Gems & Jewellery

Autumn 2020 / Volume 29 / No. 3

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— SPECIAL ASIAN CONTINENT EDITION —

Gems&Jewellery

AUTUMN 2020

GLORIOUS IN GREEN

Pia Tonna, Chief Marketing Officer of Fuli Gemstones, explains more about the business of one of the world's foremost peridot specialists.

A SONG OF ICE AND DIAMONDS

Jane Kozenko, Head of Communications at Alrosa, speaks to *Gems&Jewellery* Editor, Sarah Jordan, about mining for diamonds in north-east Russia, one of the world's most challenging landscapes.

MASTERING JEWELLERY

Wallace Chan is internationally recognised for his innovative high jewellery techniques and breath-taking creations. Here, he speaks to *Gems&Jewellery* about the inspirations behind his jewels.

COVER PICTURE

Bright Star brooch from Wallace Chan's Forever Dancing series. The brooch is composed of titanium, yellow diamond, fancy coloured diamond, crystal, mother of pearl and a genuine butterfly specimen hermetically sealed within the jewel. Image courtesy of Wallace Chan International Limited.

Published by

Gem-A (The Gemmological Association of Great Britain)

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Registered charity no. 1109555

Gem-A is a company limited by guarantee, registered in England, number 01945780

Editor: Sarah Jordan

Deputy Editor: Olivia Gillespie

Design and Production
Zest Design +44 (0)20 7403 7596

Editorial and Advertising

For editorial enquiries, media pack and advertising rates please contact editor@gem-a.com.

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Gems&Jewellery Asia Edition 2020 Featured Contributors

1. IAN MERCER
Ian Mercer FGA is a retired geologist and gemmologist. Ian's career experience includes 25 years with the Geological Survey and serving as a Director of Education for Gem-A. Ian has also written several books about geology and was recently awarded the Halstead Medal by the Geologists' Association for outstanding merit in the promotion of geology.

2. WIM VERTRIEST
Wim Vertriest FGA GG is a Supervisor of Field Gemmology at GIA. Wim has participated in GIA Field Expeditions to numerous sapphire and ruby mining areas in Asia, Africa and Europe. He has also (co-)authored several articles on new gemstone localities, updates on existing mining localities, in-depth gemmological studies and treatment experiments.

3. FIONA HAINES
Fiona Haines FGA has a background in healthcare as an eye surgeon, but now runs her own jewellery business. Fiona completed her Gemmology Diploma with Gem-A in 2019, and afterwards undertook courses in gem faceting and rough gem grading. She now cuts her own gems which form the heart of her jewellery collection.

4. YUICHI NAKAMURA
The son of a pearl farmer, Yuichi Nakamura was born in Shima-city, Mie Prefecture, Japan, the birthplace of the cultured pearl industry. He has been conducting a pearl trading business, PJ Nakamura International, for more than 25 years and has written articles for pearl magazines in Japan.

5. TAKASHI ATSUMI
Takashi Atsumi was born in Suzuka-city, Mie Prefecture, Japan. He received a Ph.D. at Mie University Graduate School in the Faculty of Bioresources, where he studied improvement of pearl production. Atsumi works for the regional government of Mie Prefecture, where he oversees pearl cultivation at the Department of Agriculture, Forestry and Fisheries.

6. GAGAN CHOUDHARY
Gagan Choudhary FGA is Director of the Gem Testing Laboratory, Jaipur. The author of *Understanding Rough Gemstones* and *Gems & Rocks* (in Hindi), Mr. Choudhary also runs gem-passion.com. He is also an editor of the Gem News International section of GIA's *Gems and Gemology* journal.

7. RICHARD W. HUGHES
Richard W. Hughes FGA is one of the world's foremost experts on ruby and sapphire. The author of several books and over 170 articles, he has received numerous industry awards for his work. Hughes also serves on the board of directors of the Accredited Gemologists Association and on the editorial review board of *Gems and Gemology*.

8. MARYAM MASTERY SALIMI
Maryam Mastery Salimi MSc GG was born in Iran and has an educational background in geo-science. She currently works as a gemmologist in GIA's Gem Identification department. Maryam has an interest in field gemmology and has researched ancient mines in Iran, in addition to having work published in the journal, *Gems and Gemology*.

9. NATHAN RENFRO
Nathan Renfro FGA GG is the Manager of the Gem Identification department at GIA in Carlsbad, CA and is also a microscopist in the Inclusion Research Department. Mr. Renfro has authored or co-authored more than one hundred gemological articles and is a member of the editorial review board on *Gems and Gemology*.

10. JEMMA BEELEY
Jemma Beeley FGA has recently returned from Sri Lanka where she completed her Gem-A Gemmology Diploma at AGIL in Colombo, taught by Dayananda Dillimuni FGA DGemG. She immersed herself in the 'land of gems', visiting gem markets and lapidaries, and taking on work experience at Ibrahim Jewellers in Galle Fort.

11. THET TIN NYUNT
Dr Thet Tin Nyunt is the Director-General of the Department of Geological Survey and Mineral Exploration, Ministry of Natural Resources and Environmental Conservation, Myanmar. Thet has carried out research and supervision on Myanmar's famous jadeite jade and amber, as well as on ruby, sapphire, diamond, amethyst, and peridot.

12. MAY TIN ZAW WIN
May Tin Zaw Win is a Manager and Head of Gems Exploration and Research in Myanma Gems Enterprise at Myanmar's Ministry of Natural Resources and Environmental Conservation. She has experience of working on gem testing and gem identification at Myanma Gems Emporium and has carried out research on sapphire from Thabeikkyin.

13. JACK OGDEN
Dr Jack Ogden FGA is a historian whose research has focused on the history of gems and jewellery. He is a fellow of the Society of Antiquaries, current president of the Society of Jewellery Historians and Visiting Professor in Ancient Jewellery Materials and Technology at the School of Jewellery, Birmingham City University.

14. GIUSEPPE AGOZZINO
Giuseppe Agozzino is a gemstone and mineral dealer based in Genova, Italy. Agozzino has spent many years collecting minerals in Europe and Asia. His new book *KARAKORUM Inferno di rocce – Paradiso di gemme e cristalli* describes his first experiences of looking for gemstones in Pakistan.

15. ARIEL TSAI
Ariel Tsai is the Business Development Manager at PingPong Digital, an award-winning Chinese digital marketing agency based in the UK and China. As her expertise lies in the fashion and jewellery industry, Ariel is able to utilise her industry knowledge to guide clients and help them plan and execute marketing campaigns in China.

Straight from the heart

Opinion and comment from CEO, Alan Hart FGA DGA in English, Chinese Simplified and Chinese Traditional.

Welcome to this Asian continent-themed edition of *Gems&Jewellery*. During these challenging times, we have made the decision to put this special edition online for our Members. Of course, that doesn't mean there's any less to read! As usual, our magazine is packed with insightful articles, from diamond mining in northern Russia and trapiche spinel hunting in Myanmar, to peridot mining in China and mineral identification in India.

We've focused specifically on authors, contributors and topics connected to the beautifully diverse continent of Asia. While we can't cover every country, we hope this edition will inspire you to explore the gemmological riches of Asia, as well as its varied cultures and traditions. Perhaps, when travelling the world becomes an option once more, you will have new destinations to add to your wish list.

As always, our editorial team are contactable on editor@gem-a.com if you have any ideas for future articles or themed editions. I hope you enjoy reading this issue and stay safe, happy and healthy as we continue to navigate this strange 'new normal' together.

> Perhaps, when travelling the world becomes an option once more, you will have new destinations to add to your wish list.

欢迎来到这个以亚洲大陆为主题版本的宝石和珠宝。在这个充满挑战的时刻，我们决定把这个特别版发布在我们的会员网上。当然，但这并不意味着可以更少的阅读！与往常一样，我们的杂志上满是有见地的文章，从俄罗斯北部的钻石开采和缅甸的达碧兹尖晶石采掘，到中国的橄榄石开采和印度的矿物鉴定。

我们专注于与美丽多样性的亚洲大陆相关的作者，撰稿人和主题。 虽然我们无法涵盖所有国家/地区，但我们希望此版本能够启发您探索亚洲的宝石财富以及其多样的文化和传统。 也许，当旅游世界再次成为一种选择时，您将有新的目的地要增添到您的愿望清单中。

一如既往，如果您对以后的文章或主题版本有任何想法，可以通过editor@gem-a.com与我们的编辑团队联系。 希望您喜欢阅读本期杂志，并在我们继续共同探索这个陌生的"新常态"的过程中，保持安全，快乐和健康。

歡迎來到這個以亞洲大陸為主題版本的寶石和珠寶。在這個充滿挑戰的時刻，我們決定把這個特別版發佈在我們的會員網上。當然，但這並不意味著可以更少的閱讀！與往常一樣，我們的雜誌上滿是有見地的文章，從俄羅斯北部的鑽石開採和緬甸的達碧茲尖晶石採掘，到中國的橄欖石開採和印度的礦物鑑定。

我們專注于與美麗多樣性的亞洲大陸相關的作者，撰稿人和主題。 雖然我們無法涵蓋所有國家/地區，但我們希望此版本能夠啟發您探索亞洲的寶石財富以及其多樣的文化和傳統。 也許，當旅遊世界再次成為一種選擇時，您將有新的目的地要增添到您的願望清單中。

一如既往，如果您對以後的文章或主題版本有任何想法，可以通過editor@gem-a.com與我們的編輯團隊聯繫。 希望您喜歡閱讀本期雜誌，並在我們繼續共同探索這個陌生的"新常態"的過程中，保持安全，快樂和健康。

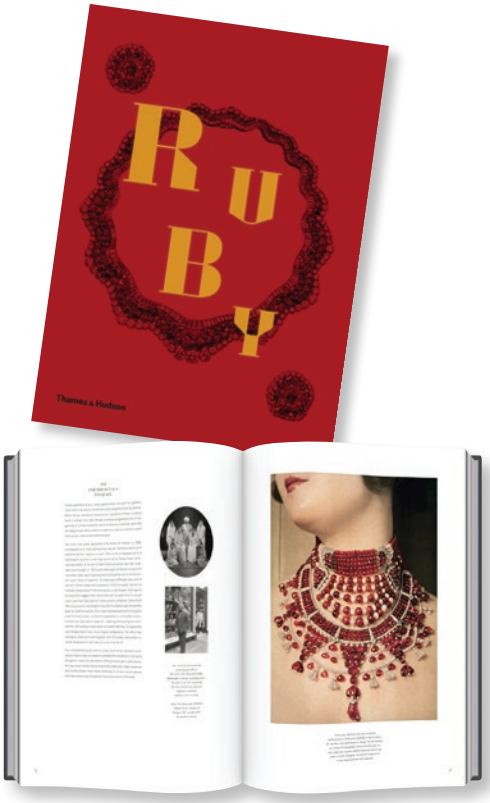
Best wishes
Alan Hart FGA DGA

Gem-A News

A round-up of the latest news from Gem-A

RUBY: THE KING OF GEMS BY JOANNA HARDY

Gem-A Instruments is excited to announce the addition of an impressive title to its selection of gemmological books: *Ruby: The King of Gems* by independent fine jewellery specialist, Joanna Hardy.



This beautifully illustrated book is packed with all the information and insights you could ever wish to know about the world of rubies, from the history of this commercially and culturally important gem, to mining localities, ruby cutting and examples of exceptional ruby jewellery designs. Throughout the pages you will learn more about significant rubies in international royal collections, as well as the iconic rubies owned by famous style icons of the past and present.

As well as glamorous photography and illustrations, *Ruby: The King of Gems* contains useful practical advice on assessing the quality of a ruby, so you can feel more confident when sourcing gemstones or purchasing a piece of ruby jewellery.

Recognisable fine jewellery houses featured in the book include Cartier, Van Cleef & Arpels and Harry Winston, among others.

Whether for yourself or as a gift, this extraordinary and eye-catching tome can take pride of place on any gemmologist's bookshelf. ■

If you require any further advice or would simply like to make a purchase, please email **instruments@gem-a.com**.

Retail Price £75.00
Current Gem-A Members and Students receive a 5% discount on books

INTRODUCING THE GEM HUB

An online educational resource for aspiring and professional gemmologists across a range of disciplines.

If you have visited the Gem-A website recently, you may have noticed a few changes. We have revamped the News & Blogs page into a brand-new Gem Hub, an online educational resource for aspiring and professional gemmologists across a range of disciplines.

On the Gem Hub you can find informative articles on a variety of gemstones and features organised in new areas named Diamond Guide, Gem Knowledge, Birthstones and Around the World. If you would like to submit an article or suggest a topic to be included on the Gem Hub, please email **editor@gem-a.com**.

To read archive issues of *Gems&Jewellery* and *The Journal of Gemmology*, you will now need to navigate through our Membership tab. This little change means all your Membership resources are now in one place.

UPDATE YOUR LINKEDIN PAGE

Gem-A Students and Graduates can now add their Gem-A qualifications or current courses to the education section of their LinkedIn profile.

Anyone who adds Gem-A courses to their profile will be automatically added to the Gem-A LinkedIn alumni group. If you would like to add your Gem-A courses to your LinkedIn profile, they should be listed as follows:

Gem-A's Gemmology Foundation – Level 4 Foundation in Gemmology

Gem-A's Gemmology Diploma – Level 6 Diploma in Gemmology

Gem-A's Diamond Diploma – Level 5 Diploma in Gem Diamond

Please remember that the post-nominals FGA and DGA are not indications of qualifications, course names or grades. These post-nominal letters indicate that a Gem-A Graduate is a Fellow of the Gemmological Association (FGA) or a Diamond Member of the Gemmological Association (DGA). Anyone wishing to use these post-nominals must be a signed-up Member of Gem-A.

GEM-A WELCOMES NEW HEAD OF FINANCE

Gem-A is pleased to welcome Michael Martin, who joined us as our new Head of Finance in July.

Michael is a Fellow member of ACCA (the Association of Chartered Certified Accountants), having qualified in 2001. He has worked with two large, nationally recognised membership bodies and is currently a serving Board Member and Treasurer for Irish Film London. Michael is excited to take up his new role and tells us that he is "looking forward to working closely with the Members, Trustees and everyone within Gem-A."

LEARN GEMMOLOGY ONLINE IN CHINESE TRADITIONAL

For the very first time, Gem-A's Gemmology Foundation ODL (online distance learning) course will be made available in Chinese Traditional.

This course will be taught by Dominic Mok FGA DGA, Founder and Principal of the Asian Gemmological Institute & Laboratory Ltd. (AGIL), which is a Gem-A ATC based in Hong Kong.

The course will commence in the Autumn 2020 term, running alongside Gem-A's next Gemmology Diploma course. If you would like further information about this course please contact **education@gem-a.com**.

AGIL ® Since 1983

GEM-A LOOKS TO THE MIDDLE EAST

GEM-A ACCREDITED TEACHING CENTRE 2020

Gem-A is delighted to announce that the Bahrain Institute for Pearls and Gemstones (DANAT) is now an Accredited Teaching Centre (ATC). DANAT is Gem-A's inaugural ATC in the Middle East, signalling an exciting future for gemmology education in the region. Read more about our new partnership with DANAT in an interview with the institute's CEO, Noora Jamsheer, on page 19.

AN UPDATE FROM ACROSS THE GLOBE

Gem-A regrets to announce the closure of our offices in Hong Kong and Japan. Our Hong Kong and Japan bases have enabled us to vastly expand Gem-A education in these countries and we will cherish the great memories, experiences and many relationships that have been formed as a result.

Looking ahead, we plan to continue providing quality gemmology education in Hong Kong and Japan for many years to come through our ATCs, GAPP Centres and many strong partnerships in both regions.

CAMBODIA

Artisanal miner shares his find in Pailin, Cambodia

Wim Vertriest FGA GG, Supervisor of Field Gemmology at GIA, shares this arresting image of a miner's calloused hand taken during a visit to the Thai-Cambodian border.

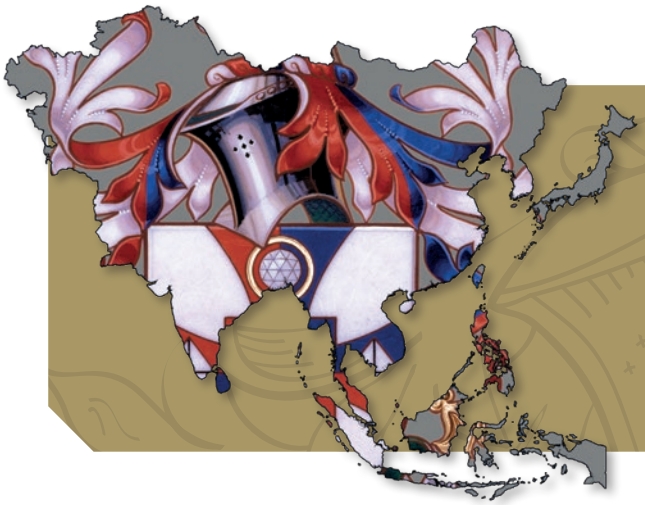
The border of Thailand and Cambodia is a famous area for gemstone mining. The centre of most trading and mining activity on the Cambodian side is a village called Pailin. Fine blue sapphires have been found here for a long time. In fact, the Thai word for blue sapphire (Ploy Pailin) can trace its roots to the name of this town!

While several mechanised gem mines stopped their operations over the past few decades, there are still several people working the alluvial deposits in the rivers surrounding the city. Miners return to the same spot every year because the river brings in a lot of sediment, gravel and gems during the rainy season, when the babbling brook transforms into a raging torrent.

These artisanal miners spend their day in the water, bringing up gravel with long shovels and washing it on portable screens. The hard work clearly leaves its marks on the miners' hands, but the rewards are often fine blue sapphires.

