

GEM AND JEWELLERY RESEARCH SYMPOSIUM OF SRI LANKA

*"ADVANCING THE FUTURE OF THE GEM AND JEWELLERY
INDUSTRY THROUGH SCIENCE, TECHNOLOGY, AND SUSTAINABILITY"*

2nd September 2026 | Silver Ray Hotel, Ratnapura

PROCEEDINGS

Gem and Jewellery Research and Training Institute
National Gem and Jewellery Authority
Gemmologists Association of Sri Lanka



Gem and Jewellery Research and Training Institute (GJRTI),
National Gem and Jewellery Authority (NGJA), and
Gemmologists Association of Sri Lanka (GASL)



Proceedings of the
**GEM AND JEWELLERY RESEARCH SYMPOSIUM
OF SRI LANKA 2026**

on

*"ADVANCING THE FUTURE OF THE GEM AND JEWELLERY
INDUSTRY THROUGH SCIENCE, TECHNOLOGY,
AND SUSTAINABILITY"*

02nd September 2026

Silver Ray Hotel, Ratnapura

ABSTRACTS

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Gem and Jewellery Research Symposium of Sri Lanka 2026

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Gem and Jewellery Research Symposium of Sri Lanka 2026

02nd September 2026

Technical Session I

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Rapporteur : Dr. Dulini Yasara Mudunkotuwa

- | | |
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Rapporteur : Dr. R.S. Diyabalanage

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Gemmological and Spectroscopic Characterization of Kornerupine-Group Gems from Elahera, Sri Lanka: Evidence for Occurrence of Prismaticine

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Kornerupine-group minerals are familiar to gemmologists as rare, strongly pleochroic collector gems, yet material from Sri Lanka's Elahera gem field remains poorly documented by integrated optical, vibrational and chemical methods. This study characterizes yellow to brownish-green Elahera specimens and tests whether material conventionally identified as kornerupine, which is sensu stricto its boron-rich analogue, prismaticine. Four transparent-to-translucent stones (1.409-4.085 ct) were examined by standard gemmological testing, petrographic microscopy and unpolarized UV-Vis absorption spectroscopy; Raman spectra were acquired from five specimens at two laboratories, and five LA-ICP-MS spot analyses were obtained from one chemically analysed specimen. All samples are anisotropic and biaxial negative, with $n_{\alpha} = 1.660-1.669$, $n_{\beta} = 1.670-1.677$, $n_{\gamma} = 1.675-1.685$ and birefringence of 0.013-0.017. Strong trichroism spans near-colourless, yellow-green and brownish-green. Polarizing microscopy reveals abundant rounded to subhedral zircon inclusions, locally surrounded by radial fractures and interference-colour strain halos, together with muscovite, phlogopite and opaque phases; this assemblage is consistent with metamorphic paragenesis. Recurrent Raman bands near 704, 753, 879, 966-972, 1013-1041 and 1117-1122 cm^{-1} confirm the kornerupine-group structure. Bands near 784-798 and 875-882 cm^{-1} support a B-rich composition, although their relative intensities are orientation dependent and cannot alone quantify boron. Additional bands at 3539-3611 cm^{-1} record structurally bound OH. LA-ICP-MS analysis yielded 3.55-4.08 wt% B_2O_3 (11,020-12,680 ppm B); structural-formula calculations normalized to 43 anion charges give 0.74-0.85 B atoms per formula unit (apfu), placing the analysed specimen securely within the prismaticine field. Unpolarized UV-Vis spectra, together with V (152-165 ppm), Cr (130-180 ppm) and FeO_t (4.76-4.86 wt%), are consistent with mixed transition-metal control of the yellow- to brownish-green coloration rather than a single chromophore. These results show that some Elahera kornerupine stones routinely identified as 'normal' kornerupine may be gemmologically characterized as prismaticine. Raman spectroscopy provides efficient screening, but quantitative boron analysis remains necessary for defensible species nomenclature.

