

The Application of Malay Indigenous Scientific and Technical Knowledge in the Production of Malay Manuscripts

Penerapan Saintifik Pribumi Melayu dan Pengetahuan Teknikal dalam Penghasilan Manuskrip Melayu

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ABSTRACT

People in the past found their own ways to record their history and ideas. This also forms their local knowledge using indigenous science and technology. As information is important for survival and progress, they have to constantly explore, create, collect and improve on them. To help them remembered this valuable information, they have to keep them “refreshed” in a format that can be easily migrated to a newer format. In this paper, Malay manuscript is any document written by hand, as opposed to being printed or reproduced in some other way, including digitization. Before the arrival of printing, Malay documents may be in tree barks, palm leaves, animal hides, metals, stones and paper. In this paper, Malay manuscripts are not only the sole written information that survived from the past, but also the best surviving specimens of Malay hand writing preserved. Over the centuries, these materials are the valuable reference sources to study the evolution and history of Malay writing – Jawi and other scripts before that. This paper is not on the development of Jawi writing system. It is on the application of Malay science and technology on the development of Malay writing accessories – pen, ink and colors. This is only a preliminary report as further research is needed to solve the many mysteries and unknowns.

Keywords: Local knowledge; Malay manuscripts; writing accessories; Malay indigenous science; manuscript culture

ABSTRAK

Orang pada masa lalu mempunyai cara mereka yang tersendiri untuk merakamkan sejarah dan idea-idea mereka. Ini juga merupakan pengetahuan mereka dengan menggunakan sains dan teknologi tempatan. Memandangkan maklumat sangat penting untuk terus hidup dan maju, mereka perlu sentiasa meneroka, mencipta, mengumpul dan memperbaiki maklumat yang sudah ada. Untuk menolong mereka mengingat kembali maklumat yang penting itu, mereka perlu menjaga maklumat itu sentiasa “segar” dalam format yang mudah dipindahkan ke format yang lebih baru. Dalam kertas kerja ini, manuskrip Melayu adalah apa sahaja dokumen yang ditulis dengan tangan, maka didapati berbeza dengan dokumen yang dicetak atau diterbitkan semula dalam cara lain, termasuk pendigitalan. Sebelum adanya teknologi percetakan, dokumen Melayu mungkin wujud dalam bentuk kulit pokok, daun palma, kulit binatang, logam, batu dan kertas. Dalam kertas kerja ini, manuskrip Melayu bukan sahaja maklumat tunggal bertulis yang terselamat daripada masa lalu, tetapi juga spesimen tulisan Melayu yang terbaik yang masih diwarisi. Selama beberapa abad ini, bahan-bahan ini adalah sumber rujukan yang bernilai tinggi untuk mengkaji evolusi dan sejarah penulisan Melayu – Jawi dan skrip lain sebelum itu. Kertas kerja ini bukanlah tentang pengembangan sistem tulisan Jawi. Ia adalah tentang aplikasi sains dan teknologi Melayu dalam pembangunan aksesori bertulis Melayu – pen, dakwat dan warna. Ini hanya laporan awal, maka penyelidikan lanjutan amat diperlukan untuk menyelesaikan misteri-misteri yang belum diketahui orang ramai..

Kata kunci: Kerarifan lokal; manuskrip Melayu; peralatan tulis; sains pribumi Melayu; budaya manuskrip

INTRODUCTION

As early as 400 AD, with the expansion and increased intensity of trade, the Pallavas from the Coromandel Coast (India) were believed to have left Brahminical altars in Kutai, Kalimantan as well as Hindu-Buddhist inscriptions in Lembah Bujang, Kedah, known as Kadaran then (Vlekke 1965). This means that following the arrival of Hindu-Buddhism, we

witness the complex socio-cultural development that transformed the mental, moral and cultural universe of the Javanese, Malays and other local peoples in the region of Indo-Malay World in the early days. Over the centuries, various cultural traits, including the Sanskrit language and literature together with the concept of royalty from India were adopted in many Javanese and Malay courts, and spread. In the process, “Indianized” courts were established

