



*GAHK Fei Cui Seminar*  
*March 2013*

**A Western look  
on Fei Cui and Jadeite  
nomenclature**



presented by  
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## Introduction

Jade, since thousand of years a mythical stone appreciated in Far East and in the high cultures of native Americans, is currently again rising high and is sought after at auctions in Hong Kong and elsewhere.



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## Jade: "Piedra de ijada"

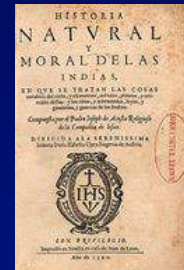
Spanish „**pedra de ijada**“ or stone of loins (deriving from the Latin word *ilia* for intestines and abdomen), based on the belief of native Indians of the Mesoamerican cultures in curing ailments of the loins and kidneys (**nephritis**, an inflammation of the kidneys) by these stones (Nicolas Monardes 1565).



Map from 1736 of mesoamerica



Copperplate engraving by Thomas de Bry (1590)



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## Jade in Mesoamerican cultures

From the Olmec civilisation (1500 BCE - 400 BCE) in Guatemala a large number of highly artistic jadeite-jade carvings and objects have been recovered by archaeological campaigns.



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## Jade in prehistoric European cultures



© Sheridan, 2007

Jadeite localities in the Italian Alps were the source of neolithic jadeite artefacts, traded throughout Europe.

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## Jade in the Far East



Jadeite bowl, Qing dynasty  
Photo © www.cultural-china.com

Jade has always been a material to represent status and was considered the "Imperial Gem" from the earliest Chinese dynasties to the present. By its durability, the possibility to be carved in delicate designs and by its mere beauty, jade has become connoted with divine qualities, such as protection, longevity, health and luck in Asian cultures up to the present day (Jones 2004).

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## Fei Cui, 翡翠

In China, the term „Yù“ 玉 - literally „*the most beautiful stone*“ – was used to describe jade, but also other hard material such as chalcedony and marble that was carved into tools and ceremonial objects since Neolithic times.

In the Chinese understanding, the term jade historically was separated into the terms Ying Yù (hard jade), mostly equal with pyroxenitic jade (also known as “*Fei Cui*” 翡翠) and Ruan Yù (soft jade), which apart from nephrite also included minerals of the serpentine group (Xiù Yù jade, Henan) (Krzemnicki 2008) and even marbles (Lantian jade, Yuchuan quarry in the Shaanxi Province).



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Emperor Qianlong (1711 – 1799), the sixth Emperor of the Qing Dynasty, had a great appreciation for Burmese jadeite-jade because of its beauty and qualities.

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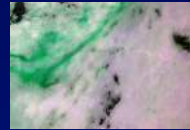


# Nomenclature

➔ Mineral nomenclature:  
 - jadeite, omphacite, kosmochlore etc. of pyroxene group  
 - tremolite, actinolite etc. of amphibole group  
 through IMA International Mineralogical Association



➔ Rock nomenclature:  
 - jadeitite, omphacitite, amphibolite, serpentine etc.  
 through IUGS International Union of Geological Sciences



➔ Gem trade nomenclature:  
 - Jade, Fei Cui  
 through CIBJO, HOKLAS ISO etc.