This photo shows the hard work and incredible amounts of energy that goes into mining gemstones. These miners are spending their time in the river, not to present some beautiful jewellery to a foreign buyer in distant lands. They work hard to provide for their families in a way that brings them pride: by mining gemstones. ■

Photography courtesy of Wim Vertriest FGA GG and GIA.



Tracing Our Roots

Ian Mercer FGA, former Director of Education at Gem-A, played a vital role in developing Gem-A education across the Asian continent in the 1990s. Here, he reflects on some of the ups and downs of growing Gem-A internationally and shares his recollections of people, places and moments in time that have stayed with him to this day.

Prior to running the Education services at Gem-A for almost 20 years, I was a geologist at the Geological Museum (part of the Geological Survey until being taken over by the Natural History Museum) in South Kensington, London. I was writing books and coordinating exhibitions for much of my 25 years with the Survey before joining Gem-A (then known as 'GAGB') in September 1990.

A few overseas teaching centres had been established over the years, each with differing agreements, such as the Barcelona, Schoonhoven (Netherlands), Japan and Hong Kong centres. Over just a very few years at the start of the 1990s an increase in overseas education output was to occupy much of my time and effort, with the extremely able assistance of Louise Macdougall.

L to R - Prof. Yan Weixuan, Ian Mercer and Mrs Mimi Ou Yang in Hong Kong, 1993

A list of ATCs on the original Gem-A website from 1997 shows that 19 centres were operating across the Far East. I ensured that all students, in the UK and overseas, had access to our teaching sets of gemstones and, eventually, to a basic kit of gem-testing instruments. I also ensured that overseas exam centres maintained a standard set of approved instruments and I inspected these whenever I could to ensure practical exam standards.

L to R – Prof. Chen Zhonghui, Ian Mercer and Prof. Yan Weixuan with an ATC class in Beijing in 1994

I set up the first Far East ATC directors' meeting, chaired by the British Council, in the Peace Hotel, on the Bund, Shanghai in March 1999. In answer to arguments put forward at this meeting, I emphasised that standard, rote-learned exam answers tended to miss the point of the question which related to varied practical situations and this had often resulted in failure, particularly in Gemmology Diploma exams: I made clear the necessity of an applied rather than rote approach to answering theory questions and a new understanding of the Gem-A approach was established with the help and support of Professor Chen Zhonghui. Other similar meetings in the Far East continued to ensure the standards and ethos of Gem-A.

The high technical standard and scientific content of our examination, together with its trade relevance, made it very attractive overseas. Our strict approach, 100-year history and international renown engendered great respect and was a prime selling attraction to potential students looking for a prestigious qualification. Examination stone sets were always different from the course sets and were separately controlled. The extremely painstaking attention to detail required for ensuring that all the different examinations take place efficiently twice per year in many centres worldwide has for long been under the supervision of Lucy Dean, upon whom so much depends.

For some years, courses and exams had been held in Hong Kong. Before 1988, Professor Yan Weixuan, the wife of the head of the China University of

L to R – Jili Qiu, Ian Mercer, Linda Anderson and Dominic Mok at the Guangzhou ATC in 1995

Geosciences in Wuhan in Hubei Province, Professor Chen Zhonghui, had set up a gemmology school in the Department of Earth Science. Prof. Yan is a long-time colleague and friend of Mrs Mimi Ou Yang Chiu Mei, President of the Hong Kong Institute of Gemmology and teaching centre in Hong Kong and a researcher of Myanmar fei cui jade. Professor Yan asked her friend Mimi which of two well-known overseas gem courses she should set up in Wuhan. Mimi approached Alan Jobbins, her research supervisor, for his opinion. He recommended that they took up the Gem-A course.

Following the Wuhan enquiry, inventor and Gem-A Education Committee member Dr Jamie Nelson, greatly assisted by his wife Doris, pioneered the first British gem course in China in 1988. Gem-A Director Dr Roger Harding travelled to the China border with Hong Kong to meet Profs. Chen and Yan to discuss the course and exam system in more detail with them: there were still travel restrictions and difficulties in non-tourist travel within China.

The Wuhan CUG Centre initially based their own course and exam directly upon that of Gem-A. Following a meeting with Mimi Ou Yang and Prof Yan Weixuan in Hong Kong in 1993, I unified the structure and contract to form the Accredited Teaching Centre (ATC) system, with separate courses and independently issued exams. Prof Chen Zhonghui, a very great and constant supporter of Gem-A and its standards, set about translating the course notes and examinations into Simplified Chinese script, ensuring that no-one, not even his wife, knew that he was the translator of the examinations. My admiration for Professor Chen and his high ethical standards and his assistance in increasing Gem-A's reach in the Far East is deep and everlasting. I was extremely sad to learn of his death shortly before I was due to visit him in 2007 in Beijing; my subsequent meeting with his wife, Professor Yan, in 2016 was a poignant but joyful reunion for both of us.

> I emphasised that standard, rote-learned exam answers tended to miss the point of the question which related to varied practical situations...

L to R - Ian Mercer, Terry Davidson, Mrs Mimi Ou Yang and Tay Thye Sun at the Hong Kong Institute of Gemmology

After Wuhan CUG linked with Gem-A, the take-up of Gem-A courses in the Far East increased dramatically. My work and travels though the 1990s and into this century extended from Hong Kong and Wuhan to Shanghai, Guilin, Beijing, Guangzhou, Taiwan, Korea, Japan and Thailand. My first visit to Hong Kong was in 1993 and I travelled into Wuhan soon afterwards. I was to witness huge changes through the years. I made about twenty Far East tours for Gem-A, sometimes more than once per year and often coinciding with gem and jewellery shows to support staff promoting Gem-A Education and attending Gem-A and local awards ceremonies. It was very important for me to understand the different cultures across the Far East. I always felt that this mutual respect was paramount in technical negotiations.

Having retired in 2008, a year earlier than I had expected, I take heart from a letter sent to me in January 2009 by Professor Alan Collins, then Chairman of the Board of Trustees. He said: "You built on the foundations of our education network to establish our global presence, and the regard in which you are held by our teaching centres around the world is just one measure of your achievements." It is my great privilege to have enjoyed such good working relationships with all Far Eastern ATC directors and staff. I miss them all. ■

All images courtesy of the author.

A JOURNEY THROUGH TIME

1960s – Gemmology and Diamond Diploma distance courses translated into Japanese.
1983 – The Association was involved in curating a library with the Gemmological Association of All Japan, in the memory of Mr T. Imai, the first tutor of the Gemmology Diploma course in Japan. The Association agreed to lend its support to the establishment of a Nepalese Gem Association in Kathmandu.
1984-85 – Collaborations with the Gemmologists Association of Sri Lanka and Singapore Gemmologists Society.
1987 – Prof. Yan Weixuan and Prof. Chen Zhonghui establish an 'Allied Teaching Centre' in Wuhan, China.
1990-2008 – Allied Teaching Centres set up throughout the Far East, with independent examination organisers aided by the British Council.
2002 – GAGB changed to Gem-A by CEO Jean-Paul van Doren.
2012 – Taiwan Gemmological Institute (TGI) named an Accredited Teaching Centre. Japan Gem Society (JGS) agrees to teach Gem-A courses at its newly formed Japan Jewelry Craft School (which took the place of the Gemmological Association of All Japan).
2020 – DANAT – the Bahrain Institute for Pearls and Gemstones becomes an ATC.

MAKING THE CUT

Jewellery Designer and Gem-A Graduate, Fiona Haines FGA, shares a memorable experience of learning to cut gemstones at the Institute of Gem Trading in Bangkok, Thailand.

Several years ago, having reached the top of my first career in medicine while marching into my forties, I had the feeling that something was still missing. I had started making jewellery as a hobby and was becoming enthralled by this whole new world, but realised that I knew nothing about gemstones. I wanted to learn, but particularly wanted to make sure that I knew enough to feel completely confident. Shortly after, having completed my Gemmology Diploma with Gem-A, I was lucky enough to win a two-week cutting and re-cutting course in a competition run by the Institute of Gem Trading (IGT), a new gem school based in Bangkok.

On the first day of class I arrived, slightly dazed from jet lag, and was welcomed into the school. IGT is located at the edge of the gem district of Bangkok. I was delighted to see that I would be learning in a small group of three with two teachers. Justin Prim is an American gem cutter and author living in Bangkok, who has trained in the USA, Thailand, Sri Lanka and Switzerland. He was supported by Sarath Chandrasiri, a Sri Lankan master cutter who has over 30 years' experience in the industry and, for the last 17 years, has been head faceter for the Yavorskyy company (**1**). Together they made a great team, with Justin leading the structured lectures, and both teachers supervising the cutting.

Over two weeks we learned the basic principles of gem cutting and put it into context with a little about the history of gem cutting in different parts of the world. We were introduced to the Sri Lankan handpiece faceting machine and worked our way through three different gemstone designs, culminating in a recut of a previously poorly cut gemstone.

1: A cutting demonstration with Sarath Chandrasiri. Photo credit: Justin K Prim.

2: Polishing the pavilion of a round brilliant cut topaz.

After just three days I was incredibly proud to have produced a round brilliant cut topaz (**2**). We then went on to complete a step cut (or two) in rhodolite garnet (**3**), and an oval mixed cut in Oregon sunstone, each of us feeling quite chuffed with ourselves on seeing the stones after a bit of a clean-up with acetone and a soft cloth (**4**). The final stone was a recut of a synthetic corundum, which was quite a challenge. It was fantastic to learn how a dull and windowed stone can be brought to life by a decent cut and careful consideration of the angles that should be applied to the crown and pavilion facets (**5**).

Over the time we spent cutting, there was lots of discussion about the reality of working as a gem cutter and how the role differs in different parts of the world. We were grateful to be welcomed into a local cutting factory where it was fascinating to see how Thai cutters work. The factory owner took time to explain the incredibly efficient process, where different individuals were assigned to different steps. The speed at which the cutters worked was phenomenal, and the machines they used quite different to what we had been learning on, with a technique relying on years of experience.

It was interesting to hear from the master cutter that none of her five children had followed her into the trade, and there is some concern amongst the community that a lack of government supported

> … a dull and windowed stone can be brought to life by a decent cut and careful consideration of the angles that should be applied to the crown and pavilion facets.

training is putting the industry at risk. The fact that years of training are required to start cutting at this level means that privately run factories are less likely to take on people who are completely new to the process and without young people coming into the industry the supply of cutters may run out in the future.

During my final week in Thailand I attended a rough grading of coloured stones course. This was taught by Jayesh Patel, an accredited gemmologist and gemmology instructor at the Asian Institute of Gemological Sciences (AIGS). Jayesh was an excellent teacher, not only explaining the science well, but also putting what he was teaching into context very effectively (**6**).

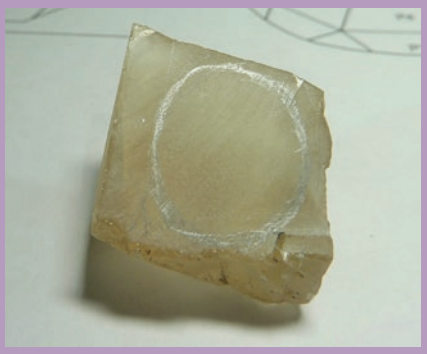
I was fortunate that Jeffrey Bergman, an American gem dealer with over 40 years' experience in the industry, was also present for much of the week and was very generous in sharing his experience. This included allowing us to examine and handle some extremely expensive emeralds and memorably de-oiling a poor-quality ruby during the session to effectively demonstrate the extent to which treatment can mask inherent problems. By the end of the week, everything I had learned in my Gem-A Diploma had really come to life.

The cutting school is located at the edge of the gem district, which was handy for spending lunch hours wandering around gem stalls. One of the most accessible places I found was the Jewellery Trade Centre, a mall with four floors of gem and jewellery shops and stalls, selling an overwhelming number of cut and rough gemstones. As the course didn't run over the weekend, I also had the opportunity to travel to visit the incredible gem market at Chanthaburi.

I feel incredibly fortunate to have had such an amazing experience in Thailand. The whole visit has helped to put my gemmology knowledge into practice and left me with a much better feel for the industry and how I could fit into it. ■

The author wishes to thank Justin K Prim, Sarath Chandrasiri, Jayesh Patel, Jeffery Bergman, the Directors and Team at IGT Thailand, Tony Chaaya at Terra Gem Sourcing Co. Ltd. and her fellow students.

3: Before and after: a rough rhodolite garnet and its finished product with a step cut.



4: Marking out an oval design onto a rough Oregon sunstone and the outcome: an oval mixed cut Oregon sunstone.

5: Before and after: a recut of a synthetic sapphire from a Portuguese cut (L) into an oval mixed cut (R).

All images courtesy of the author unless otherwise stated.

6: Fiona with instructors Justin K Prim and Jayesh Patel at IGT Thailand. Image credit: Justin K Prim.

1: A view of Ago Bay, Mie Prefecture.

LONG LIVE PEARLS

Takashi Atsumi PhD, of the Department of Agriculture, Forestry and Fisheries in Mie Prefecture, and Yuichi Nakamura, CEO of PJ Nakamura International, explain why the past two years have been so challenging for Akoya pearls in Japan.

The Ise-Shima area in Mie Prefecture is the birthplace of the cultured pearl industry (**1**). The area has a long history of pearl cultivation, however, last summer, a large number of sudden deaths occurred in the pearl oysters (*Pinctada fucata*) across Japan, including Mie Prefecture.

The mortality rate of juvenile oysters was approximately 71% while the deaths for one-year-old oysters sat at approximately 25% and the rate for two-year-old specimens was approximately 22%. Shrinkage of the mantle was recognised as a symptom of weakened oysters. Among the surviving oysters, the rate of shrinkage in the mantle tissue was approximately 26% in the one-year-old oysters and approximately 19% in the two-year-old oysters. (**2**).

In Mie Prefecture, the two-year-old oysters packed in plastic conditioning boxes showed a higher mortality rate, as well as a higher rate of mantle shrinkage. The oysters are usually packed at a high density (around 100 oysters) from late fall to early spring for nucleus implantation. This is a technique used to produce high-quality pearls by decreasing their metabolism and preventing gametogenic activity in the gonads (**3**).

CAUSE OF DEATH

The cause of this mass mortality is yet unknown. The Mie Pref. Fisheries Research Institute analysed past environmental data from the pearl culturing area (i.e. water temperature, salinity, chlorophyll, etc.) and found a few clues:

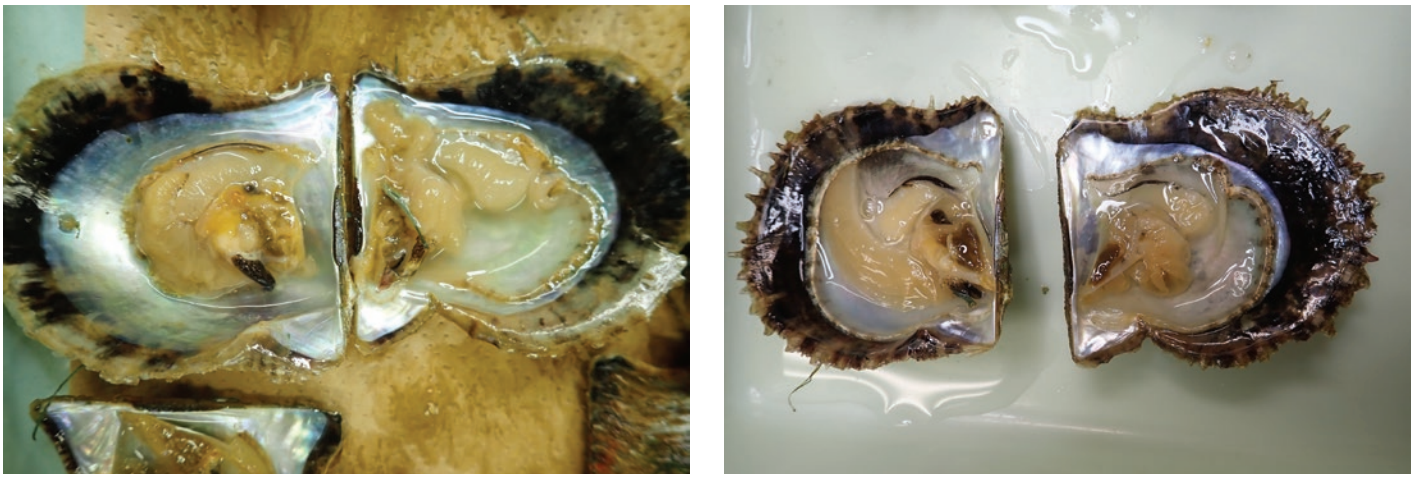
- The average water temperature from December 2018 to March 2019 was 15.8°C, which was the highest in the last 15 years (the average being 13.3°C).

- The average chlorophyll amount (an indicator for the amount of phytoplankton as feed for pearl oysters) from April to June 2019 was 3.7 µg/L, making it the third lowest among the average amounts for the past 15 years, which is normally 4.5 µg/L.

Pearl oysters generally become inactive in the wintertime as the water temperature lowers. However, the water temperature last winter (2019) was higher than average, and it is estimated that the nutrient absorption of the oysters was also relatively high. The two-year-old oysters (in particular those that were held in the plastic conditioning boxes) may have had low nutrient accumulation levels. The activity of the oysters increased with the warmer water during spring, but there were not enough phytoplankton for food to match their increased appetite for three months.

It was speculated that the pearl oysters fell into a weakened state, resulting in sudden death or shrinkage of the mantle tissue. It is believed that the high sea temperatures in winter combined with the shortage of food in spring were factors in the mass mortality and mantle shrinkage.

An array of Akoya pearls in various sizes.



