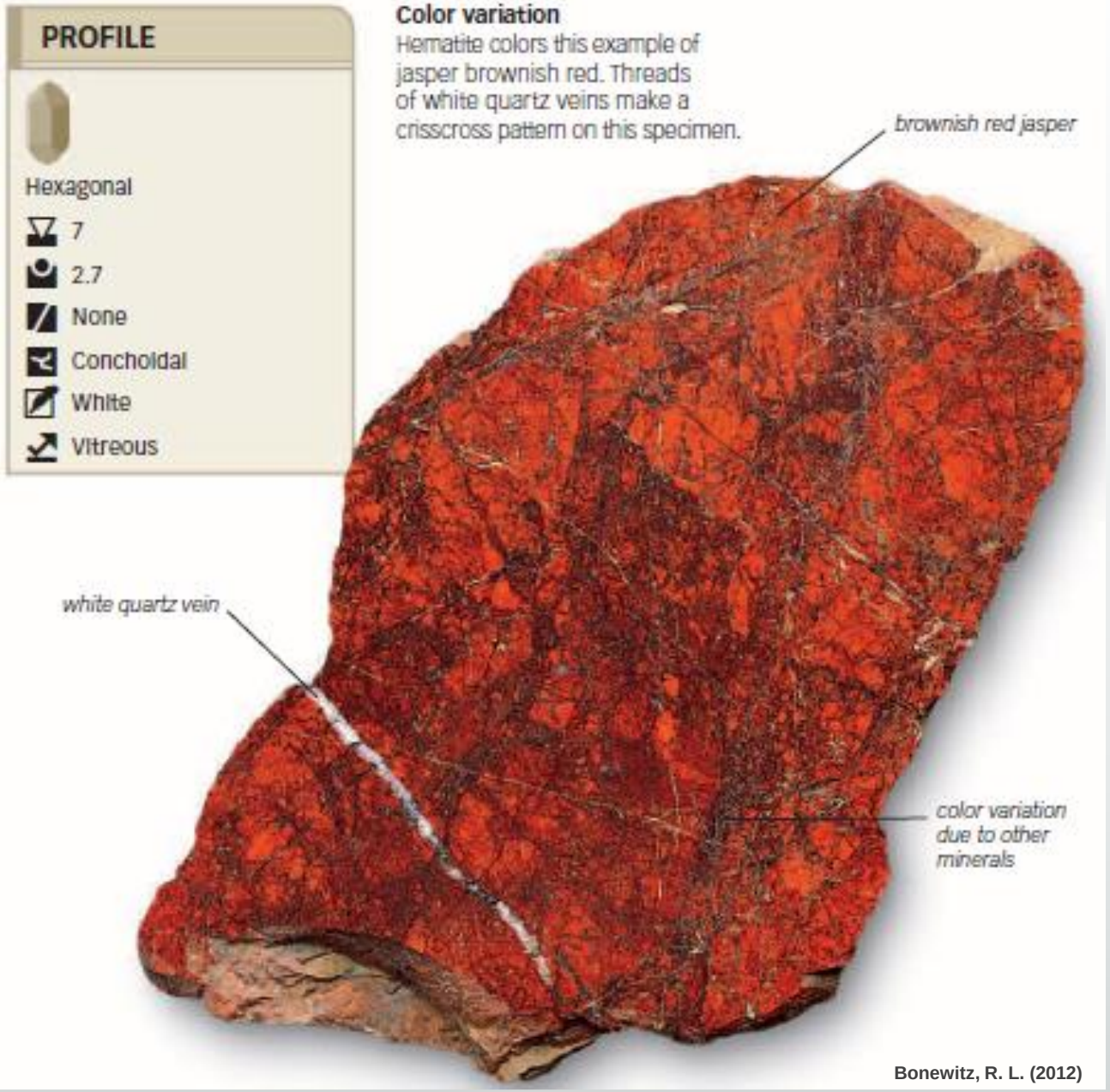


Brazilian agate
This cross section of a Brazilian agate nodule shows the concentric layering typical of agate.

Bonewitz, R. L. (2012)

Kimyasal Formülü	SiO_2

JASPER



Kimyasal Formülü	SiO_2

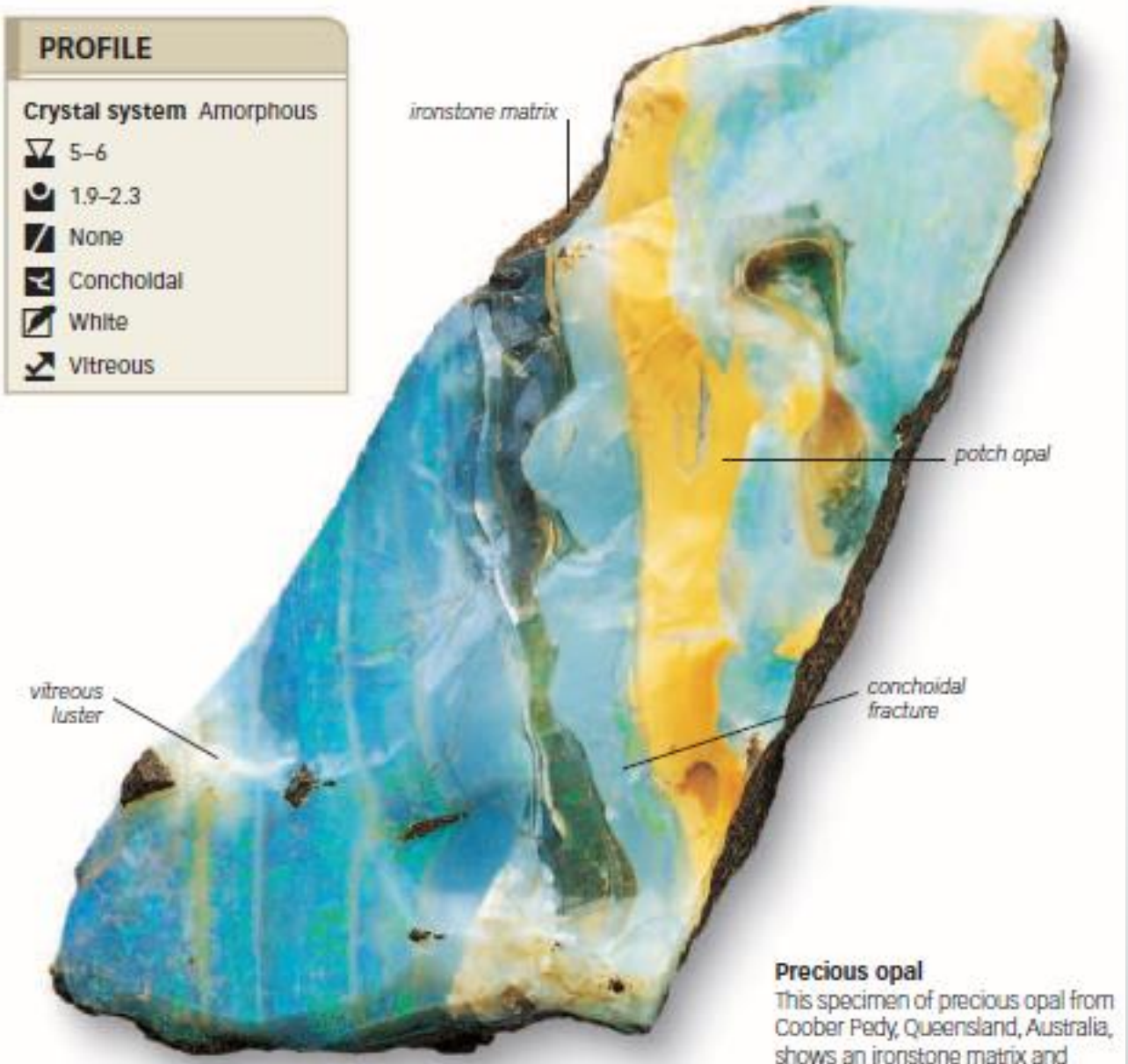
OPAL

Kimyasal Formülü	SiO_2nH_2O

PROFILE

Crystal system Amorphous

- 5–6
- 1.9–2.3
- None
- Concholdal
- White
- Vitreous



Precious opal
This specimen of precious opal from Coober Pedy, Queensland, Australia, shows an ironstone matrix and streaks of yellowish potch opal.

Bonewitz, R. L. (2012)

Victorian ring
Some cut opal dries and cracks with age and needs to be kept moist. The opal in this ring is well preserved.

ORTOKLAZ

Kimyasal Formülü	$KAlSi_3O_8$

PROFILE

Monoclinic

6–6½

2.5–2.6

Perfect

Subconcholdal to uneven, brittle

White

Vitreous

Orthoclase prisms In this specimen, white, blocky prisms of orthoclase are associated with cleavelandite albite and set in pegmatite.

Bonewitz, R. L. (2012)

VARIANTS

Yellow orthoclase A crystal of yellow orthoclase

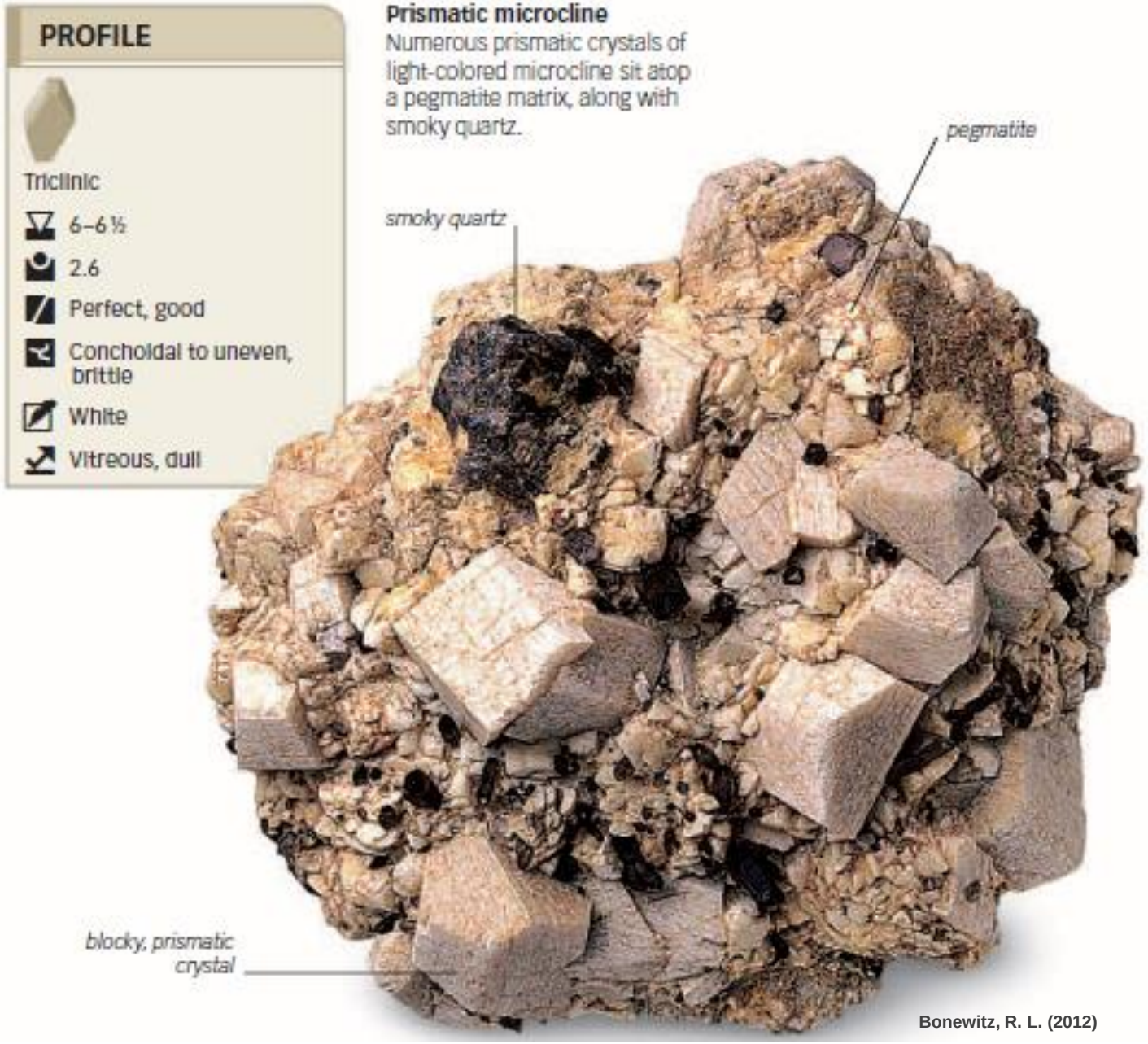
Moonstone rough An opalescent variety of orthoclase

Orthoclase crystals Twinned orthoclase with smaller prism

Moonstone-set brooch Orthoclase exhibits the schiller effect which creates the shimmer seen on the moonstones in this brooch.

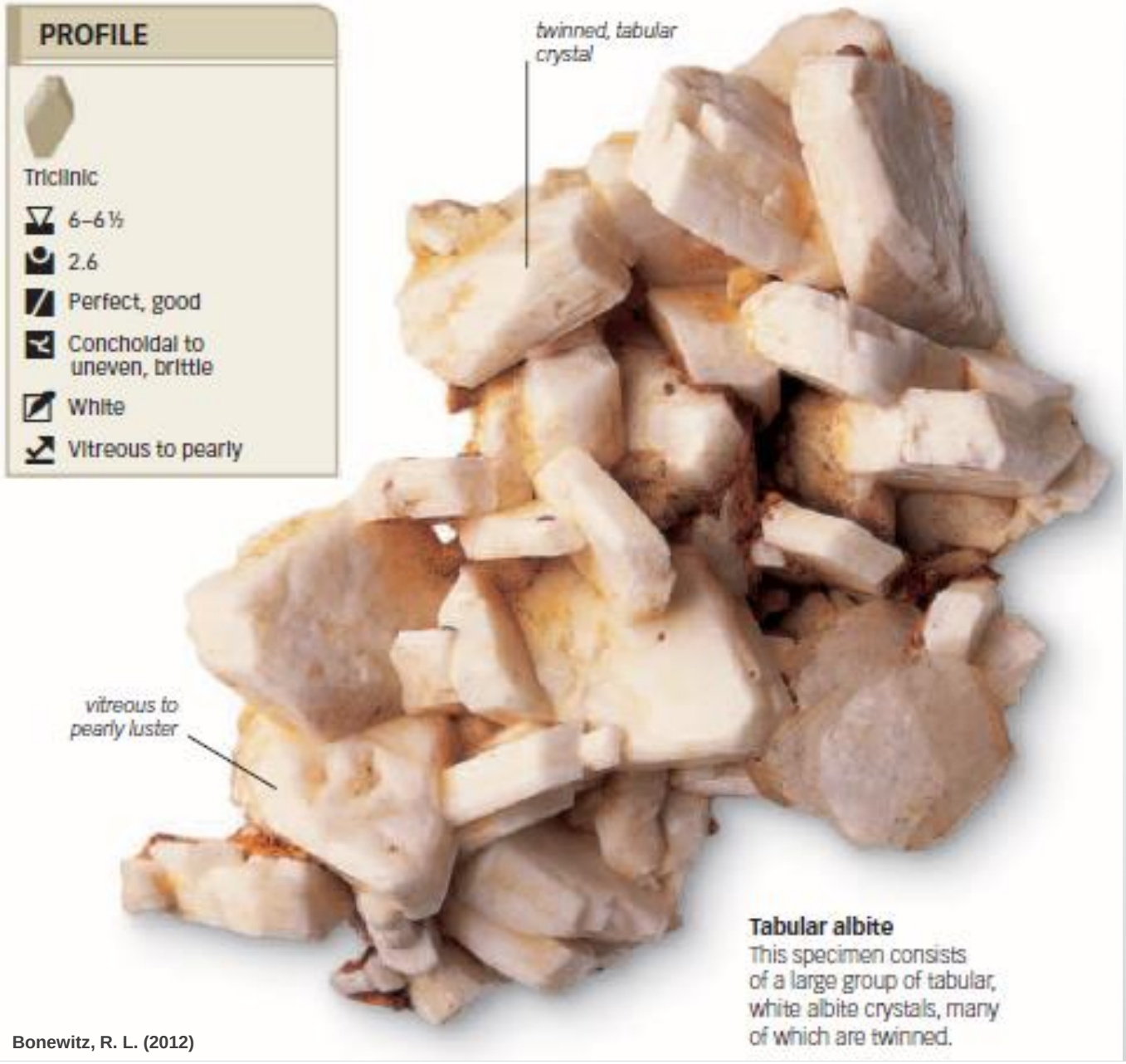
MİKROKLİN

Kimyasal Formülü	$KAlSi_3O_8$



Bonewitz, R. L. (2012)

