Jurnal Arkeologi Malaysia, 19, 2006

Preliminary Analysis of Prehistoric Pottery Sherds Excavated at Gua Peraling and Gua Cha, Ulu Kelantan, Malaysia

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Introduction

Gua Peraling is a massive rock shelter located close to the *Perias* River, a tributary of *Nenggiri* River. The site at *Gua Peraling* produced much denser fragments of Hoabinhian habitation. The reason is that perhaps *Gua Peraling* is located near to water supplies, where Haobinhian fragments extending here right to the surface layers of the sites. It seem like the people here had been in the shelter manufacturing their stone tools in huge quantities for a very long time. Some of pebble tools had ground cutting edges like tools found in ancient deposits in northern Australia (Adi Taha: 1995), A number of Haobinhian burials were excavated, but mainly found in poor state of preservation. *Gua Peraling* lies close to a famous archaeological rock shelter called *Gua Cha,* which produced many well-preserved burials of Haobinhian and Neolithic periods when excavated by Sieveking in 1954. The re-excavations were done by Adi Taha in 1979 showed that the Haobinhian and Neolithic burials formed a continuous sequence, suggesting rapid culture change to Neolithic about 3000 years ago.

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Gua Cha is the site of archaeological findings dating back to Haobinhian age (10,000-3,000 BC) situated in the *Nenggiri* valley, in the district of *Gua Musang*. Archaeologist believed that a Malenesoid group of men from mainland China in a migratory exercise passed through the Malay Peninsula when it was part of the Sunda platform which included the present day Malaysia, Indonesia and the Philippines, to other parts of Asia, Pacific Island and Australia (Adi Taha 1995).

In 1953 and in 1979, Sieveking and Adi Taha had led a team to *Gua Cha* and found rock shelters burial grounds, primitive tools, pottery and bones of cooked and eaten forest animals. The *Gua Cha* pottery assemblage comprised footed vessels, carinated bowls, biconical vessels, globular vessels, beakers, pot-stands, rounded container, jars, bucket-shape vessels and perforated cups (Noone: 1939, William Hunt: 1952, Sieviking: 1954, Peacock: 1959).

The latest research of the *Gua Cha* concludes that Sieveking statement that the resident here originated from China and India was incorrect. Sieveking stated, "Malaya is seen as an empty land without people and without culture, before the arrival of people and culture from the land of China and India". If there were immigrants in the proto-historic period under the concept of 'Greater India' and during prehistoric period also according to Dr. Benjamin is under the theory of 'Kuih Lapis'. In the meantime, Sieveking's hypothesis shows that society that lived in *Gua Cha* were living during two different stages of times.

The cultures of the two ethnic groups was different and they were Haobinhian and Neolithic cultures. The migration issue of two different ethnic groups be discussed later.

In another specific research done by Adi Taha at *Gua Cha,* shows continuity and change from Haobinhian to Neolithic. These two different societies were related to each other.

Scientific analysis of pottery plays special part in identifying the composition and morphology and more importantly the origin of the potteries (Mohd Anuar Fauzi: 1991, Chia 1997). This can be done by determining the compositions of the pottery and comparing them with the raw materials obtained from the area. From interviews conducted by Stephen Chia in *Sayong, Kuala Kangsar, Perak* it can be concluded that the traditional pottery making communities obtained their raw materials about two or three kilometres away from their village. This corresponded well with the ethnographic studies of pottery making communities. For example, Ariffin (1990) showed that the potters did not travel more than seven kilometres to obtain their clays.

Information on history of ceramics production can be obtained from archaeological assemblages through standardization of raw material composition and manufacturing technique (Rice: 1981), form and dimensions (Balfet: 1965, Sinopoli: 1988) and surface decoration (Hagstrum: 1985).

Materials and Methods

Two pottery sherds from *Gua Peraling* and four sherds from *Gua Cha* randomly been chosen were catalogued and photographed. Six clay samples from *Perias* River, *Nenggiri* River, *Betis* River, *Peralon* River, *Chai* River and *Jendra* River were also taken. All the pottery sherds and clay samples were cleaned and dried at 115°C and ground into a very fine powder. Clay samples were also heated in furnace at the temperature of 600'C. For the characterisation of the sherds and clay samples, analytical instruments used included X-Ray Diffraction SIEMENS D5000 Diffractometer, GBC 903 Single Beam Atomic Absorption Spectrophotometer (AAS), Perkin Elmer Plasma 100 Emission Spectrometer (ICP AES), XRF Spectometer Philips Model PW1480 and Perkin Elmer UV-20 equipment. Physical properties of the sherds such as water absorption capacity, porosity, density and pottery thickness also been analysed.