for some 1,500 years in Java, Sumatra, Kalimantan, Sulawesi and Malay Peninsula before the emergence of Islamic Sultanates in the 13rd century. By 8th century, there evolved the Kawi script, an old form of Javanese language from the Pallava script. Following that, Sanskrit loan-words appeared in Javanese and Malay languages, for example, when Tamils and Gujeratis conducted trade in the Indo-Malay World. Under the influence and patronage of the “Indianized” courts, there was a strong Hindu-Buddhism’s influence in Javanese and Malay literature, dance, theatre, through the rewriting of some tales from the great Indian epics, *Ramanyana* and *Mahabahrata*. But traditional Malay literature in the extant manuscript was not written until about 1400 AD, while Javanese literature was believed to date from 900 AD. From the *Mahabharata*, at least the work called *Bharatayuddha* was born in 1157 in Central Java. Looking back, Javanese influences continued in Malacca court as rulers in Malacca had large retinues of Javanese workers and artists as reflected in at least the *Hikayat Hang Tuah* and *Sejarah Melayu*. But, we have insurmountable problems in documenting the early Javanese and Malay literature from the “Hindu period” because of not only the destruction of *lontar* leaves and other easily perishable organic materials in harsh tropical climate, but also the rapid evolution of local languages and scripts, including Pallava, Kawi and Renchung, not to mention the destruction of many of the Hindu works following the ascendancy of Islam (Porch & Teygeler 2000).

We start the story of the manuscript production in the Malay World with the Jawi writing system and the emergence of dip pen, paper and color, being part of the Malay indigenous knowledge in science and technology. The emergence of these writing accessories also marked the beginning of a new epoch in Malay manuscript culture. Prior to that, important knowledge was passed down and transmitted orally. Following the invention of writing system and their diffusion, Malays began to record their information and knowledge by writing them on dried and treated palm leaves, or animal hides and tree barks. Due to the fact that almost all the extant Malay manuscripts that we have inherited from the past were in paper form, it is logical that the discussion in this paper is mainly on the paper manuscripts. Here, our attention will be drawn to the use of this new writing tool with this new media and the necessary techniques that Malay manuscript culture demands. This means that Malay manuscript culture had turned a new chapter

undergoing a rebirth of manuscripts in a different format from palm leaves, animal hides and others in the past. These changes resulting from the use of more versatile writing materials and media had certainly improved speed, leading to the creation of more manuscripts and also the emergence of manuscripts with illumination and illustration, not seen before. This would entail greater organization, specifically within the court scriptoria (Ding 1997). Though there was a strong desire for neatness, with rubrics and colophons were clearly set off from the body of a text, there was no standard on uniformity of the sizes of manuscripts. Thus, this period could be described as chaotic, partly because many of the manuscripts produced had differences in terms of size of paper, layout, size of script, and others. This may be due to the same texts were copied and recopied by many different scribes (Ricklefs 1981). This implies not only the absence of a direct authority that could maintain some kind of control and supervision over the scribes, but also that the kind of scholarship that emphasis accuracy was not there yet. But, interestingly after dip pen, paper and ink were used, replacing stone and chisel, animal hides and tree bark, more manuscripts could be copied much faster than before.

Almost all the early copies of Malay manuscript were believed to have been produced in courts. Powerful Malay sultanates, including that in Malacca, Pasai, Aceh, Jambi, Siak, Bau-Bau, Bima, Banjarmasin, Makassar, Pahang, Kelantan and Kedah, had spaces for scriptoria, the work rooms of scribes and copyists. It is here that important manuscripts were copied, decorated, bound, and conserved. This indicates how revered the scribes were in the society in copying important letters, documents and “books”. Many of the “manuscripts” were believed to have been copied after receiving a commission from rulers and wealthy patrons. Incidentally, it is believed that there were also commercial urban scriptoria in the 19th century, like that in Batavia as documented by Voorhoeve (1964). These commercial scriptoria used to employ scribes and illuminators to copy manuscripts to meet with the growing demand for Malay manuscripts from European collectors, including Sir Stamford Raffles, van der Tuuk, A. L. van Hasselt, Von de Wall, Klinkert, P. R. Roorda van Eysinga, and A. L. van Hasselt and Alfred North much later.- As the transmission of knowledge then was centered primarily on recopying, any works that were not recopied would be lost eventually though there was other means in transmitting information, orally. It

is believed too that where there is a scriptorium, there is a library to house the manuscript collection. This is also the beginning of royal and private libraries (Kratz 1977), which grew in number and became more popular as years went by, and thus the beginning of modern librarianship. At the height of the Malay Sultanates from 14th to 19th century, its power reached as far as the whole of Malay World with some 72 Malay courts documented (See Appendix). But, when the Malay empire begin to collapse to Europeans starting with Malacca in 1511, its literary influence remained as can be seen in the thousand copies of Malay manuscripts in 151 libraries in 28 countries the world over (Ding 2008). The preservation of the extant manuscripts was not exclusively the preservation of an old culture, but it is also especially relevant to understanding the glorious history of Malay civilization in the development and application of Malay science and technology in the production and copying of Malay manuscripts.

