



View of Yaowarat Road,
the main road of
Bangkok's Chinatown.
Photo by M. Chuewong.

THE STUDY OF FIVE

JADE IMITATIONS FROM BANGKOK'S YAOWARAT ROAD

Montira Seneewong-Na-Ayutthaya PhD FGA examines five samples from Bangkok's Chinatown to identify materials that are commonly used to imitate jade.

Bangkok's Chinatown is in the city's Samphanthawong district; its main street is called Yaowarat Road. Officially built by King Rama V of the Chakri Dynasty in 1891, the area known as Yaowarat Road has been important for Thai Chinese communities since they moved from their old site, at the location of the current Grand Palace, in the late eighteenth century.

The path of Yaowarat Road is said to be like the curvy body of a dragon, making it an auspicious location for business. Vendors sell all types of goods, including but not limited to gold and jewellery, souvenirs and antiques. The most prominent jewellery pieces found in Bangkok's Chinatown use gold and jade, both of which are very important to Chinese culture. There is a Chinese

saying that goes, "Gold has a value; jade is invaluable" (Roy, 2007; Tourism Authority of Thailand, 2020).

Jade, called *yu* in China, is a valuable gemstone linked to immortality, as well as good luck, benevolence, purity and enhanced intelligence. It is used as an ornament and in jewellery. There are two types of jade, jadeite and nephrite and jadeite, referred to in Thailand



Rings with Burmese imperial jadeite. Photo by mj0007, courtesy of iStock.

as 'Chinese jade', and 'Burmese jade', respectively. Jadeite is also called 'Fei cui'; it is a sodium aluminium iron silicate $[\text{Na}(\text{Al}, \text{Fe})\text{Si}_2\text{O}_6]$ and the structure is an arrangement of grainy crystals. It has a refractive index (RI) of 1.66; its specific gravity (SG) is 3.24-3.43. Nephrite is a calcium magnesium iron silicate $[\text{Ca}_2(\text{Mg}, \text{Fe})_5\text{Si}_8\text{O}_{22}(\text{OH})_2]$ that is made up of fibrous crystals that interlock in a matted texture. Nephrite has a lower RI, at 1.62, and an SG of 2.95. Nephrite is slightly softer than jadeite and tends to have a resinous lustre, while jadeite is more vitreous. Jadeite is found a wider range of colours, including green, lavender, yellow, white and black. Nephrite colours range from mid to dark green or grey-green, white, yellowish green and reddish brown. Most jadeite jade in the market is from Myanmar (Burma), while the nephrite jade is from China (J.M. Hobbs, 1982; Hughes, 2000; Franz et al., 2014; Usavagovitwong, 2013; Zeitlyn, 2018).

Jade jewellery is very popular; it is also expensive. It has therefore given rise to many imitations; especially jadeite, which is counterfeited because of its value and rarity. Jadeite imitations can be made from any material regardless of whether it is natural or fabricated. Minerals and materials used to imitate jadeite include nephrite, green chalcedony (chrysoprase), quartzite, green dyed quartz, aventurine quartz, green glass, albite, prehnite, serpentine and green garnet (Tan et al., 2003; Gem-A, 2008).

The identification of natural jade, and disclosure of treatments and imitations, is vital in the gem and jewellery industry. With study and careful practice, jadeite and nephrite can be expeditiously



Bracelet set with Burmese imperial jadeite. Photo by mj0007, courtesy of iStock.

separated, both from each other and from their imitations. Initial observation of the external appearance is performed with a 10× loupe. Through the loupe the observer can examine colour, surface lustre, texture and fractures. After that, gemmological instruments (both basic and advanced) are used to classify the material and to determine whether it has been subject to any treatment.

SAMPLES AND BASIC TESTING

Many jade imitations can be found on Yaowarat Road. For this study, five samples, all advertised as jade, were purchased from the jewellery shops in the Yaowarat Road area. All proved to be jade imitations. Sample details and basic instrument testing are provided in Table 1. SG and RI were collected to identify →

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Five samples, identified by sellers as jade, purchased from Yaowarat Road for testing Photo by M. Seneewong-Na-Ayutthaya.