Result and Discussion

Compositional and morphological analyses showed that the same technology has been used for making the pottery for example the firing method, thickness and porosity. The thickness of the six pottery sherds was measured in order to predict the function of the pottery. For example, thick walled pottery was often used for storage whereas thin walled pottery was mainly as tableware (Chia: 1997, Zuliskandar Ramli *et. al.* 2001). Two pottery sherds from *Gua Peraling* and four from *Gua Cha* are classified as medium and thin hence it may be assumed that the potteries in this area had been used for storage and as tableware.

The ranges of colour from grey to black suggest that the pottery ie were under incomplete oxidation and some had been smudged. It was probably caused by carbonaceous clay that was not sufficiently fired totally to oxidise organic components to allow colour development of any iron present (Rice: 1987, Ertem: 1997). The sherds were found to range from incompletely to relatively well oxidized forms.

Compositional analysis showed that there are differences between the pottery samples and clay samples. The mineral contents of the pottery and also the major and trace elements indicate that some of the pottery sherds are probably be of local origin but four of the sherds (GP2, GCl, GC3 and GC4) might have been brought in from outside Ulu Kelantan. Figure 1 shows a binary plot of the amount of K_2O versus the amount of CaO (De Raedt *et. al.* 2000), which reveals the existence of two compositional groups (see also figure 2 and figure 3). One group has a same elemental composition as the raw material or clay taken from Ulu Kelantan and the other one did not have the same elemental composition. Three of the samples, GP2, GC2 and GC4 have the most similar elements with the clay sample from *Jendra* River but sample GC4 have a totally different in content of minerals and therefore suggest that only samples GP1 and GC2 are probable locally made pottery.

Majority of the pottery sherds showed that they are not locally produced. This may suggest the strong possibility of some trading activities take place around this area or the people who had lived here had actually originated from other places.

Lead (PbO) content in all samples is found to be in normal range (Caleb: 1991), thus therefore suggests that there was no colouring material being added in the pottery making. Study done in *Gua Angin, Kota Gelanggi Jerantut, Pahang* showed that some potters added lead on their pottery as a colouring agent (Zuliskandar Ramli *et al.* 2001, Caleb: 1991).

Based on mineral contents, samples GP2 and GC2 can be grouped together, sample GPI GC I and GC3 in second group while sample GC4 is by itself Analyses showed that the sample GC4 contain minerals known as quartz, clinochlore and albite, sample GP2 and GC2 contain minerals known as quartz and orthoclase, while sample GP1, GC1 and GC3 contain minerals known as microcline and quartz. Analyses on the clay samples taken from the rivers near the *Cha* Cave and *Peraling* Cave such as *Nenggiri* River, *Betis* River, *Perias* River, *Chai* River, *Jendra* River and *Peralon* River showed that they all contain minerals known as muscovite and quartz accept that from the *Perias* River which has an additional mineral known as orthoclase. Muscovite decomposed at temperature of 600°C and 700°C into orthoclase, corundum and H_2O (Mason & Berry: 1968). Since samples GP2 and GC2 also contain mineral known as quartz and orthoclase this may suggest that these two samples have similar mineral contents with clay from *Jendra* River.

No kaolinite was found in the clay samples. This may be most likely due to the loss of kaolinite during heating of the clay at 600°C since kaolinite decomposes when the temperature exceeds 550°C (Stout & Hurst: 1985). Kaolinite was also not found in the shard samples. This may be due to the absence of kaolinite in the clay used to make the pottery or if it had kaolinite in it at all, it might have decomposed at temperature exceeding 550°C during the firing process. However by looking at the colour and the mineral contents of the sherds, it can be suggested that the firing temperature used might be 600°C to 750°C.

Conclusions

Elemental and mineral analyses of pottery sherds from *Gua Cha* and *Cha Peraling* showed that they do not contain similar type of minerals and elements as clay sources taken around the area. Six samples from *Gua Cha* and *Gua Peraling* were analysed and only two samples that is GP2 and GC2 are similar with clay from *Jendra* River. Other samples where found to be different elemental contents or types of minerals or both. Sample GC4 for example have a similar elemental content with clay from *Jendra* River but totally different in mineral type where sample GC4 contain minerals known as clinochlore, albite and quartz while *Perias* River contain minerals known as muscovite, orthoclase and quartz.

