

What is 'jade'?

The words '*jade*' in the West and '*yù*' 玉 in the East have different meanings and are both rather hard to define. Both words are used to refer to materials that are beautiful, tough stones used for carvings.

The western word '*jade*' comes from the Spanish, *pedra de ijada*, "flank stone" because it was supposed to cure kidney ailments if applied to the flank or waist of the body.

Jadeite and nephrite

The two materials classed as '*jade*' in western science are *jadeite* and *nephrite*. Jadeite is a mineral name, nephrite is neither a mineral name nor a rock name – it is purely a descriptive term for a certain type of natural material. The rock made up from a majority of jadeite crystal grains is properly termed jadeitite.

Jadeite and nephrite are both natural silicate materials.

Jadeite is a pyroxene mineral $\text{Na}(\text{Al}, \text{Fe}^{3+})[\text{Si}_2\text{O}_6]$.

It is a Single Chain Silicate, in which two of the oxygens are shared in a way to make long single chains of linked SiO_4 tetrahedra.

A mixture of pyroxene minerals and other minerals produces a variety of colours.

The most vivid green jadeite is known as 'imperial jade'.

Pure jadeite is colourless.

Nephrite is composed of silicate minerals of the amphibole group which have hydroxyl 'water' in their crystal structure. These are Double Chain Silicates, in which two chains are linked together so that each tetrahedral group shares 3 of its oxygens.

These minerals range from calcium-magnesium silicate *tremolite* $\text{Ca}_2\text{Mg}_5[\text{Si}_8\text{O}_{22}](\text{OH})_2$ (pure white) to *actinolite* (green) and the iron-magnesium silicate *ferroactinolite* (dark green, almost black).

In the UK we may think of 'jade green' as a pale to mid bluish-green, maybe rather milky. However, there are many shades of green and many other colours of jades.

The major distinction of the two jade materials jadeite and nephrite from other natural ornamental materials is in their texture of interlocking mineral crystals or 'grains'. Such interlocking texture results in great *toughness*, a resistance to fracture, in the way that felt is soft yet it is tough. In nephrite jade the grains make up a fine, fibrous, felted texture which makes this jade exceptionally resistant to fracture. Jadeite has a texture of blocky crystals which are interlocking and randomly oriented, with areas of more fibrous, minute crystals in certain specimens, notably in high quality green specimens. Jadeite is also very tough, but generally less so than nephrite. Both jades are moderately hard but not notably so. Distinct from inner toughness, hardness is resistance to surface abrasion. Of the common minerals, chalcedony – polycrystalline quartz – most closely resembles jade in its toughness and other characteristics.

High quality nephrite objects have a soft lustre and their slight translucency may reveal characteristic 'jagged split' fissures. Modern jadeite objects have a more glassy lustre; they may be quite translucent and can show a granular texture. Jadeite is noticeably dense, so 'feels heavier' than equivalent pieces of nephrite and many jade simulants.

The word 'yù'.

The Roman 'Pinyin' word and Chinese symbol equivalent to the English name 'jade' are yù, 玉. In Chinese academic and historical descriptions, this term has long been used to cover many types of 'precious stone' used in carvings, such as chalcedony. It is a term which, amongst other meanings, denotes 'beautiful, precious, carved hard stone'. The term is still used in this context in museums and university departments in China. There is also the opinion in China that there are four 'true jades': jadeite, nephrite, 'new jade' (bowenite serpentine) and Dushan jade, a saussurite rock. It is only when there is a need to correlate terminology and communication in the fields of petrology, mineralogy, and gemmology, for instance, that Chinese studies and research communications in English have tended to standardize to a western approach; however, in reading about jade it is wise to keep in mind the important and well-founded Chinese viewpoints.

However, in particular, the two mineralogically distinct jade materials nephrite and jadeite, with their very similar properties, were long considered to be the same material both in China and in the west due to their similarity in texture, toughness and their overlap in colour varieties. Both jadeite and nephrite were used in ancient Central American cultures, and also for some of the rare axe heads revered by European warlords. For thousands of years the Chinese used nephrite jade along with some other similar-looking materials such as serpentine. Only from the 18th century was jadeite jade used in China.