ALBİT



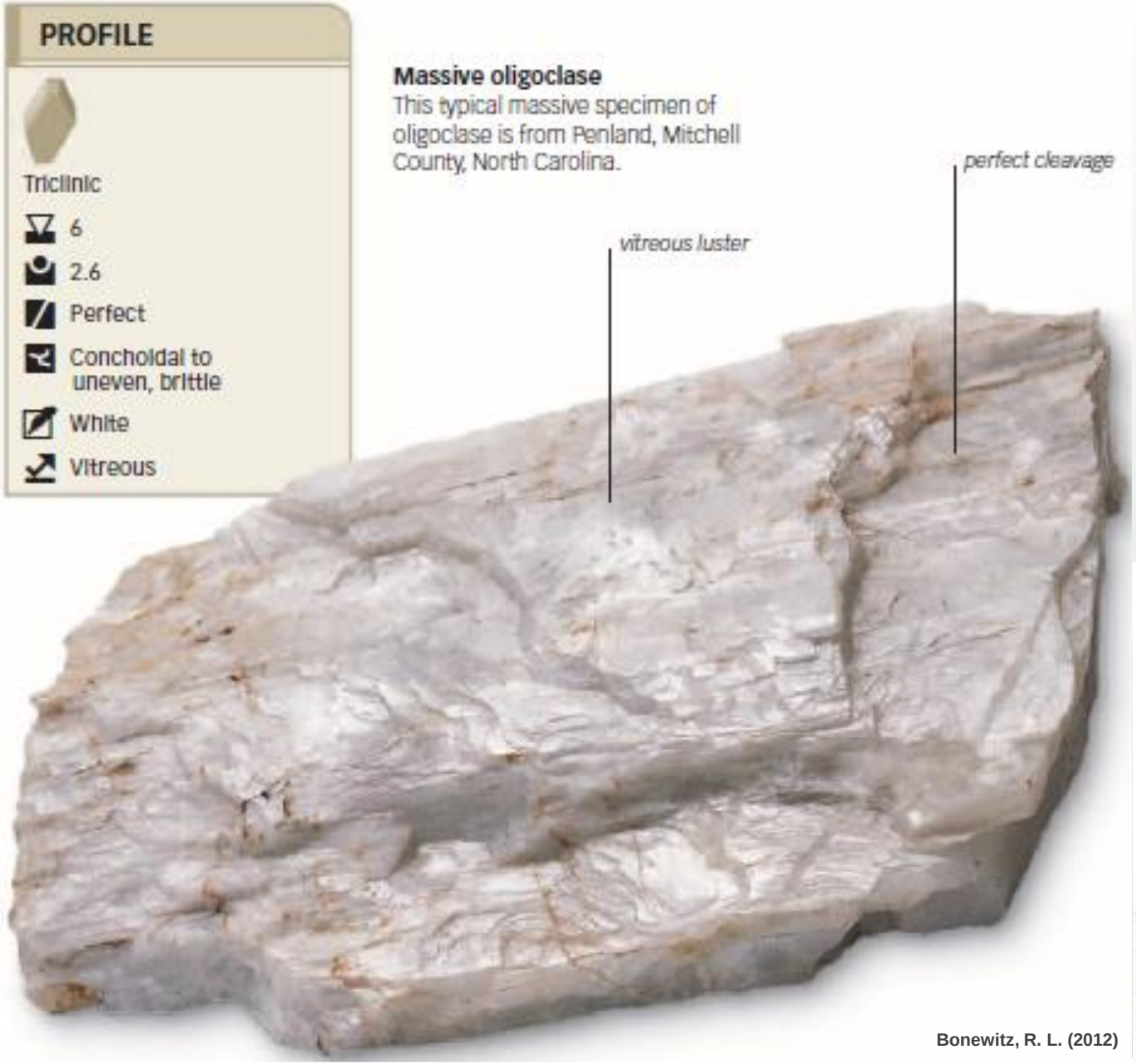
Bonewitz, R. L. (2012)

Kimyasal Formülü	$NaAlSi_3O_8$

Facet-grade albite
Faceted albite, although fragile, is sometimes used in jewelry, along with albite's moonstone variety.

OLİGOKLAZ

Kimyasal Formülü	$(Na, Ca)Al_2Si_2O_8$

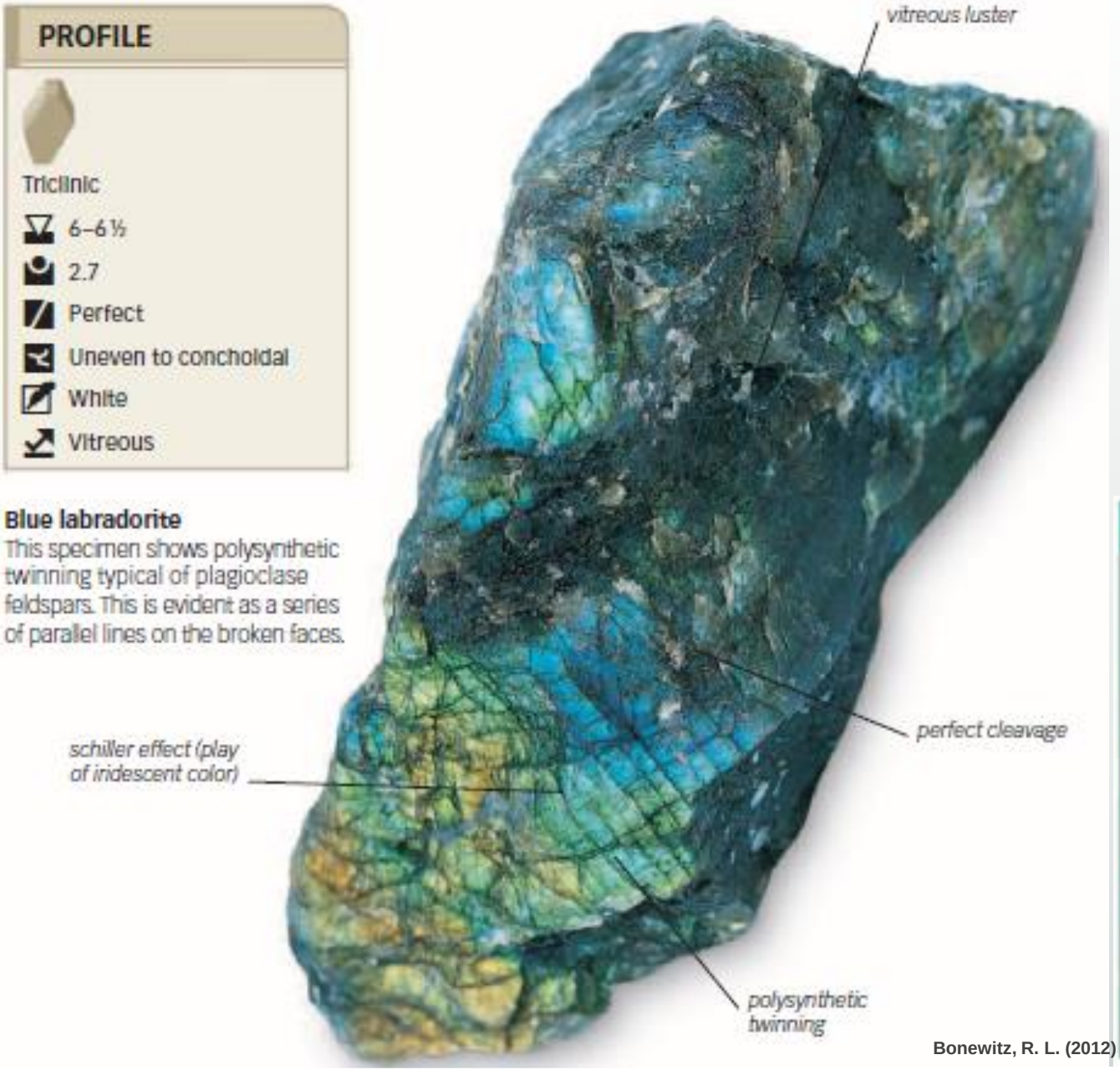


Bonewitz, R. L. (2012)

Semiprecious oligoclase
Sunstone oligoclase, such as the oval example seen here, has hematite or goethite inclusions.

LABRADOR

Kimyasal Formülü	$(Na, Ca)Al_2Si_2O_8$



Bonewitz, R. L. (2012)

SODALİT

Kimyasal Formülü	$(Na4Al_3Si_3O_{12}Cl$

PROFILE

Cubic

5½–6

2.1–2.3

Poor to distinct

Uneven to concholdal

White to light blue

Vitreous to greasy

Massive sodalite
This sodalite specimen shows intense blue color, which can sometimes lead to the mineral being mistaken for lapis lazuli.

Bonewitz, R. L. (2012)

VARIANTS

Polished sodalite A specimen that has been polished to bring out its color

Indian sodalite A specimen of light blue sodalite found in India

Sodalite beads
This unusual modern Egyptian necklace has beads made of blue sodalite and red carnelian.

SERPANTİN

Kimyasal Formülü	$(Mg, Fe, Ni)_3Si_2O_5(OH)_4$

PROFILE

Monoclinic or triclinic

3½–5½

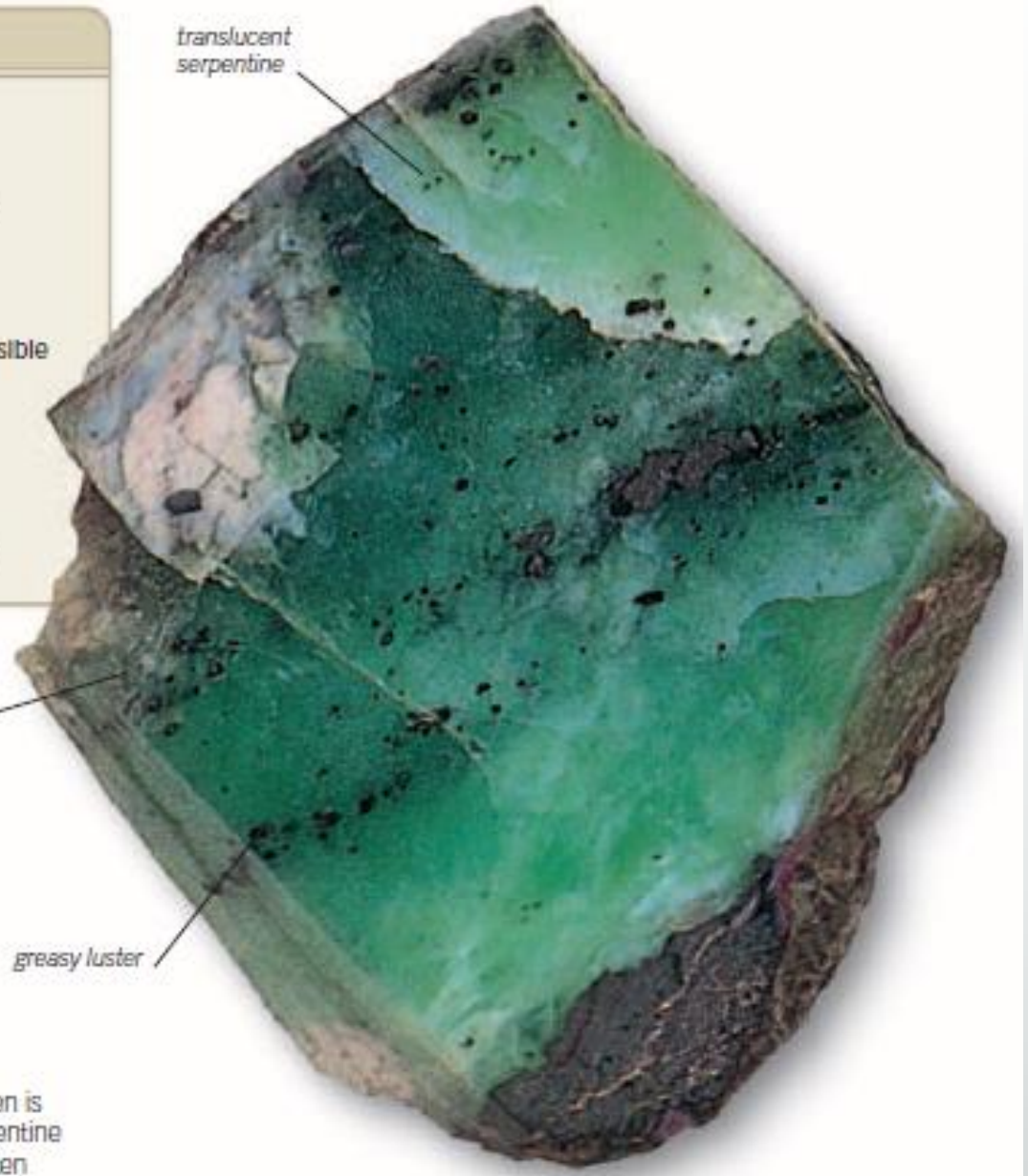
2.5–2.6

Perfect but not visible

Conchoidal to splintery

White

Subvitreous to greasy, resinous, earthy, dull



Precious serpentine
This high-quality specimen is composed of many serpentine minerals. It is the kind often carved and sold as jade.

Bonewitz, R. L. (2012)

VARIANTS

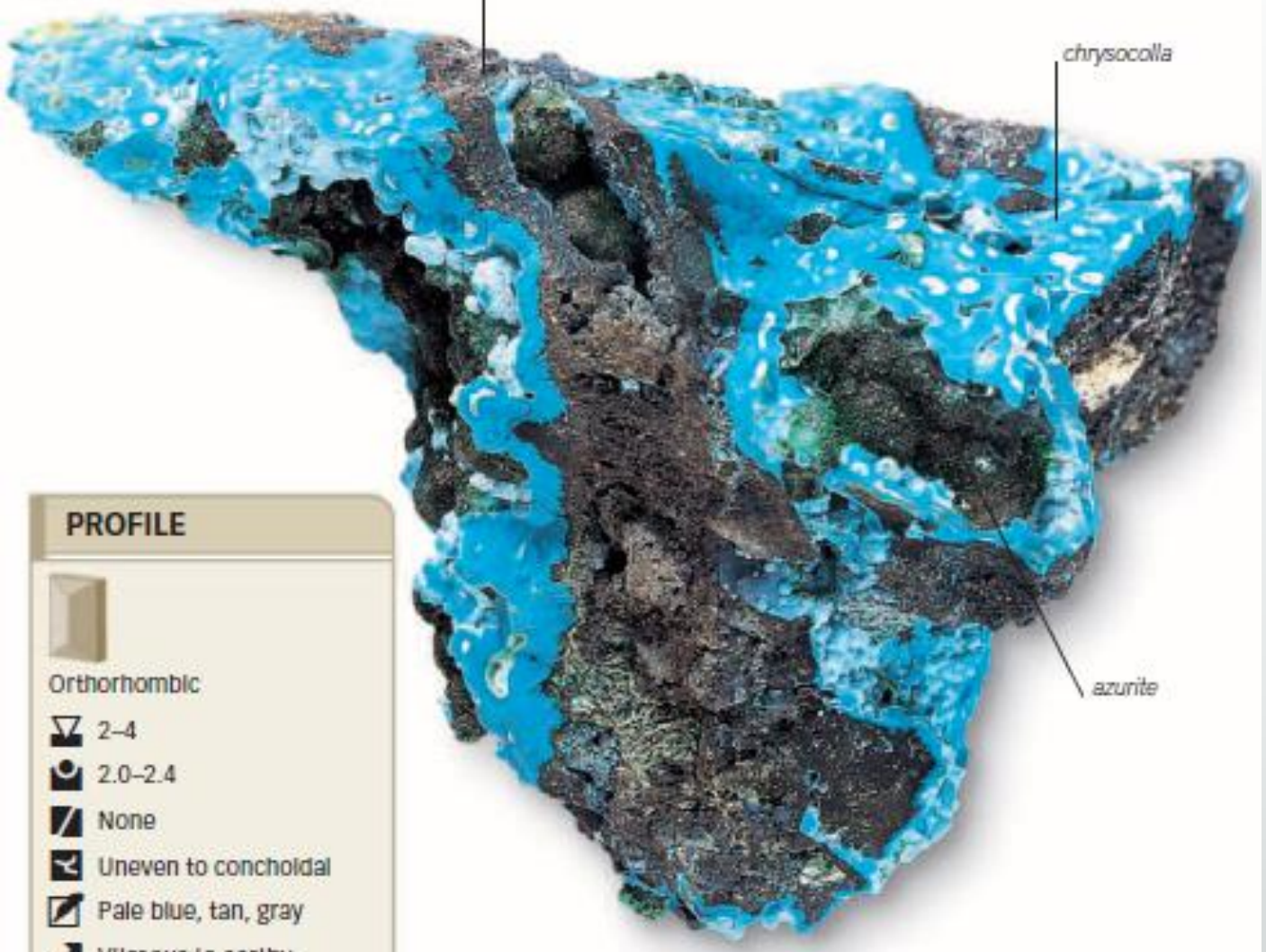
Lizardite A specimen of this fine-grained serpentine mineral from Cornwall, UK

Antigorite A specimen of this serpentine mineral with characteristic, corrugated plates

Williamsite cabochon
A variety of serpentine, williamsite is an ornamental stone that is sometimes cut as an inexpensive gem.