MALAY WRITING ACCESSORIES AND THE SKILLS NEEDED

Recognized as national heritage, the extant Malay manuscripts from around the 14th Century until the early 20th Century not only reflect the glory of Malay civilization, but also the epitome of Malay scholarship in the past. Writing in Jawi script, adapted from the 30 letters of Arabic and 5 letters of Persian languages, the writing materials used were dip pen, ink and paper. First, the dip pen that was used to dip the soot ink was the most common writing implement available. Though very different from its modern cousin, whether a ballpoint pen, a fountain pen or a marker, dip pen would also not stain either hands or paper. It was made from a suitable part of bamboo, rattan, or *resam* fern stem with a narrow slit at its nib (Wan Ali 1988; Maimood 2009). Its function and mechanism is essentially similar to that of a quill in the West or brush pen in China then. The raw materials for making dip pen could be found easily in the tropical forests. They were selected, cut and processed. Extreme care and experience are required in selecting the stem, and then cut one end to form the nib at such an angle that it not only would not break easily, but also can be used for a long time. As writing instrument, it comes with a holder and is very versatile in the sense that its nib could hold ink for both writing and drawing. The nib is made neat and flat by scrapping it carefully on

the inside and then sharpened by cutting it to have a certain angle. As it has no capillary action like that in a fountain pen, the scribe has to periodically replenish the ink by dipping the nib of the pen into an external inkwell. To replace one dip pen, the whole process involving lengthy preparation time is repeated. The other drawback is to occasionally sharpen the nib after it becomes blunt due to scratching the rough surface of paper by using a handy little knife, which is now called a pen-knife, another necessary writing accessory. Though the dip pen was fragile and imperfect in way that it did not work the way modern fountain pen, ballpoint pen or marker can work under different pressure and also at any angel, this primitive writing instrument that demanded a certain pressure at a certain angle had dominated for the longest period in Malay manuscript production. Nevertheless, this writing instrument has the general and inherent functionality of a pen in the sense that it can be used to write, draw, and make marks. Other important attributes this dip pen has as a writing material are its reusability, its permanence, and its resistance to repeated use. From studying the pens used in writing the extant Malay manuscripts, we notice that Malay authors, scribes, illustrators and illuminators had used different type of dip pens to create different kind of “marks”, instead of the most common form of writing. They all had hard tips that could hold certain amount of ink dipped at the tips to be applied to the surface of paper or other materials.

The other necessary accessory in producing Malay manuscript is paper. As the extant Malay manuscripts are written on European paper, identifiable from the watermarks (Russell 1986, 1993) there is really not much to say about the paper used in the Malay World, except to mention that *delauing* paper had been developed and used by the Javanese in the past (Ricklefs 1981, 1974; Kumar 1976). But, before and after the widespread of European paper in the Malay World, there were many Javanese and Balinese old manuscripts on palm-leaves in Sunda and the islands of Bali and Lombok, for instance. Palm leaf manuscripts made from the dried palm leaves were used to record actual and mythical narratives. Due to the shape of its leaves, which spread out like a fan, these trees are also known as ‘fan trees’. These sometime called lontar leaf manuscripts with long rectangular strips of smoke-treated palm leaves with inscriptions incised on them were gathered on top of one another with holes drilled through all the leaves, and the “book” was held together by strings. This

means that palm leaf and *daun lontar* rolls are not a continuous roll, but a collection of sheets attached at the back and sewn together. This manuscript was rolled out horizontally with the text occupied one side and was divided into columns. The task of writing and copying itself required a variety of competencies, which often made a manuscript a collective effort. By the way, the palm leaves have always been used the local people for many other purposes, including the making of plaited mats, palm sugar wrappers, water scoops, ornaments and ritual tools.