Sample	Cut/Shape	Weight (ct)	SG	RI	UV Radiation Testing	
					LWUV	SWUV
A	Cabochon (small)	9.60	2.589	1.540	Chalky green	Chalky green
B	Cabochon (large)	10.71	2.653	1.545	Inert	Inert
C	Ring	36.34	2.639	1.530	Inert	Inert
D	Donut-shaped pendant	26.58	2.605	1.540	Chalky green	Chalky green
E	Carved Buddha pendant	19.86	2.252	1.480	Inert	Inert

Table 1: Gemmological properties of five jade imitation samples from Yaowarat Road, Bangkok, Thailand.

the material used to imitate the jade. Samples A, B, C and D are crystalline-quartz or quartzite (SG \approx 2.59 – 2.63, RI = 1.552 – 1.554), while sample E is a green glass, likely an artificial glass (SG \approx 2.30, RI = 1.50 – 1.70). Samples A and B showed strong fluorescence in a chalky-green colour under long-wave ultraviolet

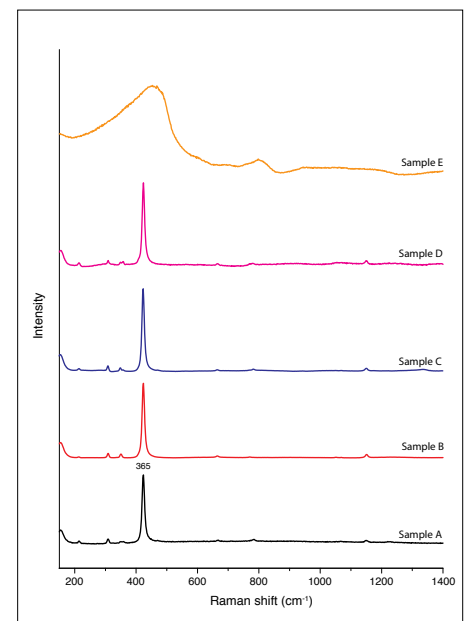
(LWUV) and short-wave ultraviolet (SWUV) testing, which may indicate trace resin or polymer filling in the specimens.

The microscopic appearance of the five jade imitation samples was then compared to natural jadeite. There is a fibrous appearance to jade imitation samples A, B, C and D; the

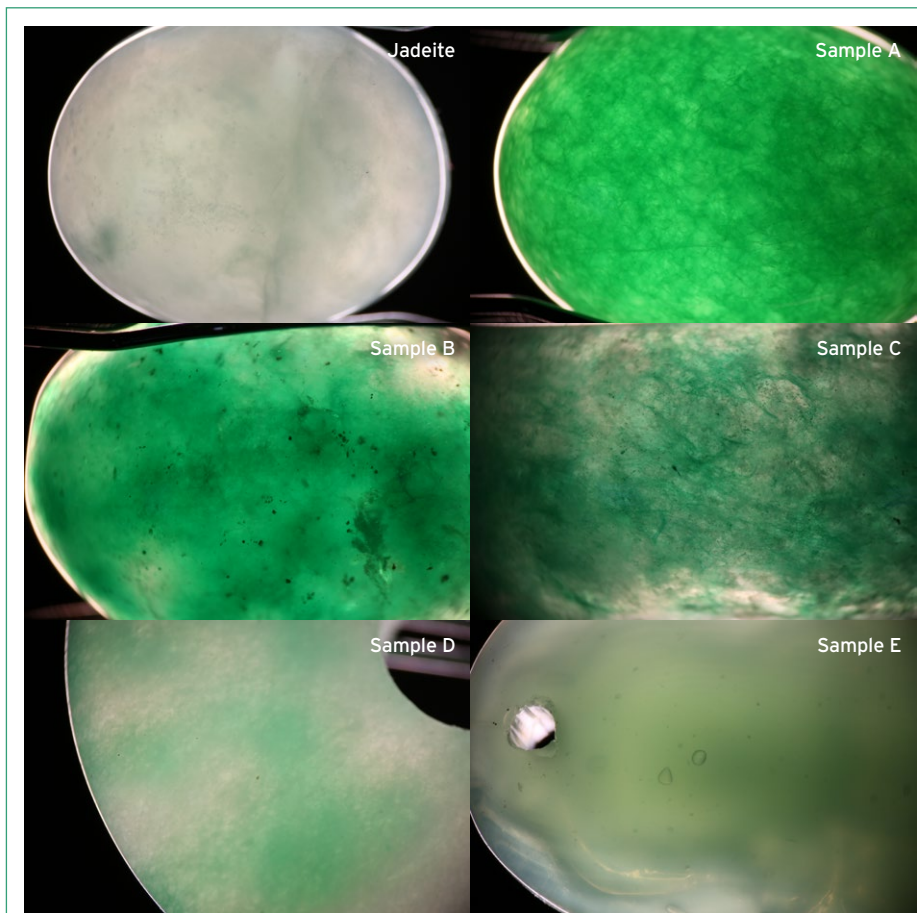
microscopic analysis also revealed green-colour concentrations between grains, indicating the presence of dye. In natural jadeite, the green area had a smoother, more consistent pale-green colour. Pale quartzite may also be dyed, usually green or other colours, with or without resin treatment. Gas bubble inclusions were found in jade imitation sample E, which could be a sign of an artificial (manufactured) glass. The samples were then ready for more advanced analysis.

