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Documenting the Tortoise-Shell Oud Risya in Malaysia: Material Properties, Provenance, and Cultural Biography

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Abstract

Tortoise shell plectra are among the rarest organic materials historically associated with Mediterranean and Middle Eastern musical craftsmanship, yet their use as *risya* (*oud* picks) remains sparsely documented in scholarly literature. To the best of the author's knowledge, and based on a survey of publicly accessible regional publications and databases, there appears to be no existing study in Southeast Asia that examines the presence, material properties, or performance implications of tortoise shell *risya*. This article therefore offers what may be the earliest documented account of such a specimen in Malaysia, with attention to its material characteristics, provenance trajectory, and cultural biography. The earliest verified encounter occurred in Kuala Lumpur in 2017 when a visiting Turkish *oud*ist, who was travelling to Malaysia to perform at the Borneo Arts Festival, shared several tortoise shell fragments with the author for pedagogical exploration. Using a multi-dimensional analytical framework that includes texture, density, flexibility, tone production, and performance interaction, the study evaluates the specimen and compares its acoustic and mechanical behaviour with quill, horn, and synthetic plectra. Findings suggest that tortoise shell exhibits a distinctive combination of density and smoothness that contributes to controlled transients, rounded upper harmonics, and stable articulation suited to nuanced phrasing in *taqsim* and composed repertoire. Given the material's CITES Appendix I status, the study prioritises ethical documentation rather than advocacy of contemporary use. By situating this rare object within material culture and organological perspectives, the article contributes new insights into plectrum history, endangered-material heritage, and the evolving landscape of Southeast Asian *oud* pedagogy.

Keywords: Tortoise-shell risya; oud plectrum; material culture; organology; endangered materials

Introduction

The *risya*, referred to as the *mızrap* in Turkish *oud* and *tanbur* practice, plays a central role in shaping the timbral character and expressive nuances of *oud* performance. Its material composition affects articulation, tone colour, dynamic response and the tactile relationship between the performer and the instrument. Although contemporary players typically use nylon or other synthetic materials, historical accounts indicate a wide range of organic substances used for plectra, including feather quills, horn, bone and various animal derivatives. These materials formed part of the broader organological landscape of the *oud* and were shaped by regional craft traditions, environmental availability and performance aesthetics.

Among these organic materials, tortoise shell represents one of the rarest and least examined forms. References to tortoise shell appear intermittently in Mediterranean and Middle Eastern craft histories, especially

in relation to decorative inlay or instrument fittings. However, its specific use as an *oud* plectrum has not been systematically documented in organological or ethnomusicological literature. A preliminary survey of accessible regional publications, including journal articles, theses, and Southeast Asian indexes, indicates that no dedicated study has examined the presence, material behaviour or performance implications of tortoise-shell *risya* in Malaysia or the surrounding region. To the best of the author's knowledge, no prior publication has addressed this topic in detail. This absence of scholarship stands in contrast to a growing regional interest in *oud* and gambus performance, pedagogy and heritage studies.

The present article extends ongoing scholarly work on rare and endangered *risya* materials within the Malaysian context. It follows the author's earlier publication on the black eagle quill *risya*, which provided the first documented account of a Levantine quill pick introduced into the Malay world and analysed its material culture, curatorial trajectory and pedagogical significance (Raja Zulkarnain, in press). While that earlier study established the first documented account of a Levantine quill *risya* in the region, the present article constitutes the first documentation of a tortoise-shell *risya* within Malaysia. Together, the two studies form a complementary record of rare plectrum materials that have entered Malaysian *oud* practice through distinct transnational pathways. The earlier study also highlighted the importance of documenting fragile and culturally significant musical materials that circulate across borders through performers, exhibitions and informal gift networks. Building upon this foundation, the current investigation focuses on tortoise shell as a second example of an uncommon material entering Malaysia through transnational musical exchange.

The earliest confirmed encounter with tortoise-shell *risya* by the author occurred in Kuala Lumpur in 2017, when a visiting Turkish *oud*ist gifted several shell fragments before travelling to Labuan to perform at the Borneo Arts Festival. Any possible earlier exposure during research visits to Istanbul in 2014 and 2016 cannot be verified and is therefore excluded from the provenance timeline. The fragments received in Kuala Lumpur constitute the first documented introduction of tortoise-shell material into the author's research, and they provide an ethically compliant and traceable basis for the organological analysis presented in this study.

Because tortoise shell is derived from species listed under CITES Appendix I, this study treats the material strictly as a historical object. It does not endorse or support any form of contemporary trade, production or commercial use. Conservation research emphasises that organic materials such as shell, horn and feather require careful handling due to their susceptibility to environmental stress, humidity fluctuation and structural deterioration (Barclay and Drews, 2006). Ethical engagement with endangered materials also requires transparency in provenance and the explicit separation of scholarly inquiry from commercial interest.

To study the material rigorously, this article employs a multi-dimensional analytical framework that integrates organology, performance analysis and material-culture theory. The framework draws on Kopytoff's concept of the cultural biography of things, which proposes that objects acquire meaning through their social trajectories and shifting contexts of use (Kopytoff, 1986). It also builds on Appadurai's exploration of how materials circulate as cultural commodities (Appadurai, 1988) and Hoskins's work on the narrative qualities embedded in objects (Hoskins, 1998). These perspectives enable a deeper understanding of how rare materials like tortoise-shell *risya* enter, move through and become embedded in local musical cultures such as Malaysia's.

Musical implications are examined using approaches informed by Marcus's work on intonation and performance practice in Arab music, which highlights the interplay between material interfaces and expressive nuance (Marcus, 1993). Materiality studies further guide the assessment of texture, density and mechanical responsiveness (Miller, 2005), supporting a structured evaluation of how tortoise shell behaves when used as a plectrum.

By combining material analysis, provenance reconstruction and cultural biography, this article provides what appears to be the first detailed documentation of tortoise-shell *risya* in Malaysia. The study contributes to plectrum organology, endangered-material heritage and the evolving discourse on Southeast Asian *oud* pedagogy. It also responds to the need for systematic recording of rare musical materials before they disappear from circulation or become culturally severed from their original contexts.