Generally, nephrite is known as *lǎo yù* (old jade) or *bái yù* for white nephrite jade. Jadeite is often called *fei cui yù* (kingfisher jade) or more often simply *fei cui* (*fei tsui* in Hong Kong). Bowenite serpentine, a very common simulant, is known across China as *xīn yù* or 'new jade'. *Yīng yù* (hard jade) is sometimes used for jadeite and *ruǎn yù* (soft jade) for nephrite. The difference in hardness is slight, jadeite being about the hardness of quartz, nephrite slightly less hard. However, toughness is their most impressive characteristic: nephrite is tougher than jadeite and tougher than many types of steel.

Origins of jadeite and nephrite

Nephrite and *jadeite* are rare metamorphic rocks, i.e. they have been re-crystallized in the solid state under the effects of high temperature and pressure and fluid transfer.

Nephrite has two main geological origins. The paler tremolite nephrite is typically derived from magnesium-containing limestone such as dolomite, $\text{CaMg}(\text{CO}_3)_2$. The darker, green actinolite nephrite is typically associated with serpentinite, a rock composed primarily of serpentine $(\text{Mg,Fe})_3[\text{Si}_2\text{O}_5](\text{OH})_4$, an alteration product of mantle rock (peridotite).

The name nephrite refers *only* to a particular type of rock material with a texture of interlocking tremolite - actinolite mineral fibres.

White nephrite is derived from silica-rich fluids that infiltrate and alter (metasomatize) dolomite rock deposits. Under the right conditions, silica from granite and magnesium plus calcium from dolomitic limestone or magnesian marble come together to form a tough, felted mass of interlocking tremolite mineral grains. This does not happen very often geologically, which means that white or pale nephrite is a rare natural material.

Sedimentary features in the original limestone layers such as bedding or breccia (rock fragments) are sometimes preserved within nephrite jade. The silica-rich fluids are usually exuded by granite intrusions or are hydrothermal (hot water) flow through the solid rocks (hot, pressurized watery fluids can seep through solid rock very easily given geological amounts of time). The famous Hotan (Khotan or Hetian) jade, white 'mutton fat' nephrite pebbles of the Yurung-kash (White Jade River) from the Kunlun Mountains have this type of origin. Green to black nephrite forms where there is also a source of iron from ironstone or dark, iron-rich igneous rocks.

The mainly green nephrite deposits that are associated with serpentinites (e.g. in South Island New Zealand, BC in western Canada and Fengtien in Taiwan) are formed by fluid infiltration during regional metamorphism. This nephrite is made up from the amphibole minerals actinolite and ferroactinolite derived from alteration of pre-existing silica-rich rocks affected by fluids from the serpentinite rocks that were originally ocean crust.

The complex origin of jadeitite (jadeite jade rock) is still a puzzle. Jadeite is a high pressure mineral forming at depths of at least 16km but at moderate temperatures of 200 to 400°C. Lenses of this jade appear within 'scars' from collisions between the Earth's tectonic plates. As ocean plate is pushed under another plate (subducted), pressure increases with only modest rise in temperature. Jadeite probably precipitates from fluids flowing up the subduction zone and into the chilled, overlying peridotite mantle that was already converted into serpentine (serpentinite rock). The serpentinite has a relatively low density and can be uplifted during subsequent continental collisions and extruded along the band of the collision boundary, carrying any jade with it. This complete tectonic sequence is a very rare set of events geologically, which accounts for the rarity of occurrence of jadeite jade deposits. Rapid uplift also means that the jade deposits have a short geological life before being eroded away.

Kosmochlor $\text{NaCrSi}_2\text{O}_6$ is the chromium analogue of jadeite and components of this mineral and chromium-rich jadeite produce the vivid green colour in certain specimens of jadeite jade. The chromium derives from the Earth's mantle where it is a relatively common component of peridotite mantle rock. Jadeite, kosmochlor and omphacite, sodium calcium pyroxene $(\text{Ca},\text{Na})(\text{Mg},\text{Fe}^{2+},\text{Al})\text{Si}_2\text{O}_6$ form a mineral series and omphacite-rich rock forms a 'black jade' (very dark green). Rocks with various proportions of these minerals are all technically defined as fei tsui in Hong Kong.

