

# A Study of Two Types of Traditional Lao Paint

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## 1 Introduction – Purpose and Significance

This research was conducted as a part of the Project to Research and Restore Buddhist Statues in the Luang Prabang Area of Lao P.D.R. (hereafter referred to as the Project). It is a continuation of the research previously published in the 2007 *Comprehensive Report of the Project to Research and Restore Buddhist Statues in the Luang Prabang Area of Lao P.D.R.* (hereafter, Research #1). Jill Emma Strothman, Faculty of Buddhism Lecturer at Minobusan University, and Yukina Ikeda, sophomore at Minobusan University were at the center of this research. Our policy is to use traditional materials and methods of the Lao People's Democratic Republic (hereafter Lao P.D.R.) as much as possible in the restoration of Lao Buddhist statues. As was previously published in Research #1, in traditional Lao Buddhist statue creation, before applying gold leaf with lacquer traditional paint was used as a base coat.

According to reports from people of Lao P.D.R., many kinds of soil are used to make traditional Lao paint. Among these, the most famous three colors of traditional Lao paint are red, yellow, and black. Red is mainly used as a base coat for applying gold leaf with lacquer, while black and yellow have been

A Study of Two Types of Traditional Lao Paint (STROTHMAN, IKEDA)

used traditionally to paint temples. In this research, we studied the red paint that is used in Buddhist statue creation. In addition, because it was readily available, we studied yellow paint as well. We also studied how the paint deteriorated in water.

Traditional red and yellow paint can be seen on temples in Luang Prabang. Specifically, red paint can be seen on Vat Sene, and yellow paint is painted on Vat Pa Phonpao.

Official studies of the traditional Lao red paint have been done previously in Research #1 and by UNESCO in *A Report of the Raw Materials for Classical Restoration (LAIT DE CHAUX ET BADIGEONS A LA CHAUX, FASCICULE No 3: MISE EN OEUVRE DES MATERIAUX)*.

However, the above research is flawed.

- I. Only one method of production of red paint is mentioned in each study.
- II. Numerical data is not included.
- III. The method of creation of yellow paint was not previously officially reported.

From February 16, 2014 to March 7, 2014, Jill Strothman, Yukina Ikeda and our interpreter Mr. Sommano Khammanivong conducted interviews with five Lao citizens regarding red paint. The citizens were Mr. Somboon Phattaphon, Mr. Bounmy, Mr. Thongkheum, Mr. Duang Thao and Mr. Phomma Vichith, residents of Peo Village, which is famous for red paint. Regarding yellow paint, we interviewed Mr. Somboum Bounthavong, a minister of the territory of Luang Prabang, and Mr. Insaveng Bounmunutham of the Ministry of Information, Culture and Tourism of Lao P.D.R. These two men are well versed in the creation and use of traditional yellow paint. As a result of these

interviews, it was discovered that there are at least four methods of creating traditional red paint. Also, none of the previous research reported the method of creating traditional yellow paint, so this is the first official report of the method of creating yellow paint.

In recent years, it has become cheaper to buy red paint than to make traditional Lao red paint, so the usage of traditional red paint is becoming increasingly infrequent.

Because the yellow soil of Xiang Ngeun Village that is used to make traditional yellow paint is free for the taking, it is used to paint walls of houses and many other things.

## **2-1 The Red Paint Experiment #1**

There are two names for the red soil that is used to make traditional Lao paint: dine-deng and dine-harng. “Dine-deng” means “red soil” and is the simplest and most commonly used term. “Dine-harng” means “tail of the volcano,” and is used by people who live in Peo Village, which is famous for the red soil. When painted, it has a deep rust color. Since Peo Villagers use “Dine-harng,” we will use that term in this report.

On February 26, 2014 a team of five people from Minobusan University went to Peo Village to dig dine-harng. We were met by five local people who served as our guides and helped dig. 20 minutes of digging to a depth of 60 centimeters produced 1.45 kg of dine-harng. We also purchased 4.5 kg of already-dug dine-harng.

The four methods of creating traditional Lao red paint that were reported to us are as follows:

- 1) From Research #1 - creation by mixing dine-harng and nam-

<sup>(1)</sup>  
 manyang.