Physical and chemical analysis showed the same technology has been used for making the pottery. Thickness of the pottery showed that they are used for storage and also as tableware. The firing range is from 600°C to 750°C and the colour of the sherds ranges from black to grey. Elemental analysis also showed there are no colouring agent been added in the sherds.

Majority of pottery sherds showed that they are not similar with clay samples taken from six different rivers in Ulu Kelantan although sample GP2 and GC2 a similar in composition with the clay from *Jendra* River. These potteries might have been imported into *Gua Cha* and *Gua Peraling* or the other possibility is that the inhabitants in *Gua Cha* and *Gua Peraling* are came from other places. More samples need to be analysed systematically from these two sites and from the other side from Ulu Kelantan in order better comparisons to be made. The possibility of some of the potteries to have been locally made is high but more studies are required before any conclusion can be drawn.

Table 1: Physical Properties of Pottery Sherds at *Gua Cha* and *Gua Peraling*, Ulu Kelantan, Kelantan.

	Physical Properties				
Sample Code	Water Absorption Capacity (%)	Porosity (%)	Density (g/CM3)	Thickness (mm)	Vessel Parts
GPI	12.78	25.75	2.03	5.57	Body
GP2	9.85	23.07	2.34'	7.74	Body
GCI	13.65	26.44	1.93	4.35	Body
GC2	12.30	17.96	1.46	6.14	Body
GC3	8.24	16.19	1.97	9.15	Body
GC4	13.59	21.25	1.56	8.95	Body

Table 2: Elemental Contents (Major Elements) of Pottery Sherds in *Gua Cha* and *Gua Peraling*, Ulu Kelantan.

	Dry weight (%)							
Sample	Al	K	Ca	Fe	Mg	Ti	Na	Si
GPI	20.50	5.61	1.16	7.49	0.61	1.27	0.92	54.34
GP2	17.69	4.43	1.32	4.51	0.87	0.69	0.56	63.44
GCI	20.99	5.24	1.59	6.96	0.86	1.16	0.64	52.49
GC2	17.15	2.31	1.77	4.30	0.51	0.59	0.62	69.12
GO	17.00	2.83	2.29	8.01	1.15	1.15	1.08	62.09
GC4	20.97	3.08	1.45	4.80	0.66	1.21	0.14	59.30

Table 3: Elemental Contents (Trace Elements) of Pottery Sherds in *Gua Cha* and *Gua Peraling*, Ulu Kelantan.

Sample	m/g (Ppm)						
	Mn	Zn	Ba	Cu	Pb	Au	Ag
GP1	343	105	13	2.8	46.6	1.1	9.8
GP2	184	96	12	5.6	58.8	0.5	3.7
GC1	215	70	40	0.7	37.1	0.8	1.8
GC2	363	111	41	0.5	48.1	0.5	0.1
GO3	465	179	44	5.6	61.1	0.6	0.1
GC4	303	127	71	4.9	38.4	1.0	0.1

Table 4: Elemental Contents (Major Elements) of clay samples taken around Ulu Kelantan.

Sample	Dry weight (%)							
	Al	K	Ca	Fe	Mg	Ti	Na	Si
Sc	21.52	3.31	0.22	3.13	1.58	0.87	0.22	65.53
SS	25.29	3.16	0.32	4.13	0.91	0.89	0.27	60.35
SP	28.87	3.42	0.09	4.35	1.56	1.01	0.34	66.35
Si	22.13	2.45	1.19	3.96	1.31	0.98	0.31	65.24
SB	23.27	2.33	0.18	1.99	0.89	0.81	0.24	61.59
SN	22.35	3.52	0.37	3.41	1.29	0.95	0.24	69.20

Table 5: Elemental Contents (Trace Elements) of clay samples taken around Ulu Kelantan.

Sample	m/g (Ppm)						
	Mn	Zn	Ba	Cu	Pb	Au	Ag
Sc	106	18.8	5.7	27.4	24.5	0.4	4.1
SS	546	99.2	10.5	53.4	21	0.7	5.5
SP	424	106	3.4	46.2	6.9	1.2	4.1
Si	428	84.3	5.3	18	10.5	0.6	10.7
SB	86	67.5	5.8	4.1	6.9	0.4	11.4
SN	15	34.3	2.7	15.1	5.2	0.3	10.7

Table 6: Meneral Contents of Pottery Sherds in *Gua Peraling* and *Gua Cha*, Ulu Kelantan.