Keywords: Erupine group, Prismaticine, LA-ICP-MS, Raman spectroscopy, Elahera

Blockchain Based Gemstone Authentication and Ownership Tracking System

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The gemstone industry faces counterfeit gemstones, ownership disputes, and legacy record-keeping systems vulnerable to tampering and lacking traceability, while public blockchain platforms such as Ethereum present limitations for enterprise and government applications, including transaction fees, privacy concerns, and reliance on public infrastructure. This research aims to design and evaluate a permissioned blockchain based system for gemstone authentication and ownership tracking, adapted to the Sri Lankan gemstone industry, addressing the gap between physical gemstone authentication and reliable digital record keeping. A web-based prototype was developed using a customized Hyperledger Fabric network with smart contracts governing gemstone registration, certification, authentication, and ownership transfer, and cloud based storage for supporting digital assets such as images and certificates. Physical authentication was performed through gemmological certification, with the resulting certification data linked to an on-chain record for each gemstone. Permissioned identity management and role-based access control support authorized stakeholders, including government authorities, laboratories, and traders, with the NGJA proposed as the primary regulatory network operator and authorized laboratories and industry participants operating additional nodes. The prototype was validated through repeated test cases covering registration, authentication, and ownership transfer transactions, alongside unauthorized-access attempts. All transactions executed successfully, and all restricted operations were correctly denied to unauthorized users. Compared with a previous Solidity-based implementation, the proposed approach eliminated public network transaction fees and provided controlled, role-based access. The findings indicate that a permissioned blockchain architecture with a smart contract-based ownership model, governed by NGJA as regulatory operator, is a viable approach for strengthening provenance, accountability, and trust in the Sri Lankan gemstone industry, supporting ethical sourcing and responsible mining, with future work needed to quantify performance at scale and extend adoption among small-scale traders and artisanal miners.

Keywords: Chain, Gemstone authentication, Digital provenance, Hyperledger fabric, Ownership tracking, Permissioned network

Gemological and Spectroscopic Characterization of an Exceptionally Large Green Beryl from Dimiyawa, Ratnapura, Sri Lanka: Evidence for Fe-Dominated Coloration

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Beryl comprises several gemstone varieties, including emerald, aquamarine, morganite, and green beryl. Although various gem varieties have been reported from Sri Lanka, gem-quality beryl remains relatively rare, and large green beryl specimens are uncommon worldwide. Recently, an exceptionally large green beryl weighing approximately 700 ct was discovered in the Dimiyawa area of Ratnapura, Sri Lanka. Beyond its remarkable size, this specimen offers a rare opportunity to establish the colour-causing mechanism in a large, gem-quality green beryl through an integrated gemological and spectroscopic approach, providing a reference dataset for a variety that remains comparatively understudied relative to emerald and aquamarine. A field investigation was conducted at the recovery locality prior to laboratory characterization. Classical gemological properties were determined, and colour grading was performed using the GIA standard colour grading system. UV-Visible absorption spectroscopy and Raman spectroscopy were employed to investigate the optical and structural characteristics, while chemical composition was analyzed using energy-dispersive X-ray fluorescence (ED-XRF). Microscopic examination revealed plate-like mica inclusions, tentatively identified as biotite or muscovite, arranged in clusters parallel to crystallographic planes. Classical gemological properties were consistent with beryl, and Raman spectroscopy confirmed the beryl structure through characteristic bands at 290, 323, 397, 686, 1010, 1068, and 1236 cm⁻¹. The UV-Visible spectrum displayed prominent absorptions near 375 and 425 nm, consistent with Fe³⁺-related transitions, a weak shoulder near 700 nm, and increasing absorption toward the red-NIR region, indicating only a limited Fe²⁺ contribution to the blue component. GIA grading classified the specimen as green to bluish green. ED-XRF detected 1.55 wt% total Fe (as Fe₂O₃), with V and Cr₂O₃ at only trace levels (0.0031 and 0.0017 wt%, respectively). These results support predominantly Fe-related coloration in this specimen, with minimal Cr/V contribution. As the study is based on a single, exceptional specimen, the findings represent a detailed case characterization rather than a generalized statement, offering a useful reference point consistent with Fe-related absorption as a key control on green beryl colour.