- 2) From the UNESCO report - (See Fig. 1 →) creation by mixing dine-harng, nam-mannyang, and light oil in a small pan, putting that pan in a big pan filled with sand, and slowly heating for five hours.

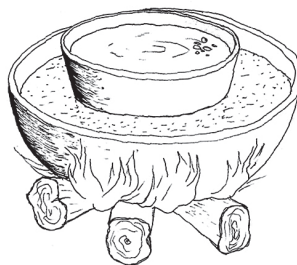


Fig. 1

- 3) From Peo Village interviews - While method 1 reported in Research #1 is traditional, due to the recent high cost of nam-mannyang, recently light oil is used instead of nam-mannyang (Creation by mixing dine-harng and light oil).
- 4) The method used to paint the Royal Palace Museum of Luang Prabang - creation by mixing dine-harng and water.

We experimented with each of the four methods simultaneously using the amounts of materials in **Chart A**. We began making paint on March 1, 2014 in the morning.

<b>Chart A</b>	dine-harng	nam-mannyang	light oil	water
Method 1	0.4 ℓ (482 g)	1.1 ℓ (1002 g)	-	-
Method 2	0.4 ℓ (482 g)	0.75 ℓ (681 g)	0.35 ℓ (266 g)	-
Method 3	0.2 ℓ (241 g)	-	0.55 ℓ (403 g)	-
Method 4	0.2 ℓ (241 g)	-	-	0.55 ℓ (550 g)

Using the amounts of ingredients in the UNESCO report as a guide, we used the same proportion of liquid mixer to dine-harng for each method.

**Method 1** requires 2 hours of heating for the nam-mannyang and dine-

A Study of Two Types of Traditional Lao Paint (STROTHMAN, IKEDA)

harnag to mix. In **method 2**, the UNESCO method, it is written that the mixture is heated, but the Luang Prabang Fine Arts School teacher who actually made the paint for UNESCO assured us that diesel catches fire and Lao people never heat paint with diesel mixed in over a

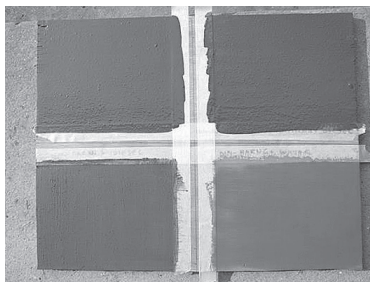


Photo 1

fire, so we didn't heat it. After making the four kinds of paint, we simultaneously painted them on a board as seen in **Photo 1**.

After painting the paint made by each of the four methods on the board, we measured the amount of time it took for each type of paint to dry completely. We finished making the paints at 16:00 PM and began to watch the clock. However, as the temperature was lower at night than in the daytime and the sun was hidden, it took a long time to dry. Therefore, we took daytime measurements the next day. We measured time only once for **methods 3** and **4** because the drying process was very fast. The results of our experiment can be seen in **Chart B**. For reference, the temperature at 9:00 AM was 21.9°C and at 12:50, 30.7°C . The humidity was 65.1% at 9:00 and 41.1% at 12:50. The weather was sunny.

<b>Chart B</b>	evening	daytime
Method 1	overnight	3hrs50min.
Method 2	overnight	3hrs30min.
Method 3	2hrs36min.	-
Method 4	7min.	-

We had been told by Mr. Phimpha Phonsavath, the Luang Prabang Fine

Arts School teacher who made the paint for UNESCO, that he mixed diesel with nam-mannyang to speed the drying time. However, no difference in drying time was noticeable.

Because our purpose in making paint is to actually use it when restoring Buddhist statues, a very important question for us was the durability of the paint. Lao P.D.R has a rainy season, with a lot of moisture in the air. In fact, the walls of the Royal Palace Museum, which were painted using dine-harn, showed that paint had run considerably due to rain despite the fact that it was painted fairly recently. So we decided to test the paint for durability in water.

