Keris Blade Protection – A Comparison of Traditional and Contemporary Coatings

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Abstract

Keris daggers are weapons and spiritual objects of unique cultural significance from the Indonesian Archipelago. They challenge conventional conservation efforts due to their composition, fabrication techniques, and, in particular, the spiritual value attributed to the traditional coating on the blade, which is applied during ceremonial processes. This study presents a comparison of contemporary and traditional coatings for keris blades. Each coating was tested on multilayer steel coupons reflecting keris blade properties (*pamor*) and standardized low-alloy steel coupons. The coupons were then exposed to a stress test to assess protective effectiveness. The results of this research suggest that conservation strategies should include the use of a traditional mixture of natural oils (coconut oil, sandalwood oil, and ylang-ylang) to protect keris in museum environments.

Keywords

keris, kris, Indonesia, dagger, coating, traditional, etching, corrosion

Introduction

The *keris* originates from the Indonesian Archipelago, where it serves as a weapon, a holy object in ritual ceremonies, and a personal symbol of protection, making it crucial to cultural identity (it has been listed as UNESCO intangible cultural heritage since 2005; UNESCO Office, Jakarta 2005) (Figure 1). In Indonesia, spirituality is present everywhere. In contrast to western culture, spirituality is not seen as something that is directly linked to religion. As religion changed over time, the myths and traditions surrounding keris remained the same.[1] A keris is composed of a sheath, handle, and blade fabricated of different alloys and various organic materials. Keris blades are made from *pamor*, a traditional Indonesian multilayered steel, whose pattern is emphasized by etching the surface with lime juice and arsenic sulfide. The etching is renewed and a new coating applied to the blade (Weihrauch 1996) during a traditional annual ceremony. Most keris are not treated during their time in museum collections, leaving only residues of coating material or coatings that are no longer protective (Figure 2). In the traditional Indonesian worldview, the coating not only serves as protection for the blade material, but it is also believed to provide spiritual nourishment. The loss of the nourishment

Figure 1. Four keris from the MKB. © JM, HE-Arc/MKB 2020

affects the intangible value, described in Indonesia as the loss of contrast between the layers of the pamor, a matt surface, and the absence of odor (Kerner 1995). In this study, it is suggested that the protective coating layer of the keris blade should be viewed as an integral part of the

Figure 2. Keris (IIc 2118) from the MKB under visible light (VIS) and under ultraviolet fluorescence (UVF) revealing the synthetic oil coating (FTIR analyzed). © JM, HE-Arc/MKB 2020

object. Multiple studies have assessed protective coatings (Dalewicz-Kitto 2016, Brüggerhoff 2001), but traditional coating materials such as natural oils and multilayer steel substrates have rarely been included. This study focuses on the specific case of protecting keris blades in western collections with the aim of guiding the development of an integrated conservation strategy specific to their cultural significance.

Methods

A collection of 144 keris at the Museum der Kulturen Basel (MKB) was examined. Of these, 13 were analyzed using X-ray fluorescence (XRF) and Fourier transform infrared (FTIR) spectroscopy to determine the composition of the coating residues and blade materials. A stress test was performed to compare the protective capability of the coatings. Coatings and substrates were selected based on the literature, analysis, and communication with experts and collectors from various institutions. The cyclical conditions during stress tests were selected based on the literature and evaluation of the climatic conditions in the museums and countries of origin.

Experimental setup

The following coupons were prepared: Six different coatings (2. to 7.) were tested on coupons of three different substrates (P, S, and K; see following section) as well as on uncoated coupons as controls (1.). As a stress test, all coupons were stored in varying climatic conditions, whereas a reference group (X) was stored in stable conditions with low relative humidity (RH). Furthermore, the test included pamor coupons with residues from etching (8.) and without etching (9.) (Figure 3).

Coupons

Three different substrates were selected: pamor multilayer steel coupons (P), produced and etched with the traditional recipe of lime juice and arsenic sulfide (Kerner 1995); low-alloy steel (S) (DC04 B (EN 10130)); and pre-corroded low-alloy steel (K) (corroded for two weeks by daily cycles of room temperature, 50 °C and 100% RH).