Keywords: *Green beryl, Sri Lankan beryl, Fe-related coloration, UV-Visible spectroscopy, Raman Spectroscopy, Mica inclusions in beryl*

RatnaCore: A Digital Record-Keeping Platform for Small-Scale Gemstone Lapidary Businesses in Sri Lanka

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Small-scale gemstone lapidary enterprises in Sri Lanka, which contribute significantly to the gem and jewellery export economy, continue to rely on paper-based or fragmented record-keeping for rough stone intake, cutting and polishing documentation, yield quantification, and worker remuneration, resulting in incomplete production histories and a disconnect between shop-floor activity and business records; generic ERP and inventory systems remain unsuited to these operations due to the digital literacy and configuration overhead imposed. This study aimed to design, deploy, and iteratively validate RatnaCore, a domain-specific, low-barrier platform that enables data capture at the point of origin on the shop floor, rather than reconstructing it later from paper records. A user-centred design methodology was employed, comprising an online survey of 47 participants (8 business owners, 39 workers) predominantly from Ratnapura, supplemented by 3 semi-structured interviews with business owners; requirements were prioritised by frequency and severity of reported deficiencies, with validation via live pilot deployment rather than pre-implementation prototyping. The survey confirmed predominantly manual or fragmented record-keeping among owners, with 75% reporting suspected yield loss; prevalent smartphone and reliable internet access among owners, alongside a strong worker preference for mobile-application input, confirmed the technical feasibility of shop-floor digital capture. All owners expressed interest in adopting a digital solution, and workers widely associated timestamped digital records with greater payment confidence. The platform, comprising a mobile application, web-based portal, and centralized backend, has been deployed for one month with two participating employers; pilot feedback and reported issues have informed rectification of several processes, reflecting iterative refinement ahead of broader rollout. No usability, accuracy, or adoption metrics have yet been collected; shop-floor data capture and yield tracking have been observed in active use, while broader adoption outcomes remain anticipated.

Keywords: Digital transformation, Gemstone record-keeping, Lapidary yield tracking, Shop-floor data capture, Small-scale enterprise, User-centered design

Trace-Element and Inclusion Characteristics of Coloured Spinel from Sri Lanka: A Preliminary Comparison to Determine the Geographic Origins

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Sri Lankan coloured spinel remains insufficiently represented in gemological reference databases, limiting confident geographic-origin interpretation. This study evaluated 33 natural-coloured spinel from localities of Ratnapura, Elahera, Rakwana, Balangoda and Okkampitiya using standard gemological testing, energy-dispersive X-ray fluorescence (EDXRF), UV-Visible spectroscopy and inclusion microscopy, with comparison to reference information for Myanmar, Tanzania and Vietnam. Refractive indices of 1.715–1.718, specific gravities of 3.51–3.61 and isotropic optical behavior were consistent with natural spinel. EDXRF provided the principal chemical discrimination. Sri Lankan samples were generally Fe-rich, containing 4,591–93,900 ppm Fe with a median of 33,770 ppm, and were enriched relative to the central Myanmar and Tanzanian distributions, although they overlapped with Vietnamese varieties. Tanzanian spinel showed comparatively Zn-rich compositions, whereas spinel from Myanmar displayed higher central Cr concentrations. Accordingly, combined Fe–Zn–Cr relationships were more informative than any single element. Microscopy provided a second major line of origin evidence through inclusion assemblages, morphology and spatial arrangement. Sri Lankan samples commonly showed fine hair- or thread-like needles, zircon-like crystals with tension halos, crystal clusters and characteristic healed fingerprint networks. Published secondary data indicate that Myanmar spinel shows well-formed octahedral negative crystals and web-like fingerprints; Tanzanian spinel displays swirls of dust-like or exsolved particles, oriented planes, platy particles and two-direction short needle-like features; and Vietnamese spinel shows dislocation-like needles, maze-like fingerprints and transparent tabular crystal clusters. These features were most useful when interpreted as complete assemblages together with EDXRF chemistry rather than as isolated inclusions. UV-Visible spectra supported the interpretation of Fe, Cr and V related colour but showed substantial inter-origin overlap and were therefore not independently diagnostic. The combined use of trace-element patterns and inclusion assemblages of coloured spinel provides a practical preliminary framework for determination of their geographic-origin.