Jadeite occurs in Myanmar, the European Alps, California, Iran, Russia and a few other parts of the world. Knowledge of the origin of the important jadeite deposits in Myanmar is still sketchy due to the chaotic topography, climate and military conflict in the area as much as to the chaotic geology. Most jadeite crystallization probably began from fluid in veins, although a partial replacement origin is possible. The jadeite deposits are now trapped in a shear zone that is part of the complex crush of crust rocks re-formed during the progress of the Indian tectonic plate into the Eurasian plate but there is some evidence that this jadeite deposit may have originated in Late Jurassic times (140-150 my), i.e. before the Indian plate pushed into the Eurasian plate.

Because nephrite and jadeite are so tough – they are the toughest of the well-known natural ornamental materials – they tend to survive well after being eroded from their primary rock source into rivers and streams. They are worn into boulders and pebbles within alluvial sands and gravels, the most resistant boulders surviving best and longest to produce relatively high-quality, unfissured material which tends therefore to be

suitable for fashioning into ornaments and jewellery. Boulders and pebbles commonly have a 'crust' or 'rind' of altered mineral which ranges from yellow through orange and brown to nearly black. Such varied colouring is frequently exploited during carving.

Top mining areas

The Polar and Kutcho mines, near Dease Lake in northern British Columbia, Canada are currently the world's major producers of green nephrite. The Hotan (Khotan, Hetian) area of NW China produces the ever more costly white nephrite jade. The Hpakan area of north Myanmar (Burma) produces by far the greatest proportion of the world's jadeite.

The art and use of jade

The texture of jade

In talking about jade and its antiquity, we are considering a range of different minerals and rock-types. These have something in common, however, although this may be impossible to pin down in a single set of scientific definitions. What the true 'jades', nephrite and jadeite, have in common despite their varied colours and transparency, not to mention different degrees of grain size, is a particular range of texture and fabric which results in a great resistance to fracture, known technically as 'toughness': it is hard to break the material (this is not the same as hardness). A related set of properties is revealed with the fashioning of jade, principally the aspect of their inner texture and their surface lustre. All these, together with desired degrees of colouring and transparency, have long been exploited with an astonishing degree of artistry, sophistication and, frequently, humour which, thankfully, flourish to this day.

The antiquity of jade working

Jade has been appreciated in China for thousands of years. It is likely that nephrite and serpentine have been fashioned in China for more than ten thousand years; the earliest written record of the Chinese character for jade is from 5000 years ago. The character for 'jade' is important in today's Chinese script, carrying connotations of purity, grace, whiteness, worship, love and care, with hundreds of nouns, phrases and idioms containing the script radical for 'jade' 玉 yù.

With its beautiful and mysterious qualities of polish, varied colours and degrees of translucency, soft lustre, great toughness and resistance to damage, jade was revered by ancient dynastic ruling classes as 'the stone of heaven' and 'the essence of heaven and earth'. On the other side of the planet, the Central American Indians also established an advanced jade culture. They believed that the stone could heal pains in the waist and kidneys, a property that the Spanish conquistadores adopted, naming the stone *piedra de ijada* 'stone of the flank', hence the European name, 'jade'.

Shang and Zhou Dynasty jades of about 1766 BC to 221 B.C. show a level of craftsmanship that is truly astounding. The greatest expressions of the quest for immortality were the jade suits that appeared around the 2nd century B.C. During the Tang Dynasty (618 - 907) jade artistry went into a period of decline. From the Sung (960 - 1279) and Ming (1368 - 1644) dynasties onward, jade artistry recovered its former grandeur thanks mainly to the emperors who used jade in official ceremonies and scholars who had studied the importance of jade in the ancient Shang and Zhou dynasty rituals. Jade pieces from the Qing imperial court (1644 - 1911) are characterized by their impressive size, neatness and symmetry.

Jadeite carving really took off in China under Emperor Qianlong (1736 – 1796 AD) who also appreciated the varied translucent colours of jadeite from Burma. Nephrite jades carved in a florid style, which originated in Hindustan in the Mughal period, began to come to China around the middle of the Qianlong Emperor's reign, and the Emperor quickly grew very fond of them. The famous Shah Jahan Cup, made in 1657 AD of pure white Hetian nephrite, is a perfect example of Mughal jade working to be seen in the V&A Museum.