ADVANCED INSTRUMENT TESTING

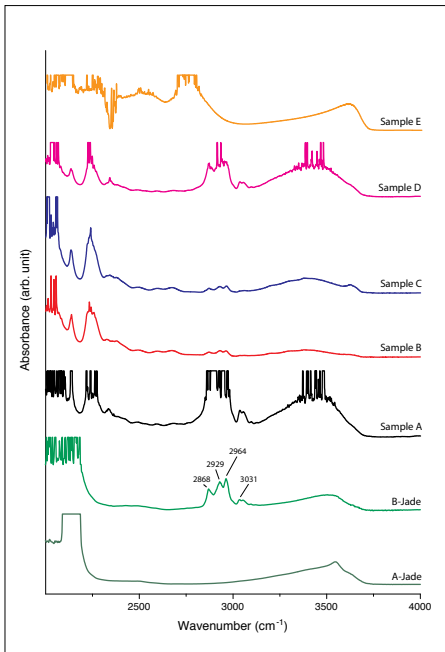
Raman Spectroscopy. The jade imitations were subjected to Raman spectroscopy, using a Renishaw inVia Raman microscope, to confirm the actual material used. Samples A, B, C and D were identified as quartzite by comparing with known spectra (Bauar, 2018). Quartzite is a polycrystalline species of the quartz group, one that has a granular structure. It is a fairly common jade imitation. Quartzite may be used to imitate white or yellow jade, or it may be dyed green to imitate high-grade jadeite. Lastly, sample E was confirmed to be a manufactured glass with an amorphous structure; this is a popular choice to imitate natural jade due to its inexpensive price point.



Raman spectra of jade imitation samples also identified samples A, B, C and D as quartzite, and sample E as an artificial (manufactured) glass.



Natural jadeite and jade imitation samples under a microscope (magnified 10x). The differences between the natural jadeite and between the five imitations can be seen. Photomicrographs by M. Seneewong-Na-Ayutthaya.



FTIR spectra of type A jade, type B jade and the five jade imitation samples. These peaks demonstrate that the type B jade and samples A, B, C and D were all subject to polymer impregnation.

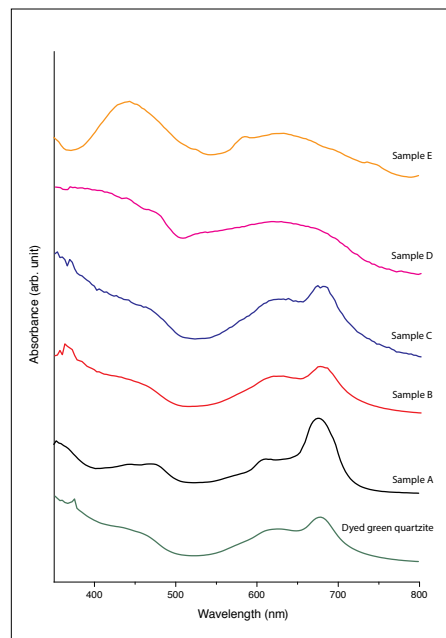
Fourier-Transform Infrared Spectroscopy.