Keywords: Coloured spinel, EDXRF, Geographic origin, Inclusion assemblages, UV-Visible spectroscopy

AR-Based Virtual Jewellery Try-On System

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Online jewellery retail is constrained by the impossibility of physical try-on: static imagery cannot convey scale, proportion or how a piece sits on the wearer, while in store sampling raises hygiene concerns. Existing augmented reality (AR) retail systems do not close this gap, addressing large scale planar placement or coarse two-dimensional facial overlays, whereas wearable item systems depend on fiducial markers, depth sensors or background subtraction, none of which achieve joint level precision. This study designs, implements and evaluates a marker less AR virtual jewellery try-on system for rings, necklaces and earrings on commodity mobile devices. Its novelty lies in two mechanisms rather than a conventional Unity and MediaPipe integration. First, dynamic landmark vector alignment resolves a 21-point three-dimensional hand topology, exposes each landmark in Unity as an individually addressable annotation, computes per-frame positional vectors against a world origin at (0,0,0), and binds the ring transform to a runtime-switchable anchor node, allowing a ring to be moved between fingers during a live session. Second, a constraint layer clamps yaw, pitch and roll and damps positional and rotational transitions through Vector3.Lerp and Quaternion.Slerp before rendering necklaces and earrings at ear and neck-base anchors derived from a Face Reference Mesh initialized via XR Origin and AR Session, sustaining alignment across changing head poses. Jewellery models were built in Blender 4.5 with physically based materials, retopologised to mobile polygon budgets and exported as FBX bundled on-device for network-independent execution. Structured observational testing across lighting conditions, skin tones, occlusion and rapid head movement, incorporating an unconstrained versus constrained ablation, showed anchoring persisted under partial occlusion without migration between fingers, while constraint removed the over rotation and clipping observed in the unconstrained baseline. Performance degrades under extreme occlusion, very low illumination and atypical facial geometry. Instrumented benchmarking and e-commerce integration remain future work.

Keywords: *Augmented Reality (AR), Virtual Jewellery Try-On, Marker less Registration, 21-Point Hand Landmark Tracking, Face Reference Mesh Anchoring*

Integrating Gemstone Traceability: A Framework for Responsible and Transparent Gemstone Supply Chains

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Over the past several decades, there has been a lack of consistent evidence for the gemstone from mining to final consumer. Although Sri Lanka is internationally recognized for producing some of the world's finest gemstones, comprehensive documentation covering the entire supply chain remains limited. Due to this deficiency in data, it impacts the transparency regarding the process from the mine to the final consumer of the gemstone. The purpose of this is to introduce the Gemstone Traceability Certificate, an all-inclusive framework created to record a gemstone's entire journey via a safe and verifiable traceability system to provide strong information set with reducing the theft risk for the gemstone. The framework records each stage of the gemstone lifecycle, including mining, lapidary processing, laboratory identification, jewellery mounting (where applicable), insurance documentation, and keeper's history. Through the Gemstone Inclusion Mapping (GIM) system, Photographic Standard Operating Procedure (PSOP) and other recording unique gemological characteristics, a unique gemstone identity is created, allowing for long-term identification throughout the system. The development of a Mining Record accompanied by a structured, Mining Site Assessment Report is one of the objectives of this study when recording all mine to final consumer data. Key assessment criteria include mining legality, regulatory compliance, human rights protection, occupational health and safety, environmental management, community engagement, and mine rehabilitation. That mining site assessment data collects through document review, interview and on-site assessment. The proposed structure enhances transparency, encourages ethical sourcing, increases stakeholder confidence, and offers a practical framework for maintain responsible gemstone traceability record from mine to final consumer by integrating sustainability and due diligence principles into gemstone traceability.