Another important writing medium before the emergence of paper was the use of animal skins as writing material. The skins used were usually from sheep, goats and cows. They were soaked in a caustic solution which would dissolve fat and help clean other adhering tissue. The skins then were laced to wooden frames. The lacings were progressively tightened to stretch the skins which were repeatedly scraped with a knife, not only to remove any extraneous matter, but also to keep the skins supple as they stretched and dried. When the treatment was complete, the hair side of the skins could be distinguished from the flesh side by color, texture and by the fact that the hair side tended to become slightly concave. They were then given a particular form of treatment to make them fine, supple and white. In Batak, Sumatera, the local people there produced *pustaka* from a certain tree available (Porch & Teygeler 2000). As there is not much is known about the writing material, we turn our attention to other writing accessory: ink.

As it is, we know that ink is either a liquid or paste that contains pigments or dyes, i.e. admixture of chemicals, and is used for drawing or writing with a pen. It can be composed of solvents, pigments, dyes, resins, lubricants, solubles, among others. The different combination of components serve such different purposes as the ink's carrier, its colorants, and other additives that can affect its flow and thickness and, therefore, its appearance when dry. Scientifically, ink generally falls into four classes: aqueous, liquid, paste and powder. But, the ink used for the writing and copying of Malay manuscripts in the past was water-based and much less viscous than the modern oil-based ink used in printing. Malay traditional ink is carbon-based and made from soot or lampblack, mix with a certain gum and animal glue as binding agent to keep the carbon particles in suspension, and adhered to paper (Wan Ali 1988). They know what chemicals, and their proportions to be mixed with water and other solvents. It is as

complicated as the making of the modern day dye-based inks from the solvents that can dry rapidly or are used with quick-drying methods of printing, such as blowing hot air on the fresh print. One distinct advantage of carbon particles is it does not fade over time even in sunlight or when bleached. Other benefit of carbon ink is that it is not harmful to paper. Thus, over the centuries, the ink used in the extant manuscripts time does not fade in color. This means the soot ink is chemically stable and does not threaten the strength of paper.

Besides the common carbon ink made from soot and gum mixed with water to form a very black ink that can adhere to the surface of paper, we have octopus ink from a certain species of octopus in Riau Islands. This ink is released from the ink sacs in the octopus and is dispersed widely by a jet of water. Its dark color is caused by its main constituent of melanin. Different species of octopus produces slightly differently colored inks: generally black, blue-black and brown-black. It is believed that some scribes around Riau Islands used to get ink from octopus from fishmongers or gourmet food suppliers.

Interestingly inks used in the extant Malay manuscripts, especially the illuminated ones were available in a range of colors that could be thinned or mixed together to produce other colors and shade of colors. This suggests that in the past the Malay artist's palette was broad. They managed to extract different colors from different leaves, flowers, fruits, fruit-skin (including henna for indigo color, *kunyit* for yellow color, *manggis* skin for purplish color, soot for dark color and *pandan* leaves for green color) and stem of plants available in the gardens and jungles in addition to some minerals (including iron gall that tends to have a brownish color). They must be professionals who could mix the different colors to produce new shade of colors, like we do by mixing the blue and yellow colors to get green color as well as yellow and red colors to get orange color. Firstly, suitable leaves, fruits and stems of plants were selected, cut, soaked in water, and underwent a long process, like that in processing palm leaves and tree barks. This suggests that Malays in the past certainly knew the so-called "basic" colors (like "red" but not "shade" of red). They had been using the colors very extensively in coloring cloth, baskets and others that they weaved palm leaves and of course the food and drinks for auspicious occasions like wedding, celebration and house-warming, but did not name them as a *science* as we know them today as the basic colors and so

on. They certainly knew not only that colors vary in several different ways, including hue (shades of red, orange, yellow, green, blue and violet), saturation, brightness, and gloss, but also knew the difference between the dark and cool colors from the bright and warm colors. They knew how to extract dyes and colors as local knowledge passed orally from generation to generation. They knew that color is complex with its inherent properties, but did not document them. They did not call that as science or technology that began in the West. That is what we learn it today in schools and universities.