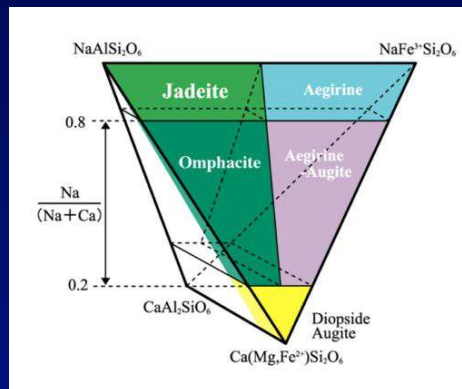


# Mineralogical nomenclature

Pyroxene nomenclature: Morimoto et al. 1988



Mineral names	Composition as end-member	Main composition as solid solution
I. Mg-Fe pyroxenes		
1. enstatite (En) (1)	MgSi <sub>2</sub> O <sub>6</sub>	(Mg,Fe) <sub>2</sub> Si <sub>2</sub> O <sub>6</sub>
2. ferrosilite (Fs) (2)	Fe <sub>2</sub> Si <sub>2</sub> O <sub>6</sub>	
3. clinoenstatite		(Mg,Fe) <sub>2</sub> Si <sub>2</sub> O <sub>6</sub>
4. clinoferrosilite		(Mg,Fe,Ca) <sub>2</sub> Si <sub>2</sub> O <sub>6</sub>
5. pigeonite		(Mg,Fe,Ca) <sub>2</sub> Si <sub>2</sub> O <sub>6</sub>
II. Mn-Mg pyroxenes		
6. diopside (Di) (4)	CaMgSi <sub>2</sub> O <sub>6</sub>	(Mn,Mg)MgSi <sub>2</sub> O <sub>6</sub>
7. hedenbergite (Hd) (5)	CaFe <sup>2+</sup> Si <sub>2</sub> O <sub>6</sub>	(Mn,Mg)MgSi <sub>2</sub> O <sub>6</sub>
III. Ca pyroxenes		
8. diopside (Di) (4)	CaMgSi <sub>2</sub> O <sub>6</sub>	Ca(Mg,Fe)Si <sub>2</sub> O <sub>6</sub>
9. hedenbergite (Hd) (5)	CaFe <sup>2+</sup> Si <sub>2</sub> O <sub>6</sub>	(Ca,Mg,Fe) <sub>2</sub> Si <sub>2</sub> O <sub>6</sub>
10. augite		(Ca,Mg,Fe) <sub>2</sub> Si <sub>2</sub> O <sub>6</sub>
11. johannsenite (Jo) (6)	CaMnSi <sub>2</sub> O <sub>6</sub>	
12. petedunnite (Pe) (7) <sup>1</sup>	CaZnSi <sub>2</sub> O <sub>6</sub>	
13. esenite (Es) (8) <sup>2</sup>	CaFe <sup>3+</sup> AlSi <sub>2</sub> O <sub>6</sub>	
IV. Ca-Na pyroxenes		
14. omphacite		(Ca,Na)(R <sup>2+</sup> ,Al)Si <sub>2</sub> O <sub>6</sub>
15. aegirine-augite		(Ca,Na)(R <sup>2+</sup> ,Fe <sup>3+</sup> )Si <sub>2</sub> O <sub>6</sub>
V. Na pyroxenes		
16. jadeite (Jd) (9)	NaAlSi <sub>3</sub> O <sub>6</sub>	Na(Al,Fe <sup>3+</sup> )Si <sub>3</sub> O <sub>6</sub>
17. aegirine (Ae) (10)	NaFe <sup>3+</sup> Si <sub>3</sub> O <sub>6</sub>	
18. kosmochlor (Ks) (11)	NaCr <sup>3+</sup> Si <sub>3</sub> O <sub>6</sub>	
19. jervisite (Jv) (12) <sup>3</sup>	NaSc <sup>3+</sup> Si <sub>3</sub> O <sub>6</sub>	
VI. Li pyroxene		
20. spodumene (Sp) (13)	LiAlSi <sub>3</sub> O <sub>6</sub>	



adapted from Morimoto et al. 1988



# Jadeite, Kosmochlor and Omphacite



Kosmochlor is dark green to nearly black.

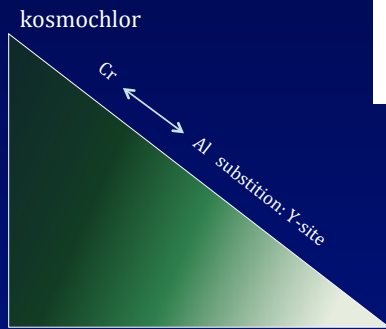
	omphacite	jadeite	kosmochlor
	wt%	wt%	wt%
Na2O	7.05	14.95	13.3
CaO	12.45	0.35	0.83
MgO	8.01	0.17	0.55
Al2O3	12.74	24.52	4.01
Cr2O3	nd	nd	27.6
Fe2O3	0.88	0.41	0
FeO	1.64	0.18	0.91
MnO	0	0.03	0.04
TiO2	0.38	0.08	0.02
SiO2	56.02	59.06	52.3
total	99.17	99.85	99.56

data from Deer, Howie & Zussman 1996 (2nd edition)

The colour of omphacite is mainly depending on the Fe content ( $\pm$  Cr) and is often greyish green.



omphacite



ideal stoichiometry:  $XYZ_2O_6$



jadeite

Chemically pure jadeite is colourless (or white).