Keywords: *Gem Mining, Gemstone Traceability, Sustainability, Transparency*

Investigation of the Effect of Cooling Rate on Rutile-Silk Dissolution in Sri Lankan Natural Sapphire

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Silky geuda is a variety of sapphire characterized by dense rutile-silk inclusions that scatter light, reduce transparency, and limit commercial value. Although conventional heat treatment can enhance blue coloration, incomplete dissolution or re-precipitation of rutile during cooling may restrict clarity improvement. This study investigated the effect of cooling rate on rutile-silk dissolution and compared a newly developed rapid-cooling technique with the conventional Lakmini-furnace heat-treatment process. Twenty silky geuda sapphire samples with comparable colour, transparency, size, and silk density were selected, cleaned, coded, photographed, and divided into paired portions. The B-series portions were heated to approximately 1800–1950 °C and maintained for 1.5 h under reducing conditions, followed by conventional cooling inside the furnace for approximately 6 h, at an average cooling rate of ~6 °C/min. The C-series portions were subjected to the same heating conditions and duration, followed by rapid cooling achieved by promptly opening the furnace lid and removing the samples to ambient room conditions. Cooling was completed within approximately 1 h, corresponding to an average cooling rate of ~32 °C/min. Before and after treatment, the samples were evaluated by visual colour assessment, inclusion microscopy, UV-Visible absorption spectroscopy, FTIR spectroscopy, and ED-XRF analysis. Microscopic observations revealed more extensive dissolution of rutile silk in the rapidly cooled C-series samples, whereas fingerprint, crystal, needle-like, and negative-crystal inclusions showed broadly similar heat-induced alterations under both treatments. UV-Visible spectra of the rapidly cooled samples exhibited stronger absorption in the 560–580 nm region, consistent with enhanced Fe²⁺-Ti⁴⁺ intervalence charge transfer associated with blue coloration. FTIR spectra initially displayed a weak band near 3309 cm⁻¹; after heating, its intensity increased, while an additional band near 3232 cm⁻¹ developed and was more intense in rapidly cooled samples, indicating reorganization of OH-related lattice defects. ED-XRF concentrations ranged from 382,300–492,300 ppm Al, 980–1,520 ppm Fe, and 75–155 ppm Ti, with no major treatment-related variation in bulk elemental composition. Overall, rapid cooling promoted greater rutile-silk reduction and improved the clarity and commercial quality of Sri Lankan silky geuda sapphire.

Keywords: Blue colour enhancement, Heat treatment, Rapid cooling, Reducing atmosphere, Rutile-silk dissolution, Silky geuda sapphire

Examining the Challenges and Barriers to Industry 4.0 Adoption in Sri Lanka's Gem and Jewellery Businesses

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Sri Lanka's gem and jewellery sector is known for its craftsmanship, authenticity, and export potential. However, many firms remain slow to adopt Industry 4.0 technologies that can improve digital production, traceability, integration, and customer confidence. This study examined the readiness of Sri Lankan gem and jewellery businesses to adopt Industry 4.0, the factors affecting adoption, and the reasons firms continue to lag in manufacturing and selling activities. An interpretivist qualitative case study design was used. Six companies were selected through convenience and purposive sampling, and one senior manager from each company took part in a semi-structured interview. The data were transcribed, coded in NVivo, and analysed through thematic analysis. The Technology, Organisation, and Environment framework guided interpretation and cross-case comparison. The findings showed that Industry 4.0 readiness is uneven and at an early stage. Three readiness themes emerged: uneven awareness, limited technical foundations, and skills and training gaps. Some firms used websites, social media, and software, but integration, smart production technologies, and structured data use were weak. Adoption factors included external market pressure, management support, and concerns about infrastructure, expertise, and risk. Foreign buyers, global competition, and transparency expectations encouraged adoption, while limited government support and weak local guidance slowed progress. Lagging adoption was linked to weak digital foundations, missing advanced infrastructure, skill gaps, traditional work culture, leadership mindset, and uncertainty about benefits and incentives. High costs, unclear returns, limited expertise, employee resistance, and owner reluctance prevented adoption from moving from intention to regular use. The study concludes that gradual digital planning, workforce training, system integration, and practical institutional support are needed to modernise firms while protecting traditional strengths. It contributes to research on Industry 4.0 adoption in traditional export-oriented industries in developing economies, especially Sri Lanka's gem and jewellery sector.