## **2-2 The Red Paint Experiment #2**

At 9:20 AM on March 3, 2014 we experimented by putting a board (**Photo 1**) painted with each of the four kinds of paint we had made in a washbasin and took photographs every ten minutes. At 12:00 we completely changed the water in the washbasin to avoid saturation problems. We took three kinds of pictures: **i** submerged in the water, **ii** lifted near the surface, and **iii** lifted out of the water. The two photographs, **Photo 2** and **Photo 3**, show **iii** the board lifted out of the water at 9:30 and 12:50. While some difference in color can be accounted for by the greater sunshine at 12:50, it is clear that the color of the paints changed considerably.

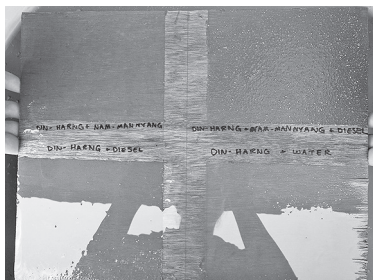


Photo 2

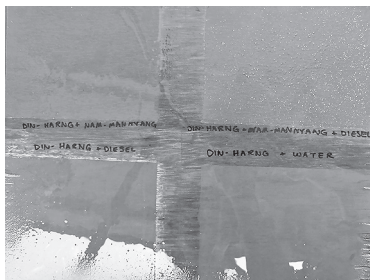


Photo 3

### Deterioration of red paint made by method 1

As can be seen in the difference between **Photo 4** and **Photo 5**, the nam-mannyang and dine-harng combination became a little bit lighter in color and more orange than the original paint had been. However, overall its durability against water was better than both the UNESCO version and the water combination.

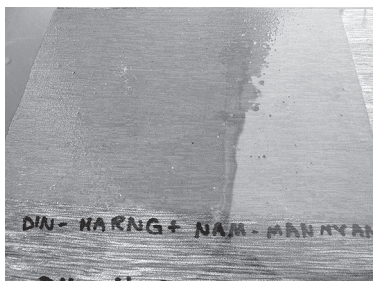


Photo 4



Photo 5

### Deterioration of red paint made by method 2

The paint made by mixing nam-mannyang, diesel and dine-harng (the UNESCO version) showed the most amazing differences. Relatively quickly, the paint began to develop round white lumps as can be seen in **Photos 6** and

7. All four types of paint became lighter in color, but as the UNESCO version also developed these white lumps, we determined that it was the most unsuitable for restoration of the four versions we had learned about.



Photo 6



Photo 7

### Deterioration of red paint made by method 3

The dine-harng and diesel combination showed both good durability and excellent color retention. After three hours the difference from the original paint color and texture was minimal compared to the other combinations. This is the method the local users of dine-harng have been using recently, and we could understand the advantages easily looking at the slight difference between **Photo 8** and **Photo 9**. However, we would like to stress that as diesel burns easily, in no way are we recommending its use on buildings.

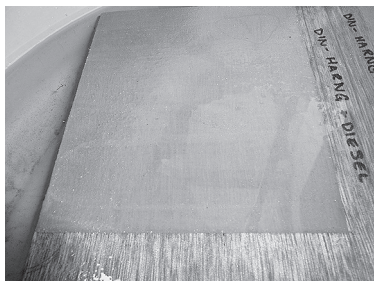


Photo 8

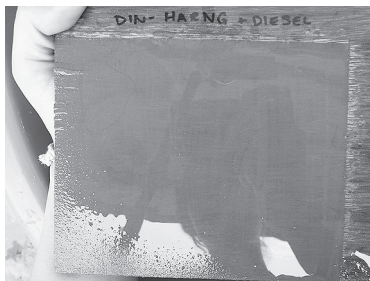


Photo 9



#### Deterioration of red paint made by method 4

When we put the mixture of dine-harng and water into the water, the paint began to run immediately. At first the paint in the cracks ran off and the board developed a striped pattern. Eventually, the color of the entire board became much lighter than the original paint color, as can be seen in the change from **Photo 10** to **Photo 11**.