Ca  $\longleftrightarrow$  Na substitution on X-site, coupled with Mg, Fe  $\longleftrightarrow$  Al substitution on Y-site

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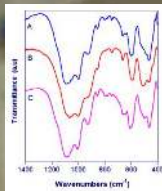
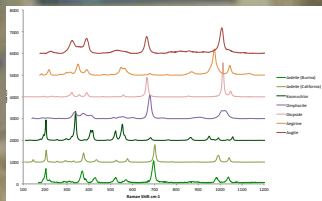


Figure 7: Infrared spectra of a sample of jadeite (A), a natural jadeite (B) and a green-white jadeite (C).

FTIR spectra of jadeite  
© Shurvell et al. 2004



© M.S. Krzemiński with data from RUFF Raman database



Mineral identification by chemical analysis (e.g. EMP) and structural analysis (XRD, FTIR, Raman)

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## Rock Nomenclature

The name of a rock is very much dependent of the mineral phases present its texture, but also its formation regime (igneous, metamorphic, sedimentary).

Rocks consisting predominatly of one mineral species (or mineral group) are usually called with the name of the main mineral and an additional -ite ending, e.g. jadeitite, omphacitite, pyroxenite, amphibolite, serpentinite



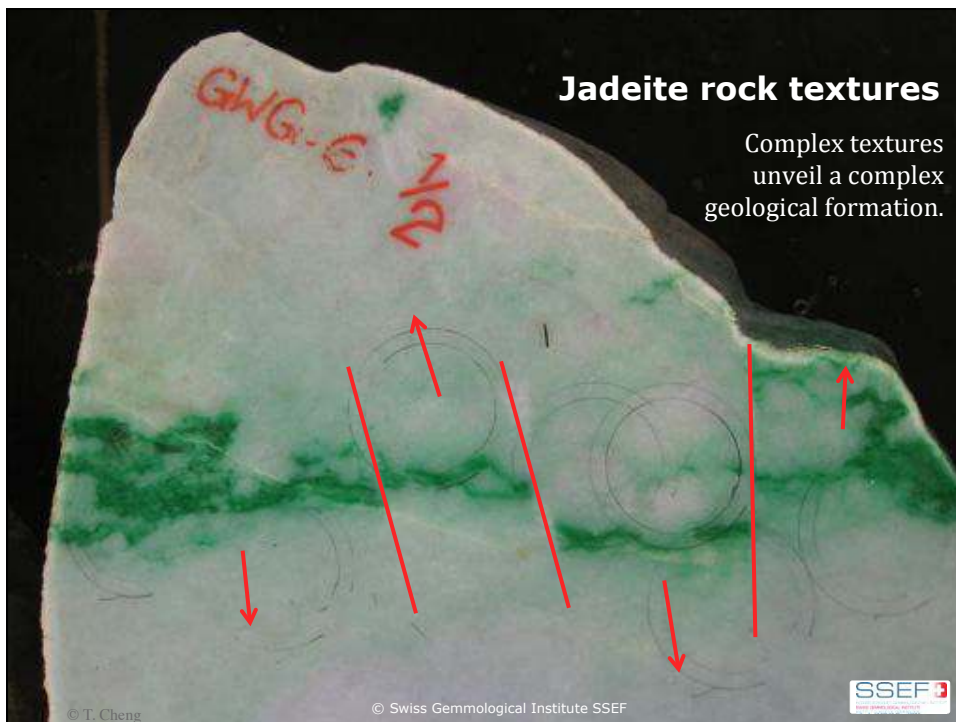
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## Jadeite rock textures

Complex textures unveil a complex geological formation.