Keywords: *Gem and jewellery industry, Industry 4.0, Readiness, Sri Lankan gem and jewellery sector, Technology adoption*

Toward a Dual-Tier Certification System for Heat-Treated Sapphire Gemstones: Distinguishing Low- and High-Temperature Treatments

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The global gem industry faces mounting threats from resource scarcity and undisclosed treatment practices, including lab-grown stones and unreported heat treatments used to enhance the value of lower-quality gemstones. While these practices serve industry interests, they also fuel fraudulent activity and undermine consumer trust worldwide, placing significant pressure on gemologists and gemological laboratories to accurately disclose treatments. Sapphire heat treatment is conventionally divided into two categories based on temperature: low-temperature treatments (below 1200°C) and high-temperature treatments (above 1200°C), with actual treatment temperatures ranging from approximately 400°C to 1950°C depending on the stone. Distinguishing low-temperature-treated sapphire stones from untreated ones is considerably more difficult than identifying high-temperature treatments, and detection becomes nearly impossible at the lowest treatment temperatures (around 400°C) without advanced analytical instrumentation. This detection gap creates a real risk that heated sapphire stones are misidentified as unheated during certification—an error that can severely damage the reputation of the certifying laboratory and gemologist, even when made in good faith. This paper proposes a modification in gem certification by mentioning low-temperature and high-temperature heat treatments, paired with the maximum observed treatment temperature. Under this system, a certification error would, at worst, misclassify a low-temperature-treated stone as untreated, while making it structurally impossible to certify a high-temperature-treated stone as untreated, even by mistake. By narrowing the margin for error to the lower-risk category, the proposed system offers a practical safeguard for laboratory credibility and strengthens consumer confidence across the gem trade.

Keywords: *Fraud prevention, Gem certification, Heat treatment, Low-temperature heat treatment*

Artificial Irradiation Enhancement and Long-Term Colour Stability of Sri Lankan Yellow Sapphires

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Corundum commands substantial value in the international gem trade, and artificial gamma irradiation is increasingly employed to enhance the colour of low-grade sapphire rough. However, reliable methods for distinguishing artificially irradiated stones from their naturally coloured counterparts remain limited. This study investigated the effect of controlled gamma irradiation on the colour enhancement and long-term photostability of Sri Lankan pale colour yellow sapphires. It evaluated whether conventional spectroscopic techniques can reliably detect such treatment. Three yellow sapphire specimens (LPS36, LYS44, LYS49) sourced from the Ratnapura gem gravels were characterised using UV-Visible, Fourier Transform Infrared (FTIR), and Photoluminescence (PL) spectroscopy before and after irradiation with a Cobalt-60 gamma source, followed by photostability testing under ultraviolet exposure and simulated daylight. Irradiation produced marked colour enhancement in all specimens, converting pale olive-grey and grey-green stones to golden-yellow and golden-orange hues. This was attributable to the formation of F-centres and F⁺-centres (oxygen-vacancy defects) absorbing in the blue-violet region (400-500 nm) that complemented the natural Fe³⁺ chromophore. PL spectra confirmed enhanced emission intensity consistent with defect formation. Critically, the defect signatures generated by artificial irradiation proved spectroscopically indistinguishable from those arising through natural geological irradiation, as UV-Vis, FTIR, and PL analyses could not resolve diagnostic differences between the two origins. Colour-stability testing, however, revealed differential fading behaviour: LPS36 and LYS44 retained stable colouration, whereas LYS49 exhibited moderate fading under prolonged daylight exposure, indicating a population of thermally metastable, radiation-induced colour centres. These findings indicate that conventional spectroscopy alone is insufficient for definitive detection of irradiation treatment in yellow sapphires, and that combining spectroscopic characterisation with systematic colour-stability assessment offers a more reliable basis for gemmological identification, with direct implications for treatment disclosure and consumer protection in the gem trade.