PRODUCTION STEPS IN MANUSCRIPT CULTURE

After discussing accessories associated with the manuscript production, it is necessary to know some of the steps involved in its long process. In the past, scribes were maintained and retained by nobles or royals in Malay courts. Their work was required (and manuscripts were created) only for unusual occasions, such as noble or royal births, weddings, or other extraordinary occurrences. Until the brink of 19th century, the number of scribes had never been big (Siti Hawa 1977), not only of high illiteracy rate, but also that manuscript was not intended for mass consumption. Most scribes would gather the texts together as they copied, but some would separate them into sections to be copied in parts, either individually or collectively among a few of them as a group. We are not clear of the detailed logistics of this work. Certainly, massive work was broken up between scribes and illuminators who were doing different kind of work. For manuscripts that need illuminations and illustrations, the scribes would normally leave sufficient space for them. This means that they had already concept of space. But, we have one problem. In some texts, one can see how the writing deteriorates over several lines, becoming scratchy and messy as if the scribe has problems with his dip pen and control of ink. Being an expensive stuff that it was, the pages with mistakes were not discarded. I guess the hapless scribe just had to tidy up his pen and soldier on, while the amateur scribe's writings are frequently irregular and different from that from the professional. The manuscripts from the latter are carefully written with their handwriting not only all exact and regular in shape, but also exactly aligned with the letters above and below, as well as those on each side. At the same time, the strokes from the

professional and dedicated scribes were of equal thickness and delicately written, while that from the amateur are more careless. But, very often we find letters in some manuscripts are irregular. This shows either that there were many ways to write or that many different scribes were involved. As some scribes were careful, steady and patient, while the others careless, hasty and sloppy, thus varying thickness. Thus it was a common phenomenon to see some of the manuscripts had different strokes and styles in different parts of the manuscripts. Of course handwritings vary greatly not only because the different the skill and experience of the scribes, but also the purpose of the manuscripts. Those for the royal are different from that as gifts to common friends. Nevertheless, the handwritings in most copies of *al-Quran* are regular in shape, nicely aligned with the letters above and below, as well as those on each side. This means that scribes doing the work regard it as a pious work. The fact is anyone in manuscript culture could have a text copied, recopied and even its contents altered. Another fact is that copying of analog information is only possible to a limited degree of accuracy, which depends on the quality of the equipments used and the quality and skill of scribes. This deterioration accumulates with each generation. Many of the scribal mistakes were not corrected, not only that they did not have eraser and liquid paper to remove the mistakes, but also that the paper was too expensive to be discarded as mentioned. Thus, we see some of the scribe's mistakes are left for eternity. But copying work was important in preserving and transmitting written information from generation to generation. That sort of work has now developed into professions in public servants, journalists, secretaries and public records keepers. With the advent of printing, that profession found in all pre-literate cultures in some form has lost most of its importance and status. However, in societies with low literacy rates in many newly developed countries, one can still find street-corner letter-writers (and readers) to be found providing the service of scribes previously.

The task of copying itself had several phrases, including the preparation of the paper to copy, the layout of the page and the copying itself, not to mention the more complicated work in illustration and illumination. In other words, the manual copying work itself was hard. This manual labor was comparable to other manual work, both outdoor and indoor. After working for hours in front of a writing desk next to a window, his whole body aches and grows weary. Though the copying work was not

called a profession, but it demands professional knowledge and hard-learned skill. Firstly, he must be able to keep the invisible horizontal and vertical lines at the edges straight and evenly spaces. Then, he had to learn the tricks to manage the dip pen and the ink to avoid the ink dripping and dirty his hands or soil the pages he was copying. To do that, he must have a dip pen with suitable nib. Only skill and experience could tell him how much ink to dip and how much hand pressure to apply to write to avoid the nib cutting into the page. And only skill and experience could tell him how much pressure to apply to pull the pen gently over the surface of the pages. Pushing the pen too hard would either make the nib “eat” into the surface of the paper or cause the ink to splatter and blot. This would damage both the pen and paper and he certainly had problem in making correction, as there was no eraser, or white liquid that are easily available now. To do that work well, he must not be afraid to experiment with the not-friendly and versatile dip pens and ink. In short, it is not easy to produce a neat and clean manuscript. But, wonderfully, after Malays had all the necessary writing accessories - the dip pen, ink and paper - handwriting had developed into an art. Their inventive and creative nature once again turned to improving the writing, leading to the production of thousands of neat and clean manuscripts that we see nowadays.