Coatings

Three contemporary and three traditional coatings were compared. The former, representing commonly used museum coatings, consisted of a microcrystalline

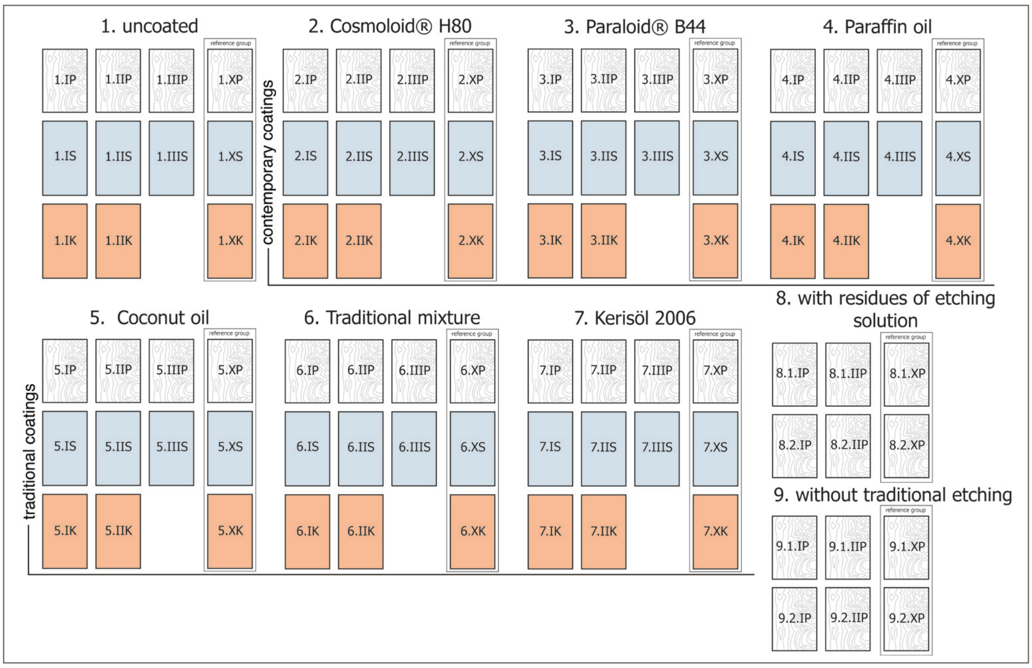

Figure 3. Coupon groups for stress test: uncoated (1), contemporary coated (2–4), traditionally coated (5–7) on pamor (P), low-alloy steel (S), and pre-corroded low-alloy steel (K) substrate. Groups 8 and 9 comprise pamor coupons. The X group represents the reference coupons not included in the stress test

wax (2., Cosmoloid H80, 20% in Shellsol T (w/w)), an acrylic resin lacquer (3., Paraloid B-44, 20% in acetone (w/w)), and paraffin oil (4.). The traditional coatings included coconut oil (5., 8.2, 9.2), a traditional mixture (6.) of coconut oil, sandalwood oil, and ylang-ylang (50%/25%/25% (w/w)), and a synthetic perfumed oil (7., Kerisöl 2006). Currently, both blends of naturally odorous oils (6.) and synthetic oils with added fragrances (7.) are used during ceremonial processes. A single layer of each coating was applied at room temperature on clean (acetone-treated) coupons, using cotton cloths to apply the oil and brushes for the wax and acrylic resin, and they were dried for three weeks.

Stress test

The coupons were exposed, at a slight angle, to a six-week stress test in a climatic chamber (Vötsch Typ VC 0020) with cycles of warm-humid (34 °C and 90% RH) and cold-dry (18 °C and 40% RH) conditions with transition phases of 30 minutes every 12 hours.

Evaluation

The coatings were evaluated according to four criteria: ease of application, protective capacity, aesthetic properties, and maintenance. The coupons were evaluated weekly during the stress test to document the develop-