Jadeite from northern Burma was imported into China in large quantities in the 19th century and became prized above all other kinds of jade.

In New Zealand, nephrite is found in the Alps of the west side of South Island. It is called *pounamu* in Maori from the Maori name for the South Island, *Te Wai Pounamu*. *Tiki* or *heitiki* are traditional ornaments created by Maori. The material they are most commonly made from is deep green nephrite; they also use bowenite serpentine, known as *tangiwai*. Maori, the Polynesian first settlers, have occupied New Zealand since about 1000 AD.

The mystery and power of jade were recognized even in the area of Britain thousands of years ago. A jade axe in the British Museum, made around 6,000 years ago, was found near Canterbury. Such jade axes are strewn across Europe; more than 140 'jade' axes are known from the British Isles, though only two have a good context - a mint condition axe from the Sweet Track on the Somerset Levels, dated to 3800 BC, and a contemporary piece from a tomb at Cairnholy, near Dumfries - they are thought to have reached Britain in the early Neolithic c. 3900 – 3800 BC. These were already ancient treasures by the time they were brought into Britain. They were shaped and polished to a mirror finish and were probably commissioned by people of high status. The jade axe would have taken many hours to shape and polish. It is unmarked and was not used for cutting as it was a luxury status symbol indicating its owner's power and prestige.

Jade is not found in Britain and this jadeite axe was made from a boulder high in the NW Italian Alps near the border with France. It was possibly traded through Brittany in France and then arrived in England as an object of ceremony or ritual. The geological signatures not only matched the Alpine mountain, but with such accuracy that the very boulder that the axe came from could be identified. And even more extraordinary, Pierre Pétrequin was able to track down a geological sibling for this axe - another jade beauty found in Dorset. Two groups of quarries (Mont Viso and Mont Beigua, Italy) were the source of this and many other axeheads that circulated throughout Western Europe during Neolithic times. The high-altitude quarries (at 2000 - 2400 m) on Mont Viso, discovered in 2003 to be ancient working sites, were only ever accessible for a few months each year. The sites have been radiocarbon-dated and this shows that jadeite, omphacite and eclogite working was at its height in the centuries around 5000 BC.

The ancient fascination with green-coloured stones is becoming easier to understand, as is the exploitation of difficult mountainous sources, as at Great Langdale, Cumbria, which could have been part of a "magic green mountain" Neolithic ideology.

A Few World Collections and Museums

The British Museum
V&A
NHM London
Fitzwilliam Museum Cambridge
Shanghai Museum
Palace Museum Taipei
The Asian Art Museum San Francisco

What is it worth? Is it real?

The Four Jades of China; the main simulants and imitations

In China Mainland there is still the opinion that the four 'true jades' are jadeite, nephrite, bowenite and Dushan jade; nevertheless the term *yù* covers many hard stones.

Dushan jade is saussurite rock from Nanyang County, Henan Province. Saussurite is an altered igneous rock made up largely of albite (sodium feldspar) and epidote or zoisite (calcium silicate minerals), with more or less chromium giving areas of green colour. Dushan jade is neither jadeite nor nephrite but is commonly accepted as a jade variety in China, as is 'new jade', bowenite. Dushan jade is varied in colour and has been carved in villages around the Dushan mountain for 7000 years. Saussurite objects are frequently sold as jade, e.g. 'jade' chopsticks in Hong Kong markets.

Bowenite serpentine, 'new jade', is mainly from Xiuyan County in Liaoning Province, NE China: *Xiuyan jade*. It is similar in appearance to pale green nephrite from the same area of China; however, it is much softer and far less tough than nephrite and, of course, much easier to carve. It varies from mid-green to pale green or yellowish green in colour, often with a slightly greasy or soapy lustre. It may show signs of powdery break-up in deep carvings due to its softness. It is usually more translucent than most true jade and often has small blebs of whitish inclusions looking like cotton wool. It should be cheap. It is very commonly sold as jade worldwide.