Nibs are sharp and stiff. They are not easy to operate and control to write every individual stroke neatly and every character evenly in a straight line within certain borders or columns. This is art. Its presentation and expression is through varying the pressure hold on the dip pen which requires replenishment by periodically dipping into the inkwell. To do that requires practice, skill, experience and expertise. Thus, a seasoned scribe would know that different sizes, shapes and types of nibs are for different jobs. Different nibs provide different points and line widths. Pens with different nibs and liquid ink can produce different sizes of stroke width depending on the degree of applied pressure. The variation range of pressure is part and parcel of the skill, experience and expertise demanded of a scribe in manuscript culture. A very delicate and fine nib must be used to write fine strokes fairly reminiscent of brushwork. Only experience would tell him how much ink a certain nib can hold to give a constant flow of the sufficient amount of ink to ensure a constant line (Maimood 2009). Every scribe had to constantly maintain the writing accessories. Dip pens must be cleaned after

every use to prevent clogging. This means that scribe had the problems of the nib suddenly exhibited changes in ink flow (e.g. flow stops and blots, etc.) and the fibers from the paper causing the problem. A good way to clean the nib is to give it a good scrub with a stiff brush. Alternatively, to prevent blockage, wipe the nib gently with a cloth to allow it to air-dry before storing. This suggests that the Malays then already has developed a holder where different dip pens are stored and kept separately. This is professional and very scientific. If cleaning doesn't help, then the nib will have to be sharpened or the whole dip pen discarded as well.

There are steps on the preparation of the pages for copying. To begin with, the scribe must be given a stack of paper. The first step is to set up horizontal straight lines to serve as baselines and also vertical straight bounding lines as borders of the columns. Though invisible, they serve as a guide for entering the text. To do that, he must have some kind of rulers – may be made of wood - with measurement to help to measure distance, closeness and width of lines one from the other. This unit of measurement was useful in the building of boats, erecting of houses and other big structures. This means that Malays from around 14th Century had already had knowledge of geometry, algebra, algorithm, numerical analysis, and calculus to ensure accuracy, though were not named as such as we know it. Besides the straight ruler, there must be other flexible devices which can be bent to get the desired shape and curve as used in constructing houses and making ships, among many others. All these accessories were part and parcel of the early science and technology in Malay society which had developed their own of engineering industry that must require accuracy. This is also part of early Malay measurement system in measuring quantity, quality, and distance between objects. They are important in expressing value, precision, reproducibility and repeatability. The Malays then were believed also to have weights and stones for pressing. This means too that they had already some kind of standards, vital to reproducibility, repeatability and others which express value, quality and other measurement other than the terms like “sejengkal”, “sehasta”, “sedepa”, “sepemeluk”, “swegulung”, dan “sepanakan nasi” which we come across in some of the texts. Another necessary step is cut the paper to the appropriate size if it is not the size they want.

Considering that the traditional organization of manuscript production was made up of scribes working under the royal patronage that supported

them by giving them the writing accessories, there might be a supervisor, may be *Bendahara* himself who is literate. He also served as a link between the scribes and the Malay rulers or wealthy and powerful *bangsawan* and elites. There, the dedicated scribes often spent their entire life in an ill-lit scriptorium. This painful and laborious process of copying manuscript can easily take a toll on his health. This picture may be rough external appearance of a scriptorium. It is believed that there were royal libraries attached to the royal scriptoria as mentioned earlier. Both had collection of manuscripts which were slowly supplemented with the new ones. In other words, the scribes, and royal patronage were the forces in the production of manuscripts, while the royal libraries are centers of manuscript.

CONCLUSION: FROM MANUSCRIPT TO PRINTING

The history of manuscript production by which human in the past record and convey thoughts, feelings and others is the history of civilization itself using whatever local knowledge and ingenuity alongside those they bring in from elsewhere from time to time. This is how we know the story of ourselves, regardless of race and place. Over the centuries, they developed systematized symbols to represent words and sentences and thus languages. The earliest means of writing that approached pens as we know them today in the Malay World were believed to have been made from bamboo, rattan, resam and wood. Malays also developed soot ink from a mixture of soot from lamp oil mixed with a certain glue and other stuff, like the Chinese who invented and perfected 'Indian Ink'. Later on, they extracted colors using the natural dyes and colors derived from berries, plants and minerals. Their scientific and technological know-how involve the processes of humidification, smoking, pressing, drying, gluing, and cutting to produce writing materials of variable quality. These early writing accessories needed a great deal of intelligence and preparation. Their functionality and durability, though non-versatile and inconvenient by modern standard, had sustained Malay civilization for hundreds of years. As they had no choice of dip pen, for example, they had to perfect their skills in writing and drawing and more interestingly adding color for illustration and illumination. Some of the examples can be referred in the books by Gallop (1991), Mujizah (2009), among many others.