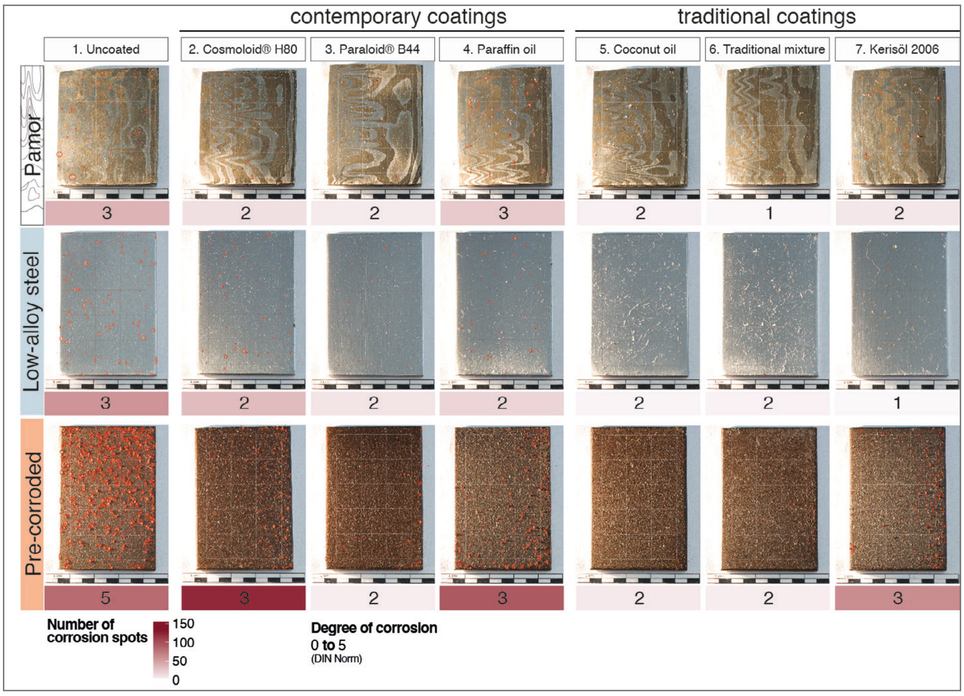

Figure 4. Results after six weeks in the climatic chamber with exemplary coupons from each group and corrosion evaluation by corrosion degree according to the DIN norm EN ISO 6270-2 and amount of corrosion spots

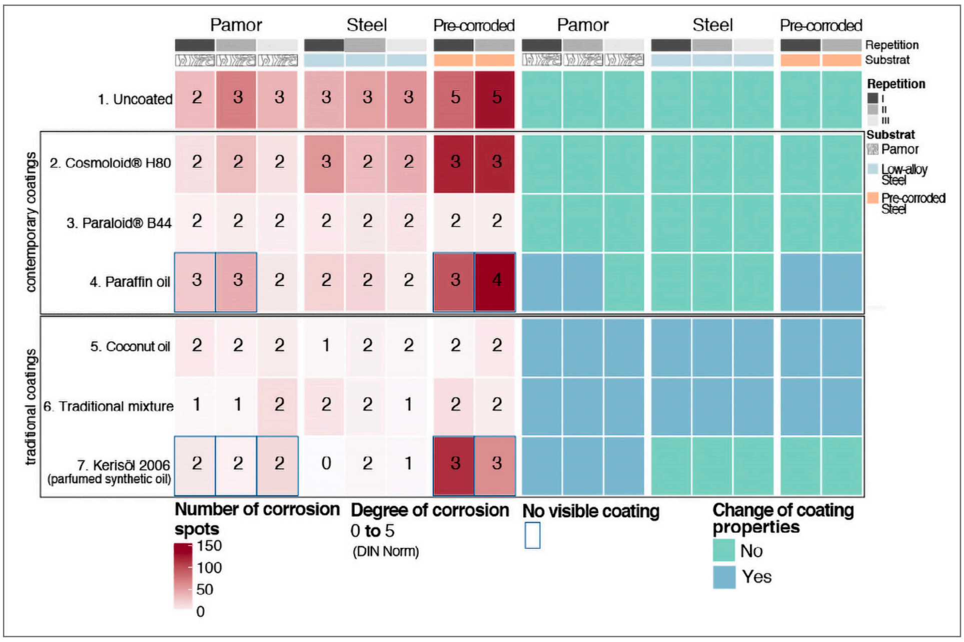

Figure 5. Results after six weeks in the climatic chamber. Shows the corrosion development and change of coating properties

ment of corrosion and visible changes in the coating with a digital microscope. The corrosion protection was evaluated by determining the degree of corrosion according to DIN EN ISO 6270-2 AHT (Deutsches Institut für Normung e. V. 2017) and the number of corrosion spots. Changes in the aesthetic properties were compared by color-calibrated photographs.

Results

The traditional coconut oil-based coatings (5., 6.) showed the best anti-corrosion properties across all three substrates (Figure 4). Cosmoloid H80 (2.) prevented corrosion the least well across all tested coatings, with light microscopic inspection revealing that corrosion developed in small, uncoated areas due to cold application. The two synthetic oils—paraffin oil (4.) and Kerisöl 2006 (7.)—achieved good corrosion protection but only for a limited period of time. These coatings provided protection for as long as they were visible as a glossy surface film (Figure 5). The corrosion morphology varies with different coatings and is highly dependent on the substrate and degree of corrosion (Figures 6–8).