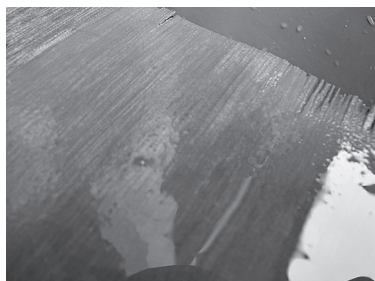


Photo 10

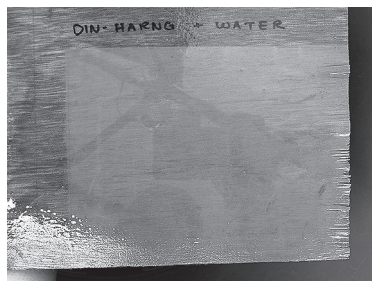


Photo 11

### 2-3 Conclusions

For this experiment we began with the instructions that UNESCO specified to make dine-harng. However, these instructions are for making paint to paint on walls of buildings. Our project is to research Buddhist statue creation. Looking at the paint made by the four methods specified above, we concluded that the paint would have to be thicker to be used as a base coat for Buddhist statues. The amount of dine-harng would have to be increased in comparison to nam-mannyang. This is because the red color must be stronger in order to completely cover underlying colors. In particular, khamouk, a filler like pate which is made by mixing lacquer and the ash of the bodhi tree, is black and would have to be painted over by a thick paint to

conceal the black color. In both Lao P.D.R and Japan, it was thought that a base coat of red under gold leaf gave the gold leaf a reddish-gold shine. The effect would be visible after weathering had removed some of the gold leaf.

In our future research, we will experiment and collect numerical data regarding the ratio of nam-mannyang to dine-harnng that is best for use in Buddhist statue restoration.

### **3-1 Yellow Paint Experiment**

Yellow paint is called dine-leuang by Lao people, and has been a familiar sight in Lao P.D.R for a long time. As a first step in our investigation of yellow paint, we went to Vat Pa Phonpao to see what the yellow paint looks like when it has been painted on a building. The color is a creamy pastel yellow. On March 5, 2014 a team of five people went to Xiang Nguen Village, 27 kilometers from Luang Prabang by car. We were met by Mr. Insaveng Bounmunutham, a local official of the Ministry of Information, Culture and Tourism. He guided us to the site, which was right off the road, and we could easily dig the soil used in yellow paint. 14 minutes of digging supplied us with 6 kilograms of dine-leuang. It's free for anyone who knows about it and wants to use it. Recently, monks from Vat May in Xayabury District came to get dine-leuang to repaint the temple building.

Next, we asked the official how to make the yellow paint. He explained the method, which has five steps.

- 1 First, pulverize the dine-leuang using a mortar and pestle.
- 2 Mix with water, and strain the mixture using a cloth. The dine-leuang remaining in the cloth cannot be used and is thrown away.
- 3 Leave the strained liquid overnight, and allow it to naturally divide

into a top layer of water and a bottom layer of paint.

- 4 The top layer is discarded, and the bottom layer is mixed before use.
- 5 Before painting, the thickness of the paint is adjusted using water.

For our experiment, we tried this method of making paint using both dine-leuang and dine-harng. We began with the amounts of each seen in **Chart C**. The temperature was 24.6°C and the humidity was 60.9% at 10:48 AM, when we began drying the paint, and 15.5°C and 56.3% humidity at 11:08 AM when both paints had completely dried.

<b>Chart C</b>	grams soil	grams water
dine-leuang	63	237
dine-harng	64	236

Both dine-leuang and dine-harng dried quickly, in 20 minutes. However, while the dine-leuang looked beautiful, the dine-harng was uneven in color and too thin a coat. It was clear that the method used to make dine-leuang is only suitable for dine-leuang, and that dine-harng requires more solids in paint than dine-harng to look beautiful. (**Photo 12**).

When pulverized, dine-leuang feels like chalk to the touch, while dine-harng feels more like sand. The feel of dine-leuang is similar to tonoko powder. In Japan, tonoko powder is used before the finishing coat of lacquer as a base coat. Tonoko powder is mixed with water only, as dine-leuang is mixed with water only.

### **3-2 Interviews**

When we visited Xiang Nguen on March 5, the local official of the Ministry of Culture, Information and Tourism took us to see a house that has been

A Study of Two Types of Traditional Lao Paint (STROTHMAN, IKEDA)

painted with dine-leuang since 1946. It is a cultural heritage of the village, and is protected because it shows how dine-leuang has been used. On this building we could see many layers of dine-leuang that had been painted over the older layers. (**Photo 13**) We were told that the oldest layer was from 20 years ago. We were also told by the man who lives in the house that he added acrylic paint to change the color of dine-leuang, as seen in **Photo 14**. In such a case dine-leuang is used as a base.