Green aventurine quartz, mainly from India, is very commonly sold as jade, as carvings and beads, and is frequently on sale in the UK as 'jade' in antique markets. It is quite hard and fairly tough but looks nothing like true jade under the lens, as it contains masses of flakes of green mica in a colourless quartzite groundmass. It is usually quite translucent, even transparent in small beads. Aventurine quartz has a pitted glassy surface polish, quite unlike any jade. Beware this material. It is everywhere, and most is sold as 'jade'. It is sometimes dyed a brighter green. Ordinary, more opaque quartzites of various colours, natural and dyed, are also used to simulate jades.

There are many other natural simulants of jade but these are by far the most common.

A huge variety of dyed and undyed natural and artificial jade imitations are out there waiting for you to buy them.

Of the artificial products, *glass and plastics* are made into 'jade' bangles and ornaments and sold widely but are less common and less convincing than bowenite serpentine and

aventurine quartz. You can find them in Temple Street Night Market in Hong Kong if you look hard. I have even seen glass bangle imitations of bowenite 'new jade' in Shanghai.

Dyed jadeite jades are very common and very cheap, especially in Hong Kong jade market. Low quality pale jadeite is dyed, sometime with varied colours to simulate expensive pieces, usually very crudely. Occasionally it is done very well and is hard to detect, even in a laboratory, particularly in lavender shades. But most are awful.

A-jade is the term given to untreated jadeite jade. B-jade and B+C jade are treated jadeite. 'B' means jadeite that is bleached and resin impregnated. Low-quality jadeite with brown or black mineral inclusions is treated with acid to bleach out the dark minerals. The resulting chalky-looking jadeite mass is then impregnated with synthetic resin which promotes efficient light transmission. The green colour is thereby much improved. It is less durable than untreated jadeite. B-jade is very common now and is sold freely as 'jade' in UK high Street jewellery shops, where its price is far too high for B-jade and far too low for untreated jade. Its colours look 'too good to be true'. Pay less for it and enjoy it for what it really is.

'B+C' is B jade that has also been dyed. Most of this is of truly awful quality; however, one should always be aware that very clever fakes abound, as there is a vast profit to be made by cheating.

Surface-altered modern nephrite jade carvings, treated with battery acids, alkali, etc. are sold as ancient archaeological grave goods. These can be excellent in quality, very hard to detect; these may be copied from scientific and museum photographs and sold widely to collectors and museums. Experts are confounded. Auctioneers and collectors are duped. Vast profits are made by clever Chinese. Nothing changes.

Valuation opinion and sale prices

Valuations are opinions. These change with time and trend and fashion and publicity. Modern jadeite items with good green colour and fine-grained translucency fetch exceedingly high prices, as do ancient nephrite grave goods and imperial treasures. Jadeite carvings that exploit varied colours are also expensive. Pure white 'mutton-fat' and pale green Khotan nephrite has been rapidly gaining in value as it becomes ever more scarce with over-mining.

At Sotheby's sale Spring 2010 in Hong Kong, a 1796 Qianlong nephrite seal 1.75" long sold for £7,130,000. A rare white nephrite jade inset 'magpie' box and cover, Qianlong period, estimated at £10,000-14,000 sold for £300,000 in June 2010 at Bonhams.

A modern jadeite bangle was auctioned in Hong Kong in December 2009 for HK\$3,860,000, US\$500,438. 'Imperial' green jadeite bangles of over £1m have been auctioned a number of times over the past few years.

黄金有价玉无价 huángjīn yǒu jià yù wújià one can put a price on gold, but jade is priceless.

Websites and Books

Comprehensive and accurate information on jade:
www.ruby-sapphire.com/jade_burma_part_1.htm

British Archaeology – e.g.
Green Treasures from the Magic Mountains on
www.britarch.ac.uk/ba/ba96/feat2.shtml

Plenty of jade information and news:
www.friendsofjade.org/

Asian Art Museum, San Francisco
<http://www.asianart.org/history.htm>

Chinese symbols and words
www.mdbg.net/chindict/chindict.php

Jade auctions:
www.bonhams.com/eur/home/
e.g.
www.bonhams.com/cgi-bin/public.sh/WService=wslive_pub/pubweb/publicSite.r?screen=MySearchResults&saction=search&sFreeText=jade

Sotheby's:
[//browse.sothebys.com/?q=jade](http://browse.sothebys.com/?q=jade)