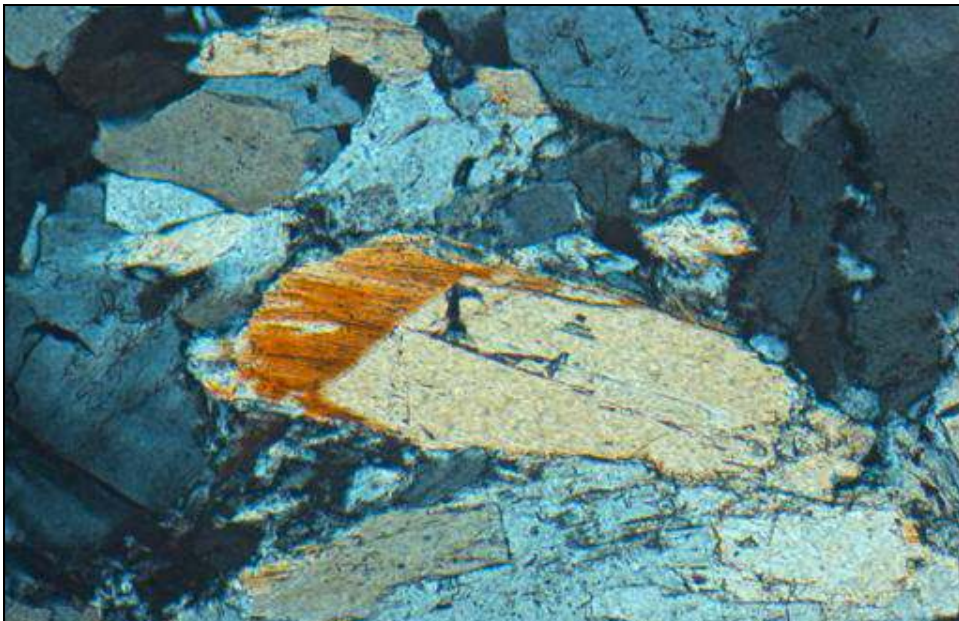
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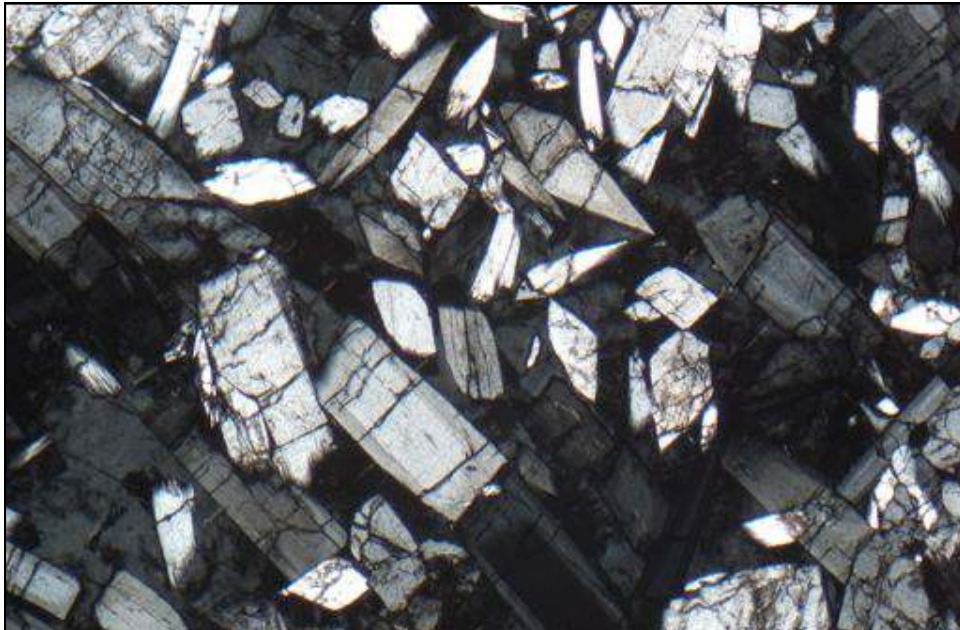
Black chromite grain with fibrous kosmochlor (green) and surrounded by fine granular colourless jadeite and greenish larger richterite (amphibole) formed during retrograde Ca-supply. Photo © L. Franz, University Basel



Jadeite grain with brownish omphacite ongrowth (Ca metasomatism) in jadeite-jade from Kazakhstan. Photo with crossed polarizers. © K. Ernst, University Basel







Prismatic jadeites with distinct zoning in crisscross microstructure characteristic for white granular jadeite-jade. Photo of a sample from Kazakhstan, with crossed polarizers.  
© K. Ernst, University Basel



## Gemtrade Nomenclature



*CIBJO:*  
*The World Jewellery Confederation*

### Jade

is a general term describing two different minerals (jadeite and nephrite) in their massive form, as polycrystalline, quasi-monomineralic rocks. The term jade is usually used as a suffix after the mineral name.



*HOKLAS*  
*The Hong Kong Laboratory Accreditation Scheme (ISO 17025; 2006)*

### Fei Cui 翡翠

is a granular to fibrous polycrystalline aggregate. It is composed of **jadeite** as major mineral. It may consist of other minor minerals such as omphacite, kosmochlor, amphibole and feldspar.