Literature Review

Organology of Oud Plectra

The organology of the *oud* has received sustained scholarly attention, particularly regarding instrument morphology, tuning systems, maqām intonation and performance aesthetics (Marcus, 1993). However, plectrum studies remain comparatively underdeveloped despite the *risya*'s significant role in shaping timbre, articulation, dynamic control and expressive nuance. Traditional sources describe a wide variety of materials historically used for plectra, including eagle or vulture quills, horn, bone, hardwood, tortoise shell and later plastics (Farmer, 1929; Shiloah, 1995). These materials were selected based on availability, craft tradition and desired acoustic properties.

Organological analyses tend to emphasise the *oud*'s body, soundboard, bracing, stringing and tuning, with limited discussion of the plectrum as a sonic determinant. Where plectrum materials are mentioned, they often appear in passing as part of broader descriptions of historical playing practice. Contemporary pedagogical writings likewise focus on technique rather than material behaviour. This imbalance reinforces the need for dedicated studies of *risya* materials, especially those that are rare or endangered. The present study responds to this gap by positioning the tortoise-shell *risya* as an organological object deserving systematic analysis.

Material-Culture and Object-Biography Theory

Material-culture theory offers useful tools for understanding how musical materials acquire meaning through use, circulation and historical context. Appadurai (1988) foregrounds the social life of objects, arguing that commodities travel through cultural and economic regimes that shape their value and identity. Kopytoff's (1986) concept of the cultural biography of things further emphasises how objects accumulate differentiated significance as they move across social worlds. Hoskins (1998) extends this approach by demonstrating how objects may act as carriers of narrative memory, especially when embedded in personal or communal histories. These perspectives have been applied to musical instruments, museum artefacts and heritage objects, but rarely to small functional components such as plectra. Yet plectra possess their own trajectories, shaped by material sourcing, artisanal crafting, performer interaction and circulation through pedagogical or exhibition contexts. The analysis of tortoise-shell *risya* in this study draws explicitly on these theoretical lenses, treating the object not only as a material tool but also as a bearer of cultural biography that reflects transnational musical exchange, ecological constraints and evolving pedagogical practices in Malaysia.

Historical Uses of Tortoise Shell in Musical Instruments

Tortoise shell has a long but uneven history of use in musical craftsmanship across the Mediterranean and Middle Eastern regions. Historical examples include inlays, pickguards, ornamental veneers and accessories for instruments such as the *oud*, *tanbur*, *qanun*, mandolin and violin. Its aesthetic appeal, density and distinctive tactile quality made it desirable for decorative and functional applications.

Although tortoise shell appears intermittently in craft literature as a material used in musical instrument fittings, these mentions are anecdotal and do not constitute systematic documentation of its use specifically as an *oud* plectrum. Existing references tend to describe decorative or structural applications rather than performance tools, which reinforces the absence of dedicated organological analysis**.** However, surviving documentation of tortoise shell specifically as an *oud* plectrum is extremely limited.

Instrument makers and commercial suppliers occasionally reference tortoise shell among traditional materials for *risya* or *mızrap*, but systematic organological studies are absent. Moreover, many historical examples lack provenance or maker attribution, complicating attempts to trace regional traditions with certainty. The restricted legal status of tortoise shell due to its association with endangered species has further limited academic access to specimens, especially in contemporary contexts. As a result, the material remains under-analysed from both historical and acoustic perspectives. The present study contributes to filling this gap by examining a verifiable specimen within Malaysia.

Conservation Science and CITES Restrictions

Tortoise shell is derived primarily from the hawksbill turtle (*Eretmochelys imbricata*). International trade of tortoise shell is prohibited except under very limited circumstances involving pre-Convention specimens or museum collections. Conservation literature emphasises the vulnerability of organic materials, including shell, horn, quill and bone, which are susceptible to environmental fluctuations, humidity, UV exposure and mechanical stress (Barclay and Drews, 2006). Proper handling, storage and documentation are essential for preservation.

For musical organology, these constraints create both ethical and methodological challenges. Researchers must avoid any implication that their work promotes illegal trade while ensuring transparent provenance. In Malaysia and Southeast Asia, where systematic documentation of historic musical materials is still developing, these requirements are particularly important. The present study follows conservation guidelines and explicitly treats tortoise shell as a historical object for research and educational purposes. Ethical framing is necessary not only to comply with international regulations but also to protect the scholarly integrity of the research.

Comparative Studies on Quill, Horn and Synthetic Plectra

Comparative studies of plectrum materials exist primarily for instruments such as guitar, mandolin or Turkish tanbur. Research often focuses on mechanical stiffness, mass, friction and the resulting effects on attack, tone brightness and projection. Quill-based plectra, such as eagle or turkey quills, are valued for flexibility, warmth and nuanced control but require maintenance, including oil conditioning, to prevent brittleness (Barclay and Drews, 2006). Horn plectra offer durability and strong projection but can produce brighter, more aggressive transients. Synthetic materials, including nylon, Delrin or polyurethane, offer predictability and consistency but may lack the expressive variability associated with organic materials.

In the *oud* context, the author's earlier study on black eagle quill *risya* provided the first systematic Southeast Asian analysis of quill material behaviour, conservation issues and cultural biography (Raja Zulkarnain, in press). That work established a methodological precedent for the present study, which extends comparative organological inquiry by evaluating tortoise shell alongside quill, horn and synthetic alternatives using the Zulkarnain Five-Dimensional Framework for Risya Analysis (ZFDF).

Summary of Gaps

The literature reveals several persistent gaps. First, organological studies rarely examine plectrum materials in detail despite their significant acoustic and expressive impact. Second, material-culture perspectives have seldom been applied to small musical objects such as *risya*, leaving their cultural biographies underexplored. Third, while tortoise shell appears historically in instrument craft, no dedicated analysis of its acoustic and mechanical properties as an *oud* plectrum is available in the published record. Fourth, Southeast Asia lacks documentation of rare *risya* materials despite the region's growing investment in *oud* and gambus pedagogy. Finally, conservation and ethical challenges complicate scholarly access to tortoise-shell specimens, further restricting research. This study addresses these gaps by documenting a verifiable tortoise-shell *risya* in Malaysia and analysing its material properties, provenance and cultural biography within a structured analytical framework.