This means that the history of developing writing accessories (pens, ink, and others) is a long and gradual process. Before the more versatile paper, the Malay scientific and technological knowledge in making animal skins and wood barks as writing materials is marvelous. Animal skins, for example, had to undergo a long treatment process including tanning, stretching and removing hairs and meat. But animal skin is not as good writing material as paper, because not only that it does not take ink very well, but also that it will usually have hair and roots still attached. But, interestingly, this long history of developing writing materials, ink and colors with varying durability and techniques represent some of the necessary steps and stages before we have what we have now. This means that Malays in the past already had a high level of scientific knowledge, but did not left behind documentation of the different chemical compounds, composition and steps involved.

They knew how to prepare the carrier and solvent for pigments, and how to keep the ink evenly mixed and able to carry the pigment from the ink stand to the nib of the dip pen. They could have used water before the use of other solvents like vinegar, salt, alcohol and other chemicals. They also did not reveal the steps and processes involved in making soot ink or preparing leaves for writing from a certain bark tree. We knew that they had to pound and grind the soot into fine powder, and pound the tree bark into paste, and also cut and dry the animal skins. We know that they used certain minerals and metals, vinegar, gall, insect, egg yolk, and others and mix them and sift them. We also do not know what they called the science of color that we now call *chromatics*, *chromatography*, or simply *color science*. We know pretty well that they too had the perception of color as any human eye and brain would experience. We know that the origin of color used in the extant Malay manuscript had been developed by them. We are told to classify this knowledge as science to be equipped with explanation and theory. They also knew the physics of electromagnetic radiation in the visible range, but again left no documentation. Likewise with octopus ink that contains a number of chemicals in a variety of different concentrations, depending on the species. Indeed octopus ink has been used in manuscript writing in Riau Islands in Indonesia until the 19th century.

Without the modern accessories, Malays in the past had produced thousand copies of Malay manuscripts, using whatever accessories available

to produce other arts and crafts. Our problem now is how to preserve these extant traditional cultural heritages. We know that soot ink is not ideal for permanence and ease of preservation as it tends to smudge in the humid and hot environments in the tropics. We are told that the best way of preserving a document written in soot ink is to store it in a dry environment. Either the ink fades or not is dependent on the conditions of storage, and the original formulation of the ink and paper. We know too that one notable characteristics of iron gall ink is that it is acidic and it can bite into the paper. Worse, dampness can also destroy the paper the way it destroyed the fragile and brittle *daun lontar* manuscripts. This is one of the reasons Malay manuscripts survive better in libraries in tropics. Today, nearly all the hand written materials from the past are in the custody of museums. But we should always keep in mind that these old writing materials have served Malay society for hundreds of years. But, in hot and humid climate, palm-leaves cannot be preserved for a very long time. Thus, preservation comes into the picture.

In preservation, we care mainly about paper stability. Much of the extant paper made from wood pulp containing significant amounts of alum that is acidic. Alum was added to paper to assist in sizing, making it water resistant so that ink did not “run” or spread uncontrollably with no consideration that the alum they added to cure the problem in making the paper is detrimental to the cellulose fibers in the paper. As it is, all paper is at risk of acid decay, because cellulose itself produces formic and other acids depending on climatic conditions. In addition, iron gall ink is also corrosive and can damage the paper making the paper containing it to be brittle, with the writing on it fades. Many of the extant Malay manuscripts are damaged by these destructive agents. As no treatment can undo and stop the damage already caused by acidic ink, deterioration can only be slowed down. There are many possible side effects from these treatments, including paper and ink color may change, and ink may bleed. Thus, many people think that it is better not to treat the paper for fear of the consequences of mechanical damage which can further weaken the paper.

The transition from hand written manuscripts to printed books had begun with the introduction of printing press in the 19th century. With that, manuscript trade also changed to book trade. But, manuscript copying by hand has not stopped in Pattani, Riau and Java until today, partly because of tourism industry with the belief that anything

handwritten can fetch a high price. But, the number of copyists had dwindled as manuscripts are no longer intended for mass consumption as in the brink of 19th century. In other words, Malay manuscript industry has fallen apart.