2: From left to right: A weakened Akoya pearl oyster showing mantle shrinkage, compared to an example of a healthy oyster.

SUSTAINABILITY MEASURES AND PEARL PROMOTION

This season, Mie Prefecture is improving a fishery monitoring system, with particular attention to the water temperature and food levels, to prevent further loss. Currently, no instances of sudden death or mantle shrinkage have been observed and the oysters are now approaching peak nucleus implantation season. As of the end of May 2020, pearl production is considered to be on track in Mie Prefecture.

3: Oysters held in a plastic conditioning box.

In 2016, the Japanese government established a law to promote the Japanese pearl industry. Also, the government in Mie Prefecture created a plan to promote the local pearl industry in 2018. In the same year, representatives from the local pearl industry (farmers, traders, and retailers) and three local governments (Mie Prefecture in cooperation with Shima City and Minami-Ise Town) signed a declaration to promote pearls in Mie Prefecture and strengthen their partnership.

To contribute to the achievement of the United Nations' Sustainable Development Goals (SDGs), from 2019 pearl farmers have moved towards implementing sustainable and environmentally-friendly pearl cultivation acts such as using shells from harvested oysters as materials for mother-of-pearl works and buttons; experimentally using sort tissue following the pearl harvest in compost for agriculture; and converting the electric power used in pearl cultivation farms into natural renewable energy.

Also, to convey the appeal of pearls and pearl cultivation in Mie Prefecture, two programmes, one aimed at tourists and the other aimed at domestic and overseas jewellers, were developed to provide hands-on experience of pearl farming. These programmes have been very popular among foreigners, especially during the harvest season (**4**).

COVID-19 AND THE PEARL MARKET

The COVID-19 pandemic has been damaging industries across the world; needless to say, the pearl industry is no exception. Auctions of South Sea pearls and Tahitian pearls, usually held in Hong Kong and Japan, were cancelled from February to June. Moreover, the lockdown of major cities across the world and the closure of retail stores has had an impact.

Unlike the white and black-lipped oyster pearls, most of the auctions of Akoya pearls were held from December to February, before COVID-19 became a serious issue. According to the results of auctions, the average price per momme (weight) was 6.3% higher than last year, but overall sales were 23.2% down in value and 18.3% lower in volume. It is easy to assume that this is the effect of the mortality of oysters. Despite this, one thing we know for sure is that the longer the COVID-19 pandemic continues, the more serious the damage will be to the global pearl industry. ■

> ...but there were not enough phytoplankton for food to match their increased appetite for three months.

All images courtesy of Satoumi Tourism Council.

4: A Gem-A organised trip to Mie Prefecture, Japan.

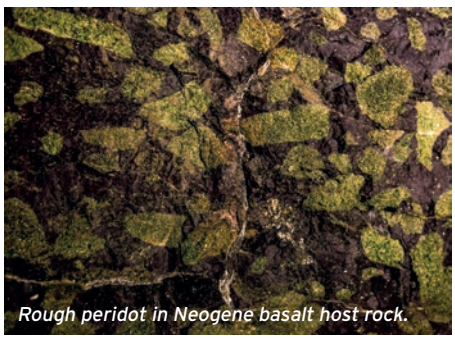
Fuli Gemstones is developing a reputation as one of the world's foremost peridot specialists, with a fully integrated business model covering mine to market. Here, Pia Tonna, Chief Marketing Officer, explains more about the business as it plots broader market visibility.

Glorious in green

A pear-shaped peridot gemstone originating from the Yiqisong Nanshan Peridot Mine.

Once upon a time, peridot was more than just a vibrant green gemstone, it was a manifestation of the sun and a guardian against night terrors and evil spirits. And while the Ancient Egyptian furore around this magical gemstone may have died down over the millennia, there are still plenty of passionate advocates for exceptional green peridot.

One such advocate is Fuli Gemstones, a mining, processing, marketing, sales, import/export and consulting business with ownership over the world's largest peridot deposit: the Yiqisong Nanshan Peridot Mine in China. Discovered in 2016, this new deposit of gem quality peridot is located in the Yiqisong District, approximately five kilometres north-east of the previously known Dashihe peridot mine near Jiaohe.



Rough peridot in Neogene basalt host rock.

The deposit covers an area of 5.1 km^2 and is hosted by Neogene basalts in the Dunhua-Mishan fault zone. The mine is conveniently located along connections to Yanji Chaoyangchuan Airport and the exit of the Yuwu expressway in Huangsongdianzi Town, in addition to having a forestry road that connects the mine area to the nearby Dianzi town, making it unusually accessible. Since its discovery, the mine has been studied and developed by the Yanbian Fuli Peridot Mining Industry Co. Ltd, now known as Fuli Gemstones.

"The significance of the Yiqisong Nanshan Peridot Mine is the quality, clarity and colour of peridot being discovered,"

explains Pia Tonna, Chief Marketing Officer of Fuli Gemstones, who has previously worked for Gemfields and Swarovski. "The reserves are estimated at approximately 501 tonnes of gem quality peridot, therefore making this mine of huge significance and importance with a superb location."

Tonna continues: "The mine is a tunnel, as opposed to an open-pit, with far less rock removal. Our intention is to use the waste material for the road and rail infrastructure of China. We are also in discussions with a company within the environmental space, who are working on a project that envisages using large volumes of olivine/olivine-bearing rock for their mission."

A number of factors have come together to make this mine of real significance for the global gem industry, including findings by the Gemmological Institute of the China University of Geosciences (Wuhan), which is also a Gem-A Accredited Teaching Centre; the combined experience of the Fuli Gemstones operations and management team; the conditions within and accessibility of the mine itself; and the quality of peridot rough produced by the mine.

As Tonna explains: "The ore body is of a regular tabular and uniform thickness, making it very suitable for high-tech, precise and high-efficiency mechanised mining operations. Low operating costs, coupled with high-quality and large reserves, gives Fuli Gemstones a clear and competitive advantage."

Studies suggest that, different from the common yellow-green peridot found in other geographical production areas available to the market, gems produced at the Yiqisong Nanshan Peridot Mine are characteristically vibrant grass green with strong hue and saturation. In addition, they boast excellent clarity with few cracks or flaws.

> The significance of the Yiqisong Nanshan Peridot Mine is the quality, clarity and colour of peridot being discovered...

The entrance to the mine; the mine is a tunnel as opposed to open pit.

A DISTINGUISHING TRAIT

Gem-A Gemmology Tutor, Charlie Bexfield FGA DGA EG, explains more about double refraction in peridot.

Peridot is an optically anisotropic material. This means that when light enters the gemstone it is split into two rays each travelling at 90 degrees to the other, but in different directions, and at different speeds. We call this double refraction. Due to the varying speeds of each ray, one ray will either be refracted more, or less. The faster the ray, the more it will refract. Sometimes the difference between these rays is so great that when looking into the stone it appears as though everything is doubled. Peridot is a good example of this. The distance between each ray is measurable with a refractometer and when they are at their furthest points apart, we refer to this difference as the birefringence.

Peridot has a relatively high birefringence of 0.036. Due to peridot's high birefringence we can see doubled images when looking into the stone with a loupe. We can use this to help with the identification because there aren't many yellowish-green gemstones which show such strong doubling. Always conduct other tests before concluding though. Sinhalite, as an example, can be a similar colour and has a birefringence of 0.038 which is why testing is so important.

As an integrated company, Fuli Gemstones is tapping into the retail market, as well as enhancing its trade and consumer-facing image with new strategies that are designed to promote the beauty of peridot. "We offer designers and brands bespoke cutting," says Tonna. "We want to work collaboratively with young creative talent to help them push boundaries in jewellery design – we wholeheartedly believe in creativity – our company ethos is 'natural innovation'."

She continues: "Our gemstones are natural and require no treatments. We want to innovate through our cutting to showcase the highly refractive nature of peridot."

Part of Fuli Gemstones' efforts to promote peridot is to develop a grading →

A trio of experienced miners at the Yiqisong Nanshan Peridot Mine.

Inset: The Yiqisong Nanshan Peridot Mine has reserves of approximately 501 tonnes of gem quality peridot.

All images courtesy of Fuli Gemstones.

system for the gem, based on colour, clarity and carat in the rough. While details have not yet been announced, Fuli Gemstones is said to be working with "leading labs and industry experts" to develop a "peridot profile" that may serve to create a value structure. At the same time, the company is plotting a peridot museum to both educate visitors and demonstrate how corporate social responsibility measures are supporting sustainable mining among local communities.

Looking ahead, Fuli Gemstones has grand ambitions to become a gemstone group, meaning they are "actively looking at new, unique assets and opportunities globally," according to Tonna. She continues: "We have a clear strategy and timeline that we are following, and we will begin advertising and promotion in the second half of 2020. August is the birthstone month of peridot and it's the perfect time to shine a light on our remarkable gems."

With operations in Beijing, Jilin Province, Hong Kong and London, Fuli Gemstones is on a mission to champion peridot, inspire fine jewellery designers and increase recognition among end consumers. While COVID-19 may have hampered its growth plans, we have no doubt that this forward-thinking company will make its mark and secure a new appreciation for this ancient terrestrial and extra-terrestrial gem. ■

NEED MORE INFO?

Discover more detailed research surrounding peridot from the Yiqisong District in an insightful report by Zhiqing Zhang, Min Ye and Andy H. Shen, featured in The Journal of Gemmology, **36***(5), 2019, pp. 436-446. Gem-A Members can search: gem-a.com/jog-contents-volume-36-issue-5*

"Peridot from Neogene olivine-bearing basalt in the Yiqisong District of Jilin Province, China, and from North Korea are available in the global gem market. We characterised 100 stones from each of these two localities, and found similar RI, birefringence and SG values, but slightly different colour ranges, UV-Vis-NIR spectral characteristics and internal features.

The most common inclusions in both the Yiqisong and North Korean samples were 'lily pad' discoid fractures; also present were diopside, chromite, enstatite and lizardite (the latter two were observed only in Yiqisong peridot).

Chemical analyses indicated that most samples had forsterite contents ranging from 89.4 to 92.2 mol.%, with a trend toward slightly higher Fe in the North Korean samples. Statistical processing of the trace-element data with Fisher linear discriminant analysis (Fisher-LDA) showed that Al, Zn, Ti, Na and Ge are useful for separating peridot from these two localities."

Rough peridot from the Yiqisong Nanshan Peridot Mine.

A Warm Welcome

Gem-A is thrilled to welcome the Bahrain Institute for Pearls and Gemstones (DANAT) to its international family of Accredited Teaching Centres (ATCs). Here, CEO Noora Jamsheer introduces DANAT and its educational specialisms.

Natural pearls.

What would you like the broader Gem-A community to know about DANAT?

The Bahrain Institute for Pearls and Gemstones (DANAT) was formed with the vision to become the world's preferred institute for pearl and gemstone third-party verification services, scientific research and education. DANAT was established as a reflection of Bahrain's rich natural pearling history and the strong desire to protect this heritage. Since establishment, DANAT has developed a reputation as the guardian of natural pearls within the Middle East and beyond. In addition to being a certifying authority for the Bahraini market, DANAT is committed to developing and promoting the industry to a new generation of gemmologists through education and training programmes.

What influence does the natural pearl heritage of the Gulf region have on DANAT?

There is a reciprocal relationship between Bahrain's history and heritage of pearling and DANAT's identity and what we, as a laboratory, institute and research centre in Bahrain, do. Our role ensures that Bahrain's legacy and status in the natural pearl industry survives and thrives. We act as guardians of the trade, from authenticating the identity of natural pearls to being strong advocates of sustaining the natural pearl industry. It is DANAT's obligation of preserving the reputation we inherited.

Also, pearling has always been a characteristic feature of Bahrain's culture, and it is one that Bahrain is recognised for and distinguished by. Therefore, as long as natural pearls exist, Bahraini experts specialised in pearls and pearl testing will continue to exist as well.

What educational courses do you offer and how does being a Gem-A ATC support this?

DANAT recently launched online e-courses – 'Pearl Principles' and 'Diamond Principles' as part of the Institute's keenness to continue its training activities during the COVID-19 pandemic. We offer a very unique course that combines a scuba diving trip, hands-on experience in DANAT's laboratory and a tour of Bahrain's UNESCO World Heritage Site – Pearling Path. This six-day course covers everything about natural, cultured and imitation pearls. DANAT also has a strong partnership with the De Beers Group Institute of Diamonds and offers many different diamond courses.

DANAT's education facilities.

DANAT is very proud to become the region's first Gem-A ATC. Gem-A courses are internationally recognised and many world-leading gemmologists began their careers with a Gem-A Diploma. That aligns with DANAT's commitment to providing higher education opportunities in the field to Bahrainis.

Do you have any insights into current market trends in Bahrain or your wider region?

Based on the vast number of items DANAT receives for testing, there has been an increased demand for high-end jewellery. At the same time, simple, everyday statement jewellery is probably what DANAT currently comes across the most in the laboratory, and this includes both pearl and gemstone jewellery pieces. The market has gravitated towards simplicity and minimalism.

As for the gemstones that are currently in demand in the region, diamond definitely sits on top of the list. Nowadays, diamond jewellery items are highly sought after by all age groups to the extent that this makes them a direct competitor to the all-time favourite in the region, pearl jewellery. ■

Find out more at danat.bh

All images courtesy of DANAT.

THE GEM/ROCK CONUNDRUM

Gagan Choudhary FGA, Director of the Gem Testing Laboratory in Jaipur, considers the need for accurate identification as the online 'gem rocks' market booms.

Gemstones are now not limited to a few minerals, which is evident from the wide range of materials, specifically 'gem rocks', available all over the internet.

In the past few years, the marketplace has flooded with large numbers of gem rocks with new and unusual names, being used as ornamental gemstones or healing stones in the form of beads, cabochons and carvings. These rocks are available in a wide range of colours and patterns, with varied mineralogical composition. Most of these materials are named, or are given 'fancy' marketing names, on the basis of colour, pattern or source, making them easier to sell. However, with slight variation in their appearance, the name changes, resulting in inconsistencies and confusion across the supply chain.

This has always been a challenge when such materials are encountered at gem labs. The two most common challenges with these materials are: correct identification of the material (including mineralogical components), which can only be possible in a well-equipped laboratory (Raman analysis is proved to be a most useful technique for identification of such gem rocks); and secondly, disclosure, because while most gem labs use accepted gemmological and mineralogical terminology for disclosure of a gem material, these terms can be quite different to a material's 'marketing name'.

Being based in Jaipur, India, a hub of coloured gemstones, we at the Gem Testing Laboratory, Jaipur face these challenges in describing such gem rocks on a routine basis. Presented here are a few examples of gem rocks with 'fancy' marketing names.

'GILA MONSTER' JASPER

A silicified rock with light brown streak-like patterns against a dark brown body, named after a species of lizard with the same name, native to south-western America and north-western Mexico (**1**). Gila monster is primarily composed of dolomite (light brown streaks) along with scattered grains of quartz and feldspar throughout the matrix, and coloured dark brown by iron oxide in the form of hematite.

'CHINESE WRITING' STONE

This is also a sedimentary rock displaying patterns similar to Chinese alphabets, hence the name (**2**). Its granular matrix is composed of calcite and coloured by hematite, while yellow patterns are coloured by goethite; some yellow areas also consist of cores composed of transparent crystals of dolomite and calcite.

'MUSHROOM' RHYOLITE

Rhyolite is basically an extrusive igneous rock rich in silica content, and mainly consists of minerals like quartz and feldspar, with minor amounts of amphibole and mica. The term 'mushroom' rhyolite is used for a specific type of rhyolite displaying mushroom-like formations of transparent colourless to grey quartz, which is lined with bands of feldspar; in some cases or areas, such mushroom-like formations are highlighted by a brown colour caused by hematite and anatase (**3**).

'APACHE GOLD' STONE

The name 'apache gold' is derived from the Apache Indians who lived in Arizona, from where this rock variety was discovered. This gem material is characterised by a black body decorated with golden specks, where the black matrix is a metamorphosed rock (schist) consisting of quartz and chlorite, while the golden specks are pyrite (chalcopyrite) (**4**).

'PRINT STONE' JASPER

A sedimentary rock (probably of stromatolitic origin) characterised by dark and light brown bands with fine granular texture (**5**). The matrix is composed of fine grains of quartz, where dark brown areas are coloured by hematite and light brown by anatase. Print stone jasper is also known as 'Newsprint' jasper or 'Stamp' jasper and is found in northern parts of Western Australia.

'PILBARA' JASPER

Named after the location, Pilbara, in Western Australia where it is commonly mined, this gem rock is characterised by a dark body with yellow-to-brown veins and streaks, forming a web or a splash of colours (**6**). The dark body of Pilbara jasper is composed of quartz, brown veins over the dark body are coloured by inclusions of hematite, while yellow areas are coloured by goethite inclusions.

'FIREWORK' OBSIDIAN

The name 'firework' obsidian continues a creative naming trend from other, relatively well-known varieties: 'snowflake' obsidian and 'flowering' obsidian. Firework obsidian is characterized by splashes of white, brown and red colours on a dark body, similar to fireworks in a night sky (**7**). The dark body is volcanic glass (of which obsidian is formed), while the splashes are of mineralic feldspar; brown and red colours are caused by hematite inclusions.

CONCLUSION

The list of fancy names for gem rocks is increasing daily, however, correct description of these materials remains a challenge. Identification of individual components may not be a difficult for a well-equipped laboratory, but nomenclature is. Disclosure by gem labs for these gem materials is based on mineralogical classification, which in most cases is different from the 'marketing' name, and hence adds to the confusion.

Further, labs are unable to use the given 'fancy' names on their reports, primarily because of the fact that the same material, having slight variation in colour or pattern, is traded by a different name, and then, there also exist materials of different mineralogical composition but with the same trading names. There is no consistency in naming these gem rocks, and hence they remain a conundrum. ■

1a & 1b: Rough and cut specimen of 'Gila Monster' jasper.