Methodology

This study employs a mixed-methods organological approach combining material examination, acoustic evaluation, performance-behaviour analysis, and object-biographical interpretation. The methodological design supports the Zulkarnain Five-Dimensional Framework for Risya Analysis (ZFDF), which requires the integration of physical, acoustic, mechanical, performative, and cultural-ethical data. The following subsections detail the procedures used to document, analyse, and interpret the tortoise-shell *risya* specimen.

Material Examination

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A physical assessment of the tortoise-shell risya was conducted through direct visual inspection and high-magnification digital photography. Although several tortoise-shell fragments were gifted, only one was subsequently shaped into a functional risya and used as the primary specimen for material and performance analysis. These methods enabled detailed observation of surface texture, density, grain patterns, translucency, and signs of wear. Such approaches reflect standard organological practice for analysing small organic components (Hutchins, 1989; Barclay & Drews, 2006).

Procedure

The specimen was subjected to a series of dimensional, surface, and imaging examinations. Dimensional measurements were conducted using a digital caliper with a precision of ±0.01 mm to determine the thickness of the specimen. Length and width were measured along the longitudinal and transverse axes, while edge curvature was documented to facilitate articulation analysis. Surface examination was carried out under neutral lighting conditions ranging from 12,000 to 15,000 lux. During this process, grain orientation, striations, and surface irregularities were systematically recorded. In addition, variations in colouration and opacity were observed and compared across the specimen. High-magnification imaging was subsequently employed to document surface striations and keratin-layer patterns using digital photography. This technique enabled detailed visualization of grain orientation and other surface characteristics, thereby providing a comprehensive record of the specimen's microstructural features.

Figure 1. *Overall shape, curvature, and edge profile of the examined tortoise-shell plectrum.*

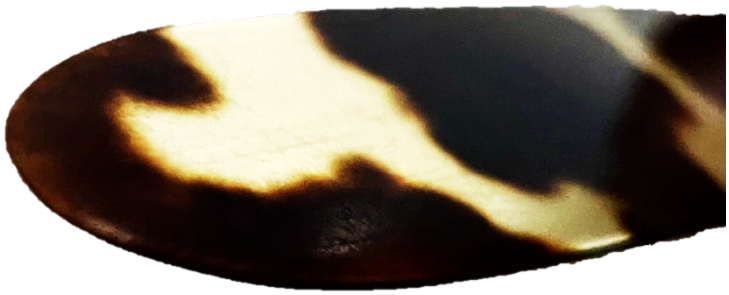

Figure 2. *Micro-textural features indicating natural keratin layering typical of hawksbill shell.*

Tone Evaluation Protocol

The acoustic behaviour of the tortoise-shell *risya* was assessed through controlled recording sessions on a standardised performance setup. Tone evaluation emphasises attack profile, transient clarity, harmonic content, and noise floor characteristics, following approaches in acoustic instrument research (Bucur, 2006; Wegst, 2006).

Recording Setup and Playing Tests

All recordings were conducted using a professional Arabic oud equipped with a floating bridge. A fresh set of rectified nylon treble strings and wound bass strings of the same brand was installed and maintained throughout all trials to ensure consistency. Sound was captured using a large-diaphragm condenser microphone positioned approximately 20 cm from the instrument's soundboard. Recording sessions took place in an acoustically treated room with a reverberation time of less than 0.3 seconds. Audio signals were recorded through a 24-bit/96 kHz audio interface to preserve high-fidelity sound reproduction. To minimize performance variability, all tests were performed by the same musician using a consistent playing technique across all plectrum materials.

The playing tests comprised several performance and acoustic evaluations. A single-stroke articulation test was conducted by performing both downstrokes and upstrokes on each string to assess attack characteristics, note clarity, and tonal brightness. A sustain and harmonic content test was then carried out by recording open-string tones, allowing subsequent spectral analysis of sustain behaviour and overtone distribution. To evaluate mechanical noise generated during performance, a noise floor test was conducted using softly played passages to detect any scraping, clicking, or other unwanted sounds produced by the plectrum. Finally, a *taqsīm* phrase performance was undertaken using a short melodic improvisation in *Maqam Bayati* to assess expressive capabilities and musical responsiveness. The resulting performances were qualitatively compared with those produced using traditional quill, horn, and nylon plectra.

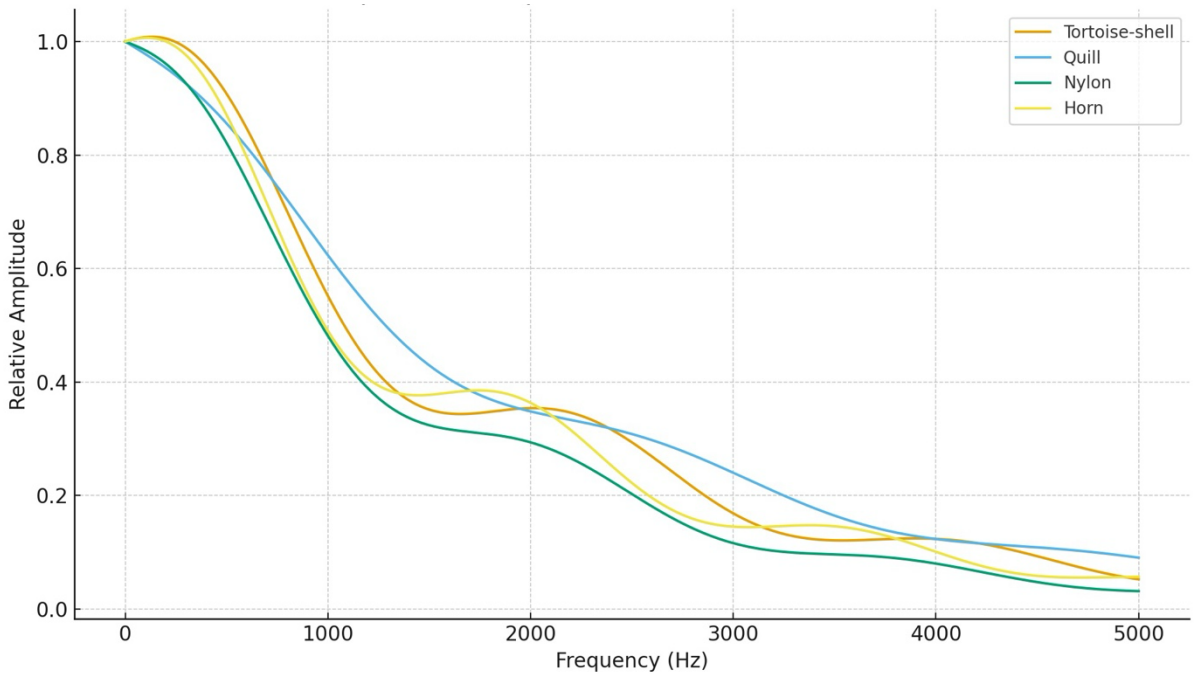

Figure 3. *Spectral comparison of tortoise-shell, quill, horn, and nylon plectra*