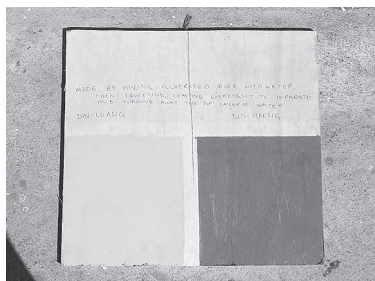


Photo 12

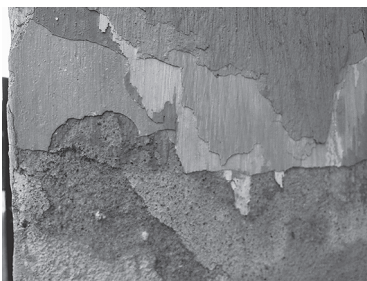


Photo 13



Photo 14

#### 4 Testing of dine-harng and dine-leuang

On August 5, 2014 we had dine-harng and dine-leuang tested at Kosai Test Labo LLC, in Shizuoka Prefecture. None of the previous research had investigated the mineral composition of dine-harng and dine-leuang, so although they were well known traditional paints, there was no information as to what they actually were.

Dine-leuang and dine-harng were tested using X-ray fluorescence analysis and X-ray diffraction analysis. Nam-mannyang is liquid and therefore was tested differently, using Gas Chromatograph Mass Spectrometer analysis (Refer to affixed data for details).

	Chemical compounds presumed to be contained
dine-harng	$\text{SiO}_2$ , $\text{Fe}_2\text{O}_3$ , $\text{Fe}_3\text{O}_4$
dine-leuang	Silicon dioxide, maghemite, hematite, magnetite
nam-mannyang	$\text{C}_{15}\text{H}_{24}$ , $\text{C}_{15}\text{H}_{22}$ , $\text{C}_{30}\text{H}_{48}\text{O}$ , $\text{C}_{32}\text{H}_{52}\text{O}_2$

##### I. Dine-harng

$\text{Fe}_2\text{O}_3$ , called iron (III) oxide, is approved for use as pigment for cosmetics in the United States. It is a rust color, as seen below in **Photo 15**. This iron oxide causes dine-harng to have a dark red color.



Photo 15

## II. Dine-leuang

Silicon dioxide is used in microchips, sand casting and as a paint to spread light effectively in lightbulbs. Inhalation of a large amount of fine grained silicon dioxide can cause cancer and lung illness. Pure silicon dioxide is white, as seen in **photo 16** below. Maghemite is yellowish brown. The differences in color of the house painted many times with dine-leuang (**Photo 13**) can be explained by a difference in the ratio of white silicon dioxide to yellowish-brown maghemite.



Photo 16

## 5 Conclusion and continuing study goals

Our conclusions are as follows:

A Study of Two Types of Traditional Lao Paint (STROTHMAN, IKEDA)

1. Dine-harng can be made by four methods, but considering flammability and lasting time we recommend making it using nam-mannyang alone, and not using petrol or water.
2. The method of making dine-leuang can not be used to make dine-harng.
3. The red color of dine-harng comes from iron oxide.
4. The yellow color of dine-leuang comes from silicon dioxide and maghemite.
5. Continuing research goals
  1. When we went to collect dine-harng and dine-leuang, our guides told us that some of the rocks could be used to make paint, but some similar rocks in the same location could not. We want to collect some of the rocks that we were told could not be used and see if they are made of the same thing and if it really is impossible to make paint with them.
  2. We must take samples of the nam-mannyang tree and make a video of the method of collecting nam-mannyang in order to research it further.
  3. We must research the correct ratio of dine-harng to nam-mannyang for use as a base coat before applying gold leaf with lacquer.

note

- (1) The sap of the nyang tree (liquid).

keywords

Lao P.D.R., traditional paint, dine-deng, dine-harng, dine-leuang, nam-mannyang.