2a & 2b: Rough and cut specimen of 'Chinese writing' stone.

3a & 3b: Rough and cut specimen of 'Mushroom' rhyolite.

4a & 4b: Rough and cut specimen of 'Apache Gold Stone'.

5a & 5b: Rough and cut specimen of 'Print stone' jasper.

6a & 6b: Rough and cut specimen of 'Pilbara' jasper.

7a & 7b: Rough and cut specimen of 'Firework' obsidian.

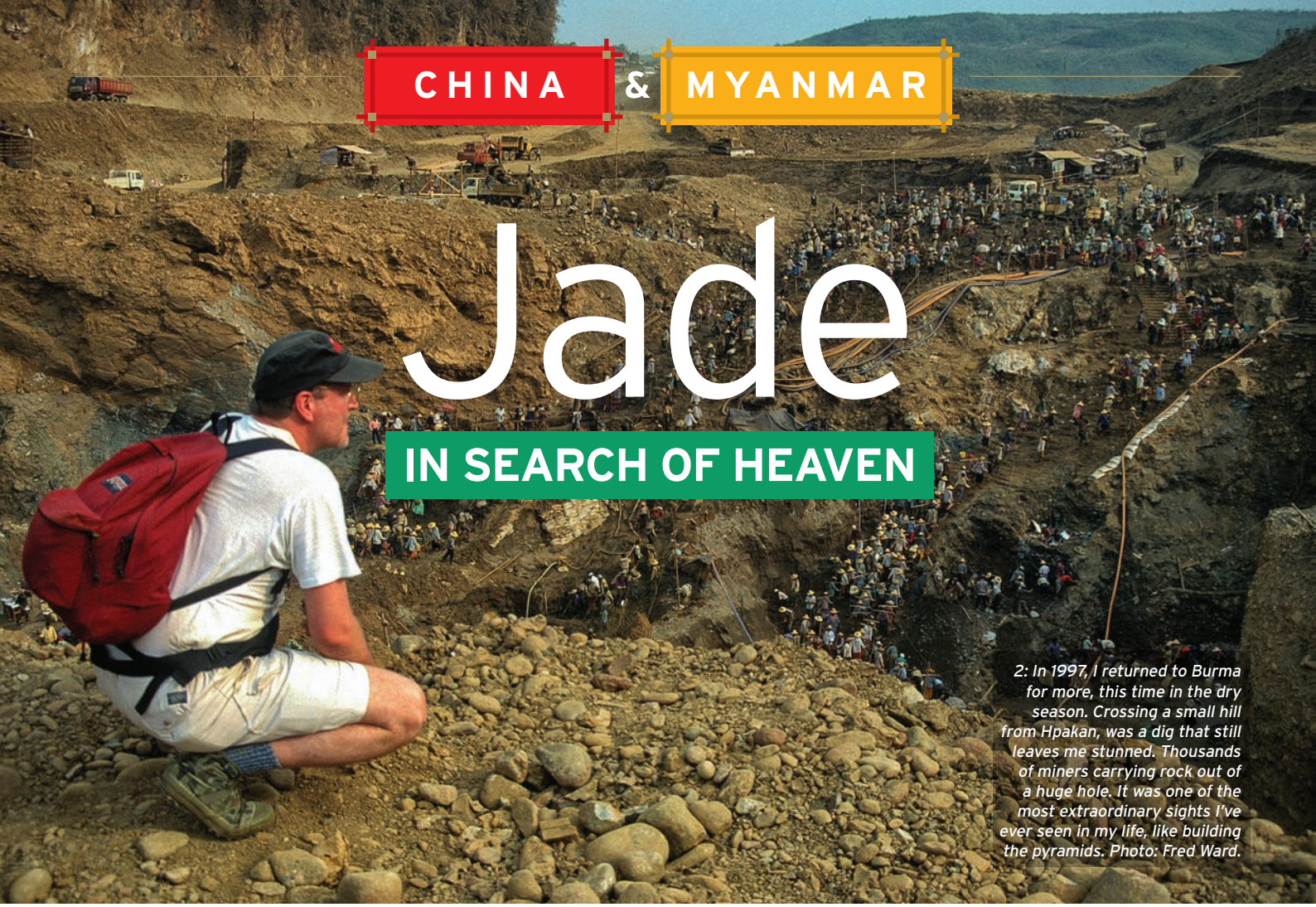
All images courtesy of Gagan Choudhary FGA.

Acknowledgement: Mr. Sandeep K. Vijay, staff gemmologist, for collecting Raman data and assistance in identification of these rocks.

CHINA & MYANMAR

Jade

IN SEARCH OF HEAVEN



2: In 1997, I returned to Burma for more, this time in the dry season. Crossing a small hill from Hpakan, was a dig that still leaves me stunned. Thousands of miners carrying rock out of a huge hole. It was one of the most extraordinary sights I've ever seen in my life, like building the pyramids. Photo: Fred Ward.

Corundum expert Richard W. Hughes takes us through his four-decade adventure with jade, from Burma's jadeite mines to China's classic mutton-fat nephrite mines at Hetian, Xinjiang Province.

My journey into jade started at age 18, when a friend invited me to travel with him to Europe. One thing led to another, Europe became Turkey, Iran, Afghanistan and India, and by 1977 I found myself in the dusty upcountry town of Mandalay, Burma. It was there that I saw my first piece of jade. Now – 43 years on – I've spent much of my life working with this stone. As I look back upon that road, I am still stunned at how every twist and turn revealed new secrets, new adventures, new friends. What follows is my story of a lifetime spent in pursuit of heaven.

ROAD TRIPS

By 1979, I was living in Bangkok and studying gemmology. But there is only so much one can learn staying in place. So, I travelled; Burma, India, Sri Lanka, wherever there were gems, I went. In 1996, while journeying back to Mandalay from Mogok, I asked a military officer if my friend and I could visit the jade mines. When he said yes, I had to stop myself from immediately kissing his feet.

The result was a series of epic journeys to the jade mines, opening to the Western gemmological world a place that had not been visited by outsiders since Eduard Gübelin in the early 1960s (**1**). From that point on, I was on a mission to learn as much as possible about this incredible stone we call jade (**2**).

1: The road to Burma's jade mines on my first trip there in 1996. It took three days through the mud to make it to Hpakan, known to locals as "Little Hong Kong." Photo: Richard Hughes.

DEFINING JADE: MORE THAN JUST A STONE

Yü, the Chinese word for jade, is one of the oldest in the Chinese language with its pictograph (玉) said to have originated in 2950 BC, when the transition from knotted cords to written signs occurred.

The pictograph represents three pieces of jade, pierced and threaded with a string that together represent virtue, beauty and rarity. The addition of the *dian* stroke (dot) completes the character and distinguishes it from 王 (*wǎng*), the character for emperor. Just how fundamental this character is in the Chinese language is illustrated by the modern form of the character for kingdom – 国 (*guó*) – which has the jade character enclosed in a boundary to represent 'country'.

Thus, the jade character is a component of the name for the country of China – Zhongguo – 中国. The English name 'jade' comes from the Spanish *piedra de ijada* – literally "stone of the flank of the lower back" – from the Mesoamerican native belief that jade combats kidney ailments.

3: Map of China showing the location of major jade mines, markets, and carving centres. The major source of Chinese nephrite is Hetian (a.k.a. Khotan) in western China's Xinjiang Province, while jadeite comes from the Hpakan region of Upper Myanmar (Burma). Map: Richard W. Hughes.

A TALE OF TWO GEMS

For some eight thousand years, jade has been treasured by the Chinese. While there are a number of different sources in China, the most important is the White Jade (Yurungkash) and Black (a.k.a. Green) Jade (Karakash) Rivers near the town of Hetian (和田; a.k.a. Khotan, Hotan) in western China's Xinjiang Province (Chinese Turkestan). From these deposits comes a creamy white to greenish stone, with the most valuable 'Hetian jade' being pure white, termed 'mutton fat'. Sitting astride one of the old Silk Roads, it first entered China proper via traders from Central Asia (**3**).

While the discovery of jadeite jade in Myanmar dates back to the 6th Century AD or earlier, and its first entry into China was dated by British Sinologist William Warry in the 13th Century (Hertz, 1912), it did not come into prominence until the Qing Dynasty (1644–1914).

When Emperor Qianlong saw a piece of this white-to-bright green jade, he was besotted. Learning it came from a wild country south of Yunnan, he sent columns of troops down to secure a supply. But even the Chinese armies were no match for the difficult terrain and fierce Kachin hill people. They returned empty handed, beaten back by malaria, mud and tribespeople who toyed with the outsiders from the north.

Thereafter, Chinese traders generally never attempted to venture into the hills to the mines, content to deal with the Kachin on the comparatively tranquil plains at Mogaung. The Chinese understood this material was different from the Hetian jade and named the vivid green variety *fei cui* (翡翠) or kingfisher jade.

MUTTON FAT JADE

Although I have been involved with jade since 1977, it was only when I visited China's famous Guangzhou jade market in 2009 that I was exposed to Chinese mutton fat jade (nephrite). It was love at first sight; now I better understood the deeper attraction of 'jade'.

While I once believed that only jadeite had high value as a gem material, this opinion was born of ignorance. The white Chinese nephrite is a lovely gem material possessing a sublime beauty all its own →

When Emperor Qianlong saw a piece of this white-to-bright green jade, he was besotted.

4: In 2017, I realised my dream of going to Hetian, the source of China's mutton fat jade. There we found one old jade picker who had a single boulder that we purchased from him. Photo: Richard Hughes.

5: Left to right: Jason Kao, Wimon Manorotkul, Richard Hughes, Wu Desheng, and Adam Zhou Zhengyu in Wu Desheng's Shanghai compound. Photo: E. Billie Hughes.

and today fetches prices that sometimes compete with the finest imperial jadeite.

Today, this 'mutton fat' jade from Hetian is considered to be the finest in the world, with the highest prices being paid for white stones from the rivers. Material quarried nearby from hard rock mines is much less valuable as it may have hidden cracks and it lacks the natural surface staining of the river stones that is prized by carvers.

Ever since I discovered Chinese mutton-fat jade, I had a desire to visit the source. Hetian is located in western China just north of the Kun Lun mountains that separate China from Pakistan and India. Thus it was that in the summer of 2017, I set out for Hetian with the highest anticipation. We came upon one old man with a shovel, when he reached down into his bag and produced a boulder, we quickly bought it off him (**4**).

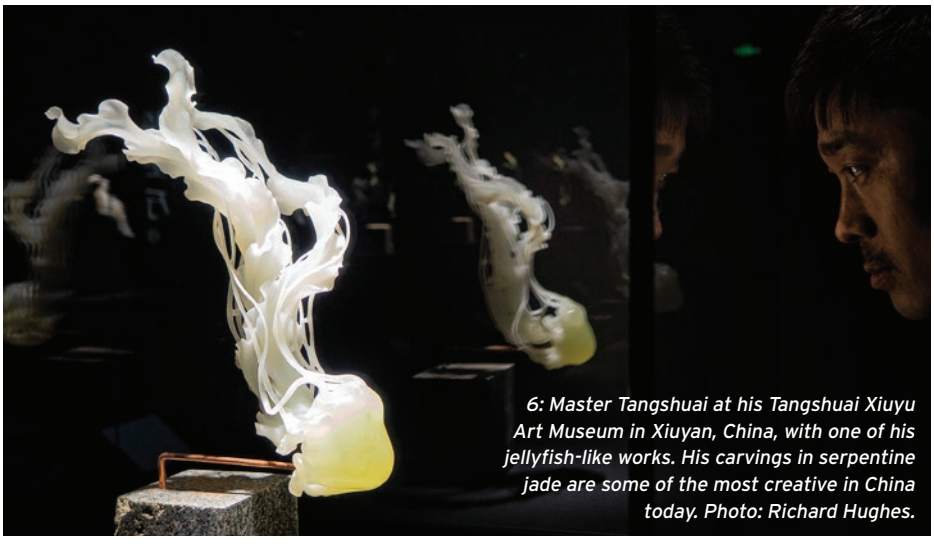
CONTEMPORARY CARVING

The first time I visited Shanghai in 2011, I found Fuzhou Rd, a lovely street with several great bookstores. Several years later, I was back in Shanghai at the invitation of Tongji University's "Adam" Zhou Zhengyu. I mentioned to Adam that I wanted to go back to Fuzhou Rd. He said I should first visit the 'Tongji Bookstore'. That turned out to be his office and, as I departed, I was overloaded with kilos of books on Chinese jade that he had gifted me.

Back in Bangkok, I opened them up and was completely floored. Expecting to see scholarly reproductions of older jades, I was amazed to discover page after page of stunning contemporary designs. When I later asked Adam if he could arrange visits to meet some of these carvers he slyly smiled and said: "Of course. They are my friends."

This is how I came to meet China's new jade masters, people like Ma Hong Wei, who makes jade reproductions of ancient Chinese bronzes, Yu Ting, who specializes in eggshell thin carvings and Yang Xi, whose negative space works are as fresh as any contemporary art in the world. But the carver I most wanted to meet was Wu Desheng.

Wu Desheng is perhaps China's most famous contemporary jade master and has a studio on the outskirts of Shanghai. Master Wu was a gracious host and gave us a full tour of his compound, with various workshops filled with people carving jade (**5**). As we were leaving, Wu casually mentioned that, if I had a piece



6: Master Tangshuai at his Tangshuai Xiuyu Art Museum in Xiuyan, China, with one of his jellyfish-like works. His carvings in serpentine jade are some of the most creative in China today. Photo: Richard Hughes.

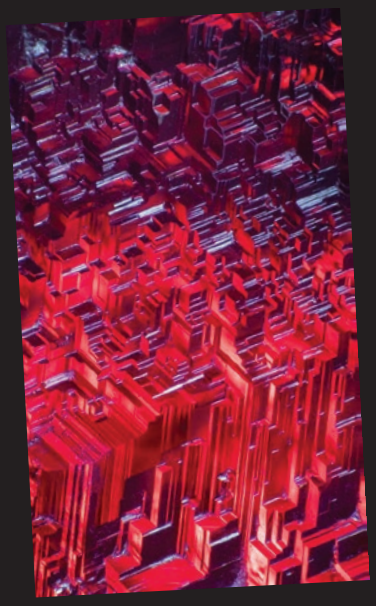
7: Wu Desheng, one of China's top master carvers, created this exquisite carving from the piece of jade we had purchased in Hetian in 2017. Photo: Wimon Manorotkul.

of jade, he would carve it for us. After kissing his feet, I quickly whipped out the jade boulder we had purchased in Hetian the previous year before he could change his mind.

TOUCHED BY JADE

In September 2019, Adam invited me to visit one of China's most famous jade deposits in Liaoning Province in the northeast. There we visited the studio of Master Tangshuai, who creates organic flowing carvings in serpentine (**6**). Returning to Shanghai, we learned that Master Wu had finished the carving of my boulder, and so once again visited his compound. As I opened the box that Master Wu had presented me, I touched something smooth, creamy, almost like a woman's skin. As I brought Wu's creation into the light, for the first time I truly understood what jade means to the Chinese (**7**). I was touching heaven. ■

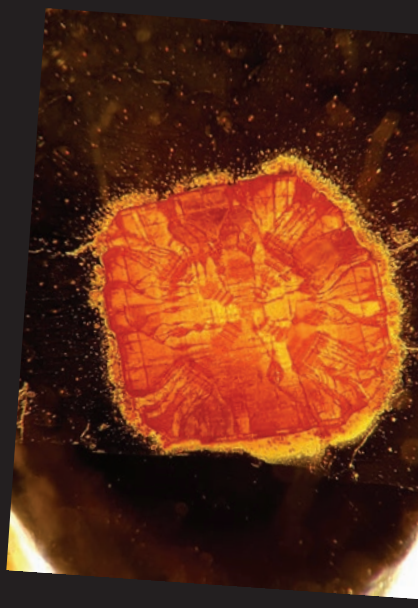
An extended version of this article and a reference list are available upon request.



'Crimson Geoscape' by Melissa Allen FGA was named a runner-up in last year's Competition.

CAMERAS AT THE READY!

The Gem-A Photographer of the Year Competition returns for another year to discover the very best images which capture facets of the gem world in all its diversity and beauty.



The winning entry of 2019's Competition: 'Microchip' by Evgenios Petrides FGA.

Gem-A is pleased to announce that the Gem-A Photographer of the Year Competition is returning for 2020! This year's competition has three themed categories: **Cover Shot**, **The World of Gems** and **Photomicrographs and Special Details**. If you've captured a truly dazzling piece of jewellery, an incredible inclusion or an eye-opening image of gem mining in the field, we want to see it!

WHY ENTER?

- Win the chance to have your photograph featured in *Gems&Jewellery* magazine. Winners could be featured on our cover, our Last Impression or our Big Picture feature page
- You can add the accolade of being named Gem-A's Photographer of the Year to your portfolio
- Entry is free and open to all

THE PRIZE

- The overall winner will be gifted a £300 voucher to spend at Gem-A Instruments and one year's free Membership of Gem-A
- Two runners up will win a £50 Gem-A Instruments voucher
- All three winning entries will see their photographs published in *Gems&Jewellery* magazine

Billie Hughes FGA' 'Floating Mushroom' – a runner-up in the 2019 Competition.

JUDGING PROCESS

- The *Gems&Jewellery* editorial team will shortlist nine entries (three from each category) which will be uploaded to the Gem-A Facebook page where the public can vote for their top five.
- A guest judge will then choose a winner and two runners-up from the final five photographs.