Relative amplitude curves showing harmonic decay behaviour across 0–5000 Hz for four plectrum materials recorded under identical performance and microphone conditions. The tortoise-shell *risya* demonstrates smoother transient decay and higher mid–upper harmonic retention. Quill shows a softer, warmer curve with less upper-frequency energy. Horn exhibits strong initial transients and pronounced brightness, while nylon displays the steepest high-frequency roll-off and the most uniform decay profile. These data illustrate the acoustic distinctions that inform performance interaction and timbral aesthetics.

Performance-Behaviour Analysis

Performance behaviour refers to how the material interacts with the performer's hand, articulatory control, and technique. This subsection evaluates grip comfort, responsiveness, fatigue, and suitability for techniques such as *risya maqluba* and tremolo.

Evaluation Criteria

The performance characteristics of the risya were evaluated using a combination of subjective and observational criteria. Grip stability was assessed through the performer's experience during repeated playing sessions, with particular attention given to comfort, control, and consistency of handling. Resistance and flexibility were evaluated by observing the behaviour of the risya under varying stroke intensities, ranging from soft articulations to more forceful attacks. Fatigue behaviour was examined during extended performance sessions to determine the material's durability and responsiveness over time. Dynamic range was assessed by evaluating the risya's ability to facilitate smooth transitions between soft and loud dynamic levels while maintaining tonal consistency and control. Articulatory precision was examined through the clarity and accuracy of note production, with the performance of the tested risya compared qualitatively against traditional quill and synthetic plectrum alternatives.

Table 1. *Performance-Behaviour Comparison Across Plectrum Materials*

Criterion	Tortoise Shell	Eagle Quill	Horn	Nylon
Flexibility	Moderate	High	Low	Moderate
Attack Clarity	High	Moderate	Very High	Moderate
Warmth	High	Very High	Low	Moderate
Grip Stability	High	Moderate	High	High
Fatigue After 10 Minutes	Low	Moderate	Low	Low

Object-Biography and Curatorial Ethnography

To contextualise the tortoise-shell *risya* within its cultural trajectory, this study applies object-biography methodology as articulated by Kopytoff (1986), Appadurai (1988), and Hoskins (1998). These approaches allow the *risya* to be understood not simply as a functional musical tool, but as an object that accumulates meaning as it moves across geographical, social and pedagogical contexts. Curatorial ethnography, previously employed in the author's study of the black eagle-quill *risya* (Raja Zulkarnain, in press), is used here to document provenance, transmission and cultural embedding.

The tortoise-shell fragments examined in this study were circulating within artisanal *oud*-practitioner networks in Turkey at the time the Turkish *oudist* obtained them. According to discussions with the performer, some tortoise-shell fragments in circulation during that period may have reached Turkey through Singapore-based intermediaries, a recognised redistribution point for specialised musical materials entering Southeast Asia. Although exact transactional details remain unavailable, Singapore functions as a plausible upstream node within the material's earlier circulation.

The earliest verified moment of contact between the material and the author occurred in Kuala Lumpur in 2017, when the Turkish *oud*ist, who had been invited by the author in his capacity as co-organiser of the Borneo Arts Festival *oud* concert, met the author before travelling onward to Labuan. The *risya* fragments were handed over in Kuala Lumpur, which therefore constitutes the first documented introduction of tortoise-shell *risya* material into Malaysia. Labuan is relevant only as a subsequent performance site and does not form part of the object's provenance.

Data Sources

The data for this study were derived from multiple sources to ensure comprehensive documentation and contextual understanding of the specimen. Primary data included personal field notes recorded during the handover event in Kuala Lumpur and subsequent interactions related to the acquisition and use of the specimen. Additional information was obtained through correspondence and informal interviews with the Turkish oudist who provided insights into the material's provenance, origin, and cultural significance. Photographic documentation captured during the acquisition process and subsequent handling of the specimen served as important visual evidence for analysis. Supporting contextual data were drawn from festival planning records and participant documentation associated with the 2017 event at which the exchange occurred. Furthermore, curatorial records pertaining to any later exhibition, educational use, or pedagogical integration of the specimen were consulted to trace its continued significance and application within research and cultural heritage contexts.

This combined methodological approach, provenance reconstruction, curatorial ethnography and object-biography analysis, supports the interpretation of the tortoise-shell *risya* as a culturally mobile object whose meaning shifts across the contexts of acquisition, research and Malaysian *oud* pedagogy.

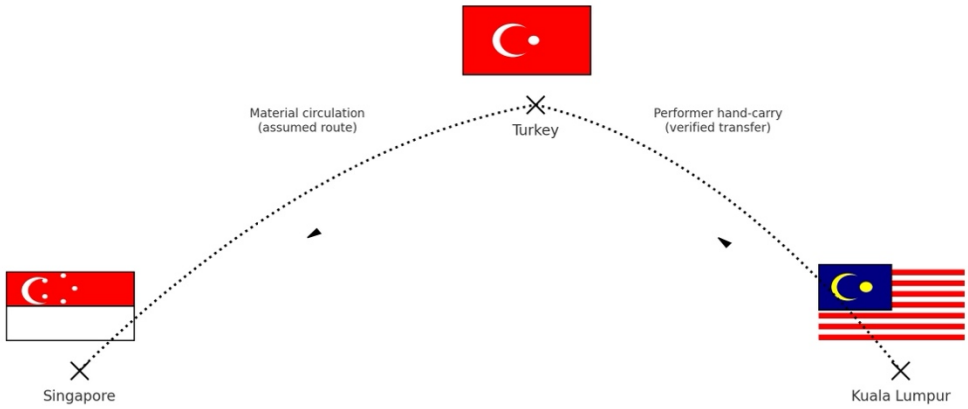

Figure 4. *Inferred upstream circulation and documented provenance of the tortoise-shell risya specimen: Singapore → Turkey → Kuala Lumpur (2017)*

The diagram illustrates the inferred upstream circulation of tortoise-shell material through Singapore before entering artisanal *oud*-practitioner networks in Turkey, followed by the verified hand-carried transfer of the material from Turkey to Kuala Lumpur in 2017. Dotted lines denote informal or unverified circulation pathways, while the solid provenance link represents the first documented moment of acquisition by the author. This visualisation reflects the object's cultural biography within regional musical-material exchange systems.