KRİZOKOL

Chrysocolla with azurite
In this specimen, chrysocolla can be seen with the carbonate mineral azurite in a rock matrix.



PROFILE

Orthorhombic
2–4
2.0–2.4
None
Uneven to conchoidal
Pale blue, tan, gray
Vitreous to earthy

Bonewitz, R. L. (2012)

Kimyasal Formülü	$Cu_2H_2(Si_2O_5)(OH)_4nH_2O$

Chrysocolla bracelet
Rich blue-green chrysocolla, such as the cabochon in this antique bracelet, is highly prized as a gemstone.

Cabochon Green chrysocolla within reddish iron oxide

PREHNİT

Kimyasal Formülü	$Ca_2Al_2Si_3O_{10}(OH)_2$

PROFILE

Orthorhombic

6–6½

2.9

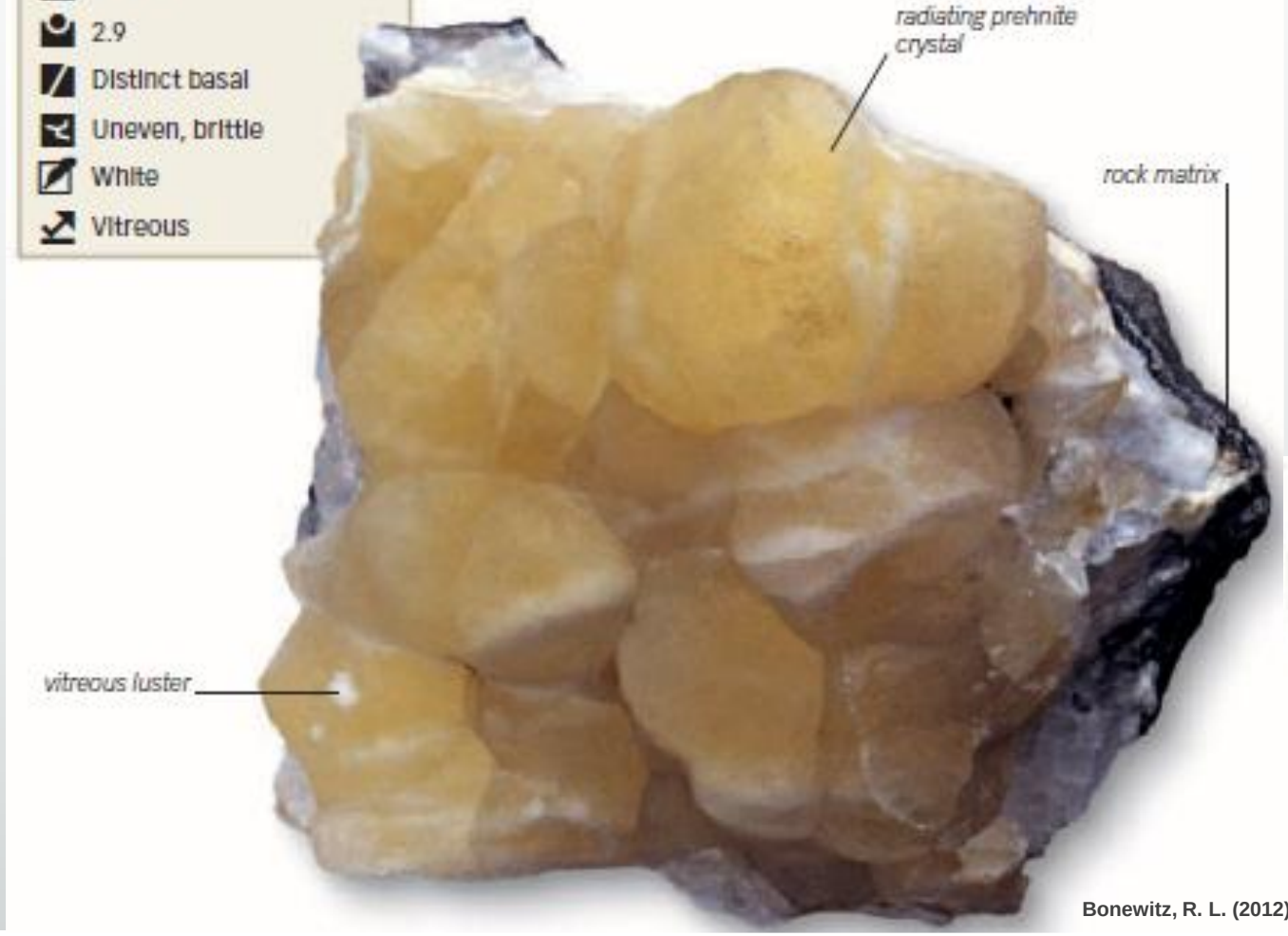
Distinct basal

Uneven, brittle

White

Vitreous

Botryoidal prehnite
A group of radiating crystal masses of prehnite resting on a rock matrix gives a botryoidal form to this specimen.



White cabochon
Prehnite gems, such as this creamy white cabochon with dark inclusions, are almost too soft to wear.

Bonewitz, R. L. (2012)

ENSTATİT

PROFILE

Orthorhombic

- 5–6
- 3.1–3.9
- Good to perfect
- Uneven
- Gray to white
- Vitreous

Prismatic crystals
This mass of small, prismatic enstatite crystals rests on a rock matrix.

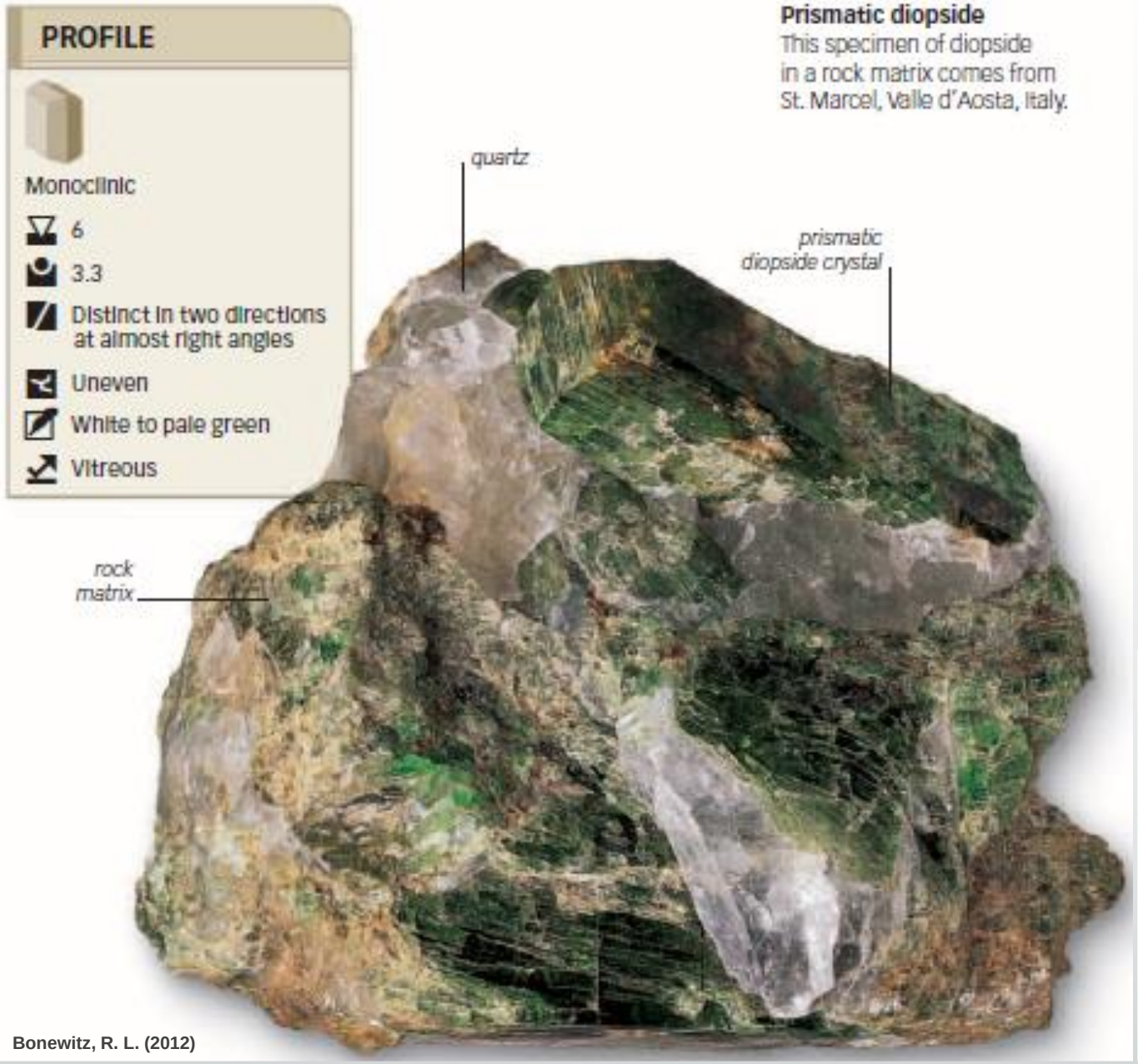
Bonewitz, R. L. (2012)

Kimyasal Formülü	$Mg_2Si_2O_6$

Mixed-cut enstatite
Recovered from Myanmar and Sri Lanka, facet-grade enstatite, such as this gem, is mainly cut for collectors.

DİYOPSİT

Kimyasal Formülü	$CaMgSi_2O_6$



Prismatic diopside
This specimen of diopside in a rock matrix comes from St. Marcel, Valle d'Aosta, Italy.

Bonewitz, R. L. (2012)

Chrome diopside
Emerald-green diopside, such as the gem shown here, is chromium-rich and is also known as chrome diopside.

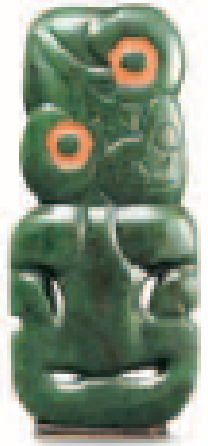
NEFRİT

Polished nephrite
This small boulder of nephrite has been sliced and polished to reveal its quality.

PROFILE

Monoclinic
6½
2.9–3.4
Perfect
Splintery, brittle
White
Dull to waxy

Kimyasal Formülü	$Ca_2(Mg, Fe)_5(Si_8O_{22})(OH)_2$



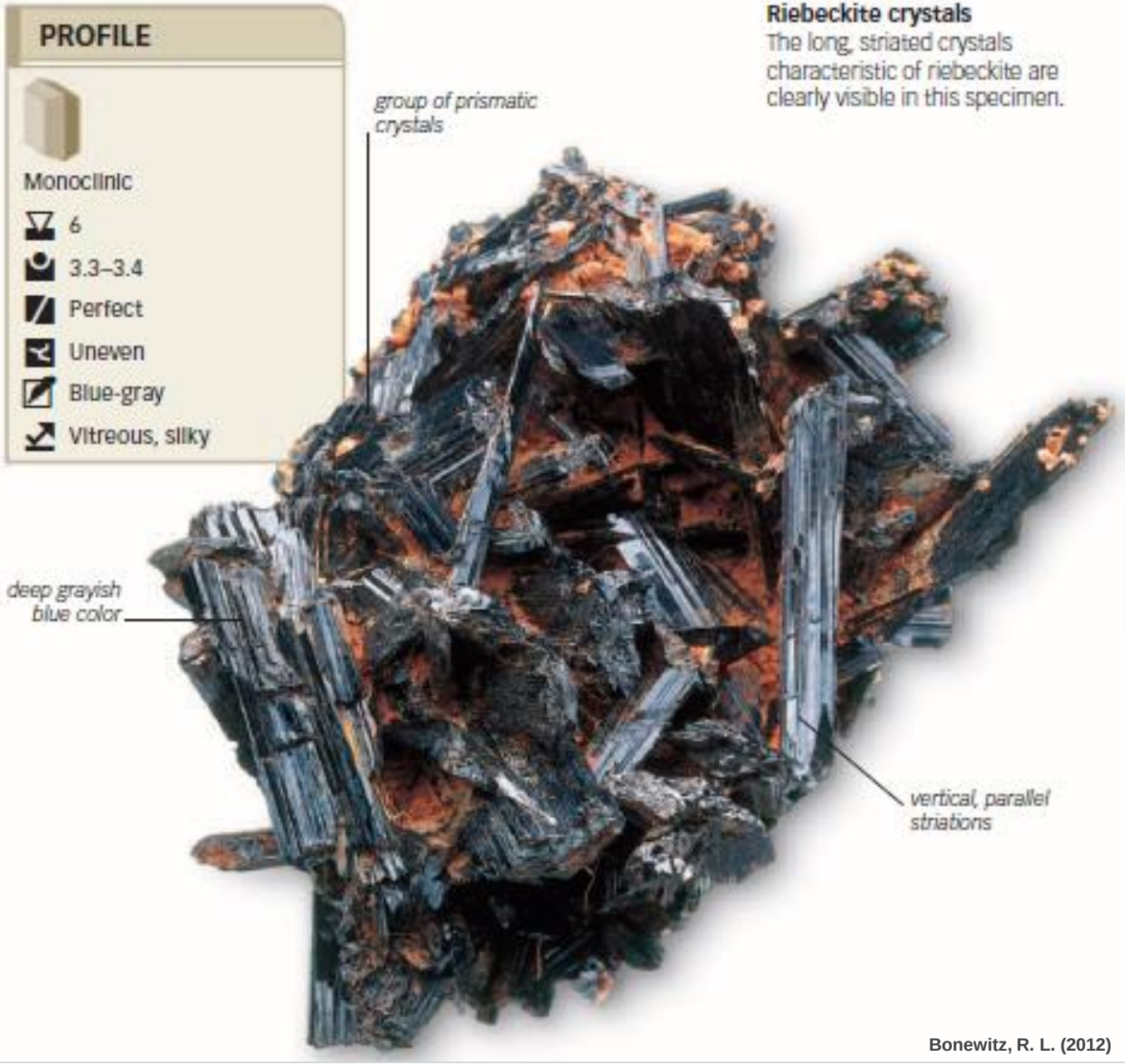
Nephrite tiki
Hei tikis, such as this one made of nephrite, are worn by the Maori of New Zealand.