The extant hand-written Malay manuscripts produced around the 14th to 19th century are recognized as our national heritage. The knowledge preserved therein reflects not only the wealth of local knowledge, but also the glory of Malay civilization. They are the epitome of Malay scholarship, science and technology in the past. In this respect, the writing and copying of Malay manuscripts in various subjects is to bequeath the knowledge, scholarship, science and technology to the future generation.

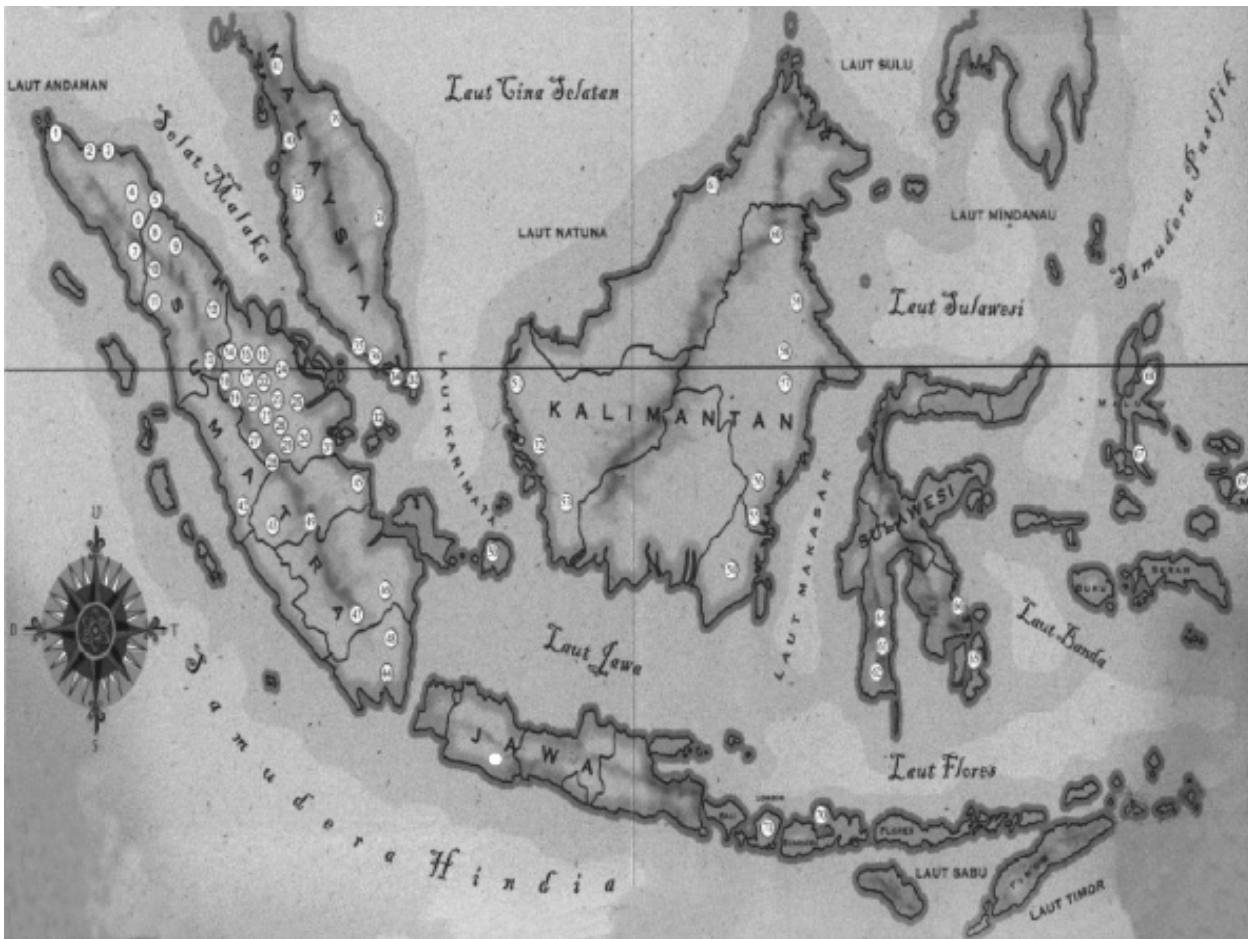
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APPENDIX



A map showing some of the location of Malay sultanates