Keywords: Sapphire irradiation, Colour centres, F-centres, Spectroscopic analysis, Colour stability

Knowledge, Attitudes and Practices Regarding Gemstone Therapeutics among a Selected Adult Population in Sri Lanka

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Gemstones have a long-standing cultural and traditional significance in Sri Lanka and are closely connected with astrology, spirituality, traditional beliefs, and perceptions of health and well-being. Although gemstones continue to be used for various traditional and therapeutic purposes, limited information is available on how people understand gemstone therapeutics and how these beliefs influence their attitudes and practices. This study aimed to assess the knowledge, attitudes, and practices regarding gemstone therapeutics among adults in the Colombo District, with particular attention to traditional and astrological influences. A descriptive cross-sectional survey was conducted among 100 adults in the Colombo District who were selected using a random sampling method. Data were collected through a structured questionnaire covering awareness, scientific understanding, attitudes, and practices related to gemstone therapeutics. The collected data were analyzed using descriptive statistics. The results showed a high level of awareness, with 92% of respondents reporting that they had heard of gemstone therapy. Traditional and astrological beliefs influenced gemstone selection, with 56% identifying horoscope-based recommendations as an important factor. Furthermore, 62% believed that gemstones could positively influence health and well-being, while 53% expressed trust in astrological prescriptions. A considerable proportion (70%) considered gemstone therapy an important part of Sri Lankan cultural heritage. Regarding actual practices, 52% were current gemstone users, while 32% had consulted an astrologer during the previous year. Nearly half (49%) reported experiencing positive changes after wearing gemstones. However, 71% expressed concerns regarding gemstone authenticity and quality, and 64% believed that improper use could produce negative effects. Notably, 58% believed that gemstone therapy should be used alongside conventional medical treatment rather than as a replacement. Overall, the findings indicate that gemstone therapeutics remains culturally relevant among the surveyed population, with astrology and traditional beliefs continuing to influence gemstone-related decisions. Concerns regarding authenticity, appropriate use, and scientific understanding were also evident. The localized study setting and sample size of 100 adults may limit the generalizability of the findings to the wider Sri Lankan population. Nevertheless, the study provides useful baseline information for further research and supports the promotion of scientifically informed and responsible gemstone-related practices in Sri Lanka.

Keywords: *Gemstone therapeutics, Knowledge, Attitudes and practices, Astrology, Traditional beliefs, Sri Lanka*

Morphometric study, age determination and extraction of DNA from shells from colonial harvests and freshly collected Pearl Oyster (*Pinctada* spp) in the Gulf of Mannar, Sri Lanka

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Pearl oyster fishery in the Gulf of Mannar collapsed during 1920s due to overexploitation. This study was conducted to compare the morphometry of old (>100 years) and new shells, to determine the age of two group of shells and to extract genetic materials from present and past Oyster shells for further studies. Older shells (119) were collected from the shell mound at Silavathura. New shells entangled to fish nets in Mullikulam and dead shells found in the sea-bed in Arippe were collected. Hinge length and six morphometric parameters were measured on pallial line. Ratio of each parameter to hinge length was subjected to canonical discriminant analysis (CDA). Age was estimated through the acetate peel method by observing growth lines. DNA was extracted using an improved phenol-chloroform method and a commercial kit, amplified with universal primers, and verified by gel electrophoresis. Results revealed that the old shells exhibited a larger mean pallial length (41.059 ± 3.94) and width (34.429 ± 3.66) compared to new samples respectively ($21.48 \pm 5.91, 17.56 \pm 5.13$); ($p < 0.05$). Morphometric analysis through CDA showed significant difference between colonial and present shells ($p < 0.05$) creating two distinguish clusters between old and new shells. Pallial length and width were identified as the most important variables for grouping in first function of CDA. No significant differences were observed among new samples collected from two locations ($p > 0.05$). Age determination indicated that colonial oysters ranged from eight to twelve years, and the age of new shells ranged from zero to six years. Molecular analysis successfully extracted DNA from both old and new shells. PCR amplification produced clear bands ~800 bp, confirming successful amplification of the target gene confirming successful DNA extraction from both old and resent shells. Therefore, colonial and present pearl oyster shells show clear morphometric differences, with older oysters comparatively larger and mature. Molecular findings further confirm the applicability of DNA-based methods for comparative identification of historical and contemporary populations.

Keywords: Discriminant analysis, Gulf of Mannar, Molecular identification, Morphometry, *Pinctada* spp.