HOW TO ENTER

Email your entry to editor@gem-a.com. The Competition is open now and we will be accepting entries until 30 September 2020. The winner will be announced on Gem-A's Facebook page shortly after the Competition has closed. **Good luck!**

COMPETITION RULES

- A maximum of three photographs may be entered per person and must fit into at least one of the three categories
- Entries must be accompanied by your name and post-nominals (if applicable)
- Images must be captioned with a title and a description of no more than 150 words telling the story behind the photograph
- All photographs entered into the Competition must have been taken within the last 18 months
- The image must be your own work and not belonging to a third party
- Photographs must be high resolution, with a minimum of 300dpi and ideally a minimum of 1mb in size
- Please send files larger than 10mb via Dropbox.com or WeTransfer.com (these are free to use media transfer services)
- By entering the Competition you accept that your image may be used in *Gems&Jewellery* magazine, on the Gem-A Blog and on Gem-A's social media channels. You will always be credited as the creator of the work

For more information on the Competition rules please contact editor@gem-a.com.

A Persian Paradise

Maryam Mastery Salimi GG and Nathan Renfro FGA GG, Staff Gemmologist and Manager of Gem Identification at GIA respectively, consider various forms of turquoise from Iran and explore the influence this gem has had on the country's history.

1: Carving of a Persian Lion Rython symbol on Persian turquoise from Nishapur, Iran. Photo by the gemstone's cutter, Hossien Basirat.

3: Maryam with her son, Aiden, at the entrance to a turquoise mine in Iran. Photo by Maryam Mastery Salimi.

The turquoise mine of Nishapur (Neyshābūr), Iran, is the most important turquoise mine in the world. The very ancient Nishapur turquoise mines are located in the north-eastern province of Khorasan, 58 km north-west of Nishapur city in Iran. Named after Shapur I, the second king of the Sassanian Empire, his name combines the Persian words for '*son*' and '*king*,' literally translating to '*king's son*'. These mines still hold their old romantic appeal and still produce beautiful turquoise (**1**).

Turquoise from the Nishapur mine can be found in three main colours: blue, bluish green and green. All these colours may be found in one specimen. The lustre of the mineral is earthy or vitreous, waxy or pearly when it is polished. In Iran, the turquoise used in jewellery is classified into three types according to whether it is nodular, massive or compact. Of every type, the blue variety, which is the purest, is considered the most precious. After cutting and polishing, the turquoise is used in necklaces, bracelets, watch bands and decorative objects.

The turquoise of the Nishapur mine is a secondary mineral (**2**). It is found as nodules in cavities and as veins in the fractures of volcanic rocks. Sometimes it occurs as a thin crust on the walls of these cavities and fractures.

For at least 2,000 years, the region once known as Persia, has remained an important source of turquoise. Although Iranian production accounts for just a small proportion of the world's total output, its turquoise still sets the standard for quality. Current estimates suggest that between 40 to 50 tons of rough turquoise leave the country each year. Experts believe that, at these levels of production, the mine has enough material to continue producing for another 200 years (**3**).

The mines themselves are based around the village of Firoozeh, about 30 miles north-west of Nishapur. Notably, Firoozeh is named after the Farsi word for turquoise, owing to its significance to the way of life for people. In Iran, turquoise is called 'Firoozeh,' which translates to 'victory'. It is also Iran's national gemstone.

2: Persian turquoise cutter with rough turquoise in a cutting centre in Nishapur, Iran. Photo by Maryam Mastery Salimi.

4: A Persian turquoise dealer presenting a variety of Persian turquoise and his finest blue turquoise, temporarily mounted as a ring, near the mining area of Nishapur. Photo by Maryam Mastery Salimi.

It is believed that the first specimens of turquoise to which Europeans were exposed probably came from Iran via trading posts in Turkey. In the ancient world, Nishapur was an essential stop along the fabled Silk Road. From here, turquoise gems would make their way to both Europe and Asia.

The best of Iranian turquoise is rich blue, with minimal matrix. It may occasionally show white patches. Traditionally, the turquoise trader in Iran classifies turquoise into three quality groups:

1. Angushtari: This is first-quality, suitable for the finest jewellery. These stones have the rich blue 'Persian turquoise' colour with little marking or matrix.
2. Barkhaneh: This is second-quality turquoise, much like Angushtari but with more markings and matrix.
3. Arabi: These stones are considered third-rate due to a pale blue or green shade or unwanted speckles.

Rough turquoise is often pre-shaped by local artisans. Pre-shaping is the process of roughly forming a stone into a mockup of its final polished shape (**4**). Over 300 workshops deal in working with Persian turquoise in the Khorasan Province. Iranian artists use turquoise in various forms of art including calligraphy, handicrafts, ceramic and mosaic works as well as turquoise inlaying.

Inlaid turquoise is one of the most beautiful Iranian artworks with a history of at least half a century. The art consists of setting small pieces of turquoise on copper, silver, brass and bronze dishes. The turquoise inlayer buys waste turquoise chips from turquoise cutters or turquoise mines.

In 2005, a new source of Persian turquoise 1,200 km south-west of the Nishapur mines in Kerman Province (south-eastern Iran) was explored. The mining area is positioned approximately 90 km north-east of the town of Bardsir.

The colour range of turquoise from Kerman Province varies from very light blue to 'sky' blue resembling those from the Nishapur mines (**5**). Dark greenish blue to yellowish green material has also been found there. The high-quality 'sky' blue material usually only makes up 5% of the total production and is often found in small sizes ranging from 1 to 5 cm, but larger pieces have been recovered.

The annual gemstone exports from Iran total to almost US $58 million. The Iranian coloured gemstone industry's main export is turquoise, along with carnelian and demantoid garnet. Iran's third economic development plan (2000-2005) has attached special significance to the extraction, processing and export of precious and semi-precious stones. Deposits of such stones have been found in more than 30 locations in Iran and their number is rising; at present, sapphire, garnet, agate, turquoise, topaz and jasper are among Iran's main precious and semi-precious stones.

Although economic sanctions against Iran are strengthening, the country's coloured gemstone business is nonetheless still operating. Hopefully, the gem trade in Iran will continue its long history of successful operation for years to come. ■

5: Cut Persian turquoise from Kerman, Iran. Photo by the gems' cutter, Hossien Basirat.

REPUBLIC OF SAKHA

A SONG OF ICE AND DIAMONDS

1. Reindeer herding day in Yakutia.

Mining in the far north-eastern reaches of Russia, Alrosa must navigate a complex web of challenges, from sheer size and sparse populations to freezing terrain and river cargos. Here, Jane Kozenko, Head of Communications at Alrosa, speaks to *Gems&Jewellery* Editor, Sarah Jordan, about mining for diamonds in one of the world's most challenging landscapes.

Imagine for a second a phenomenally vast area of almost empty space, totalling three million square kilometres, with just one million people congregating around a handful of small towns and a capital city. This is Yakutia, more formally known as the Republic of Sakha (Yakutia), in the north-eastern most edges of Russia. It is the largest administrative region not only in Russia, but globally, and has developed a fearsome reputation for its extreme climate swing from surprisingly hot summers to crushingly low winters, in which temperatures can drop to -50°C — the lowest in the Northern Hemisphere.

And yet where diamonds lead, man will follow despite the challenges. Alrosa – the partially state-owned Russian diamond mining company – has become adept at getting the best out of the region. In the 1930s, Russian researcher Vladimir Sobolev published a paper on the geological similarities between South Africa and Siberia and, following World War II, expeditions were sent out to find diamond deposits around the river Vilyui and its tributaries. Finding kimberlite pipes was certainly not easy, and geologists had to trudge through dense taiga forests (sometimes referred to as 'snow forests') and wade through swamps that were hundreds of miles from human habitation. Moreover, due to the permafrost in this region, bedrock erosion was much weaker than in the dry South African semi-desert, making it harder to follow alluvial diamonds to their source. The authentication of rough diamond finds in Yakutia in 1949 was no doubt a relief for these weary field geologists! In 1954, the Zarnitsa pipe – the first primary diamond deposit found in the then Soviet Union – was discovered and documented, although it has never been developed due to its low-grade diamonds. In 1955, the first Yakutian diamond mine was built at the Mir pipe, making this a milestone year for Russian diamond mining.

Alrosa emerged later, in the 1990s, and

has since become one of the foremost names in industrial-scale diamond mining globally. Today, the west of Yakutia is home to the vast majority of Alrosa's diamond production (and diamond production in Russia overall). "After the discovery of the first deposits in the taiga forests, transport and energy infrastructure for their development was created from scratch, including the towns of Mirny and Udachny, and the Aikhal township, Vilyui hydroelectric power station and a township for the station's personnel," explains Jane Kozenko, Head of Communications at Alrosa.

When asked to outline some of the challenges of mining in this region, Kozenko says: "The administrative centre of the Yakutia diamond province, the town of Mirny, is located 1,000 km from the Republic's capital, Yakutsk, and 4,000 km by air from Moscow. There is no railway connection in the region. To deliver cargos vital for residents and production, Alrosa must use river transport, winter roads and aviation. Russian law treats this zone as equivalent to the Far North, despite the fact that most operations are located south of the Arctic Circle."

That designation as being 'Far North' is important, as it requires Alrosa to consider greater social guarantees and benefits for people living and working in these extreme climate conditions (**1**). "Being the largest, and in some places the only, employer in the region, Alrosa has and fully meets vast social obligations for communities of the diamond province," Kozenko explains.

Further challenges come in the form of solid, ice cold ground, known as permafrost. Alrosa has its own engineering institute, Yakutniproalmaz, which focuses on designing mining enterprises that can cope with difficult mining and geological conditions, like permafrost. It was established 45 years ago in Mirny and has been vital in the engineering and construction of mining and processing facilities.

The scale of the diamond mining region of Yakutia, could only really be taken on by a company of equally ambitious size and scale. Alrosa operates 12 kimberlite pipes and 16 alluvial deposits, mostly in Yakutia, where the oldest and largest of these deposits reside. It mines from open-pits and underground mines, with the former reaching depths of 500 metres and the latter up to 1,000 metres deep.

Alrosa Group's assets in Yakutia include several different mining and processing divisions, abbreviated to MPD. Examples include the Mirny MPD (International underground mine and the Mir mine currently under conservation mode); Udachny MPD (Udachny underground mine and the Verkhne-Munskoye deposit); Aikhal MPD (Jubilee open-pit and Aikhal mine); Nyurba MPD (Nyurbisky and Botuobinsky open-pits), as well as Almazy Anabara — a subsidiary working at placers in the very furthest northern reaches of the Republic.

ARKHANGELSK OBLAST

In addition to its enterprises in Yakutia, the Alrosa Group mines diamonds in the Arkhangelsk Oblast region at the north European side of Russia (Severalmaz subsidiary) (**2**). Kozenko goes on to explain: "Discovered in 1980, the Lomonosov diamond deposit [in the Arkhangelsk Region] consists of several kimberlite pipes and is the largest diamond deposit in Europe. Nevertheless, the Arkhangelsk diamond deposits are not as rich as those in Yakutia. In 2019, the Lomonosov MPD provided 11% of the total production of the Alrosa Group."

We could no doubt write an article about each of Alrosa's diamond mines in Yakutia: each one is different and has its own history, geological quirks and surrounding communities. The Aikhal →

2. Alrosa open-pit mines, including Karpinskogo-1 (left) and Arkhangelsky (right).

3. The Jubilee open-pit mine.

MPD, for example, employs some 4,000 people and incorporates the Jubilee open pit mine (discovered in 1975), which ranks among the largest primary deposits both in Yakutia and globally (**3**). To put this in perspective, in 2019, Jubilee gave Alrosa over seven million carats of rough diamonds. It has also become known as Alrosa's leading deposit for the recovery of exceptionally large diamonds.

Mirny MPD employs around 2,500, with one major operational mine, the International underground mine. Discovered in 1969, this mine is acknowledged for its high grade rough (more than eight carats per ton of ore) and represented Alrosa's first foray into underground mining back in 1999. In 2019, it produced around 2.2 million carats of rough diamonds.

A sizeable asset in Alrosa's Yakutia arsenal is the Udachny underground mine, which transferred from an open-pit (with depths of 640 metres) to an underground operation in 2014/15. In 2019, this mine produced 3.1 million carats, supported by a team of 1,070 workers. Within the Udachny MPD there is also the Verkhne-Munskoye open-pit mine, which is the youngest of all Alrosa's deposits (**4**). Its reserves are said to be sufficient to continue mining for more than 20 years.

Alrosa also has several alluvial sites in Yakutia, led by its subsidiary, Almazy Anabara (Anabar Diamonds), in the northwestern part of the region. "We develop 10 placer deposits there, famous for their coloured diamonds," Kozenko notes. "In 2019, Anabar mined 5.2 million carats of rough diamonds, or 14.7% of Alrosa Group total production."

Speaking of coloured diamonds, they are considered rare findings for Alrosa. Currently, coloured diamonds are more commonly found in two spots: Almazy Anabara (Anabar Diamonds) in Yakutia and the Lomonosov deposit in the Arkhangelsk region. Exciting exceptions are still found once in a while though. Kozenko says: "In February 2020, the first large (17.44 carats) yellow diamond was found at the new Verkhne-Munskoye deposit. Coloured stones are less than 0.1% of the overall output of gem quality diamonds at Alrosa. With the closure of the Argyle mine [in Western Australia] scheduled for the end of 2020, Alrosa is set to become the world's largest producer of coloured rough."

When these ultra-rare diamonds do surface, the company's Diamonds of Alrosa division cuts and polishes the stones in-house (**5**). In fact, this facet of Alrosa's business model has produced the bright yellow 20.69ct Firebird diamond, which was purchased by Graff in December 2019, and the 14.83ct pink Spirit of the Rose diamond. Kozenko

4. The Verkhne-Munskoye open-pit mine.

describes Diamonds of Alrosa as a "competitive advantage" for the group, while also serving as a guarantee of Russian origin for significant diamonds and conscious buyers and collectors.

Alrosa's sparkling output, dotted with spectacular colours, is the most likely story to end up in the news, but what about the culture around its mines and the people who work there? Like all large-scale diamond miners, Alrosa bears responsibility for the local people and environment within which it operates (**6**). Each year, Alrosa spends over RUB 10 billion on social investments to benefit its 35,000-strong workforce.

Kozenko says: "The majority of workers are members of a specialised trade union, which protects their interests. Our employees are mostly local citizens of Yakutia, who live there with their families — they are several generations of miners. We also hire workers from indigenous groups and train them in a college supported by Alrosa. Moreover, we understand that the number of women among our staff is very important. Alrosa has become an absolute leader among its peers in the number of women in the overall structure [of the business and its staff]: their respective share is over 30%. The average salary of Alrosa workers is twice higher than the average salary in Yakutia, and three times higher than the average salary in Russia."

Just for another dose of perspective, Alrosa pays more than USD $1 billion in taxes and dividends to Yakutia, accounting for almost 40% of its regional budget. Its presence in the region, both socially and economically, cannot be underestimated. Alrosa, like its peers in the international diamond industry, equips schools, supports higher educational institutions, and offers grants and financial aid to those in the most need. The Alrosa group has four corporate social programmes, divided into Wellness and Recreation of Employees and their Children; Healthcare; Culture and Sports; and Housing. These programs cover a diverse range of schemes, from children's summer camps and health resorts to medical centres, free media screenings, thousands of sports and cultural events and a mortgage-lending program to attract and retain personnel who may be daunted by both the remoteness and coldness of Yakutia as a region.

The company doesn't just strive to help its own. Every year, around 3,000 children with physical disabilities receive medical care in a rehabilitation centre in Yakutsk, the capital city of Yakutia. "The company has also financed the construction of a social rehabilitation centre for minors called Kharyskhal ('Protective Amulet' in English) in Mirny," explains Kozenko. "Among the main goals of this centre is the preservation of the family, protection of childhood [...] and psychological services and pedagogical work with difficult teenagers."

MASTERS OF MINING

We could fill countless pages of this magazine with details of the many social projects that Alrosa implements, including some that are specific to the unique culture of local people. Attention is also paid to the land and the surrounding environment, including an Alrosa reindeer migration monitoring programme that protects against poaching and financing the maintenance of a nature park, which opened in 2009. The latter covers more than 32 thousand hectares and provides a secure and safe home for musk sheep, grunting oxen, red deer, axis deer, Yakutian horses, bears, reindeers, rabbits and peacocks.

Ecology is one aspect, but what about climate? Kozenko says: "We have set ourselves ambitious goals to reduce consumption of water, energy and CO_2. For example, we reduced water consumption by 60% over the last five years and greenhouse gas emissions by 55% over 5 years, and our goal is to reduce this amount by a further 3% in 2020. Today, 86% of energy consumption is from renewable sources."

Alrosa's operations in Yakutia are a prime example of how punishing conditions and logistical challenges can all be overcome in the pursuit of diamonds. Just 70 years after geological explorers hacked through frozen forests to discover diamond rough, there are 12 kimberlite pipes and 16 alluvial deposits under Alrosa's umbrella alone. Russia is a remarkable source of diamonds, with Yakutia being a sparkling jewel at the centre of its crown. ■

All images courtesy of Alrosa.

5. Alrosa diamonds being polished at its in-house manufacturing facilities.

6. A man playing guimbarde, a national Yakut instrument.

SRI LANKA

A Study in Synthesis

Gem-A Graduate, Jemma Beeley FGA, recently returned from Sri Lanka where she completed her Gem-A Gemmology Diploma at the Allied Gemmological Institute & Laboratory (AGIL) in Colombo, taught by Dayananda Dillimuni FGA DGemG. Here, she shares an abridged version of her final student project focused on the history of emerald synthesis.

During her studies, the author undertook work experience at Ibrahim Jewellers – a third-generation jewellery business in Galle Fort, Sri Lanka.