As expected, the degree of corrosion on the pre-corroded coupons (K) was higher than on the non-corroded substrates, and the uncoated coupons corroded more than the coated coupons. On pamor coupons (P), the corrosion developed across the two alloys of the multilayer steel. Additional tests indicated that residues of the etching solution (8.) were not a source of corrosion acceleration, and the lack of traditional etching (9.) did not influence the corrosion process.

Most of the contemporary and traditional coatings tested increased the contrast in the pamor pattern and the gloss. However, the wax and coconut oil did not have this effect on the pamor coupons. The spiritually important odor requirement was only met by the traditional mixture (6.) and the Kerisöl 2006 (7.). None of the coatings changed in color during the test. Dust particles were observed on the sticky surface of the natural and synthetic oils.

The oil coatings could be evenly applied to the coupons except for the coconut oil, which produced nonuniform and thicker coating films. The Paraloid B-44 was challenging to apply evenly. The Cosmoloid H80 did not cover all of the coupon cavities when applied at room temperature.

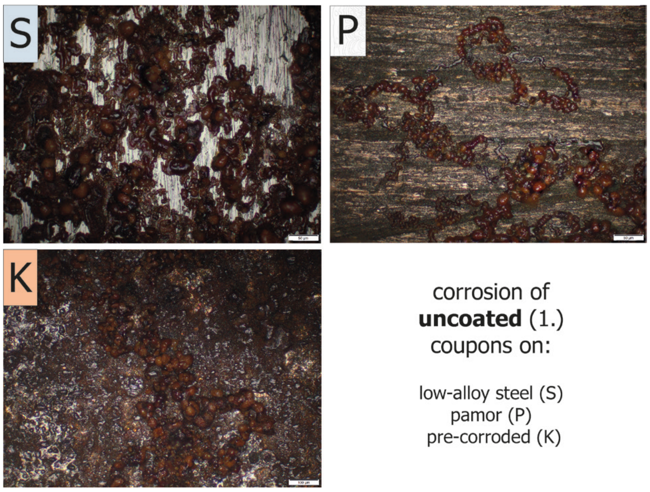

Figure 6. Corrosion of uncoated coupons S, P, and K (200× magnification)

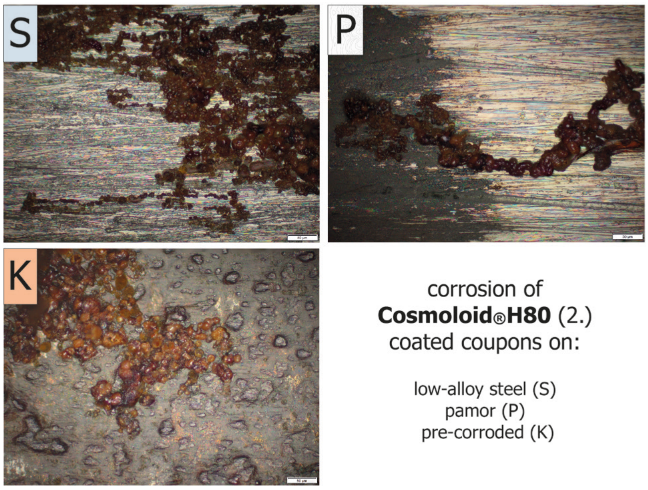

Figure 7. Corrosion of Cosmoloid H80-coated coupons S, P, and K (200× magnification)

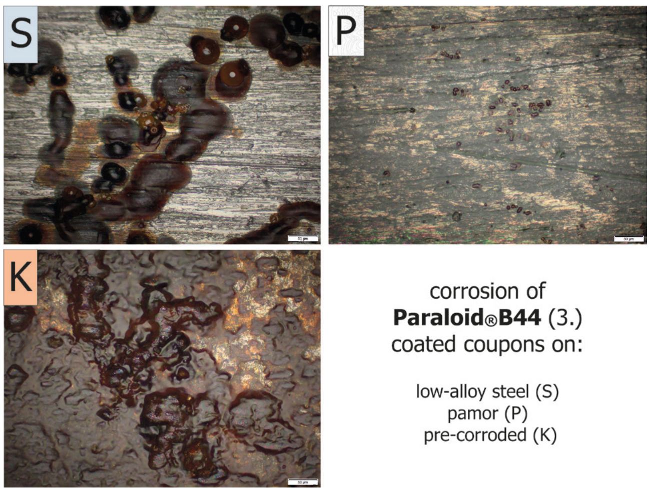

Figure 8. Corrosion of Paraloid B-44-coated coupons S, P, and K (200× magnification)

Discussion

The mixtures of natural oil-based coatings provided higher corrosion protection, better aesthetic characteristics, and greater maintenance advantages than the synthetic oil, wax, or lacquer coatings. In addition, natural oils are often less toxic and harmful to conservators and the environment.