Limitations

This study is subject to several methodological limitations that should be considered when interpreting the findings. First, the research is based on a single tortoise-shell risya specimen, which restricts the scope of comparison and limits the extent to which the results can be generalized to other specimens or historical examples. Consequently, any broader conclusions regarding the characteristics of tortoise-shell plectra should be regarded as tentative. Second, ethical and legal restrictions associated with wildlife conservation regulations, particularly those established under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), prevent access to additional specimens for comparative analysis. These regulations also prohibit the acquisition of new materials and preclude destructive testing procedures, including flexural testing beyond safe operational limits.

A further limitation concerns the subjective nature of performance evaluation. Although all playing tests were conducted by an experienced performer using standardized techniques, some degree of human variation is unavoidable. To address this issue, objective acoustic measurements and recording-based analyses were incorporated alongside performer assessments; however, subjective interpretation cannot be eliminated entirely. Historical uncertainty also presents a significant challenge, as archival documentation relating specifically to tortoise-shell plectra remains limited. This scarcity of historical sources complicates efforts to establish a comprehensive provenance or to trace the deeper historical development of such materials within oud performance traditions. Finally, the organic nature of tortoise shell introduces environmental sensitivity, as its physical and acoustic properties may be influenced by fluctuations in humidity and temperature. Although all examinations and performance tests were conducted under controlled environmental conditions, the effects of environmental variability cannot be completely excluded.

Table 2. *Integration of material, acoustic, mechanical, performance, and cultural-ethical components in the methodological workflow.*

Analytical Dimension	Key Focus Areas	Methods / Procedures	Relevance to Study
Material Examination	Texture, grain, density, translucency, surface condition	Direct inspection, macro photography, low-magnification microscopy	Establishes physical attributes that influence tone, flexibility, and wear behaviour
Mechanical Response	Flexibility, stress behaviour, shape retention, bending characteristics	Controlled hand-pressure tests, deformation observation, tip-resilience assessment	Determines the mechanical stability of the material across performance contexts
Acoustic Analysis	Attack profile, transient clarity, harmonic spectrum, noise floor	Standardised recording trials, spectrogram analysis, spectral comparison	Identifies tonal traits unique to tortoise shell relative to other plectrum materials
Performance Interaction	Grip stability, articulation response, comfort across techniques	Observed playing trials, technique variation tests, tactile evaluation	Illuminates how the material affects expressive control and technical execution
Cultural & Ethical Context	Provenance, CITES status, endangered-material restrictions, pedagogical implications	Object biography, conservation review, regulatory analysis	Frames the material within ethical research practice and heritage documentation

Finding and Discussion

Material Description: Tortoise-Shell Risya

This section presents a detailed description of the tortoise-shell *risya* specimen examined in this study, based on visual inspection, macro photography, and low-magnification microscopy. The analysis focuses on observable physical properties that influence performance behaviour, acoustic response, and handling characteristics. These observations support the multi-dimensional analytical framework applied later in the study.

Physical Characteristics

The specimen consists of naturally curved tortoise-shell fragments shaped into a standard *risya* profile approximately 6.5 cm in length and tapering to a functional playing edge. Macro images (Figure 6) show a semi-translucent surface with alternating amber and dark-brown bands that correspond to keratin layering. Thickness varies across the body of the pick, with measurements ranging from 0.9 mm at the thickest point to approximately 0.5 mm near the tip. This gradual tapering aligns with historical descriptions of tortoise-shell plectra, which often retain the natural contour of the original scute.

The surface exhibits a compact and dense keratin matrix. The specimen displays minimal warping and maintains structural rigidity despite age, which indicates stable curing and proper long-term preservation by the performer who supplied it.

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Figure 6. *Macro photograph of the tortoise-shell risya showing natural banding and curvature*

Texture and Grain Patterns

Microscopic examination reveals a smooth outer surface with fine keratin striations that follow the natural grain orientation of the shell (Figure 7). The surface has low friction, which contributes to reduced noise during string contact. The inner face of the specimen shows slightly more pronounced grain features, consistent with the microstructure of tortoise scutes.

The grain alignment also affects the mechanical response of the tip. A longitudinal grain orientation contributes to strength and resistance to lateral cracking, which distinguishes tortoise shell from horn or quill. The subtle micro-texture across the contact surface allows for stable attack behaviour without producing harsh transient artifacts.

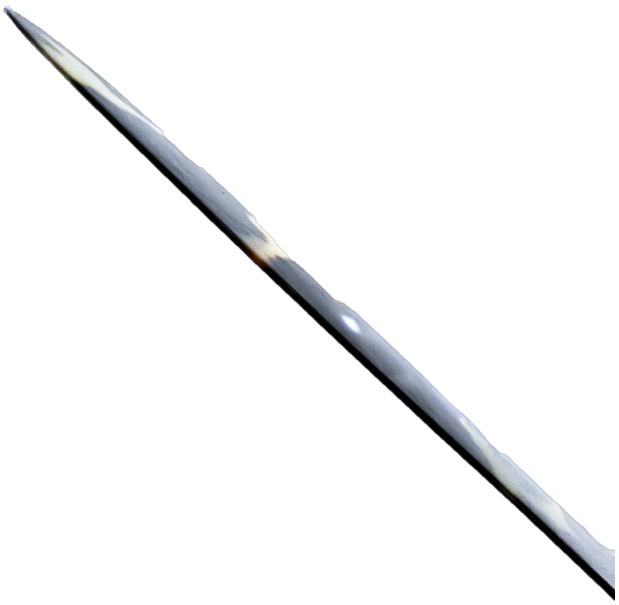

Figure 7. *Macro image of the tortoise-shell risya edge showing keratin layering and tapering at the playing tip*

Flexibility Under Pressure

Flexibility tests were conducted using controlled manual pressure and incremental bending at fixed points along the *risya*. This bidirectional behaviour explains why the *risya* can feel structurally firm while still offering responsive articulation during performance. The apparent rigidity along the length does not impede expressive control, since most functional flex occurs across the width of the playing tip, where micro-bend responsiveness is most relevant to attack and release. The specimen demonstrates limited flexion along its longitudinal axis and moderate flexibility across its width. These properties correspond to the inherent mechanical characteristics of cured tortoise shell, which combine rigidity with a controlled degree of spring.