Light green nephrite A mass of light green nephrite

Bonewitz, R. L. (2012)

RİBEKİT

Riebeckite crystals
The long, striated crystals characteristic of riebeckite are clearly visible in this specimen.



Bonewitz, R. L. (2012)

Kimyasal Formülü	$Na_2(Fe_3,Fe_2)(Si_8O_{22})(OH)_2$

Tiger's eye ring
Crocidolite, a variant of riebeckite, forms the gemstone tiger's eye when it is silica-saturated.

KORDİYERİT

PROFILE

Orthorhombic

7–7½

2.6

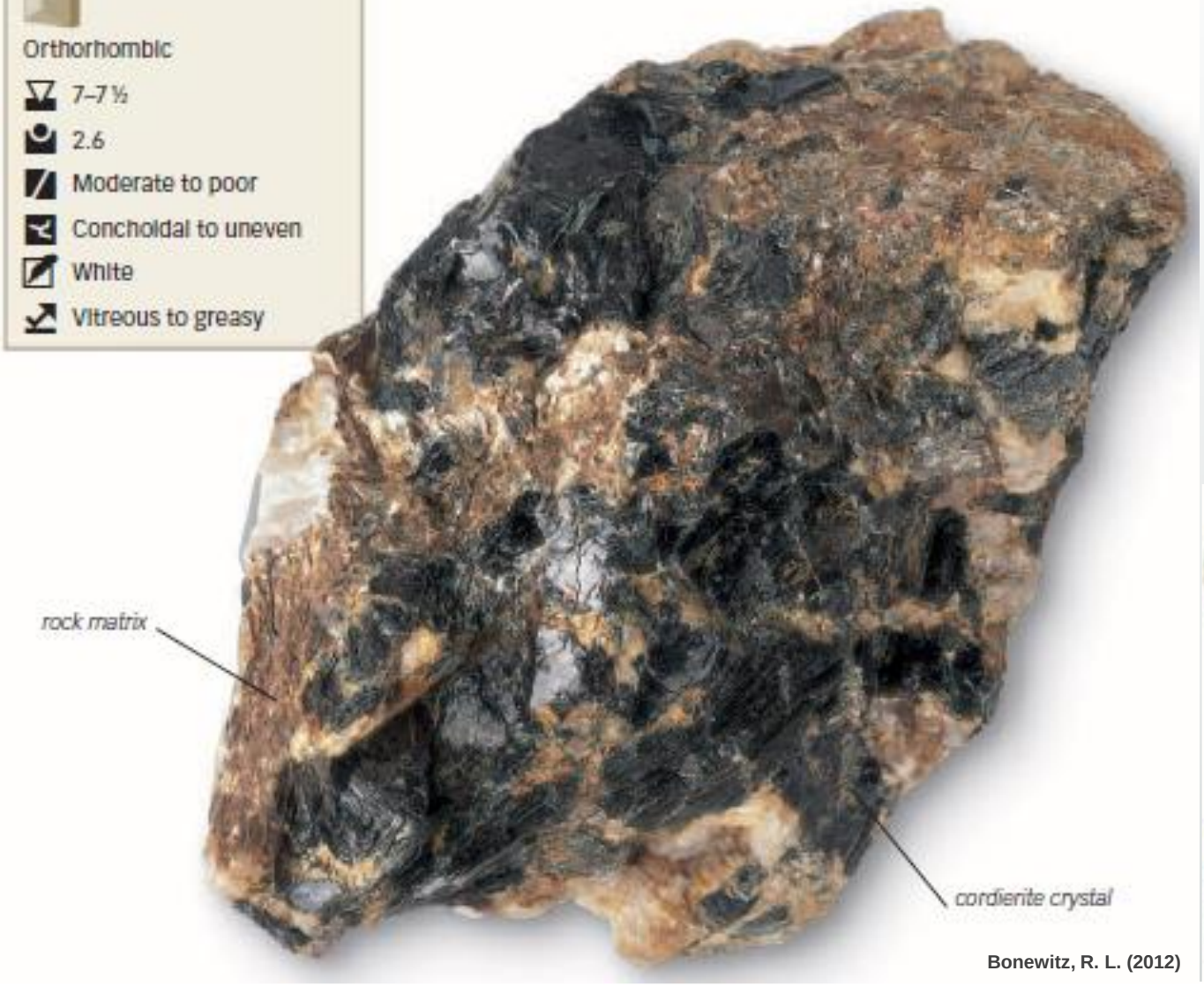
Moderate to poor

Conchoidal to uneven

White

Vitreous to greasy

Cordierite crystals
This group of short prismatic, dark gray cordierite crystals occurs in a rock matrix.



Bonewitz, R. L. (2012)

Kimyasal Formülü	$(Mg, Fe)_2Al_4Si_5O_{18}$

Cordierite jewelry
A variety of cordierite, iolite is used in ornaments because of its color and brilliance.

TURMALİN

PROFILE

Hexagonal or trigonal

7–7½

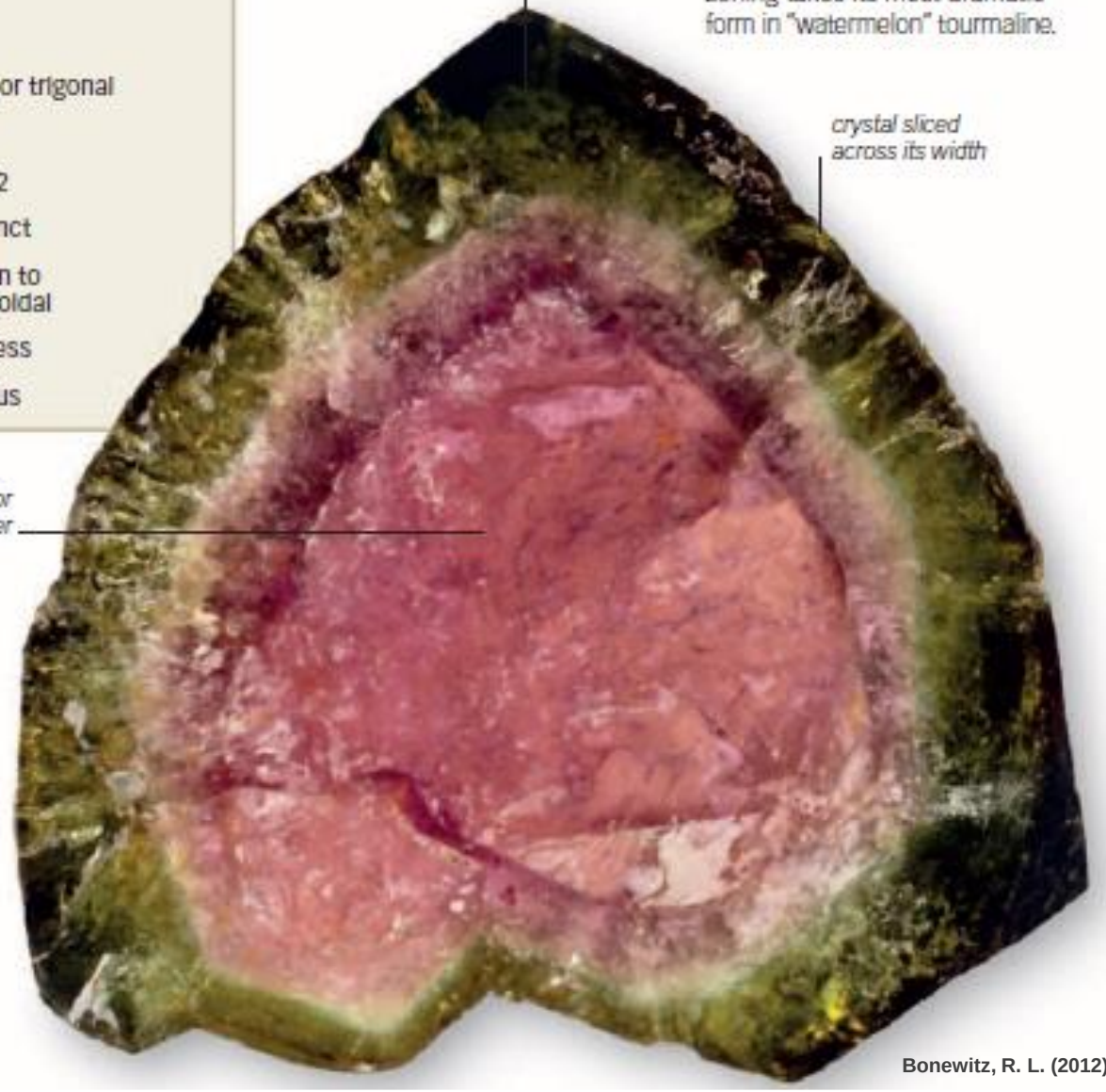
3.0–3.2

Indistinct

Uneven to conchoidal

Colorless

Vitreous



Watermelon tourmaline Color can vary either along or across a tourmaline crsytal. This zoning takes its most dramatic form in "watermelon" tourmaline.

Bonewitz, R. L. (2012)

Kimyasal Formülü	$FeWO_4$

Schorl Probably the most common tourmaline mineral

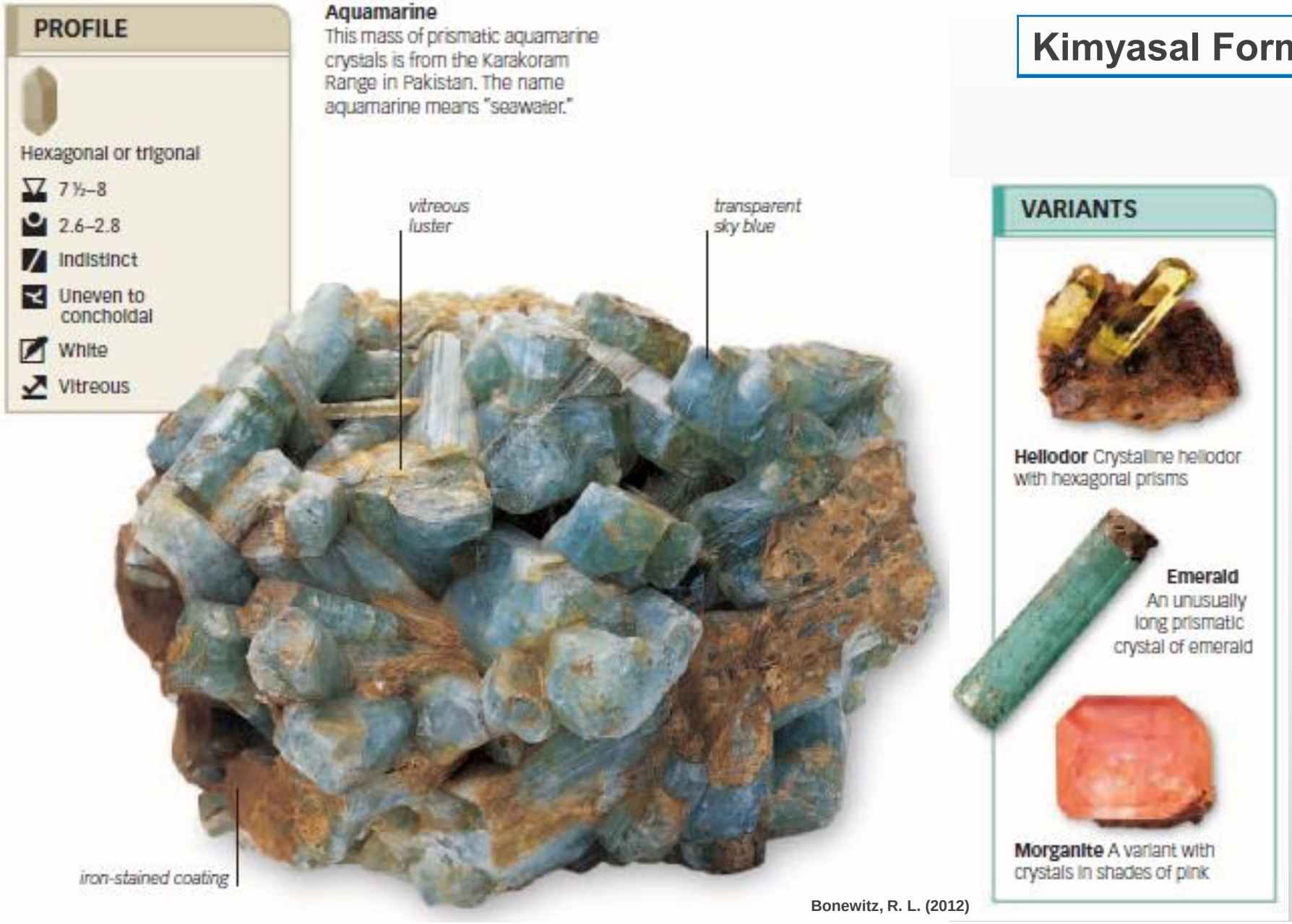
Elbaite A gemstone-quality variant of tourmaline

Indicolite A blue-colored variant of tourmaline

Cut rubellite This specimen shows the rich red coloration and transparency found in some specimens of rubellite.

BERİL

Kimyasal Formülü	$MnWO_4$



Bonewitz, R. L. (2012)