Due to the irregular surface on keris blades, coating interventions are not entirely reversible, with residues remaining on the surface. Consequently, the introduction of a new material to the object, such as contemporary coatings, must be carefully considered.

Coatings need to be renewed periodically. Therefore, monitoring and renewal must be included in the conservation strategy. Oil coatings can be renewed easily with less time, which simplifies regular maintenance. Natural oils (5., 6.) protect longer than synthetic oils (4., 7.) and therefore lead to less frequent renewal cycles. The stress test demonstrated the importance of scheduled reapplication of synthetic and natural oils to prevent accelerating corrosion due to dust particles adhering to the oil coatings (Figure 9). For coconut oil-based coatings, temperature fluctuations should be avoided to prevent cyclical hardening and liquefying, which results in an uneven coating film.

The corrosion morphology that arises when natural and synthetic oil coatings lose their protective properties is equivalent to corrosion observed on keris blades with traditional coatings. However, the filiform corrosion of acrylic coatings (Figure 10) is atypical and distracts aesthetically from the highly valued pamor pattern. Consequently, lacquer coatings are unsuitable for keris blades.

It is important to recognize that cultural significance and the goals of contemporary conservation are not

Figure 9. Dust particle on pamor coupon with paraffin oil coating (4) and localized corrosion development (50× magnification)

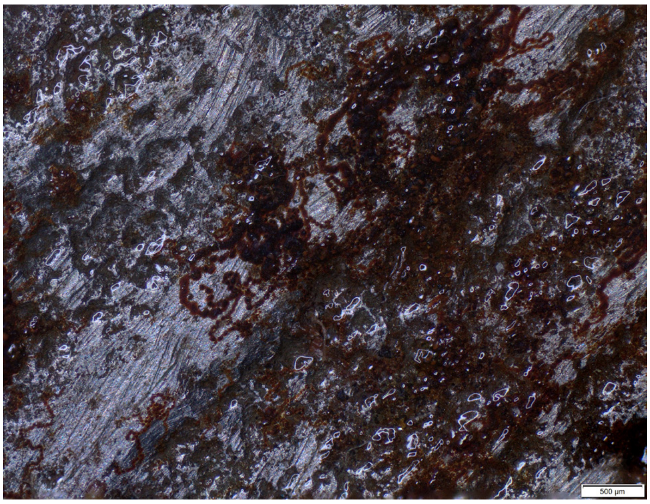

Figure 10. Filiform corrosion under acrylic coating (FTIR analyzed) on keris blade (IIc 22217) from the MKB (20× magnification).
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intrinsically contradictory. According to the Burra Charter of 2013, which defines ethics in conservation and takes into account cultural significance, traditional techniques should be favored if there are no conservational disadvantages (Australia ICOMOS 2013, Article 2.1/4.2). Since keris blades benefit from traditional coatings, these techniques are recommended.

Conclusion

The results of this work suggest that traditional and natural coating materials should be employed in museum environments due to their superior protective properties. The traditional approach used throughout the Indonesian Archipelago for keris blade preservation adheres to ethical standards and historic aesthetic qualities, while also providing an environmentally conscious and user-friendly conservation approach. Ideally, objects are protected from dust, monitored regularly, and receive a periodic reapplication of the coating. Additionally, preservation with a traditional coating allows visitors to experience a nourished keris in a traditional and spiritual sense as a blade with enhanced contrast in the pamor layers and the intended luster and odor. The fact that olfaction is an important part of these objects offers a rather unexplored opportunity to use the sense of smell as a means to access those objects. In conclusion, this study demonstrated the necessity of studying traditional techniques and the value natural products can add to contemporary conservation methods.

Acknowledgments

The author would like to thank the Haute École Arc Conservation-restauration in Neuchâtel for providing equipment and expertise, the Museum der Kulturen Basel for the possibility to study its collection, and all experts for generously sharing their experiences.

Notes

[1] See article "Simpler keris cleansing ritual this year," *The Straits Times*, 21 May 1996, Singapore.

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Janine Meier's professional education started with an apprenticeship as a goldsmith. She completed her master's degree in conservation and restoration of scientific and technical objects at the Haute École Arc Conservation-restauration in Neuchâtel in 2020, after which she worked at the Museum der Kulturen Basel and the Bernisches Historisches Museum. She completed a fellowship at The Metropolitan Museum of Arts, New York, and is currently working in a permanent position at the Historisches Museum Basel, Switzerland.