It is important to begin this investigation into synthetic emerald by first establishing the identity and significance of its natural mineral counterpart. Emerald can be described as the naturally occurring bluish-green to green variety of the mineral species beryl. This gem material is composed of beryllium aluminium silicate ($Be_3Al_2(SiO_3)_6$), with trace amounts of chromium (Cr) and vanadium (V) producing its distinctive green colour.

The first reliable accounts of emerald originate from ancient Egypt, where it has been suggested they had knowledge of the mineral's existence as far back as 3,500 BC. However, it is likely that extensive mining did not begin until around 330 BC, when the ancient Mediterranean empires turned their focus to these deposits. The Spanish conquistadors later reported an abundance of Colombian emeralds in 16th-century Peru, which the Incas had been incorporating into religious ceremonies for 500 years. The colonial plunder and ensuing vigorous trade of these gemstones developed a new and enduring global market for emerald.

Today, emerald is considered one of the 'big three' coloured gemstones, ranking amongst ruby and sapphire in terms of desirability and value. In fact, as far back as 1572, an early guide to evaluating gemstones lists emerald as inferior in status only to diamond, ruby and green sapphire. The relative rarity of sizeable, 'gem-quality' material provided a clear commercial incentive to develop a synthetic alternative.

Synthesis refers to the manufacture of artificial gem materials that possess the same chemical, physical and optical properties as a natural, inorganic mineral counterpart. Since 3,500 BC, alchemists have concerned themselves with metallurgy, the transmutation of base into precious metals, and Egyptian documents dating from AD 250-300 contain recipes for dyeing and creating artificial gemstones. Here, it is important to distinguish between simulants and synthetics, these early examples being simulants: used to imitate the effect, colour and appearance of other gem materials without possessing their chemical and physical properties. It was not until the late 1700s, when considerable scientific advancements were made, that we gained sufficient knowledge of the structure of crystalline gem materials to make significant progress with synthesis.

1. Synthetic emerald created using the flux-melt method. Photo courtesy of Henry Mesa, Gem-A.

The earliest commercial success in gemstone synthesis came in 1891, when A. Verneuil used the flame fusion process to artificially produce corundum. This method, however, proved incompatible with emerald growth and it was not until the 1930s that synthetic emerald came to the market. Since then, two principal methods, termed flux-melt and hydrothermal, have been used for this purpose. Both approaches rely on solvents; the former involves heating a flux solution to a high temperature, whilst the latter uses water at a high temperature and pressure. In the context of geological origin, natural emerald occurs in hydrothermal and metamorphic deposits. Hydrothermal synthesis recreates these hydrothermal conditions, whilst flux-melt employs an artificial 'magma', resembling the igneous origins of other beryl varieties.

The flux-melt method (also known as flux-fusion) is primarily used for the synthesis emerald, corundum, chrysoberyl and spinel. In the simplest

terms, the process uses a molten fluid, or flux, which acts as a solvent in which various reagents dissolve and then crystallise in mineral form. This reaction takes place in a crucible made from a heat-resistant material, such as platinum.

In the case of emerald, higher density beryllium oxide (BeO), aluminium oxide (Al_2O_3) and chromium oxide (Cr_2O_3) are fed down to the bottom of the crucible. Meanwhile, lower density silica (SiO_2) in the form of silica glass is floated on the surface, above a perforated platinum screen. At a temperature of around 800°C the reagents dissolve in the flux and diffuse through the melt, reacting to form emerald crystals. Typically, beryl seed plates are provided, though alternative techniques encourage more spontaneous nucleation.

> The relative rarity of sizeable, 'gem-quality' material provided a clear commercial incentive to develop a synthetic alternative.

The hydrothermal method has been successfully used to grow synthetic beryl, corundum and quartz. This involves enclosing the required reagents, in addition to seed crystals, in a container called an autoclave (also known as a 'bomb' due to the high pressure involved). As with the flux-melt process, pieces of silica (in the form of crushed quartz) float on top of the solution and the oxides of Be, Al and Cr rest at the bottom. The sealed autoclave, which has been partially filled with water, is then heated to a temperature in excess of its boiling point until the water exists as a high pressure, dense fluid. This hydrothermal solution is capable of dissolving ingredients considered insoluble under normal conditions. A combination of diffusion and convection brings the

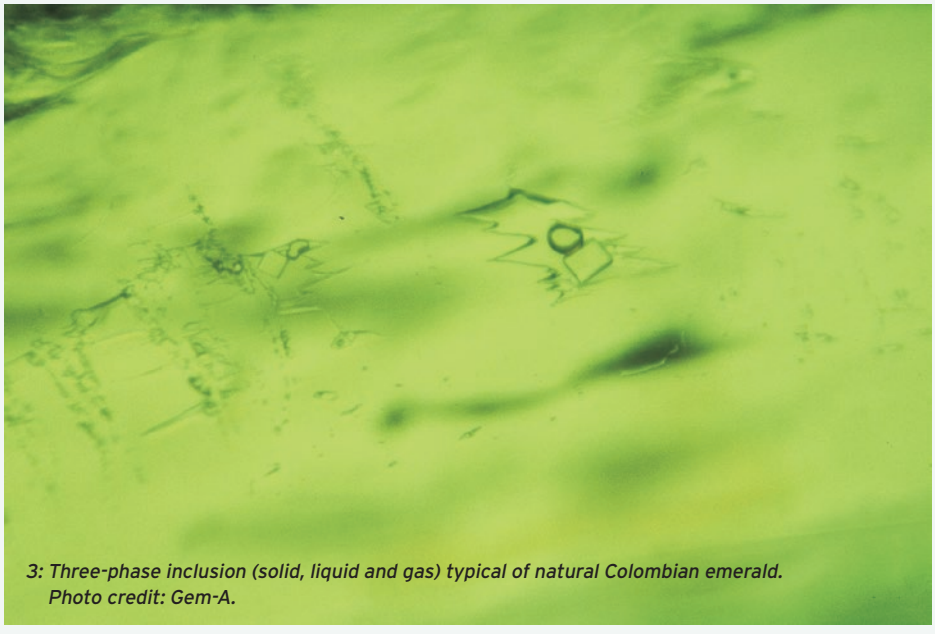
2: Synthetic emerald created using the hydrothermal method. Photo courtesy of Henry Mesa, Gem-A.

reagents to the slightly cooler centre of the autoclave where they form an emerald solution that crystallises on the seed material.

Hydrothermal growth requires 600°C temperatures and a pressure of around 1,000 times atmospheric pressure. Depending on the crystal size, the process takes around two weeks, whilst flux-melt emerald requires significantly longer growth times of between two months and a year. This accounts for the higher cost of flux-melt synthetic emeralds.

The first known synthetic emerald was produced by J. J. Ebelman in 1848 by adding natural emerald powder to a boric acid flux; however, the resultant crystals were minute. Then, in the late 1800s P. G. Hautefeuille and A. J. E. Perrey experimented with further flux compositions; in 1888 they succeeded in growing a 1 mm emerald crystal with a lithium molybdate flux. K. Nassau, a foremost commentator on the subject, asserts that 'all successful flux growth of emerald derives from the work of Hautefeuille and Perrey'.

One of the difficulties faced when tracking the development of gemstone synthesis is that, for commercial reasons, the technical details tend to have been closely guarded. An important exception to this rule is H. Espig, who collaborated with the I. G. Farben emerald project from 1924 until 1942. In 1960 he published an account of their work which provides a valuable insight into the problems faced by those exploring flux-melt synthesis. Their initial discovery was that simply dissolving and recrystallising emerald gave them little control over nucleation. Instead, the raw materials containing the essential ingredients for emerald needed to react in the flux, crystallising steadily within a designated growth region. Here, the advantage of lithium molybdate is that beryl is less soluble in it than the reagents required for its synthesis. This means that emerald crystals are able to grow whilst the reagents gradually dissolve to provide continuous feed materials. →



3: Three-phase inclusion (solid, liquid and gas) typical of natural Colombian emerald. Photo credit: Gem-A.

In order to avoid oversaturation, which causes the formation of many tiny crystals as opposed to fewer larger ones, the reagents needed to be separated for part of the process. This was initially achieved by adjusting the flux density so that the silica floated. The problem with this method was that the emerald was inclined to grow on the silica. This issue was resolved by incorporating a platinum screen to physically separate the growing emerald crystals from the silica. The final I. G. Farben method was able to produce crystals up to 20 mm in length, though abundant inclusions resulted in an undesirable translucent appearance.

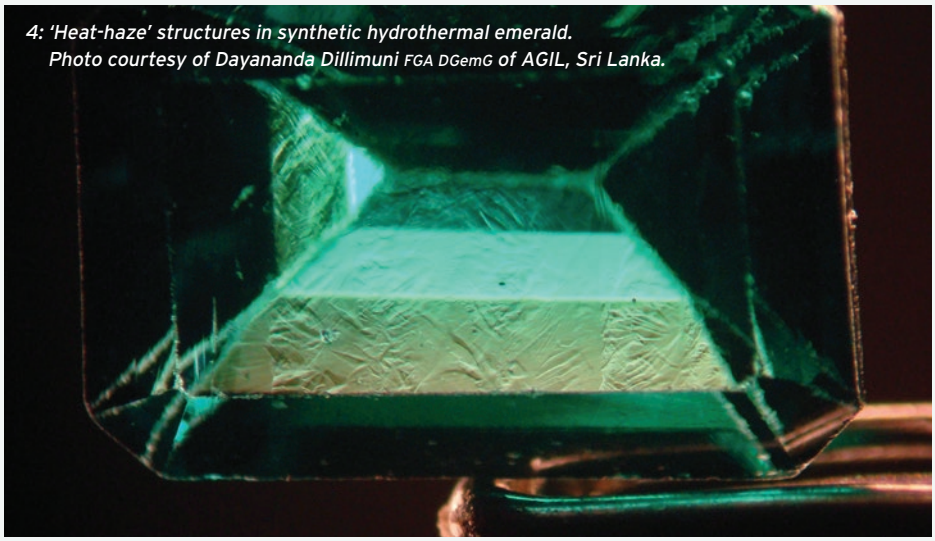
Another important figure in the 1920s was R. Nacken, who developed his own flux-melt method independently of I. G. Farben/Espig. It was he who succeeded in producing the first, albeit small, gem-quality synthetic emeralds (up to 0.15 ct when faceted).

Commercial success was finally achieved in 1935 by C. Chatham and again in 1964 by P. Gilson, both of whom developed their methods independently of I. G. Farben/Espig, Nacken, and of each other. Influenced by the work of Hautefeuille and Perrey, they used a lithium molybdate flux in what is thought to be a similar process to that established by both Espig and Nacken back in the 1920s. By 1952 Chatham was growing emeralds weighing up to 4.00 ct when faceted.

By the mid-1970s J. Sinkankas reports that Gilson commanded 95% of the synthetic emerald market. According to R. Diehl, by 1977 Gilson was growing large synthetic emeralds which were 'completely eye-clear'. This was a major development as relatively clean synthetic emeralds are not only highly desirable, but the absence of characteristic inclusions makes them more difficult to distinguish from the natural mineral.

The growth of emerald by a hydrothermal process was first reported by A. Van Valkenburg and C. E. Weir in 1957, though J. Lechleitner is usually cited as the first commercial producer. Marketed from 1960, Lechtleitner's synthetic emerald consisted of emerald grown in a thin layer around a colourless beryl seed, resulting in an unsatisfactory pale green appearance. The real breakthrough came in 1965 when the Linde Division of Union Carbide made available the first entirely synthetic hydrothermal emeralds.

Earlier successes have been attributed to I. G. Farben, Nacken, Chatham and others; however, Nassau states that 'these claims must be denied'. He accepts that powdered emerald was recrystallised under hydrothermal conditions but argues that 'useful'-sized crystals were not produced until later. Nacken's contribution has proved the most contentious, with primary sources indicating a successful hydrothermal method. Again, Nassau makes a strong case against this, in part by showing that samples held by the British Museum constituted colourless natural beryl fragments covered with a thin layer of flux-grown emerald.



4: 'Heat-haze' structures in synthetic hydrothermal emerald. Photo courtesy of Dayananda Dillimuni FGA DGemG of AGIL, Sri Lanka.

> The future of this industry depends on several factors, primarily the enduring popularity of emerald-set jewellery and the increasing scarcity of high-quality emerald deposits.

5: Platinum wire hook in synthetic flux-melt emerald. Photo courtesy of Dayananda Dillimuni FGA DGemG of AGIL, Sri Lanka.

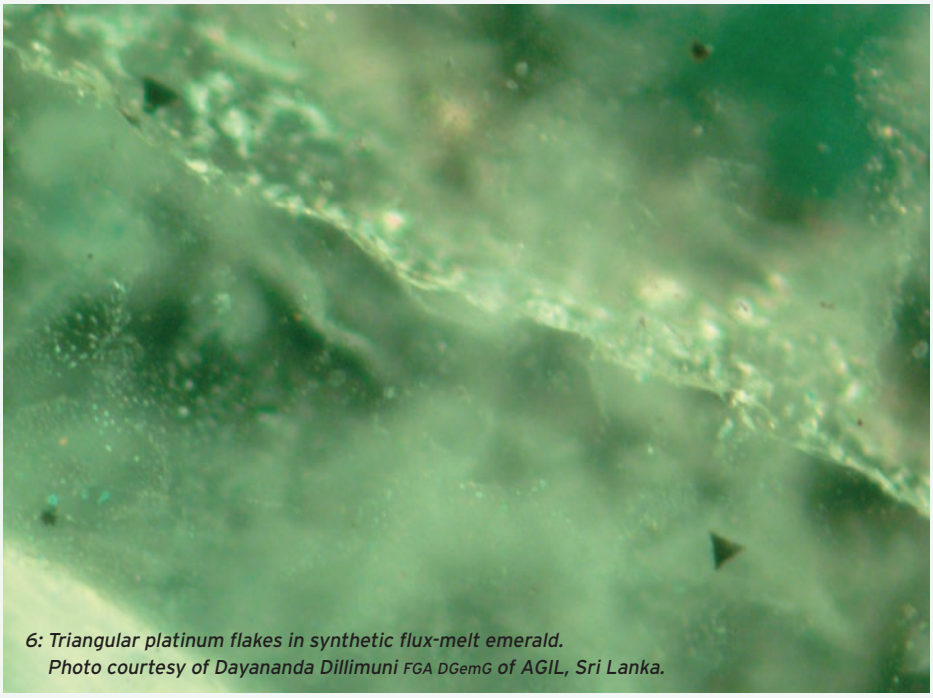
Patents issued in 1971 provide details of the process developed by Linde. These suggest that they adapted a method previously used to grow other varieties of beryl, replacing the neutral to alkali medium with an acid medium. The crucial discovery was that acidic conditions prevented the Cr from precipitating. Large crystals were produced by separating new growth from the original beryl seed and using it as the seed for the next growth run; this process could be repeated several times. Growth rates of 0.3 mm per day far exceeded those of flux-melt synthesis. An updated process is revealed in a further patent issued by Linde in 1973. This describes the use of an extremely acidic medium, which resulted in reported growth rates of up to 0.8 mm per day.

By the mid-1980s Biron had developed a new hydrothermal process that produced exceptionally clean and large single crystals. Then, in the late 1980s Russia emerged as a leading producer of hydrothermal emerald, which remains the case today.

In terms of identification, although synthetic and natural emerald share the same essential chemical composition and crystal structure, the crystal habit, internal appearance, refractive index (RI), birefringence (DR) and specific gravity (SG) may vary. Conforming to its hexagonal crystal symmetry, natural emerald typically exhibits a hexagonal prism habit. Flux-melt crystals display a similar form (**1**); in contrast, hydrothermal emerald occurs in tabular square or rectangular wafers (**2**). When viewed from the side, these can show the paler seed at their centre. In some instances, it is therefore possible to identify rough hydrothermal crystals by careful observation of their form.

When it comes to fashioned gem material, internal features known as inclusions can indicate a natural or artificial origin. Natural emerald typically reveals a 'jardin' effect, where its densely included interior resembles a garden. Examples include two- and three-phase inclusions (**3**), bamboo-like forms and a range of different mineral inclusions.

On the other hand, modern methods of synthesis enable the production of clean, or only slightly included gem material. Examining the interior of a specimen, ideally under magnification, can reveal types of inclusions that are characteristic of either natural or synthetic emerald. It is common for flux-melt emerald to contain partially-healed flux 'feathers' and 'wispy veils'. Though potentially inclusion-free, hydrothermal emerald may possess chevron-like zones and 'heat-haze' structures (**4**). Both types of synthetic material can display nail-shaped inclusions, in addition to colourless phenakite crystals and small pieces of metal from the crucible or autoclave, such as platinum (**5** & **6**).



6: Triangular platinum flakes in synthetic flux-melt emerald. Photo courtesy of Dayananda Dillimuni FGA DGemG of AGIL, Sri Lanka.

The author photographed at the AGIL booth at the Facet Sri Lanka 2019 International Gem & Jewellery Show. Photo courtesy of Dayananda Dillimuni FGA DGemG.

It is important to combine these observations with an assessment of RI and SG. Despite a significant overlap, synthetic emerald tends to have a lower RI, DR and SG in comparison with its natural counterpart. There is also a difference between the range of values for flux-melt and hydrothermal synthetics. Synthetic emerald can feature an unusually strong dichroism and absorption spectrum, in addition to appearing a brighter red under the Chelsea Colour Filter (CCF). However, manufacturers may add iron (Fe) to suppress this result. Some natural Colombian emeralds can also appear bright red under the CCF.