Optimizing Heat Treatment Techniques for Enhancing Color and Clarity of Kowangu Pushparaga from Sri Lanka

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Corundum is one of the world's most valuable gemstone families, comprising gemstone varieties such as ruby and sapphire. Among its coloured sapphire varieties, the yellow sapphire (Pushparaga) is highly valued for its attractive yellow colour and commercial significance. Kowangu Pushparaga is a naturally occurring variety of Sri Lankan yellow sapphire. However, many natural Kowangu Pushparaga exhibit pale or uneven colour and visible inclusions, reducing their aesthetic appeal and market value. Although heat treatment is widely used to improve gemstone quality, reliable scientific information on the heat treatment behavior of Kowangu Pushparaga remains limited. Therefore, this study aimed to evaluate the effectiveness of controlled heat treatment in improving the colour and clarity of Kowangu Pushparaga, identify the material most suitable for treatment, and provide a scientific reference for future research. Natural Kowangu Pushparaga samples collected from the Ratnapura gem-bearing region were characterized before and after heat treatment using gemmological observations, Energy Dispersive X-ray Fluorescence (EDXRF), UV-Visible spectroscopy, and Raman spectroscopy. The results demonstrated that heat treatment enhanced yellow colour intensity and transparency in several samples. UV-visible spectral analysis showed a broad spectral peak develop at 449 nm relevant to Fe^{3+} - Fe^{3+} iron transition, indicating yellow colour improvement caused by heat treatment. Medium-quality Kowangu Pushparaga responded most favorably, developing a stronger and more uniform yellow colour with improved clarity due to the reduction of visible inclusions, while the corundum crystal structure and overall chemical composition remained stable after treatment. These findings demonstrate that controlled heat treatment can improve the quality and commercial value of Kowangu Pushparaga while preserving their structural integrity, providing a scientific basis for future studies and supporting sustainable value addition in Sri Lanka's gem and jewelry industry.

Keywords: Kowangu , Sapphire , Heat Treatment, Colour , Clarity

Sedimentological and Mineralogical Evidence for a Probable Skarn-Related Provenance of Gem Deposits in the Upper Kelani River Basin, Sri Lanka

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Sri Lanka, historically known as “Rathnadeepa,” hosts gem-bearing terrain across an estimated 25% of its land area, yet exploration has traditionally relied on indigenous knowledge rather than systematic scientific assessment. The provenance of secondary alluvial gem deposits in the upper Kelani River Basin remains poorly constrained, limiting the development of targeted, evidence-based exploration strategies in this economically important region. This study addresses that gap by evaluating the provenance and economic potential of alluvial gem deposits in the Norwood and Bogawantalawa areas of the upper catchment, through integrated sedimentological and mineralogical characterization of core material recovered from three exploratory boreholes (BH1–BH3) drilled along the floodplain of the Kehelgamu Oya. Core samples were analyzed for grain size, grain shape, sorting, sediment maturity, and depositional characteristics. Grain size varied vertically from clay to coarse sand and pebble-grade material, reflecting fluctuating depositional energy within a single fluvial system. Rounded to sub-rounded grains within gem-bearing horizons indicate prolonged fluvial transport and abrasion, whereas angular to sub-angular grains point to more proximal source rocks. Multiple gem-bearing horizons were identified across the boreholes, including one horizon at Norwood associated with a marble boulder containing coarse purple spinel crystals, and, at Bogawantalawa, two horizons of phlogopite-rich sand with spinel crystals directly overlying weathered marble bedrock while this site recording the highest gem potential in this study. Mineralogical analysis across all sites identified an economically significant suite of heavy minerals such as sapphire, spinel, garnet, zircon, citrine, and rutile with gem-mineral abundances averaging 9%, 15%, and 23% across the three boreholes, the highest recorded at Bogawantalawa (BH3). Geomorphological analysis further indicates that broad, low-gradient floodplain segments reduce stream velocity, promoting the settling and concentration of dense heavy minerals. Collectively, these sedimentological, mineralogical, and geomorphological observations point to a probable genetic association between the alluvial gem deposits and proximal skarn-type marble sources, offering a preliminary framework to guide future gem exploration in the upper Kelani River Basin, pending further petrographic and geochemical verification.

Keywords: *Alluvial gem deposits, Gem provenance, Kelani River Basin, Sedimentology, Skarn mineralization, Sri Lanka*

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