AKSİNİT

Kimyasal Formülü	$Ca_2FeAl_2(BSi_4O_{15})(OH)$

PROFILE

Triclinic

6½–7

3.2–3.3

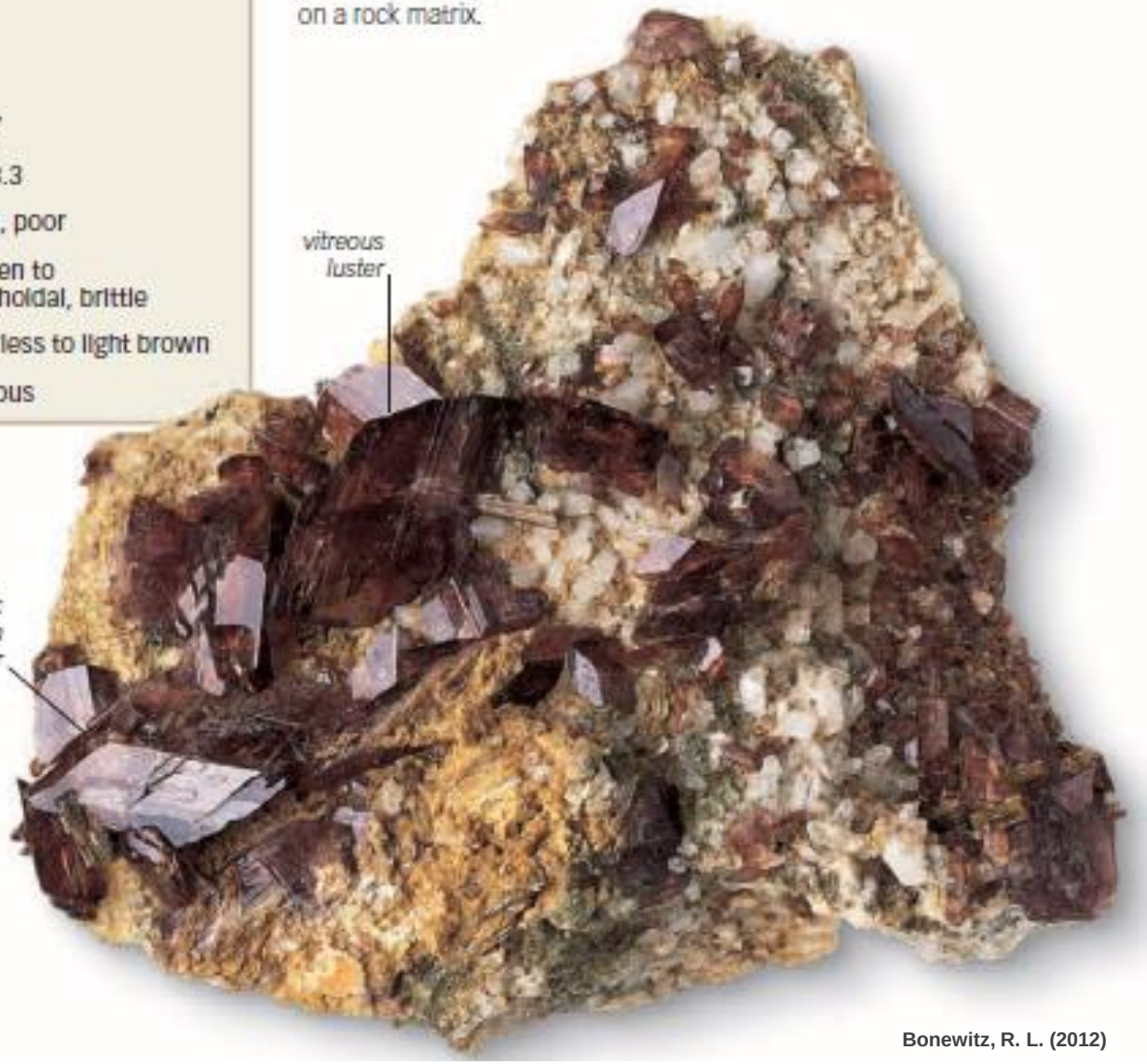
Good, poor

Uneven to conchoidal, brittle

Colorless to light brown

Vitreous

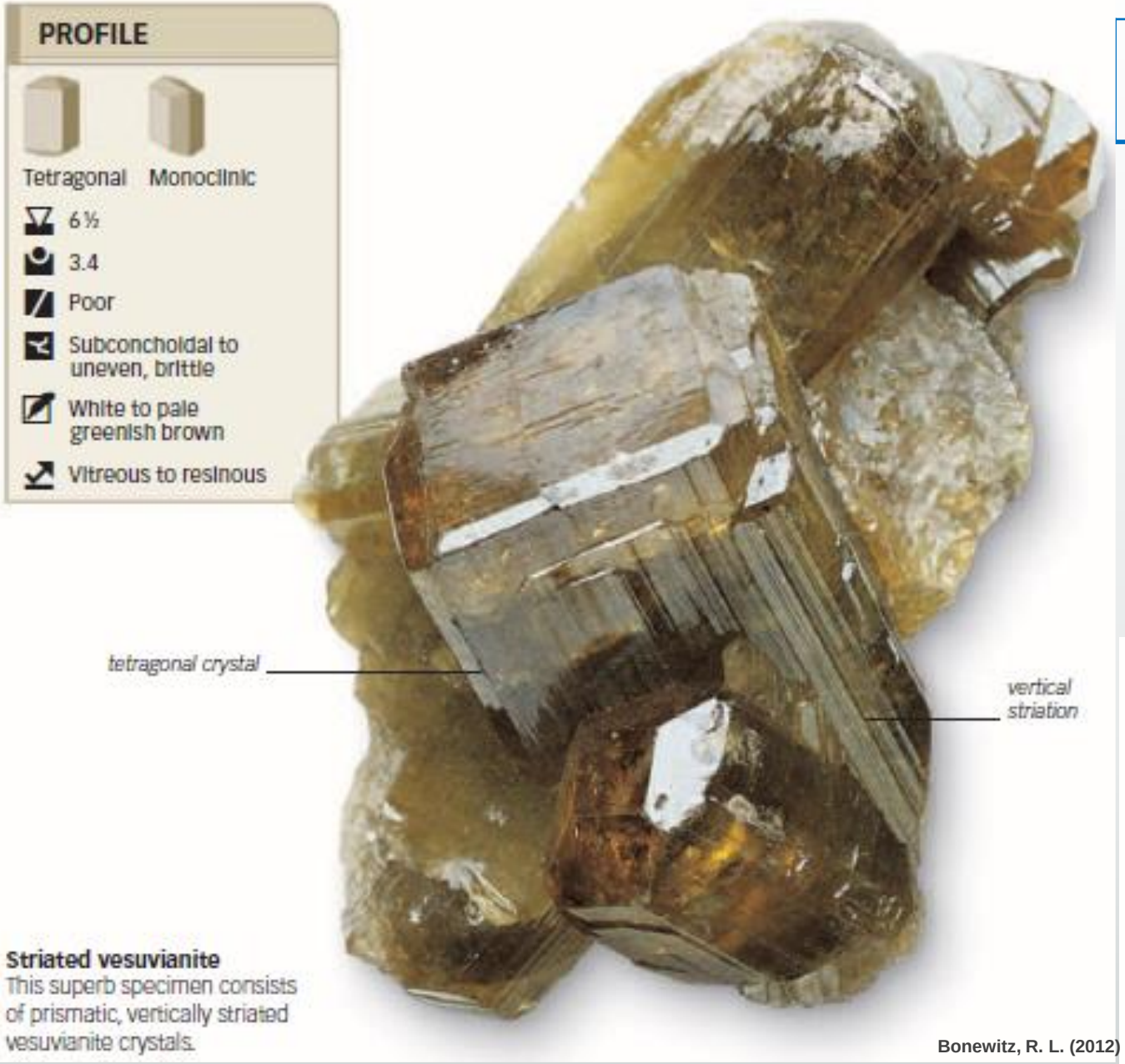
Axinite crystals
This mass of well-formed, transparent, wedge-shaped, tabular axinite crystals rests on a rock matrix.



Bonewitz, R. L. (2012)

Axinite gemstone
Brilliant-cut axinite crystals, such as this specimen in an unusual shade of violet, are popular with collectors.

VEZÜVİYANİT



Striated vesuvianite
This superb specimen consists of prismatic, vertically striated vesuvianite crystals.

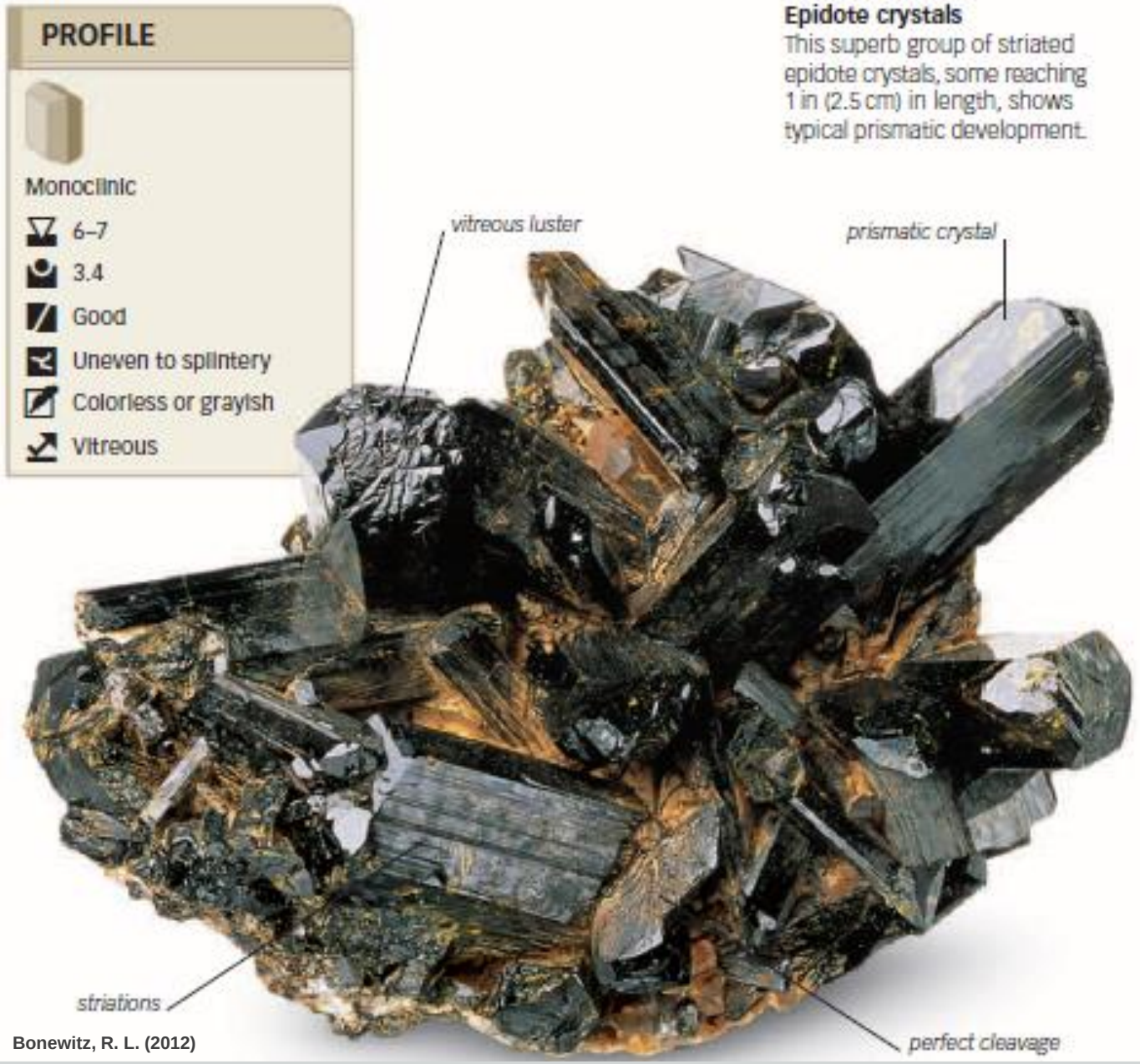
Bonewitz, R. L. (2012)

Kimyasal Formülü	$Ca_{10}(MgFe)_2Al_4(SiO_4)_5(Si_2O_7)_2(OH, F)_4$

Vesuvianite gem
Occasionally, vesuvianite is found in translucent to transparent crystals suitable for cutting into gems.

EPİDOT

Epidote crystals
This superb group of striated epidote crystals, some reaching 1 in (2.5 cm) in length, shows typical prismatic development.



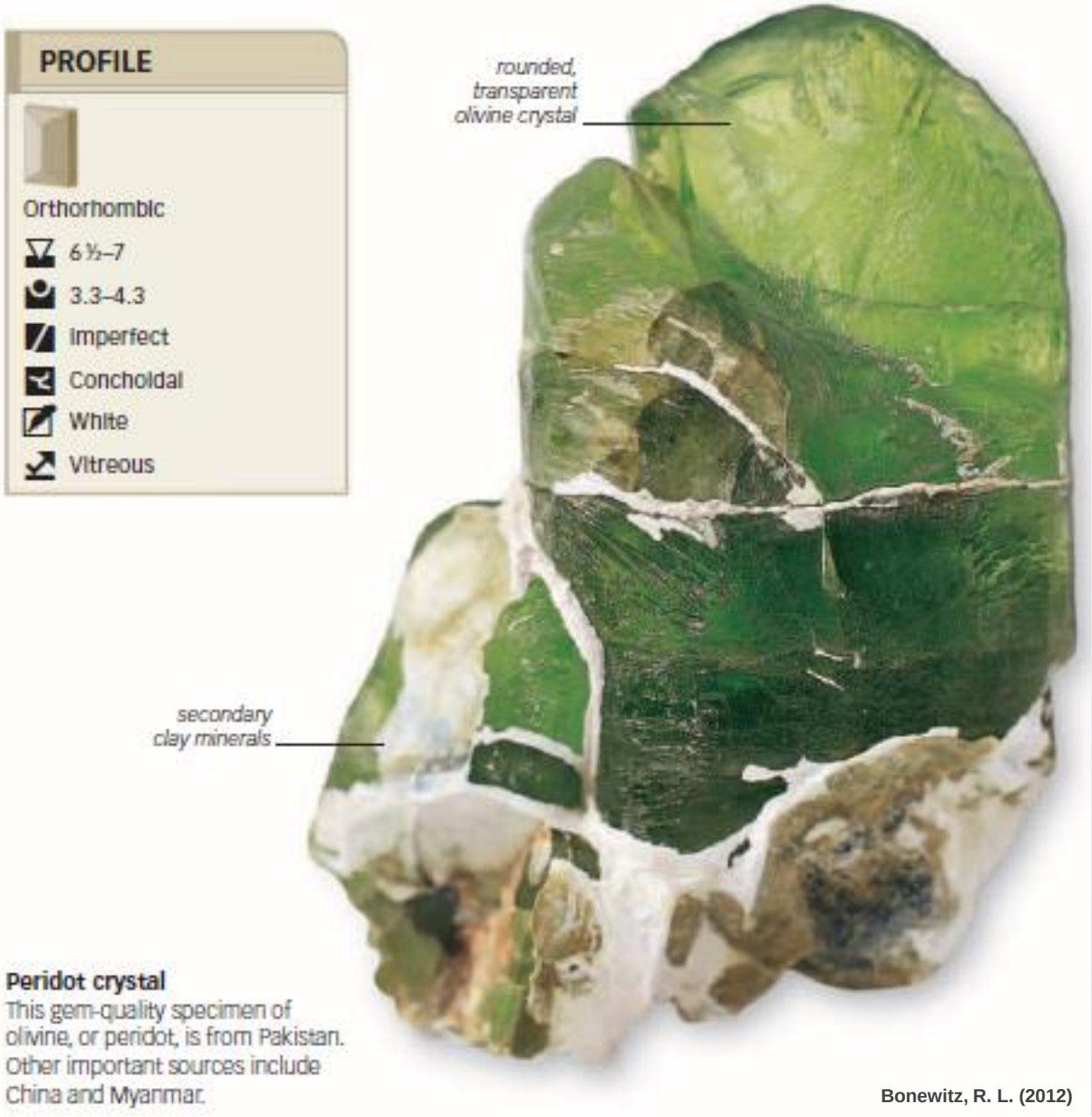
Bonewitz, R. L. (2012)

Kimyasal Formülü	$Ca_2Al_2(FeAl)(SiO_4)(Si_2O_7)O(OH)$

Epidote gemstone
Clear, yellowish green to dark brown epidote gems are rare. Transparent crystals are cut for collectors.

OLİVİN

Kimyasal Formülü	$(Mg, Fe)_2SiO_4$



Peridot crystal
This gem-quality specimen of olivine, or peridot, is from Pakistan. Other important sources include China and Myanmar.

Bonewitz, R. L. (2012)

Peridot gemstone
Green peridot, such as the one in this brooch, was used by Egyptians since the second millennium BCE.

ZİRKON

Kimyasal Formülü	$ZrSiO_4$

PROFILE

Tetragonal

7½

4.6–4.7

Imperfect

Uneven to conchoidal

White

Adamantine to oily

Afghan zircon
This specimen of zircon crystals in a feldspar-and-biotite matrix is from Afghanistan. The crystals are up to 1¾ in (3cm) long.