Bentley and Skinner, Bond Street:
www.bentley-skinner.co.uk

<http://www.wsjade.com/>
sales and good information

<http://tenayahurst.com/geology.html>
by Tenaya Irene Hurst

Gemmological Association
www.gem-a.com

NZ nephrite:
<http://collections.tepapa.govt.nz/exhibitions/pounamu/>
<http://www.teara.govt.nz/en/pounamu-jade-or-greenstone/6>

BC nephrite:
<http://www.jademine.com/>

www.littletonandhennessy.com
Asian Art consultancy, London and New York

Some books

'The Immortal Stone' by James C S Lin, The Fitzwilliam Museum / Scala 2009 £14.95 ISBN 978-185759594-9. Chinese jades from the Neolithic to the 20th century, thus mostly about nephrite. An excellent discussion and catalogue.

'Chinese Jade' by Jessica Rawson, British Museum Press 1995 £50.00 ISBN 0-7141-1469-3. The Hotung Collection. Lots of illustrations and very good information including a chapter of geological origins. Mostly about nephrite.

Have a look on the internet for these useful books:

'Jade' - ed. Roger Keverne; Lorenz 1995. A very useful, comprehensive account of world jade, its evaluation, history, markets; a very well illustrated, valuable book. ISBN 1-85967-191-8. About £50 secondhand.

'Jade' by Cecilia Lam; Lead-on Publishing Hong Kong 2005; about £40.00 ISBN 962-86332-5-2. There are very few good books on jadeite in English. This is an excellent and comprehensive, colourful book with straightforward information on all jades, jade simulants and treatments. See <http://www.ivanhome.biz/jadebook/>

'Chinese Jade' - selected Articles from 'Orientations' magazine 1983-2003. These articles investigate the long history of jade culture in China and the superb craftsmanship it produced. A huge and varied store of good information on historical jades. See <http://www.orientations.com.hk/php/index.php>

'Chinese Jade Throughout the Ages' by Stanley Charles Nott; Batsford 1936. A nice big book to sniff out in secondhand bookshops. Treasure it if you find one. Second edition 1962 was reprinted many times. Nice to sniff out the original though.

'The World of Jade' by Gildo Fossati; Crescent 1992. Many, very good pictures; the text is somewhat less useful.

'Exhibition of Special China-Peking Arts and Crafts' by S. Manatt, K H Leung; Tamar 1st ed edition January 1979. A truly amazing collection of carvings and ornaments; jades and other materials.

Also see top auction house catalogues for special sales, such as Sotheby's 'Magnificent Jadeite Jewels', Hong Kong 29th April 1998.

Credits for information and pictures

British Museum	Bonhams
Natural History Museum London	Anna da Costa
V&A Museum	Eddie Fan
Richard Hughes	Bentley & Skinner
Pala Gems, California	W S Jade
Friends of Jade	N Mortimer, GNS Science New Zealand
Fitzwilliam Museum Cambridge	Tenaya Irene Hurst
Gemmological Association of GB(Gem-A)	Jade Mine/Jade West Resources
Sotheby's	Littleton & Hennessy Asian Art

Learn some 'precious' Chinese

The marks above vowels indicate the 'tone' of voice. The meaning of a word depends partly on the tone it is given in speech, as with chá and chā.

玉 yù jade, precious stone, gem ('down' tone)

石 shí rock / stone / stone inscription ('rising' tone)

玉石 yùshí precious stones / jade and stone

宝 bǎo treasure, jewel; precious, rare ('down-up' tone)

宝石 bǎoshí precious stone / gem

玉洁冰清 yùjiébīngqīng
clear as ice and clean as jade (idiom):
spotless / irreproachable / incorruptible

王 wáng, wàng, yù wong
king or monarch / ruler; royal / best or strongest of its type / grand / great; a surname

The symbol for jade 玉 thus shows a king with treasure in his pocket.

茶 chá tea * ('rising' tone)

晶 jīng crystal ('level' tone)

茶晶 chájīng yellow quartz / topaz

刚玉 gāngyù 'hard jade' = corundum. This is one of various Chinese terms for corundum (mineral species name for emery, ruby and sapphire)

插 chā ('level' tone) means 'insert / stick in / interfere' so be very careful to get the tone right if you want to ask for tea.