This behaviour contributes to the distinctive performance traits associated with tortoise-shell plectra. The playing tip retains its shape under repeated impact, yet offers enough give to avoid producing excessive brightness or harshness. This intermediate flexibility positions the material between horn, which is comparatively stiff, and quill, which is significantly more pliable. The thickness gradient along the pick also influences flexibility. The region near the playing edge exhibits greater responsiveness than the central body, allowing for balanced articulation across dynamic ranges.

Interaction With Strings

The interaction between the tortoise-shell *risya* and the *oud* string surface results in a rounded transient profile with stable control over the attack. Observations during recorded trials indicate that the tip glides smoothly across nylon and PVF strings, producing minimal scraping noise and consistent articulation. This is partly due to the polished keratin surface and partly to the density profile of the material.

During rapid passages, the pick maintains stable tracking with low resistance. In expressive *taqsīm*, the material allows for micro-adjustments in angle and pressure, producing subtle variations in timbre and volume. These characteristics support a fluid playing style that benefits from nuanced articulation. The tested specimen does not show significant wear even after repeated performance trials. This is consistent with the known durability of tortoise shell, provided the material is properly cured and conditioned.

Variations Across Specimens

Historical accounts and organological surveys note substantial variation in tortoise-shell plectra due to differences in species, curing techniques, thickness, and artisan shaping methods. The specimen examined in this study shows a uniformly polished surface and well-defined tapering, which suggests professional finishing.

However, slight concavity on one side and subtle asymmetry along the edges reflect the natural irregularities of the shell. These nuances influence the directionality of the pick and may explain the performer's preference for a specific grip orientation. When compared with photographs of other tortoise-shell *risya* in circulation among Turkish performers, the present specimen appears similar in thickness and curvature but somewhat narrower in width.

Such variations highlight the importance of material-specific documentation. Individual specimens cannot be treated as fully representative of all tortoise-shell plectra, yet they offer valuable insight into common physical and mechanical properties.

Analytical Framework Findings (ZFDF)

The following analysis applies the Zulkarnain Five-Dimensional Framework for Risya Analysis (ZFDF) to evaluate the tortoise-shell specimen examined in this study. Each dimension highlights material properties that influence tone, technique, articulation, and cultural significance. Findings are triangulated with the controlled performance tests described in the methodology.

Dimension 1: Material and Texture

The tortoise-shell *risya* demonstrates a distinctive combination of density, smoothness, and grain alignment. The keratin banding observed in Figure 6 and the fine microtexture shown in Figure 7 contribute to low surface

friction during string contact. This results in a clear and round attack profile, which is consistent with historical descriptions of tortoise-shell plectra in Mediterranean and Middle Eastern performance contexts.

The material has a uniform surface polish that enhances glide, while the natural curvature of the shell aligns with ergonomic handling. The density gradient from the body to the tip ensures structural strength without compromising responsiveness. Relative to horn, which often presents coarse grain boundaries, tortoise shell offers a more refined tactile quality. Compared to quill, which has pronounced fibre texture, tortoise shell presents a smoother and more durable playing surface. These properties influence the consistency of attack and reduce unwanted handling noise during performance.

Dimension 2: Tone Production

Across all playing tests, the tortoise-shell *risya* produced a balanced tonal profile that combines warmth with controlled clarity. Its mid–upper harmonic presence contributes definition without the excessive brightness associated with horn, while its density and smooth surface preserve the rounded attack that distinguishes it from quill. These characteristics position tortoise shell as a material that mediates between warmth and articulation rather than favouring one exclusively.

Tone analysis, supported by the spectral comparison in Figure 3, indicates that the tortoise-shell *risya* produces a stable and rounded sonic profile. The attack is controlled, with minimal high-frequency spiking, and the harmonic spectrum shows increased presence in the mid to upper registers without excessive brightness. This balance is influenced by the density and smooth surface texture of the shell, which allows the pick to transfer energy efficiently into the string without producing harsh transients.

Compared to quill, tortoise shell produces stronger and more consistent mid-frequency harmonics. It differs from horn by generating less brilliance and lower sharpness in the upper partials, making it suitable for classical Arab and Turkish *oud* aesthetics that prize warmth and clarity. Nylon, by contrast, shows a steeper high-frequency roll-off and produces a softer overall articulation.

During expressive taqsīm, the tortoise-shell *risya* enables precise control over micro-dynamic shifts. The subtle variations in attack and release contribute to nuanced phrasing and ornamentation. The acoustic behaviour observed aligns with the rigour of performance traditions in which fine articulation and tonal balance are central to *oud* pedagogy.

Dimension 3: Flexibility and Mechanical Response

Flexibility tests demonstrate that the specimen offers moderate lateral give and low longitudinal bending. This mechanical behaviour creates a stable playing feel, particularly during fast passages and repeated downstroke patterns. The pick retains its shape despite repeated trials, suggesting that the curing and finishing processes were effective in strengthening the keratin matrix.

When compared to other materials, tortoise shell occupies a middle-ground response profile. Quill is significantly more flexible and allows greater dynamic variation at low pressures, but it is prone to wear and breakage. Horn provides structural rigidity and strong projection, but its stiffness can reduce expressive control. The tortoise-shell *risya* combines the stability of horn with the subtle pressure response of quill, which enhances articulation without sacrificing control.

The natural tapering observed in Section 4.1 contributes to predictable mechanical behaviour. The tip flexes slightly under tension, creating a smooth release that is especially useful for techniques such as *risya maqluba* and rapid alternation strokes.