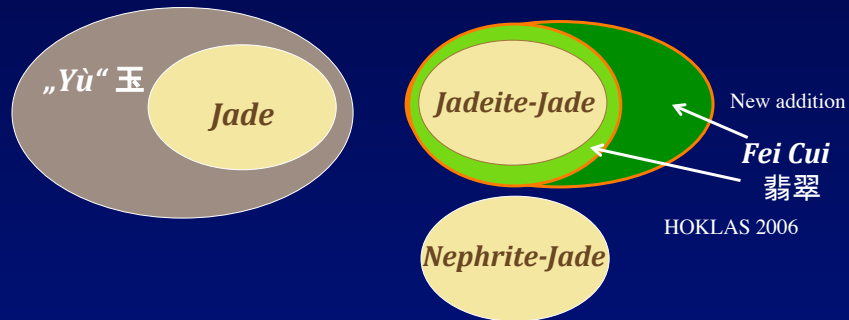
**New addition 2013** to include omphacite- and kosmochlor-jade into the Fei Cui definition (GAHK)

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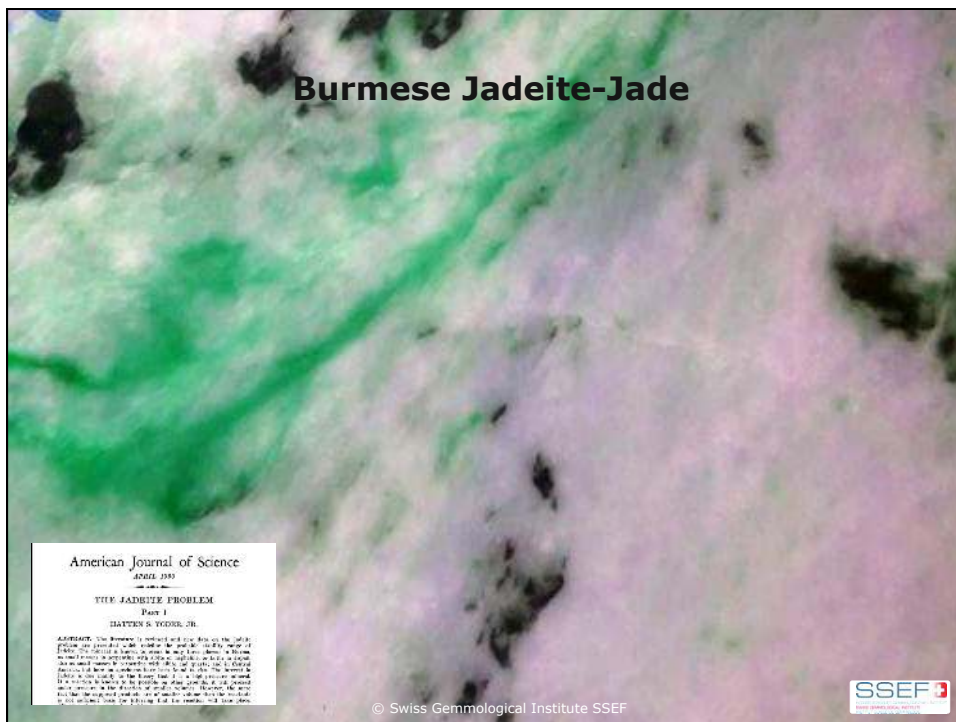
## Gemtrade nomenclature

Based on historic references, the Chinese understanding of terms for jade is not equal to the Western understanding.



Despite all differences, common understanding is, that jade is a polycrystalline aggregate made of fine and very densely interwoven mineral grains or fibres, thus resulting in its outstanding workable properties.

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## Personal view on Fei Cui & Jade nomenclature

- Fei Cui and Jade are trade names and as such can and have been defined and adapted after the needs of the gem community (CIBJO, HOKLAS).
- Adding now omphacite and kosmochlor to the term Fei Cui demands clear definitions of where to put the limits to the numerous other pyroxene minerals not to be included in this term.
- When using the term Fei Cui, it is in my opinion mandatory to add **always** the mineralogical identity - i.e. jadeite-jade, kosmochlor-jade and omphacite-jade – on all commercial and non-commercial documents.
- The term Fei Cui probably will not be easily adapted in the western trade community. But as long as the mineralogical identification (e.g. jadeite-jade) is added to the term Fei Cui, there will be however an easy understanding and harmonization possible between these different cultures.
- Fei Cui (jade) is often chemically and structurally complex. Furthermore, extensive chemical miscibility and retrograde transformations may complicate the situation. Adapted and standardised testing procedures using sophisticated analytical instruments are mandatory for a correct identification.
- The analysis of the chemical composition is in our western (SSEF) understanding mandatory for identification.

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