In conclusion, two principal methods of emerald synthesis have been developed since the mid-1800s, with manufacturers achieving varying degrees of success. The processes outlined have continued to evolve to this day, resulting in the range of products currently on the market. The continued manufacture of synthetic emerald can be attributed to the current demand for commercially viable alternatives to natural, gem-quality emerald. The future of this industry depends on several factors, primarily the enduring popularity of emerald-set jewellery and the increasing scarcity of high-quality emerald deposits. Ethical concerns and consumer confidence also play an important role, demanding transparency at all levels of the industry. ■

References and a bibliography are available upon request.

MYANMAR

1: A trapiche spinel specimen from Mogok, Myanmar.

A LESSER-KNOWN TREASURE

Mogok in Myanmar is known for its quality rubies, however, this famous mining area also produces the lesser-known trapiche spinel. Two gem professionals from Myanmar's Ministry of Natural Resources and Environmental Conservation, Thet Tin Nyunt, Director General of the Department of Geological Survey and Mineral Exploration, and May Tin Zaw Win, Manager at Myanma Gems Enterprise, share their findings on this unusual gemstone.

Myanmar is famous for producing the finest ruby, sapphire and jade. Mogok is an important source of rare and collectors' gemstones, which includes varieties of trapiche gemstones. In this article we focus on trapiche spinel, a very rare gemstone that has been recovered only occasionally from Upper Chaunggyi village, Mogok.

The term 'trapiche' derives from the Spanish word for the cogwheels used in old sugar mills. In Myanmar, the local name of the trapiche gemstone is 'Kyauk Sat Kyar' (swastika rock) or 'Kyauk Hle Bein' (cartwheel rock). Most of the people in Myanmar traditionally believe that this stone can bring both luck and mental power (**1**).

Trapiche spinel was first discovered by a local person in 2008. Since the first discovery it has been found mainly in three places in Mogok: The Upper, Middle and Lower Chaunggyi villages. Trapiche spinel is mainly recovered from secondary placer alluvial and eluvial deposits, most of them being artisanal mines (**2**).

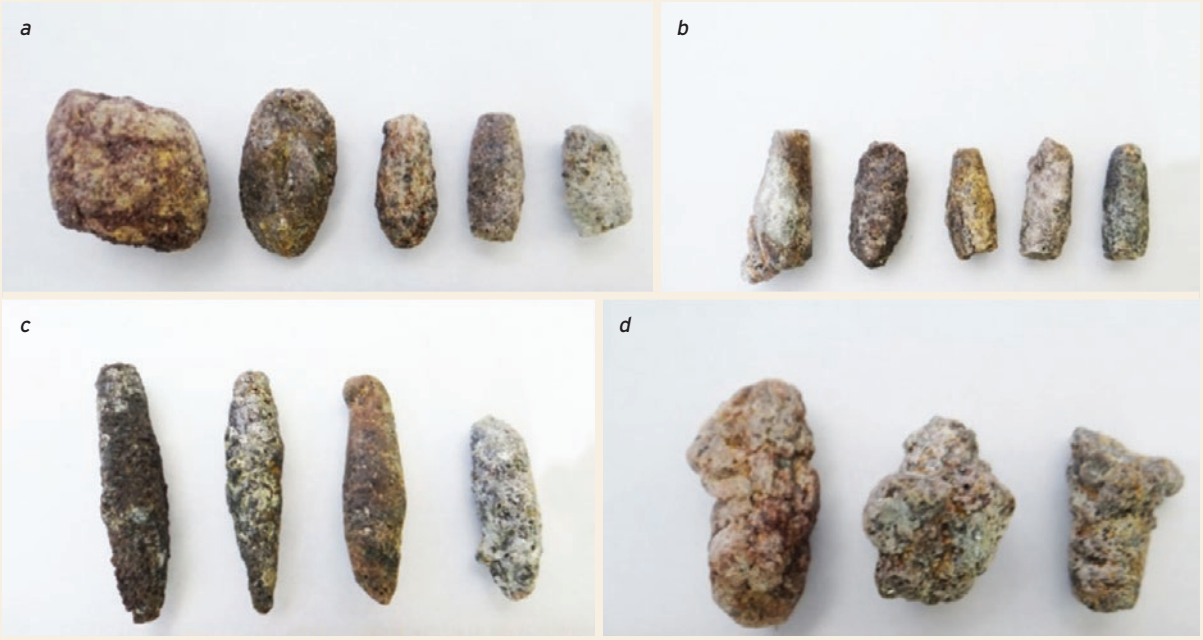
2: A view into the trapiche spinel mine at Upper Chaunggyi village.

A local rare gem dealer from Mogok recently reported that he has sold about 50-60 specimens to date and has said that the price of a small cut trapiche spinel (4-6 carats) is US $50 per piece and larger sizes (7 cts to above 10 cts) are US $100 per piece.

The trapiche spinel market depends on the buyers because it is primarily a collectors' gemstone, but it can also be used in jewellery. The best pieces of trapiche spinel show a clear trapiche pattern and are transparent. For that reason, careful cutting and polishing are important, as well as the experience of the lapidarist.

ANALYSIS OF TRAPICHE SPINEL

The geometry of the six-arms pattern in trapiche spinel is very rare; this can be seen when the crystal is cut perpendicular to the long axis. The 14 trapiche spinel samples studied show pseudotrigonal habit and aggregate habit (**3**). Among the pseudo-trigonal habits, we can differentiate three groups: pseudo-barrel habit (**3a**); pseudo-pyramidal habit (**3b**); and pseudo-bipyramidal habit (**3c**). In all types, the crystals are terminated by the pinacoid-like faces. In the aggregate habit, the above-mentioned crystals are associated together (**3d**). The studied samples were cut parallel to these pinacoidal faces and also perpendicular to the vertical axis of the crystal. The surface of the crystal (pseudo-pyramidal) faces is more or less rough, pitted and uneven with a sandy appearance.



3. (a) Common pseudotrigonal habit of trapiche spinel: pseudo-barrel habit; (b) pseudo-pyramidal habit; (c) pseudo-bipyramidal habit; (d) aggregate habit.

The common colour of rough trapiche spinel is grey; some purplish grey specimens are also found. It mostly shows opaque and uneven surface features, some of which are covered with graphite minerals on the surface. Rough can range from 5×16 mm to 13×29 mm in size.

Cut trapiche spinel shows pinkish, purplish brown, orangy brown, and reddish brown colours with a translucent, vitreous lustre. They show six dendrite arms in various shapes. All cut trapiche spinel showed black inclusions under magnification. The sizes of the analysed cut trapiche spinel varied from 6.5 mm – 16 mm in diameter.

The presence of graphite on the surface of trapiche spinel suggests that it originated in the graphite marble or in the skarn zone where intrusive rock is in contact with the (graphite marble) country rock due to metasomatism and/or metamorphism. The composition of the trapiche in the trapiche spinel is still under research with some modern analytical instruments. The possible composition may be carbon, which later developed as graphite on the surface.

TYPES OF TRAPICHE SPINEL

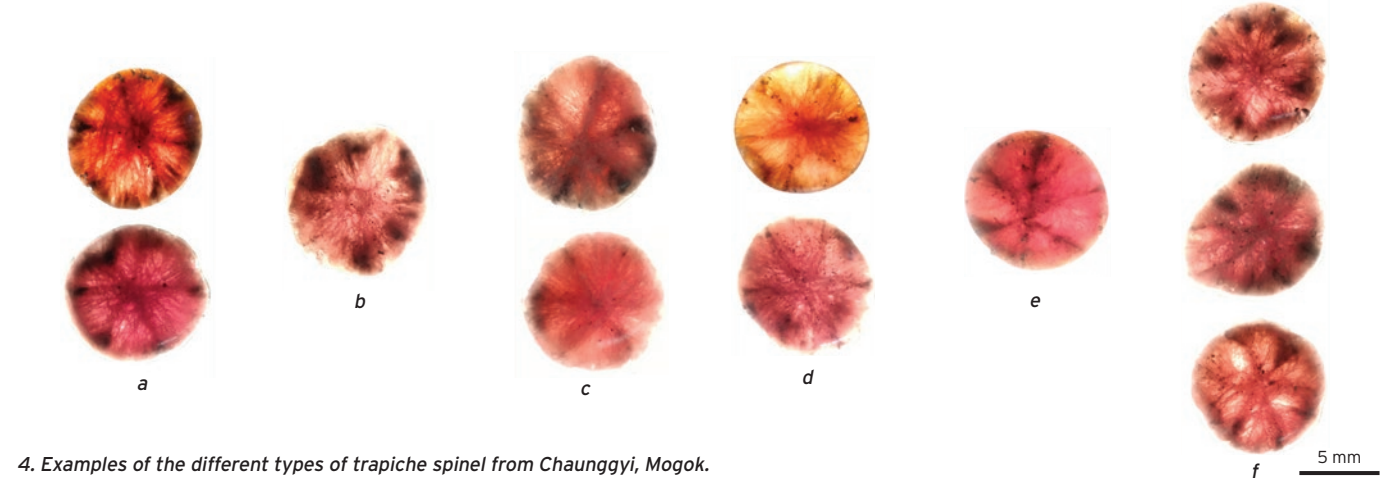
In this study, the analysed trapiche spinel can be classified according to the nature of the core and dendrite arms pattern. Type I trapiche spinel has a central core and Type II has no central core. Type I trapiche spinel can be subdivided into four sub types according to the shape of the dendrite arms: Arrow-shaped dendrite (**4a**); fan-shaped dendrite (**4b**); spoke-shaped dendrite (**4c**) and star-shaped dendrite (**4d**). Type II trapiche spinel can also be subdivided into two sub types: single arm (**4e**) and double arms (**4f**).

While trapiche spinel is an attractive stone, gem quality trapiche spinel is very rare. Therefore, trapiche spinel is one of the rarest collectors' gemstones found in the Mogok Gemstone Tract in Myanmar.

ACKNOWLEDGEMENTS

The authors would like to thank Mr Tay Thye Sun from Far East Gemological Laboratory, Singapore, for his kind knowledge sharing and encouragement; Ko Myo of Golden Virtue Gems for providing a spinel trapiche photo and information; and Ko Min Thiha DGSE for photo arrangement. ■

References and further details are available upon request.



4. Examples of the different types of trapiche spinel from Chaunggyi, Mogok.

All images courtesy of May Tin Zaw Win.

INDIA

History, Heritage … and Hype

Renowned jewellery historian and published author, Jack Ogden FGA, traces the history of Indian diamonds and questions the sustained marketing hype around the famous Golconda mines.

Today India is the largest centre for diamond cutting, handling some 90 percent of the world's diamonds. But most who cut, sell or buy these diamonds, in the cutting centre of Surat or at the vast diamond exchange in Mumbai, are probably unaware that in the past the country was also the world's major source of diamonds. Exceptions are the dealers in larger stones, ones they hope a laboratory report might link to the famous Golconda mines in India, a link that allows a price premium. This article will look at India's remarkable diamond history and ponder whether associating a diamond on the market with 'Golconda' is really just marketing hype.

2: Dating to about 300-350 AD, this ring is set with an uncut brown diamond weighing about seven carats and is the largest diamond surviving from the ancient world. Photo credit: Jack Ogden.

Before the discovery of diamonds in Brazil in the 1720s, most came from India, a few from Borneo. The ring in figure **1** was made two thousand years before the Brazilian discoveries by a Greek goldsmith who had travelled as far as what is now Aï Khanoum in the extreme north of Afghanistan, a city founded in the wake of Alexander the Great's conquests. A pink sapphire, almost certainly from Sri Lanka, is flanked by two small diamond crystals. Found in 1999, it is the earliest surviving diamond ring from an archaeological excavation.

This early jewellery use of diamonds had been preceded by diamond chips used to drill and engrave other gemstones. The hardness that made them so useful here also led to their use as gems. Rough diamond crystals are hardly pretty, but they were a perfect symbol for strength. Indeed, our word 'diamond' derives from the Greek for 'invincible'. Diamond-set jewellery only appeared in the countries around the Mediterranean a few centuries later than they had further east. The ring in figure **2** dates to about 300–350 AD and was found in Syria, then under Roman rule and strategic in the trade in luxury goods from India and the East. This ring is set with an uncut brown diamond weighing about seven carats and is the largest diamond surviving from the ancient world.

With the fall of the Roman Empire, trade with India fell off and we find little evidence for diamond-set jewellery in Europe again much before the 1200s when the Eastern trade began to be re-established. A superb example of Medieval diamond-set jewellery from the mid to late 1300s is the Crown of

1: A pink sapphire and diamond ring, crafted by a Greek goldsmith, two thousand years before the discovery of diamonds in Brazil in the 1720s. It is the earliest surviving diamond ring from an archaeological excavation. Photo credit: Osmund Bopearachchi.

Princess Blanche, also called the Bohemian or Palantine crown, now in the treasury of the Munich Residenz (**3**). The crown left England as part of the dowry of Princess Blanche, daughter Henry IV, when she married Ludwig III in 1402. In addition to the wide range of coloured gems it is set with, it also has just over thirty diamond crystals of which a quarter are imitation — as described in an original inventory.

These diamonds and the other gems in this crown were discussed in detail by Karl Schmetzer and Albert Gilg in *The Journal of Gemmology* Vol. 37(1). Whether the 'invincibility' of diamond was associated in Europe with a hoped-for constancy in love by the time the crown was made is uncertain, but this link

3: The Crown of Princess Blanche, also called the Bohemian or Palantine crown, from the mid- to late-1300s. Photo credit: Jack Ogden.

had certainly appeared by a few generations later. It was not an invention of De Beers. A diamond and ruby ring specifically described as a marriage ring is listed in the will of an English woman written in 1505. This was quite probably like that in figure **4**, of which several examples are known. This particular one, from the late 1400s, was found near Launde Abbey in Leicestershire, England, in 2013 and later sold at Sotheby's.

Perhaps here the diamond represented the unbreakable nature of marriage, the ruby a wish for fertility (red gems had long had such an association). Unlike those in Blanche's crown, the diamond here is polished. Very rudimentary cutting and polishing of diamonds had become possible by the later 1200s and during the 1400s improved machinery provided the rapid, even rotation necessary for the development of more sophisticated cutting. Perhaps the earliest European representation of a diamond-cutting machine – not unlike those used until very recently – is shown in figure **5**. This is from the section on diamond in Adam Lonizer's *Naturalis Historiae* of 1551.

Seven years before that English woman had written her will, the Portuguese explorer Vasco da Gama had stepped onto Indian soil following the first direct sea voyage from Europe. Sea trade with India and the spice lands of the East Indies began to blossom. The English and Dutch wrestled this trade from Portuguese hands and the English East India Company became a major player in the Indian diamond trade. There were rich diamond mines in India and huge treasures of diamonds amassed by the local rulers over the previous centuries. William Hawkins who was with the East India Company in India in the early 1600s, estimated that the treasury of the Mughal emperor Jahangir at Agra included more than 135,000 carats of uncut diamonds, with none under two and a half carats.

Our knowledge of the localities and working of the Indian diamond mines are largely derived from the accounts of traders coming to India from medieval times onwards. Early Indian texts sometimes list diamond sources, but it is seldom possible to identify these with modern places names. The earliest Indian diamond mines were likely those in the north of India, with two mining areas further south coming later. One of these was Golconda. The name Golconda can refer to a city, the region of which it was capital, or to a particular diamond mining area. This area is shown in the map of 1744 in figure **6**.

Golconda, essentially modern Hyderabad, was an important centre for trading diamonds from local and other mining areas. The 'Golconda' diamond mines are usually accepted to be those from the south-east, between the city and the sea, →

4: A diamond and ruby marriage ring from the late 1400s, found near Launde Abbey in Leicestershire, England, in 2013 and later sold at Sotheby's. Photo credit: Sotheby's, London.

Whether the 'invincibility' of diamond was associated in Europe with a hoped-for constancy in love by the time the crown was made is uncertain... It was not an invention of De Beers.

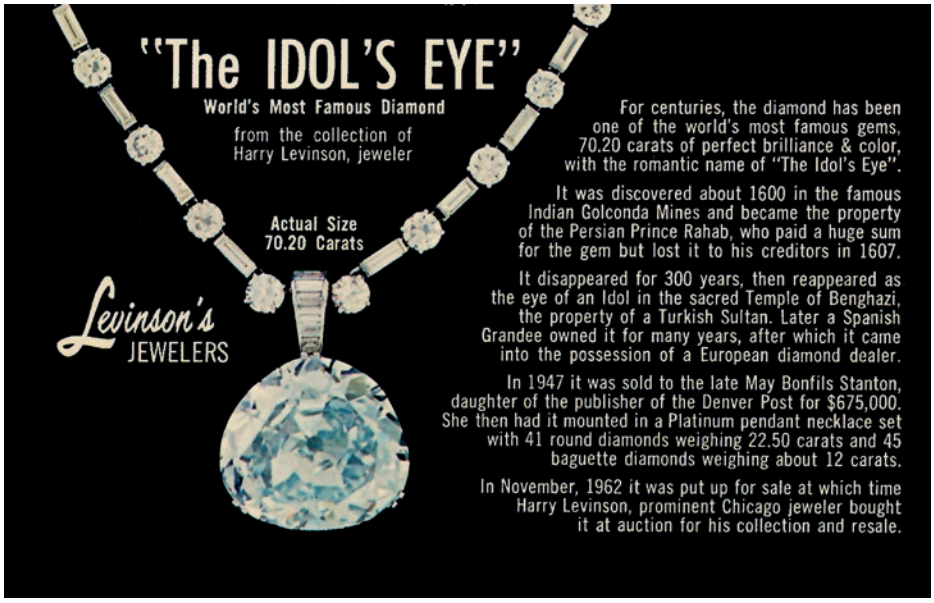
5: The earliest European representation of a diamond-cutting machine taken from Adam Lonizer's Naturalis Historiae *of 1551. Photo credit: Mannheim University Library.*

primarily along the Krishna river. However, these Golconda mines are almost certainly not the 'legendary' source of diamonds in early times, nor the oldest source in the world, as is often asserted.