Polymer treatment is used to enhance the durability and translucency of jade imitation. Fourier-transform infrared (FTIR) spectroscopy provides an excellent tool for analysing the polymer treatment in imitation jade samples. FTIR spectra of type A jade (natural, or polished with wax only), type B jade (bleached with acid before polymer resin impregnation) and jade imitation samples were taken using the Thermo Scientific Nicolet IS50 Spectrometer. The result showed that the type B jade has a large peak located in the aliphatic hydrocarbon region at 2868, 2929, 2964 and 3031 cm^{-1} , indicating the presence of polymer, wax or epoxy resin (Fritsch et al., 1992; Promdee & Wongkokug, 2014). Peaks in the aliphatic hydrocarbon region were also found in the spectra of samples A, B, C, and D, indicating that the polymer was found in the jade imitation samples. Samples A and D have strong polymer peaks that indicated a larger amount of polymer. The presence of polymer would account for the appearance of the chalky-green colour under UV radiation testing.

Ultraviolet/Visible/Near-Infrared Testing.

Ultraviolet/visible/near-infrared (UV-Vis-NIR) analysis has been used to reveal the colour treatment in jade

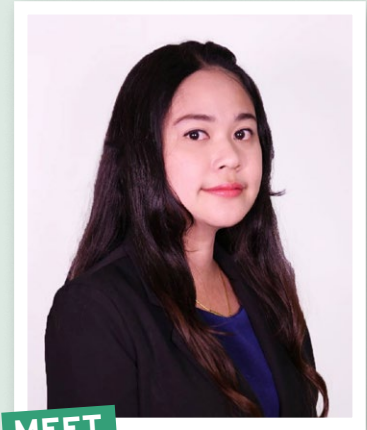
imitation, most notably by dyeing. Jade imitations are often dyed to look like natural jade. UV-Vis-NIR absorbance spectra were taken of a dyed green quartzite and the jade imitation samples using a PerkinElmer LAMBDA 1050 Spectrophotometer. The absorption bands of the jade imitation samples were then compared with the dyed green quartzite. Samples A, B and C are shown the same absorbance spectra as the dyed green quartzite. Sample E showed a green glass absorbance spectrum pattern (Liu et al., 2009). The results of this study indicate that most of the jade imitations obtained from Yaowarat Road for this study were dyed green quartzite.



UV-Vis-NIR spectrum of dyed green quartzite and jade imitation samples. Samples A, B, C and D showed the same absorbance as the spectrum for the dyed quartzite.

CONCLUSION

Five jade imitation samples from Bangkok's Yaowarat Road were analysed by basic techniques (specific gravity, refractive index, ultraviolet radiation and microscopic observation), then tested with advanced methods (Raman, FTIR and UV-Vis-NIR). Analysis indicated that four of the five samples are dyed green quartzite; sample E is green artificial (manufactured) glass. Dyed green quartzite is popularly used to imitate natural jade in Yaowarat Road because its appearance looks like natural jade at a cheaper price, but buyers must be aware of such imitations through disclosure. ■



MEET

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I have been working as a research scientist with The Gem and Jewelry Institute of Thailand (Public Organization), known as GIT, in Bangkok, Thailand. Because of my background is chemical engineering, I needed to acquire fundamental knowledge for conducting gemmological research. As we all know, Gem-A is well-respected around the world, and the Association's FGA programme is renowned for its in-depth scientific study of gems. Thus, I decided to obtain my Diploma in Gemmology. The FGA has helped me to enjoy this fantastic opportunity at GIT and empowered me to work and meet new challenges within in the gem and jewellery industry. Above all, I believe that the FGA will be key in raising the standards for my own research interests.

For my Diploma project, I chose to write on jade imitations. Most jade jewellery that sold on Yaowarat Road, in Bangkok's Chinatown, are jade imitations. They are made from other stones such as dyed green quartzite and green artificial glasses. This report is to educate both Thai people and tourists, and to build trust and confidence when purchasing jade and jewellery in Bangkok and beyond.

A list of references is available upon written request to the editor.