VARIANTS

Purple zircon Crystals of zircon in a rock matrix

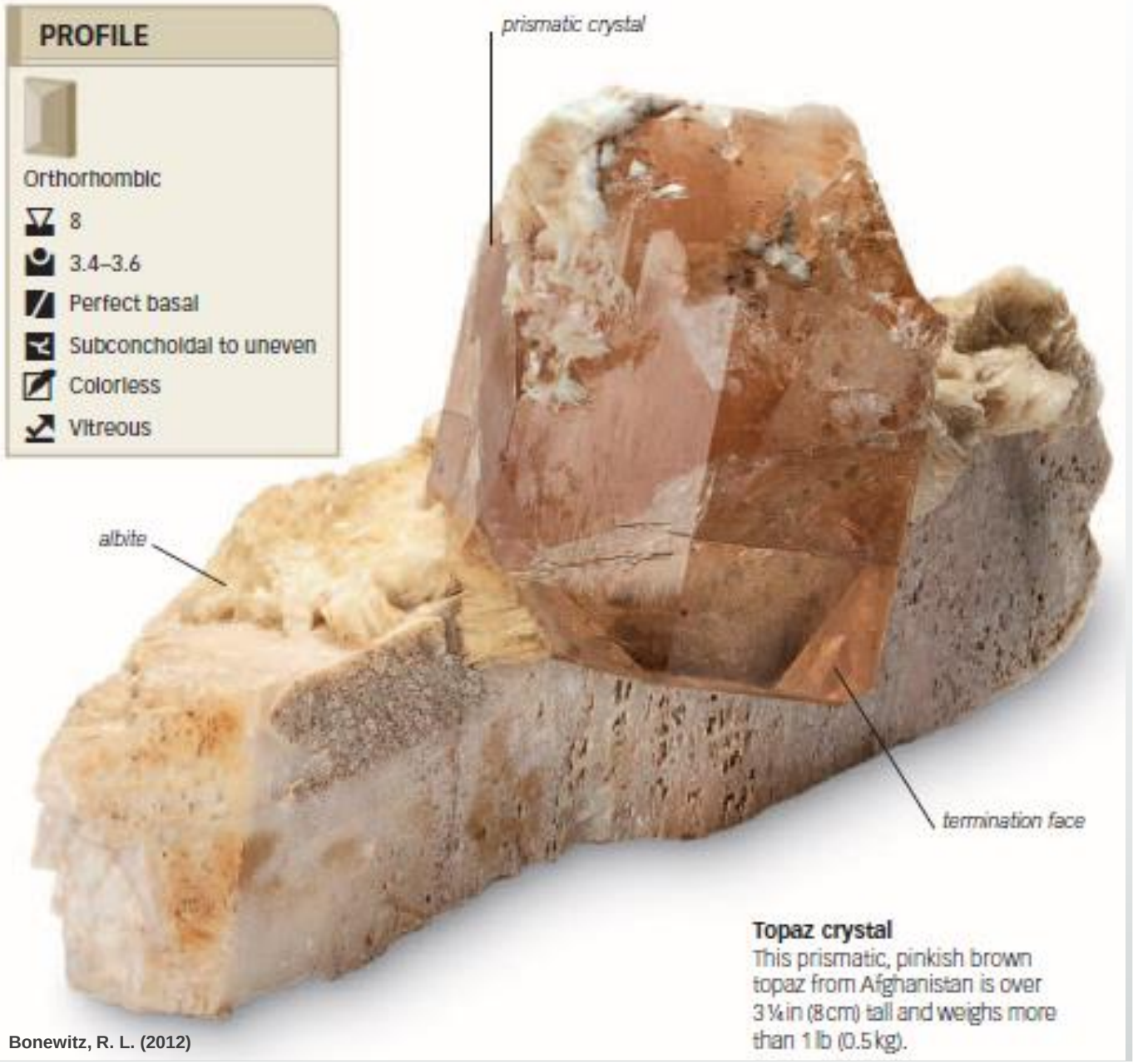
Crystalline cluster Zircon crystals that are embedded in pegmatite

Zircon bracelet
Gem zircons, such as the colorless, faceted zircons in this bracelet, have been mined for over 2,000 years.

Bonewitz, R. L. (2012)

TOPAZ

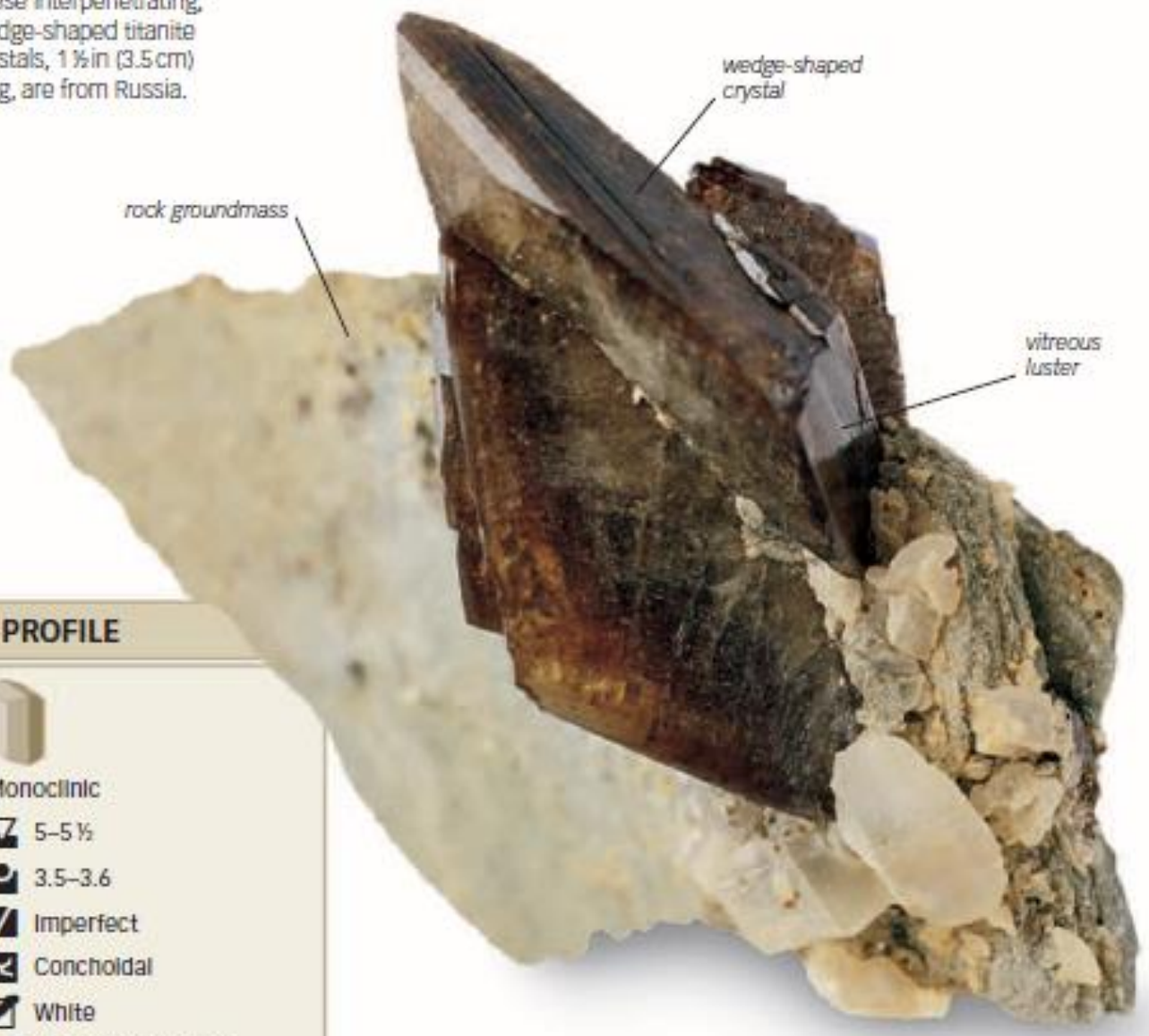
Kimyasal Formülü	$Al_2SiO_4(F, OH)_2$



Bonewitz, R. L. (2012)

TİTANİT

Titanite crystals
These interpenetrating, wedge-shaped titanite crystals, 1½ in (3.5 cm) long, are from Russia.



PROFILE

Monoclinic
5–5½
3.5–3.6
Imperfect
Conchoidal
White
Vitreous to greasy

Bonewitz, R. L. (2012)

Kimyasal Formülü	$CaTiSiO_5$

Titanite ring
Faceted titanites, such as the brilliant cut set in this gold ring, have superb fire and intense colors.

ANDALUZİT

Kimyasal Formülü	Al_2OSiO_5

PROFILE

Orthorhombic

6½–7½

3.2

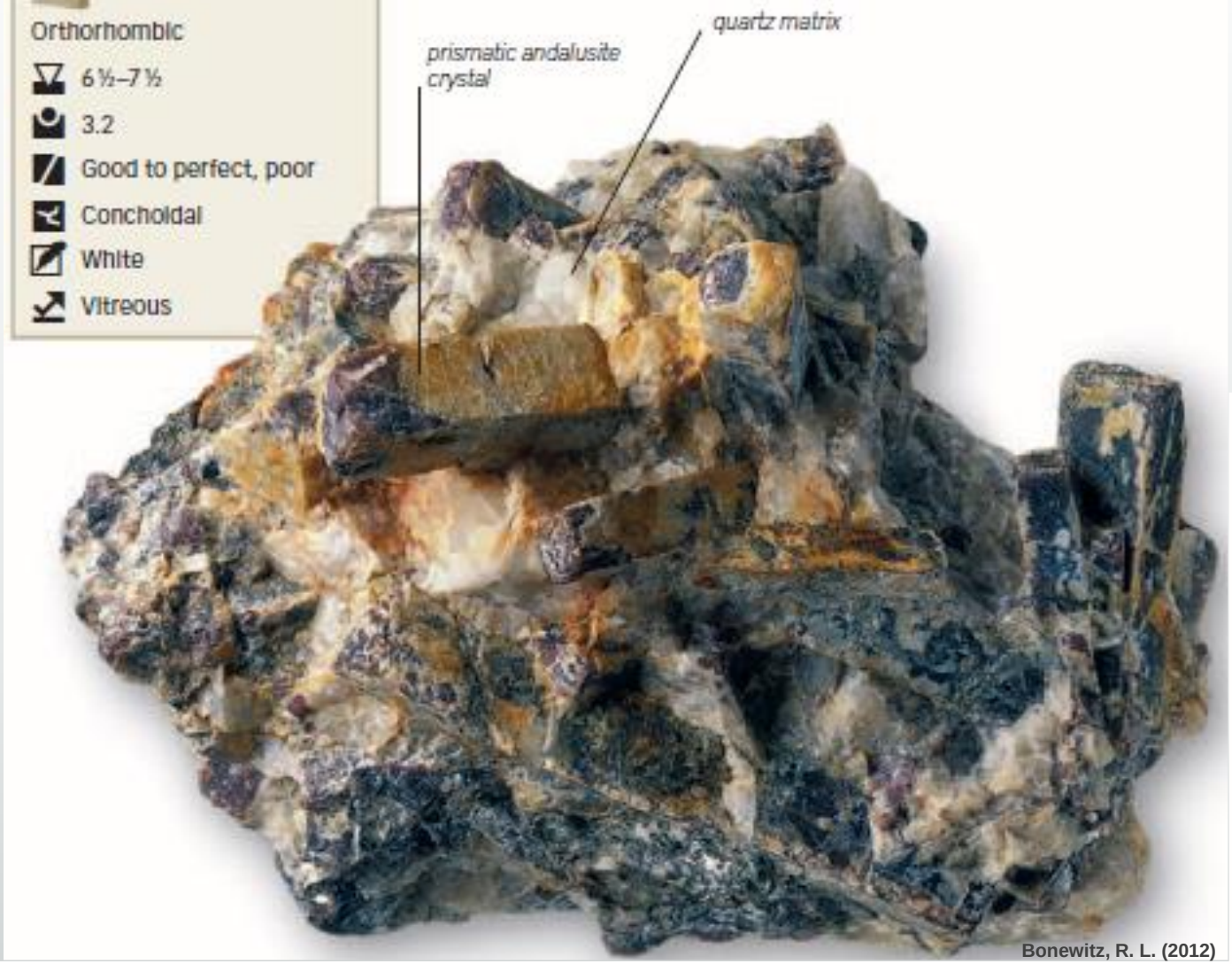
Good to perfect, poor

Conchoidal

White

Vitreous

Andalusite crystals
This group of prismatic andalusite crystals from the Austrian Tyrol is in a matrix of quartz.

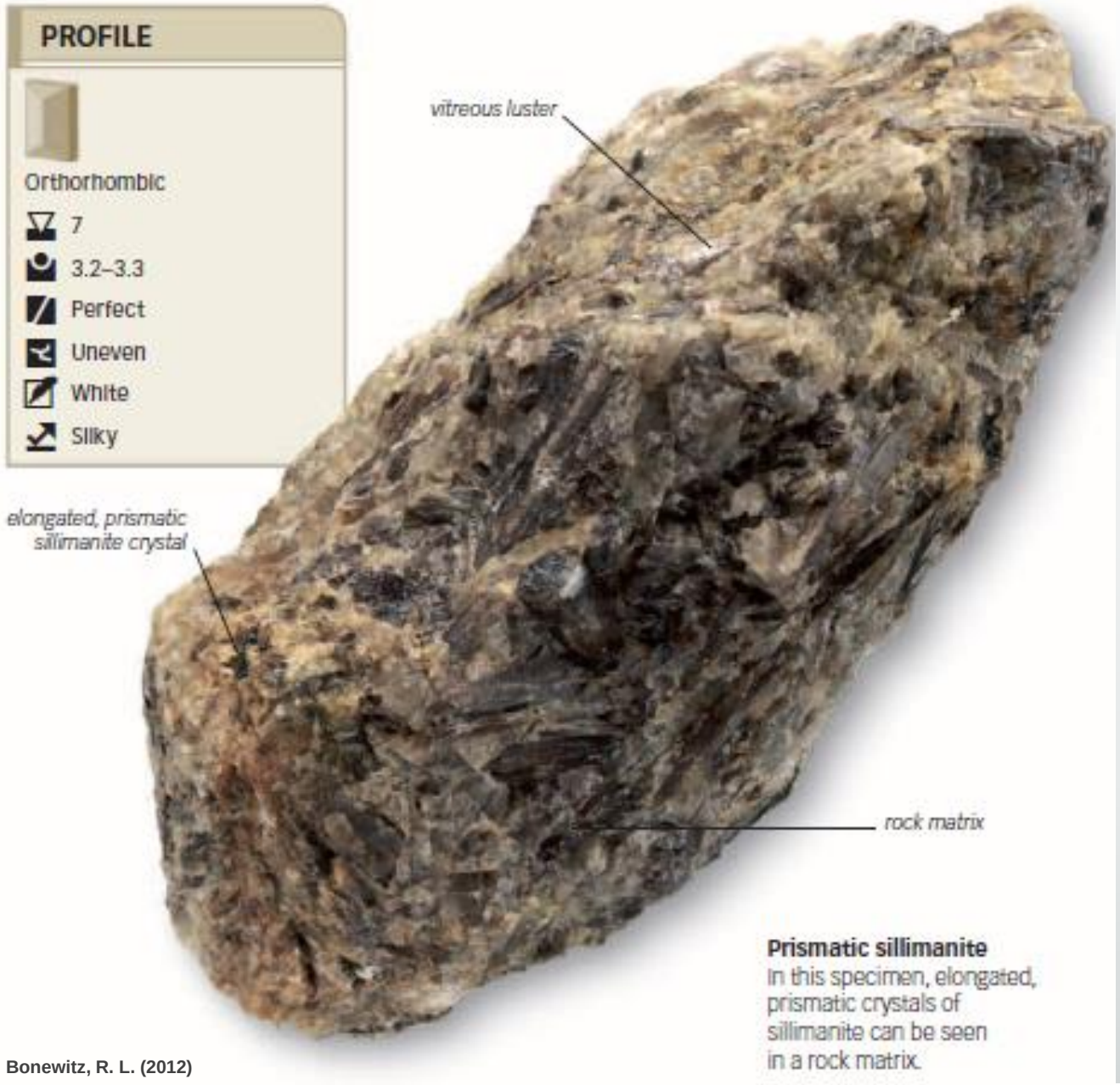


Bonewitz, R. L. (2012)

Rectangular step cut
Relatively uncommon, transparent andalusite is too brittle to be worn. It is faceted for gem collectors.