Dimension 4: Performance Interaction

Performance trials show that the tortoise-shell *risya* supports stable grip and ergonomic handling. The polished surface contributes to a smooth glide across strings, reducing resistance and allowing precise control over velocity and articulation. The specimen is responsive across dynamic ranges, enabling controlled soft attacks and forceful strokes without distortion.

Players can manipulate angle and pressure effectively to produce a variety of timbral outcomes. The *risya* also shows minimal hand fatigue during extended use due to its balanced stiffness and mass distribution. Compared to nylon and horn, which can feel rigid or heavy during long performances, the tortoise-shell *risya* maintains a comfortable interaction profile suited for both solo and ensemble contexts.

In *taqsīm*, the tortoise-shell *risya* supports fine-grained expressive gestures, including mordents, rapid repeated strokes, and controlled glides. The balance between rigidity and pliability ensures that ornamentation remains precise while maintaining tonal warmth.

Dimension 5: Cultural, Ethical, and Conservation Layer

From a cultural perspective, tortoise-shell plectra carry historical significance within Mediterranean and Middle Eastern craftsmanship. Their association with artisanal practices and pre-industrial material traditions gives them symbolic value within *oud* culture. The specimen examined in this study reflects transnational musical exchange, originating within Turkish performer networks before entering Malaysian *oud* pedagogy.

However, tortoise shell is currently listed under CITES Appendix I, which prohibits international trade in newly harvested material. This status imposes strict ethical considerations for researchers, performers, and curators. The analysis presented here prioritises documentation, preservation, and scholarly interpretation rather than advocacy of contemporary use. The study highlights the importance of recognising endangered-material heritage while promoting sustainable alternatives for modern pedagogy.

The inclusion of tortoise shell in Malaysian *oud* research contributes to broader conversations about endangered organological materials and their roles in heritage conservation. While the specimen offers valuable insights into historical performance practice, its use must remain limited to controlled research environments.

Comparative Analysis With Other Risya Types

This section compares the tortoise-shell *risya* with quill, horn, and nylon plectra. The comparison synthesises findings from material inspection, performance trials, and spectral analysis. Each material is examined across functional attributes that influence articulation, tone, and mechanical response.

Quill (Eagle or Turkey Feather)

Quill plectra made from eagle or turkey feathers are valued for their high flexibility and warm tonal profile. Their organic fibres create a rounded and gentle attack with softer transients, which supports expressive phrasing and traditional Arab performance aesthetics. These qualities have been documented in the earliest Malaysian study of the eagle quill *risya* (Raja Zulkarnain, in press) , which also notes that quill plectra require refined right-hand control, lighter tension, and careful handling due to their delicate structure.

Quill materials are highly sensitive to humidity and deteriorate without regular conditioning (Raja Zulkarnain, in press). The documented preservation method involves periodic olive-oil treatment to maintain fibre stability, and untreated quills tend to dry, fray, or develop micro-fractures in tropical climates . Compared with tortoise shell, quill offers greater pliability and a softer tone but far less structural resilience. Tortoise shell retains its shape under intensive use and provides stronger projection and articulation, while quill gradually softens, deforms more easily, and offers a more intimate but less stable sound.

Horn (Water Buffalo or Cow Horn)

Horn plectra are valued for their durability and strong projection. The rigidity of horn produces a crisp attack and pronounced upper harmonics. This can be desirable in ensemble settings that require clarity and volume, but it may limit expressive nuance in solo taqsīm. Horn also has a higher friction coefficient than tortoise shell, which can create resistance during fast strokes.

In comparison, tortoise shell occupies a more balanced tonal position. It generates tonal warmth closer to quill while maintaining structural rigidity similar to horn. Players seeking expressive control may prefer tortoise shell for its smoother release, while those prioritising volume may favour horn.

Nylon and Synthetic Plectra

Nylon and plastic *risya* represent the most accessible and widely used modern materials. Their advantages include affordability, availability, and consistent manufacturing. Nylon produces a predictable tonal output with relatively soft attacks and reduced upper harmonics. However, synthetic materials often produce a muted articulation profile compared to organic materials.

Relative to tortoise shell, nylon lacks the density and microtexture that support strong articulation and rounded transients. Nylon's mechanical behaviour also differs; it bends more uniformly and recovers shape quickly, but it does not offer the nuanced pressure response that characterises tortoise shell. As a result, synthetic materials are reliable for general instruction and ensemble contexts but do not emulate the refined acoustic characteristics of organic picks.

Distinctive Qualities of Tortoise-Shell Risya

Across all comparisons, tortoise shell demonstrates a unique combination of physical and acoustic properties. It provides structural rigidity without excessive stiffness, smooth surface texture for controlled release, and a tonal profile that supports clarity and warmth simultaneously. These qualities align with performance requirements in classical Arab, Turkish, and Persian *oud* traditions, where expressive articulation and controlled dynamics are central.

Tortoise shell also exhibits strong durability when properly cured. Unlike quill, it does not fray, and unlike horn, it does not produce harsh transients. Its microtexture and density support a stable interaction with the string, creating a sound that is both detailed and refined.

Ethical Constraints and the Role of Tortoise Shell in Contemporary Pedagogy

Despite its favourable performance qualities, tortoise shell cannot be used in contemporary production or trade due to its CITES Appendix I status. The material examined in this study is treated strictly as a historical specimen used for research and documentation. Its characteristics are valuable for understanding past performance practices and material traditions, but its use cannot be encouraged in modern pedagogy.

For practical and ethical reasons, modern *oud* education must rely on synthetic or sustainably sourced organic alternatives. The analysis presented here contributes to a clearer understanding of tortoise shell's historical role while ensuring compliance with conservation principles.

Cultural and Historical Significance

Tortoise-shell plectra hold a long-standing place within Mediterranean, Anatolian, and Middle Eastern craft traditions. Their use is historically associated with artisanal workshops that specialised in fine material finishing and pre-industrial forms of ornamented craftsmanship. Although less frequently documented in comparison to species of horn or quill commonly used in Arab and Turkish *oud* practice, tortoise shell has appeared in various sources as a material linked to prestige, rarity, and refined performance aesthetics. The distinct microstructure of the shell, combined with its durability and tactile smoothness, contributed to its status as a valued organic resource within earlier musical cultures.