Reports from East Indian Company personnel, Dutch diamond merchants and others make it clear that the famous Golconda mine at Kollur (shown as Coulour on the old map in figure **6**) was the first mine found in this area and that was not until around 1619. The area quickly began to produce a large number of diamonds, often of good sizes. William Methwold, an administrator with the East Company noted that "jewellers of all the neighbouring nations resorted to the place" and that there were 30,000 working there. But there was still a huge amount of diamond mining going on elsewhere in India and the 130,000 carats that Jahangir had amassed in his treasury had been found before these Golconda mines had been discovered.

6: The area of 'Golconda' shown in a map from 1744. Photo credit: antiqueprints.com.

century and a half later by those from Africa. The importance of the Golconda mines to the East India Company's trade in the 1600s had made the name a household one in England and it has continued to resonate since, leading ultimately to the almost mythical status apportioned to 'Golconda' for diamond marketing purposes. To save embarrassing modern auction houses, I will show an older example.



7: An advert from Harry Levinson of Levinson's Jewelers Inc in Chicago from the late 1960s or early 1970s, showcasing the blue Idol's Eye diamond, which is almost certainly from India. Image from a private collection.

An older, and still very productive, diamond mining area further west did technically become part of the Kingdom of Golconda in 1564, but these mines were always clearly distinguished from the famous 'Golconda mines' in past descriptions by diamond merchants, geographers or other observers.

After the 1720s the importance of Indian diamonds was eclipsed by the discovery of diamonds in Brazil, and a

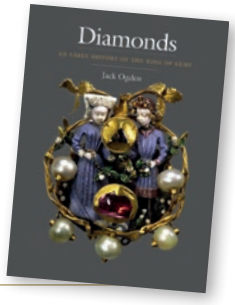
The advertisement in figure **7** is from Harry Levinson of Levinson's Jewelers Inc in Chicago from the late 1960s or early 1970s. The blue Idol's Eye diamond is almost certainly from India, but there is no evidence whatsoever to support the assertion that, "It was discovered about 1600 in the famous Indian Golconda Mines" let alone that it had once belonged to an otherwise unknown "Persian Prince Rahab".

These statements had first been made when the stone sold at auction in New York in 1962. Things have become slightly more objective since then and laboratories tend to apply the term 'Golconda type', if they use it at all, only to large Type IIa diamonds of exceptional colour and clarity. But to my knowledge there is no evidence that top quality Type IIa diamonds were more prevalent in the Golconda mines than at others in India.

It would be naive not to understand that laboratories, auction houses and other sellers of large diamonds are working in a competitive field and must strive to provide what their customers want. Nevertheless, the sellers take their lead from the labs and these, by definition, should provide objective and cautious reports or risk becoming what I recently described as the marketing arm of the gem trade (*The Journal of Gemmology* Vol. 35(5)). If there was some likelihood that a particular large, highest quality Type IIa diamond came from India, it might be reasonable to describe it as "probably from an Indian mine", but I doubt that would allow the price premium possible with the magic word 'Golconda'.

Diamonds have a remarkable history in which India plays an important part, including the renowned mines of Golconda. This should be celebrated. But am I alone in thinking that it is unfair to the ultimate buyers to use 'Golconda' like a brand name to boost profits with seemingly little concern for historical accuracy or scientific justification? ■

For more on the early history of diamonds see Jack Ogden's Diamonds: An early History of the King of Gems. *(Yale University Press 1918).*



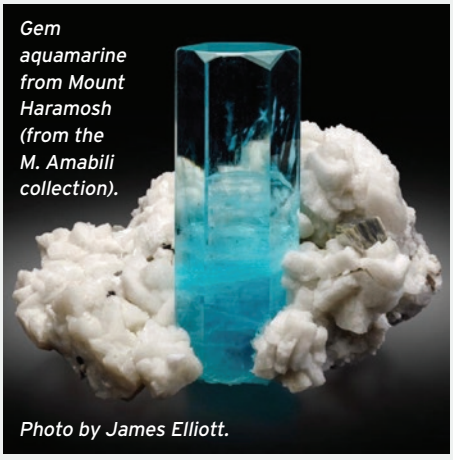
Memories of Pakistan

Giuseppe Agozzino with an outstanding Afghan kunzite crystal. Photo by Roberto Appiani.

International gem and mineral dealer Giuseppe Agozzino recounts his experiences in Pakistan in the 1980s, including the hunt for gems in the Karakorum mountains.

The majestic Karakorum mountains, in the eastern part of the great Himalaya range, have been from time immemorial an impassable barrier between the Indus plane to the south and the harsh plateau to the north. That being said, they are also home to a spectacular variety of desirable gemstones.

In 1979 the government of Pakistan began an ambitious project to explore and expose the wealth of their country to the wider world. Although fine emeralds had been mined for a long time at Mingora in Swat Valley, the Karakorum region of north Pakistan was later selected to concentrate the efforts of the Gemstones Corporation of Pakistan.



Gem aquamarine from Mount Haramosh (from the M. Amabili collection). Photo by James Elliott.

I personally started field research in the Karakorum Mountains in 1981 with the help of the Balti people. From 1981 to 1984, I completed more than 20 gem-mineral explorations, focusing my efforts on the Haramosh Mountains group and on the areas around Shigar, Basha and Braldu valleys. Other research into the Nanga Parbat and Babusar Pass area, was conducted with the help of my friend Mulana, the well-respected mullah of Chilas, and brought to light fabulous Sappat peridot at the end of the 1990s.

The queen of Karakorum gemstones is undoubtedly the aquamarine. The only known places where aquamarine could be found at the time when the Gemstones Corporation started its research were the Dassu area in Braldu River, the Shengus area and Mount Haramosh.

In front of Dassu Village, beyond Braldu River, there is a huge granite wall rock with hundreds of rich veins which produce beautiful blue aquamarine and fabulous sherry topaz.

Another mine camp was installed on the road that links Gilgit and Skardu, next to the village of Shengus, just 50 metres above the mighty Indus River. In Shengus the pegmatites bearing aquamarine are scattered all over the mountains around the camp. The crystals are mainly elongated, very brilliant and gemmy, although pale in colour.

In 1987, a huge deposit of aquamarine was discovered by a group of hunters from villages in Nagar Valley. Nagar Valley is just to the east of Karimabad, the capital of Hunza, and the pegmatites are located at an altitude of 5,000 metres. They can only be mined for a few months every year. Enormous quantities of aquamarine have been mined in this location; most of the production is high-level mineral specimens, while the percentage of gemstones is unfortunately low.

I taught many people how to look for gemstones and how to mine them. Many of those first miners are still my friends. Experience has been passed on and shared again and again, leading to a large community of miners, dealers and scientific institutions.

During my adventurous collecting expeditions in the Karakorum mountains, I realised that the mountains around me were so rich in gemstones that nobody other than local inhabitants could afford to mine them. At the bottom of the valleys, many areas are suitable for mining purposes, but other promising sites are situated very far in the upper glaciers or at the top of inaccessible peaks. Who knows what further treasures could be uncovered in the future? ■

Further information on gems from the Karakorum Mountains can be found in Giuseppe Agozzino's book, Karakorum: Inferno di rocce – Paradiso di gemme e cristalli.

Miners in the southern foothills of Mount Dobani, Karakorum, Pakistan in 1983. Photo by Giuseppe Agozzino.

Wallace Chan is internationally recognised for his innovative high jewellery techniques and breath-taking creations. Here, the master jeweller speaks to *Gems&Jewellery* about his humble beginnings and the inspirations behind his jewels.

MASTERING JEWELLERY

It could be said that Wallace Chan is the epitome of a modern renaissance man; the master jeweller combines his expertise in mathematics, science and technology with an extraordinary skill for design and craftsmanship to create jewellery pieces that have secured global recognition.

Although Chan runs a successful luxury business today, his early life couldn't have been more different: "My childhood was far from a fairy-tale. I experienced hunger, poverty, loss and grief." Chan believes his challenging beginnings are an important catalyst for his work today and he encourages others to embrace their own difficult memories and backgrounds.

He says: "I want to show people that it is okay to experience all of these challenges, and then turn our experience into something true, kind and beautiful."

During a talk at the Gem-A Conference in 2018, it was clear to all those assembled that Chan has an especially strong dedication to his craft. In order to develop his trademark Wallace Cut – a unique carving technique that creates the illusion of a three-dimensional engraving in transparent stones – he went back to square one and worked as an apprentice for seven months.

1: The Wallace Cut in smoky quartz.

Chan felt this specific and extensive training was vital for him to gain the mechanical expertise necessary to invent new tools, which would later enable him to realise his vision (**1**).

However, Chan certainly doesn't rest on his laurels when it comes to his innovations; once one is mastered he moves onto the next. Other notable innovations from Chan include his patented jade technique, which maximises the colour and light of jewellery-set jade; his diamond claw setting method – inspired by a Ming-style architectural joining method – where gemstones can be set into jewellery without a claw; and his 'Secret Abyss' pendant, a piece of rutilated quartz containing a dazzling arrangement of 1,111 emeralds and a yellow diamond, which took 10 years to complete.

In 2019, Chan unveiled another invention, The Wallace Chan Porcelain. "I spent decades of my life observing and admiring porcelain and its history", Chan says. "Seven years ago, I set out

2: Celestial Rhythm: A ring crafted from The Wallace Chan Porcelain and titanium featuring diamonds and a fancy coloured 6.21 carat diamond.

to create a new type of porcelain. To achieve the results I desired, I spent a great deal of time studying, researching and experimenting."

The most remarkable feature of Chan's porcelain is that it is virtually unbreakable, in fact, it is said to be five times stronger than steel. The key to creating this ultra-strong material, Chan reveals, is down to the firing:

"Generally, porcelain is fired to a maximum temperature of 1400°C; I fire my porcelain to a temperature between 1550°C and 1650°C. The material's ability to endure high temperature, and to remain stable and consistent throughout, ultimately produces stronger, harder and more lustrous porcelain."

The Wallace Chan Porcelain is another example of how multifarious skills are needed to reinvent jewellery (**2**). Chan explains that maths and science were integral to accomplishing this invention: "Precise calculations are key to a successful creation. If at a certain point the temperature increases too slowly or too quickly (by even a fraction of a degree), the chemical make-up of the porcelain may be altered, preventing me from achieving the desired result. Also, porcelain shrinks during the firing process, so to ensure the perfect fit of the various components within each creation, I must study and calculate the shrinkage rate accordingly."

Going the extra mile to invent new materials is of paramount importance to Chan, who attests that his innovations have enabled his design ideas to flourish: "The Wallace Chan Porcelain, together with the titanium material, has given my creations many more possibilities. The different materials complement each other to elevate the aesthetics and mechanical complexity of the jewellery creations. The Wallace Chan Porcelain also has a smooth, lustrous texture and adds a new palette of colours to the creative process."

3: The 'Music of Dawn' titanium earrings set with diamond, yellow diamond, emerald, spessartine garnet and pink sapphire.

> "Today, I am glad to see that titanium is no longer a stranger in the world of jewellery."

4: The Bright Star brooch from Chan's Forever Dancing series which is crafted in titanium and composed of yellow diamond, fancy coloured diamond, crystal, mother of pearl and a genuine butterfly specimen hermetically sealed within the jewel. In Chinese culture the butterfly is associated with everlasting love.

The master jeweller has also been keen to share his secrets with the jewellery industry. Following seven years of research, Chan accomplished the key to adapting titanium for use in jewellery and subsequently made the technology available within the public domain (**3**).

He says: "Without new knowledge and innovations, there can be no progress. When I first launched my titanium creations in 2007, not many people understood why I wanted to use titanium, when gold and platinum were the most popular metals, and thus the obvious choices. I spent many years promoting titanium because I knew its hardness, lightness and colours had a lot of creative possibilities for the development of jewellery culture. It is also biofriendly and known as a space age metal. Today, I am glad to see that titanium is no longer a stranger in the world of jewellery." →

The Keeper of Time necklace made from titanium and The Wallace Chan Porcelain, set with blue topaz, green tourmaline, fancy sapphire, aquamarine and diamond.

Chan may be recognised all over the world, but he certainly doesn't see himself as a global player and doesn't have grand ambitions to expand his small, Hong-Kong based company: "I don't have a global luxury jewellery business. My team is small, and we are tight as a family." Rather, what appears to be most important to Chan is dedicating as much time as possible to his craft: "Life is short, and there is never enough time. I can only seize the moments I have to create. I have many dreams, and each of my creations is a dream come true."

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As technologically and artistically impressive as Chan's jewellery designs are, perhaps the key to their appeal is the clear sense of passion and feeling infused within them (**4**). Indeed, Chan admits that "love is key to my creations". He continues: "Love is what I want people to feel when they see and touch my creations, and when they hear the stories of my pieces."

Despite being endlessly busy with researching, creating, inventing and travelling to international jewellery shows throughout the year, Chan always finds time to give back to the industry by sharing his knowledge and experience with the next generation of jewellery professionals. Chan says: "As I never received a formal education, it means a lot to me that I have something to contribute to the education sector."

Chan shows us that there is so much more to being a master jeweller than simply having skills and creativity; relentless dedication, a willingness to never stop learning and a selfless love for your craft are essential if you want to go down in jewellery history. As he affirms: "Creating is not like watering a single plant, it's more like sowing many different seeds in a garden or even a forest. Today, I still have seeds that I sowed three decades ago, still waiting for the right moment to bloom." We certainly can't wait to see what future jewels will blossom from this atelier. ■

All images courtesy of Wallace Chan International Limited.

Detail of the Butterfly Nebula pair of brooches, crafted in titanium and set with yellow diamond, diamond, tsavorite garnet, pink sapphire, amethyst, ruby (left) and yellow diamond, diamond, tsavorite garnet, pink sapphire, ruby (right).

Let's talk China

Are you a growing jewellery brand or e-commerce business looking to make your mark in China? Ariel Tsai, Business Development Manager at UK-based Chinese digital marketing agency, PingPong Digital, shares her insights.

With the start of a new decade, China is no longer a second-thought market for many western brands. Western brands often find it difficult to see the full picture of the Chinese market as what they are used to in the west has no bearing at all. The blockage of Western social media like Facebook, Twitter and Instagram means China has developed its own version of social media and established its own ecosystem.

LIVE STREAMING

Live streaming is an incredibly popular format in China and serves as a marketing tool for a wide range of industries. Currently, there are more than 200 live-streaming platforms. New and rapidly growing sites such as Yizhibo and Huajiao have gained popularity and established their own positions in the market. Technology is the left hand that helps push live streaming forward and the internet celebrity is the right hand that popularises the technology among consumers.

Austin Li, one of the top live streaming celebrities in China, has 16 million followers on Weibo and can sell hundreds of thousands of products in one night during a live stream. The internet celebrity phenomenon is more significant in China than anywhere else in the world. Chinese consumers tend to trust other people's recommendations, opinions and reviews more than an official brand message. Internet celebrities build up good relationships and trust with their followers and lead them to live streaming where they can see a product and purchase it instantly. The industry has grown so much so that it is more than just a tool for e-commerce in China. It is now live commerce and it is shaping the buying habits of Chinese consumers across the whole country.

Live commerce could become the new normal for businesses across the globe, filling the gap of offline (bricks and mortar) shopping in the future. China has set a good example for a new way of not just doing business but also bringing a new form of entertainment to the public.

VERTICAL COMMUNITY: A CLOSED LOOP ECOSYSTEM

Have you ever felt annoyed when you click a link on Facebook and another page loads that takes you out of the app? The interruption of the user experiences has been a critical issue. Live streaming e-commerce is a good example of a 'closed loop ecosystem' that enables consumers to watch and shop at the same time. Aside from live streaming, Chinese tech giant Tencent is doing more on this subject.

Tencent, which owns WeChat, has done an exceptional job in creating a closed ecosystem using vertical platforms and community. On WeChat, one of the biggest social media channels in China with over 1.1 billion users, consumers can do pretty much everything: texting a friend, shopping, reading, booking an appointment, paying for electricity bills, and watching live stream videos. WeChat uses mini programs (sub-applications within the app) to help brands build a vertical community. WeChat is not the only app that adopts this pattern; Weibo, another popular app in China, has recently announced its social commerce store function in an attempt to compete.

Brands can utilise the vertical platforms to direct consumers to buy instantly and directly on the platform. Brands can also use the vertical community to build up an after-sales service and consumer loyalty. As Chinese consumers are becoming more conditioned to this experience, it is vital for brands to make sure whatever they do in the market is tied together under one roof — proving a seamless experience to the customer.

Brands need a strategic approach to get their brand messages and product/service information across to Chinese consumers in a compelling way. It is also vital to keep cultural differences and consumer behaviours in mind when making decisions in the Chinese market. As the saying goes: 'When in Rome, do as the Romans do.' ■

Find out more about PingPong Digital at pingpongdigital.com

Plume Agate from Iran

Nathan Renfro FGA GG and Maryam Mastery Salimi GG explain more about this striking mineral.

Iran has long had a reputation as a source of quality agate, principally derived from several extensive volcanic deposits throughout the country. Archeological research on ancient finds in early human settlement sites and ancient tombs in Iran show that agate, chalcedony and jasper were used not only for making stony blades and instruments like arrowheads, but also as a gemstone for ornamental purposes, often seen carved into beads and pendants. Several varieties of agate can be found in the market, but plume agates are the most colourful and sought-after. Shot with a 6.00 mm field of view, this photomicrograph shows red, green and yellow inclusions in a piece of 'autumn agate' from Iran. ■

Image credit: Nathan Renfro FGA GG.

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