SİLİMANİT

Kimyasal Formülü	Al_2OSiO_5



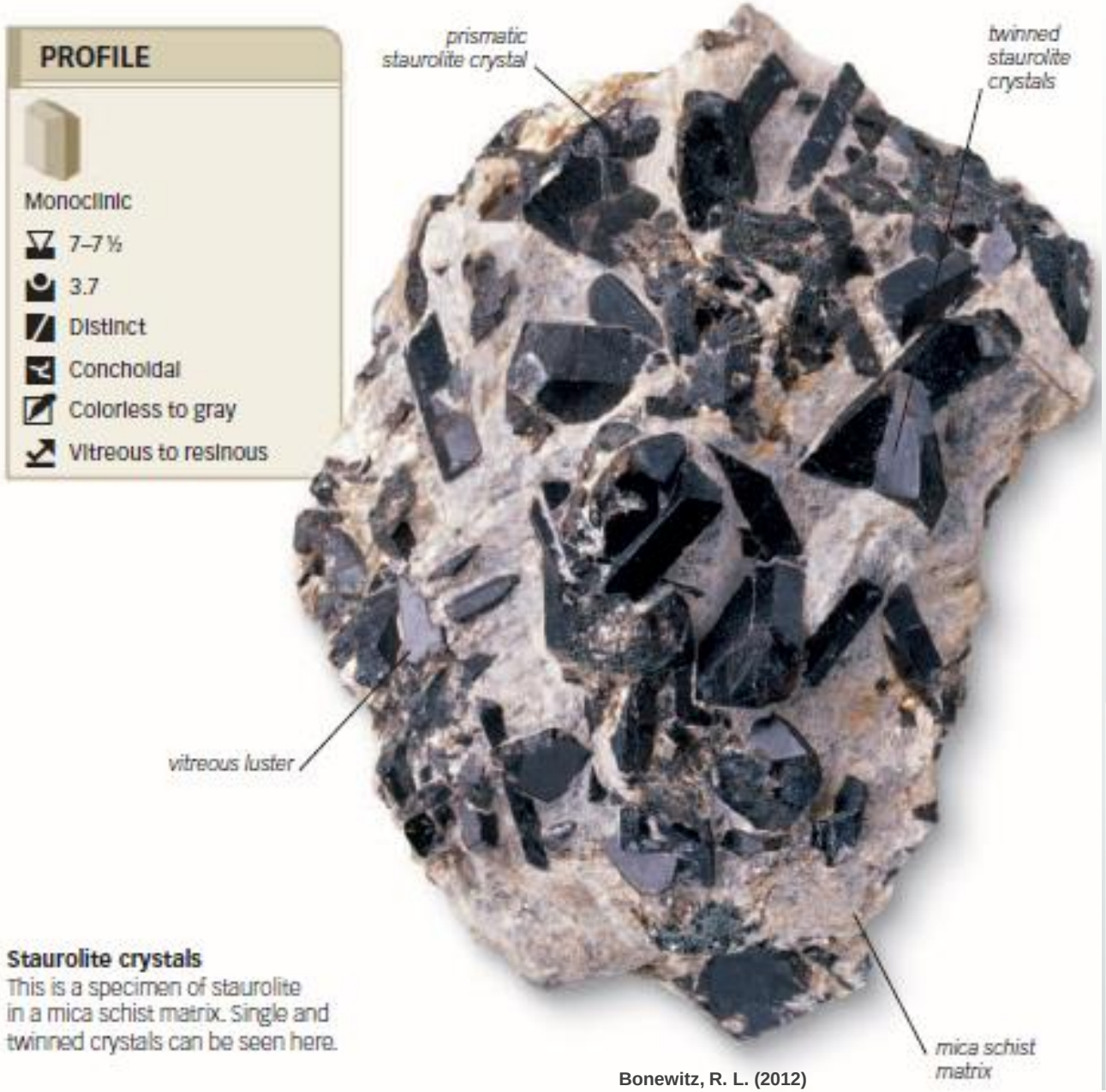
Prismatic sillimanite
In this specimen, elongated, prismatic crystals of sillimanite can be seen in a rock matrix.

Collectors' gem
Facet-grade sillimanite, such as this specimen, occurs in the gem gravels of Sri Lanka and Myanmar, and in Brazil.

Bonewitz, R. L. (2012)

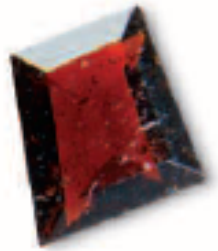
STAVROLİT

Kimyasal Formülü	$(FeMg)_4Al_{17}(SiAl)_8O_{45}(OH)_3$



Staurolite crystals
This is a specimen of staurolite in a mica schist matrix. Single and twinned crystals can be seen here.

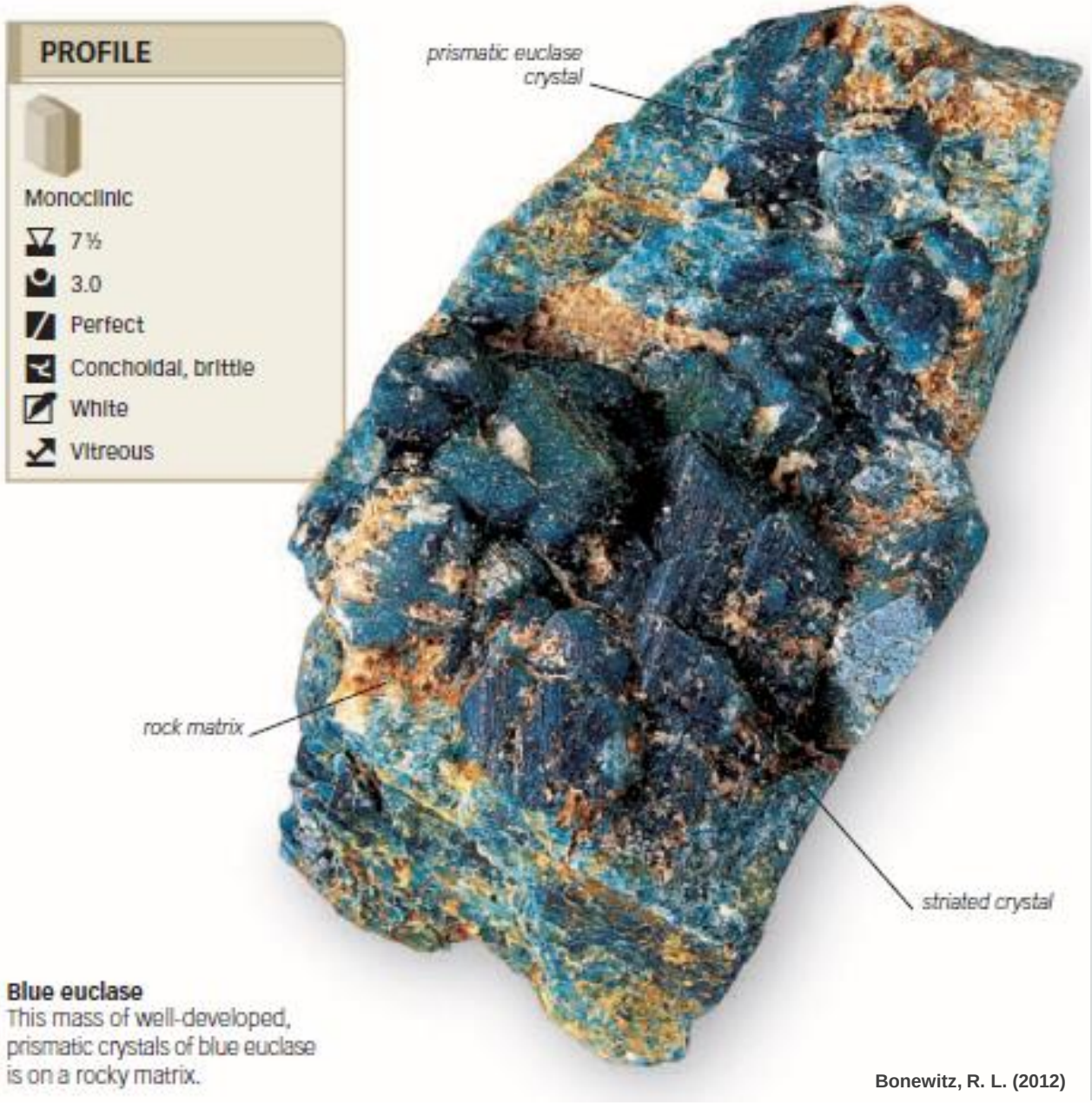
Bonewitz, R. L. (2012)



Trapeze-cut staurolite
Transparent staurolite, as in this stone, is a rare faceting material because of its dark color and lack of brilliance.

ÖKLAZ

Kimyasal Formülü	$BeAlSiO_4(OH)$



Blue euclase
This mass of well-developed, prismatic crystals of blue euclase is on a rocky matrix.

Bonewitz, R. L. (2012)

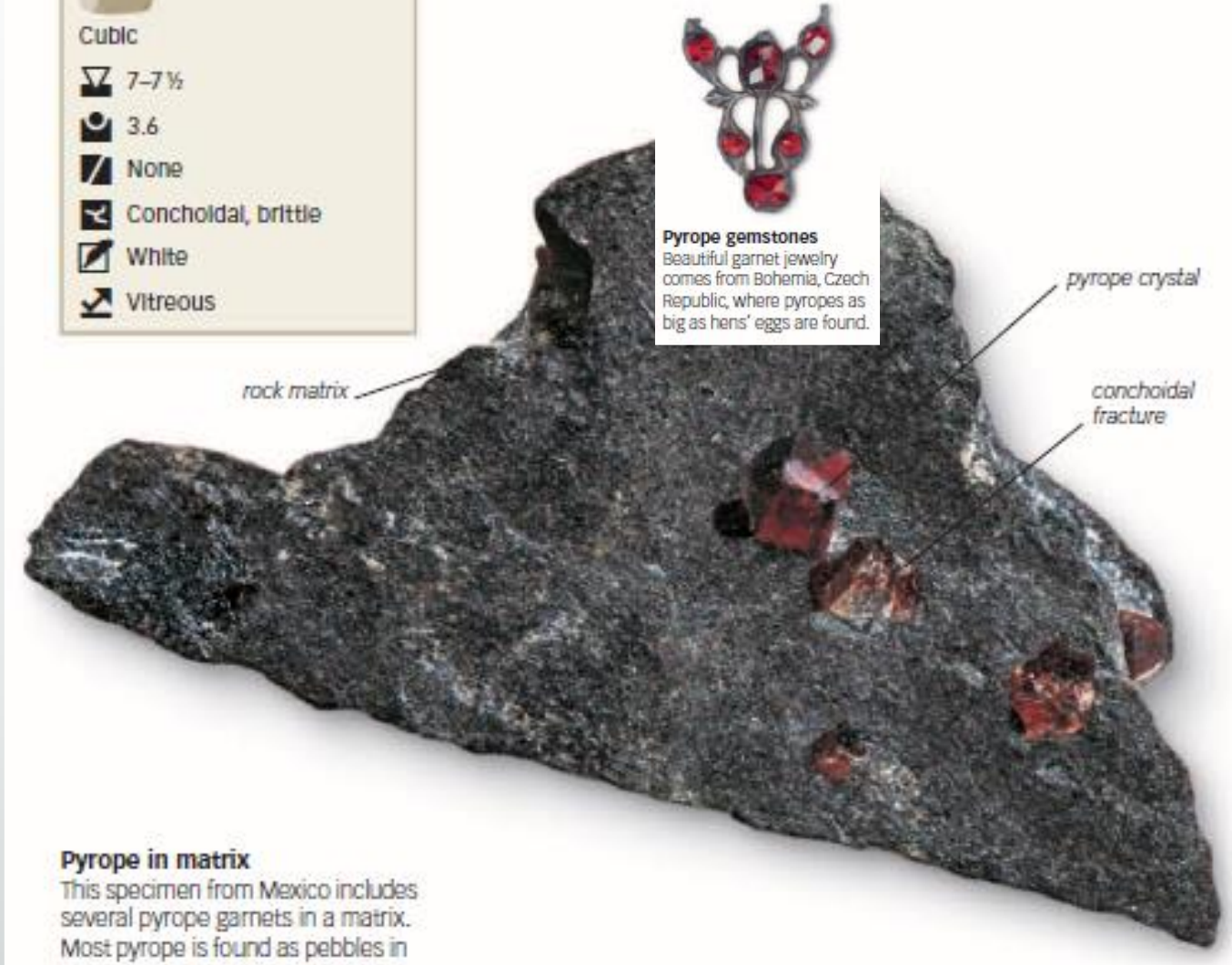
Euclase gemstone
This square-cut euclase gemstone shows small, dark inclusions of another mineral.

GRANAT

Kimyasal Formülü	$Mg_3Al_2(SiO_4)_3$

PROFILE

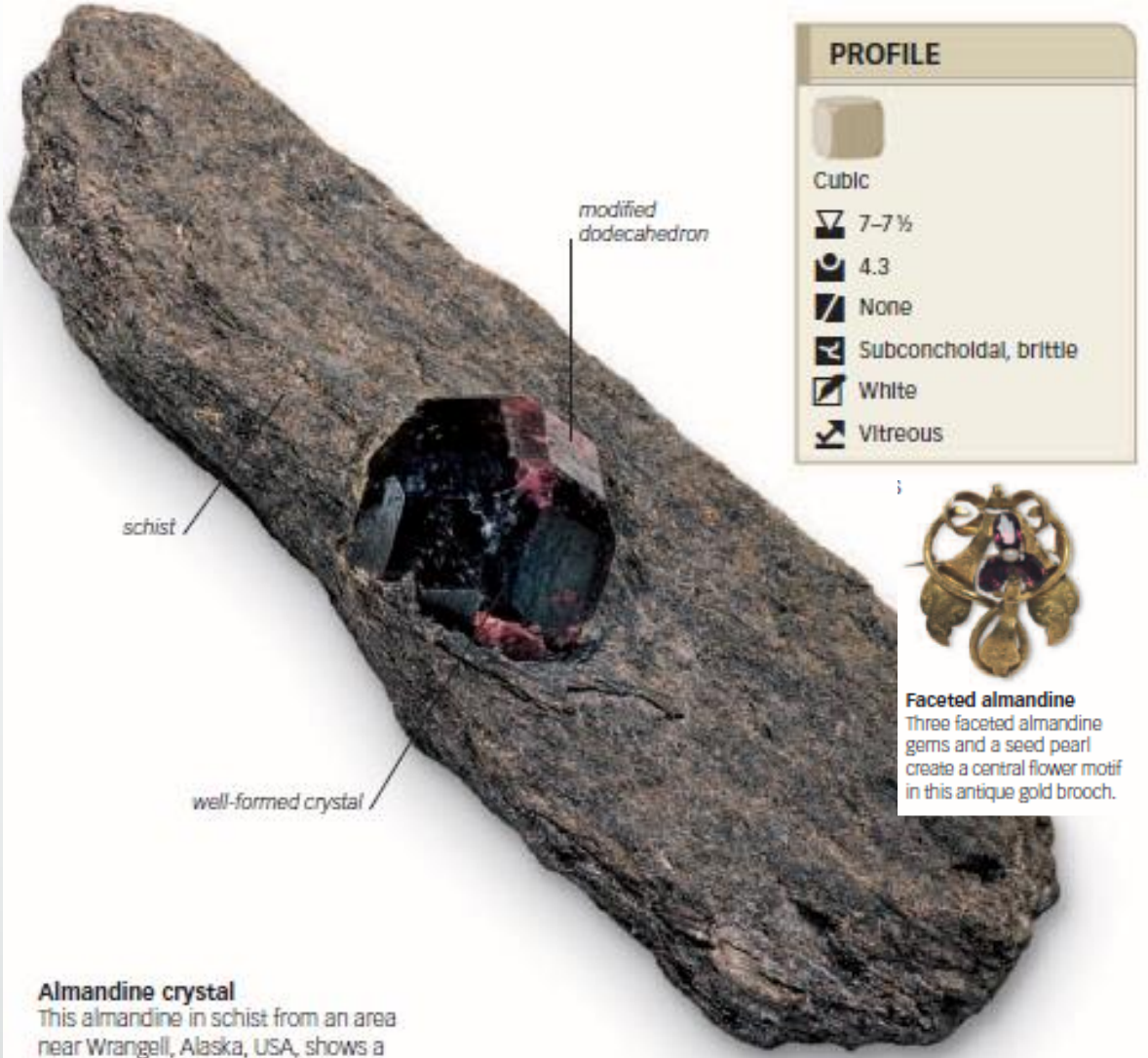
Cubic
7–7½
3.6
None
Concholdal, brittle
White
Vitreous



Pyrope gemstones
Beautiful garnet jewelry comes from Bohemia, Czech Republic, where pyropes as big as hens' eggs are found.