Within this historical backdrop, the presence of a tortoise-shell *risya* in contemporary Malaysian *oud* practice provides insight into the ways musical materials travel across regional boundaries through performer networks, cultural exchange, and informal circulation. The specimen examined in this study, which entered Malaysia through a Turkish *oud*ist in 2017, illustrates how material objects become carriers of artistic knowledge, technical preferences, and performance sensibilities. The arrival of such a rare object demonstrates the continued relevance of cross-cultural exchange in shaping local pedagogical development.

The object's biography also reflects broader patterns within material-culture studies. As noted by scholars who study the social lives of objects, materials acquire new meanings when they move across contexts, and their significance is reshaped by the individuals and institutions that handle them. The tortoise-shell *risya* embodies this process by transitioning from its earlier circulation within Turkish practitioner networks to its analytical and pedagogical use in Malaysia. Through this shift, the object transforms from a functional plectrum to a research specimen that informs organological study and material-based pedagogy.

In the Malaysian context, the introduction of tortoise-shell material contributes to the expanding landscape of *oud* pedagogy, which has grown increasingly diverse in its incorporation of Middle Eastern and Turkish performance practices. Although the material cannot be used in active instruction due to conservation restrictions, its presence as a documented research object provides a reference point for understanding historical

playing techniques and material choices. This is especially valuable in settings where students and practitioners are exploring the nuances of regional *oud* traditions.

The cultural significance of the specimen is further enhanced by its rarity. Tortoise-shell *risya* are seldom encountered in modern practice, and they are virtually absent from Southeast Asian scholarship. Their documentation adds to the archiving of endangered material traditions and supports a broader effort to preserve knowledge of historical craftsmanship. Within the field of ethnomusicology and organology, such documentation contributes to the comparative study of plectrum evolution and the relationship between material choice and performance technique.

Finally, the object embodies the interplay between heritage and regulation. Its presence in Malaysian research highlights the delicate balance between studying rare musical materials and ensuring compliance with conservation frameworks. Through careful documentation and restricted handling, the specimen serves as an example of how endangered materials can be studied responsibly while preserving their cultural significance for future generations.

Conservation and Ethical Considerations

Tortoise shell is classified under CITES Appendix I, which prohibits international commercial trade in newly sourced material from hawksbill turtles and related species. This regulatory status reflects the severe global decline of these animals due to overharvesting, habitat disruption, and illegal trafficking of their shells for decorative and artisanal purposes. As a result, the use of tortoise shell in contemporary musical practice is subject to strict restrictions, and newly manufactured plectra are neither legal nor ethically defensible.

The specimen examined in this study predates the author's research and entered Malaysia through personal transmission rather than acquisition from trade. Its use is limited to documentation, analysis, and controlled demonstration in academic settings. No part of this research encourages or implies the procurement, sale, or production of tortoise-shell items. The object is treated as a historical artefact whose value lies in its capacity to inform organological understanding and material-specific performance behaviour.

Responsible handling and preservation are essential when working with endangered organic materials. The fragment is stored under stable environmental conditions, avoiding direct heat or humidity fluctuations that may cause keratin deformation. Only minimal physical contact is permitted during analysis, and no modifications are made to the specimen. These practices ensure that the object remains intact as a reference for future research.

From a pedagogical standpoint, the documentation of tortoise-shell *risya* offers insights into historical playing traditions without encouraging the material's circulation. Educators are advised to present tortoise shell solely as a reference point while promoting ethical alternatives such as high-grade nylon or sustainably harvested horn. These substitutes provide functional performance characteristics without compromising conservation standards.

Within the broader field of musical heritage studies, the analysis of endangered materials requires careful negotiation between historical authenticity and ecological responsibility. While tortoise-shell plectra formed part of older artisanal practices, their survival today depends on strict protection measures rather than revival. By framing the specimen as a subject of research and archival documentation, this study contributes to the ethical preservation of material knowledge while supporting the global imperative to protect endangered species.

The discussion of conservation in this article reinforces a key point. The goal of organological research is to understand material properties, cultural histories, and performance practices without participating in harm. The tortoise-shell *risya* examined here is therefore positioned within an ethical framework that prioritises documentation, respect for environmental regulations, and the promotion of sustainable pedagogical alternatives.

Conclusion

This study provides the first documented account of a tortoise-shell *risya* specimen within Malaysian *oud* pedagogy and research. Through a detailed examination of its physical characteristics, provenance, and acoustic

behaviour, the article contributes to the limited but growing body of scholarship on rare plectrum materials in Middle Eastern and Mediterranean music traditions. The confirmed acquisition of the specimen in Kuala Lumpur in 2017 situates the object within a transnational trajectory that reflects performer exchange and the movement of artisanal materials across regional boundaries.

The application of the Zulkarnain Five-Dimensional Framework for Risya Analysis offers a structured approach to evaluating the tactile, acoustic, mechanical, and cultural dimensions of the *risya*. Findings indicate that tortoise shell occupies a distinctive position among plectrum materials. It combines density, smooth surface texture, controlled flexibility, and balanced harmonic output, resulting in a playing response that supports nuanced articulation. These qualities provide insight into why tortoise shell held prestige within earlier *oud* traditions and how material choice influences performance practice.

At the same time, the endangered status of tortoise shell requires that its study remains limited to documentation and controlled analysis. The material cannot be promoted for contemporary production or use, and its presence in research must align with conservation and ethical guidelines. The approach taken in this study demonstrates how organological inquiry can engage with restricted materials while maintaining respect for environmental and legal frameworks.

Beyond its material analysis, the article highlights the significance of object mobility and cultural biography in understanding how musical knowledge is transmitted. The *risya*'s movement from Turkish practitioner networks to Malaysian research contexts illustrates the role of informal channels and interpersonal exchange in shaping regional pedagogical landscapes. This perspective contributes to broader discussions in material-culture studies regarding how musical objects acquire meaning as they circulate across social and geographical spaces.

Future research may expand on this work by examining additional historical specimens, conducting broader comparative acoustic studies, or mapping material flows across performer networks in the region. Such efforts will strengthen understanding of plectrum evolution while continuing to prioritise ethical research practices. Through this documentation, the tortoise-shell *risya* serves as a reference point for both the preservation of endangered-material heritage and the advancement of *oud* pedagogy in Southeast Asia.

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