Pyrope in matrix
This specimen from Mexico includes several pyrope garnets in a matrix. Most pyrope is found as pebbles in placer deposits with other gems.

Bonewitz, R. L. (2012)



Almandine crystal
This almandine in schist from an area near Wrangell, Alaska, USA, shows a modified dodecahedral form.

PROFILE

Cubic
7–7½
4.3
None
Subconchoidal, brittle
White
Vitreous

Faceted almandine
Three faceted almandine gems and a seed pearl create a central flower motif in this antique gold brooch.

Kimyasal Formülü	$Fe_3Al_2(SiO_4)_3$

GRANAT

Kimyasal Formülü	$Mn_3Al_2(SiO_4)_3$	Kimyasal Formülü	$Ca_3Al_2(SiO_4)_3$

Spessartine crystals
In this specimen from Norway, well-formed dodecahedral crystals encrust a rock matrix.

PROFILE

Cubic
7–7 ½
4.2
None
Concholdal, brittle
White
Vitreous

Octagonal step cut
Because of spessartine's rich color, the liquid inclusions under the edge facets in this gem are not very noticeable.

Bonewitz, R. L. (2012)

PROFILE

Cubic
6 ½–7
3.6
None
Concholdal
White
Vitreous

Grossular on diopside
These grossular crystals from Piedmont, Italy, are set on a matrix of diopside.

Grossular beads
This strung group is made up of size-graded, round, luminescent green grossular beads.

MERCAN

Kimyasal Formülü	$CaCO_3$

PROFILE


Trigonal


Orthorhombic

Amorphous

3½

2.6–2.7

None

Hackly

White

Dull to vitreous

Red coral
The use of red coral dates back to the Iron Age. This specimen from the Mediterranean has a wood-grain pattern on its branches.

Bonewitz, R. L. (2012)

VARIANTS

Blue coral
A type of coral used in artifacts and jewelry

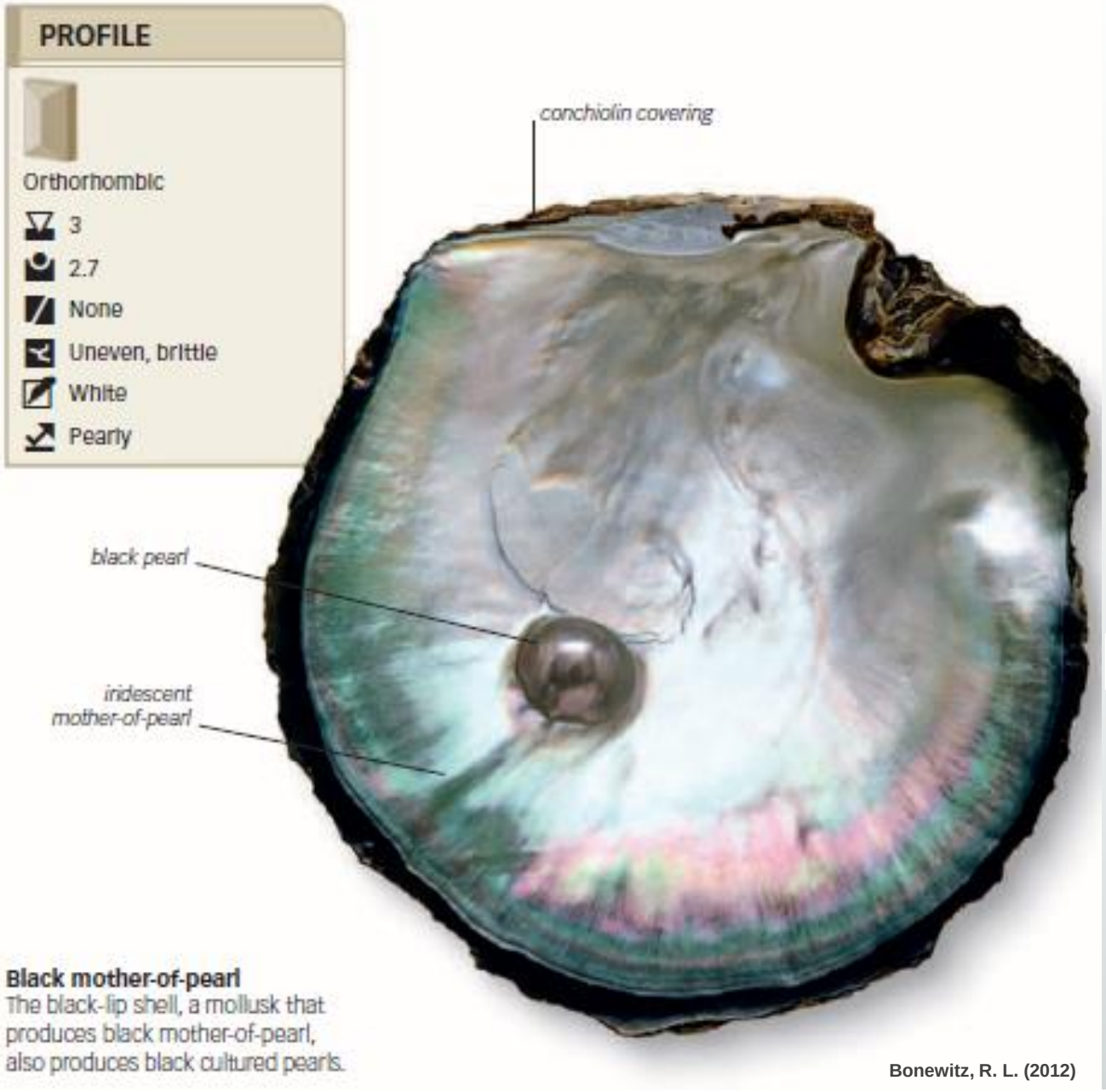
Black coral
A variant that is polished to make jewelry

Brain coral
An elaborate confection of organic aragonite

Coral necklace
This triple-stranded necklace from Morocco is made of coral, silver, and turquoise.

İNCİ

Kimyasal Formülü	$CaCO_3$



Black mother-of-pearl
The black-lip shell, a mollusk that produces black mother-of-pearl, also produces black cultured pearls.

Bonewitz, R. L. (2012)

Pearl bracelet
This Cartier Art Deco bracelet has five strands of cultured pearls with a gold and oxidized-silver clasp.

KAVKI

PROFILE

Hexagonal Orthorhombic

Amorphous

2½

About 1.3

None

Concholdal

White

Dull to vitreous

Abalone shell
Found in warm seas, abalone shells, such as this one from New Zealand, are noted for their multicolored, iridescent, mother-of-pearl lining.

Bonewitz, R. L. (2012)

Kimyasal Formülü	$CaCO_3$

Shell perfume bottle
This 19th-century perfume bottle is made of two shells glued together. It has a chain, ring, and pinchbeck stopper.

REÇİNE

PROFILE

Crystal system None
2–2½
About 1.1
None
Conchoidal
White
Resinous

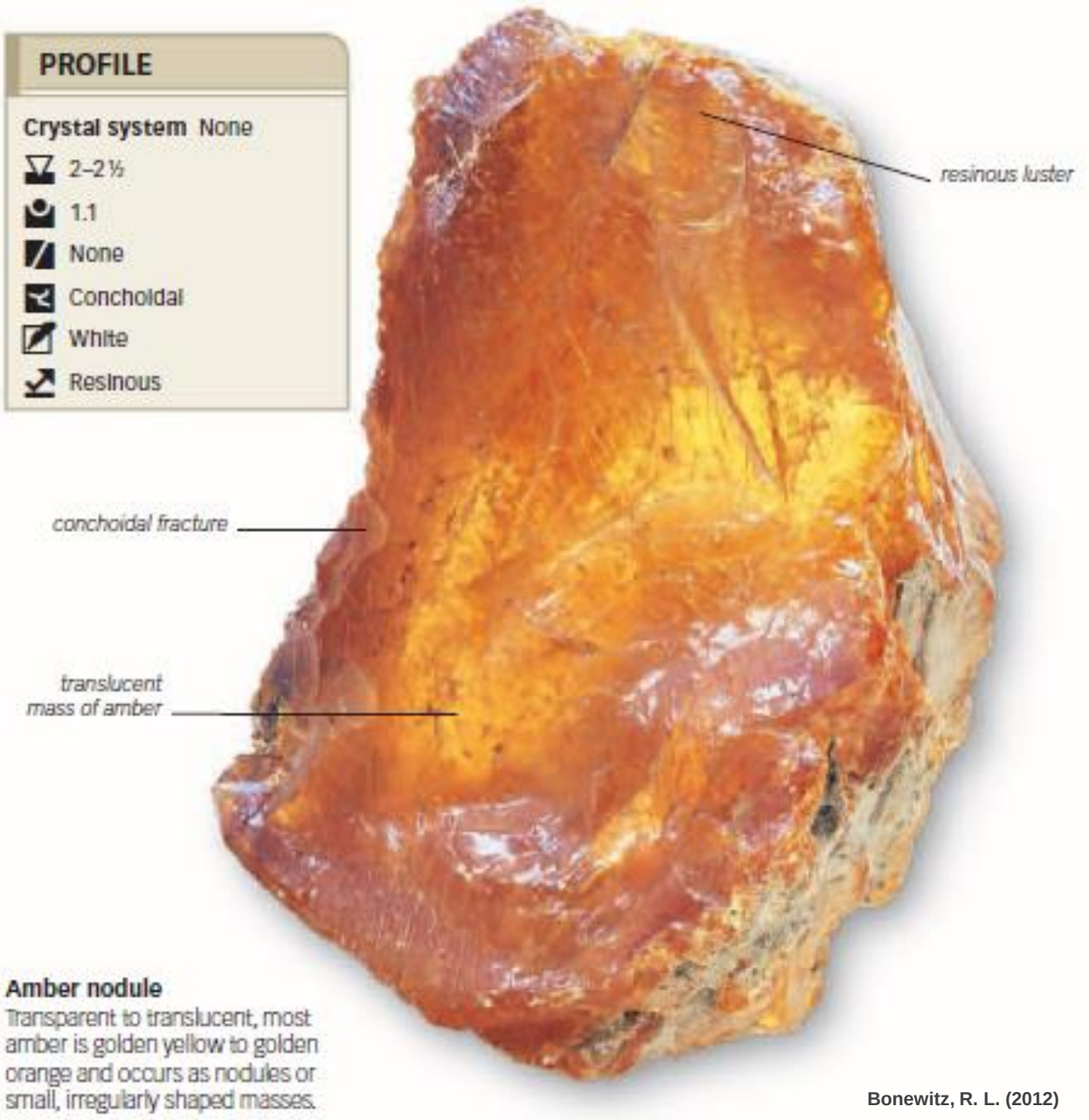
Copal nugget
This specimen of copal closely resembles amber. Some copal is used as an amber substitute in jewelry.

Bonewitz, R. L. (2012)

Copal beads
In this necklace, beads of a tough and compact form of copal alternate with beads carved from seeds.

KEHRİBAR

Kimyasal Formülü	C, H, O



Bonewitz, R. L. (2012)

OLTU TAŞI

PROFILE

Crystal system None

- 2½
- About 1.3
- None
- Concholdal
- Black to dark brown
- Velvety, vitreous, or waxy

Woody structure
This specimen of jet shows the layered, woody structure that is sometimes characteristic of the mineral.

Jet necklace
This Native American necklace is made of high-quality, fine-grained jet, which shows velvety luster.

Bonewitz, R. L. (2012)

Referanslar

Deniz, K. and Kadıoğlu, Y. K., 2015. FTIR, CRS and LA-ICP-MS Characteristics of Different Coloured Fluorites from Central Anatolia (CAF), Turkey. 12th International Congress for Applied Mineralogy (ICAM2015), İstanbul-Türkiye.

Kabakcı, B., Deniz, K., Kılıç, C.Ö., Güllü, B., 2012. Fluorit Oluşumunda Alkali Magmatik Kayaların Önemi: İç Anadolu'dan Örnekler, Uluslararası Katılımlı V. Ulusal Jeokimya Sempozyumu, Denizli-Türkiye.

Kadıoğlu, Y. K., Dilek, Y. and Foland, K. A., 2006. Slab break-off and syncollisional origin of the Late Cretaceous magmatism in the Central Anatolian crystalline compleks, Geological Society of America, special paper 409, 381-415.

Kadıoğlu, Y. K. ve Deniz, K. 2015. Orta Anadolu Fluoritlerinin (OAF) Kökeni: NTE ve Sr İzotop Jeokimyası, Türkiye. Doğu Anadolu Jeoloji Sempozyumu, Van-Türkiye.

Şaşmaz, A. and Yavuz, F., 2007. REE geochemistry and fluid-inclusion studies of fluorite deposits from the Yaylagözü area (Yıldızeli-Sivas) in Central Turkey, N. Jb. Miner. Abh., 183, 2, 215–226.

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- https://crystal-cure.com
- http://www.old-earth.com/
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- https://www.etsy.com
- https://www.tumblr.com
- http://www.dhgate.com
- https://www.etsy.com/
- http://www.amazon.com

REFERANSLAR

- Alpaslan, M. 1993. Yıldızeli yöresi metamorfitlerinin petrolojik incelenmesi. – Cumhuriyet Üniversitesi Fen Bilimleri Enstitüsü Doktora Tezi, 359 sayfa.
- Evensen, N. M., Hamilton, P. J., O'nions, R. K. 1978. Rare Earth Abundances in Chondritic Meteorites. Geochim. Cosmochim Acta 42, 1199–1212.
- Karabulut, Ü. 2008. Orta Anadolu Florit Provensi (OAFP) Florit Yataklarının Sınıflandırılması ve Cevherleşme Potansiyeli, Dokuz Eylül Üniversitesi Fen Bilimleri Enstitüsü Yüksek Lisans Tezi, 59 sayfa.
- Koç Ş. and Reçber A. 2001. Fluid Inclusion studies and Geochemistry of Rare Earth Elements of Hydrothermal Fluorites from Pohrenk, Kırşehir, Central Turkey, ACTA Geol. Si. 75,1, 59-66.
- Möller, P., Parekh, P. P., Schneider, H.-J. 1976. The application of Tb/Ca-Tb/La abundance ratios to problems of fluorspar genesis. – Miner. Deposita 11, 111–116.
- O'Connor, P. J., Högelsberger, H., Feely, M., Rex, D. C. 1993. Fluid inclusion studies, rare-earth element chemistry and age of hydrothermal fluorite mineralization in western Ireland-a link with continental rifting? – Trans. Instn. Metall. (Sect. B: Appl. Earth Sci.). 102, B141–B148.
- Piper, D. Z. and Bau, M. 2013. Normalized Rare Earth Elements in Water, Sediments, and Wine: Identifying Sources and Environmental Redox Conditions. American Journal of Analytical Chemistry 4, 69-83 .
- Sing, R. K. 2013. FTIR Spectroscopy of Natural Fluorite from Ambadongar, Gujarat. Journal Geological Society of India 81, 215-218.
- Şaşmaz, A., Yavuz, F., Sağıroğlu, A., Akgül, B. 2005. Geochemical patterns of the Akdagmadeni (Yozgat, Central Turkey) fluorite deposits and implications. Journal of Asian Earth Sciences 24, 469–479.
- Şaşmaz, A. and Yavuz, F. 2007. REE geochemistry and fluid-inclusion studies of fluorite deposits from the Yaylagözü area (Yıldızeli-Sivas) in Central Turkey. N. Jb. Miner. Abh. 183-2, 215–226.
- Uras, Y., Yaman, S., Öner, F. 2004. İsahocalı (Kırşehir) ve Feke (Adana) Fluoritlerinde Nadir Toprak Elementi (NTE) Jeokimyası. Yerbilimleri 44-45, 125-136.
- Uras, Y. 2007 Pöhrenk (Kırşehir) Fluoit Yataklarının Kökensel İncelemesi. Çukurova Üniversitesi Fen Bilimleri Enstitüsü Doktora Tezi, 133 sayfa.