Location	Sample	Mineral
Gua Peraling, Ulu Kelantan	GPI	$KAlSi_3O_8$ Microcline Intermediate
		SiO_2 Quartz
	GP2	$KAlSi_3O_8$ Orthoclase
		SiO_2 Quartz
Gua Cha, Ulu Kelantan	GC1	$KAlSi_3O_8$ Microcline Intermediate
		SiO_2 Quartz
	GC2	$KAlSi_3O_8$ Orthoclase
		SiO_2 Quartz
	GC3	$KAlSi_3O_8$ Microcline Intermediate
		SiO_2 Quartz
	GC4	$(Mg_3 13Fe_2AI_{0.87})Si_3.AI_{0.7}O_{10}(OH)_8$ Clinochlore
		$NaAlSi_3O_8$ Albite
		SiO_2 Quartz

Table 7: Meneral Contents of Clay Samples From Ulu Kelantan, Kelantan.

Location	Sample	Mineral
Nenggiri River	SN	SiO_2 Quartz
		$KA1_2Si_3AI0_{10}(OH)_2$ Muscovite
Betis River	SB	SiO_2 Quartz
		$KA1_2Si_3AIO_{10}(OH)_2$ Muscovite
Perias River	SS	SiO_2 Quartz
		$KA1_2Si_3AIO_{10}(OH)_2$ Muscovite
Chai River		$KAlSi_3O_8$ Orthoclase
	SC	SiO_2 Quartz
Jendra River		$KA1_2Si_3AIO_{10}(OH)_2$ Muscovite
	Si	SiO_2 Quartz
Peralon River		$KA1_2Si_3AIO_{10}(OH)_2$ Muscovite
	SP	SiO_2 Quartz
		$KA1_2Si_3AIO_{10}(OH)_2$ Muscovite

Figure 1: Amount of K_2O versus the amount of CaO.

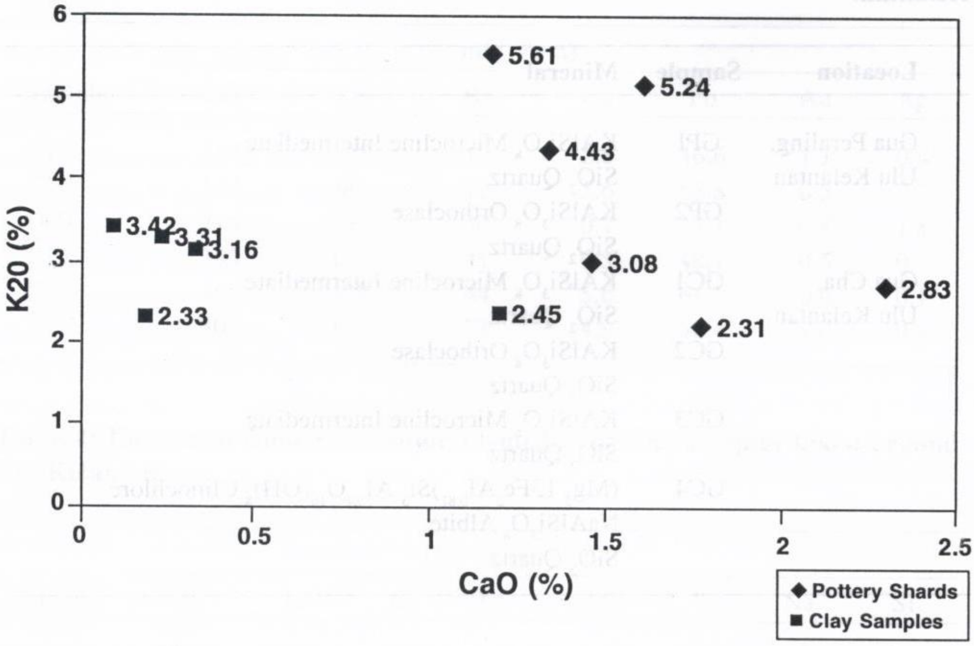


Figure 2: Amount of Ku versus the amount of Cu.

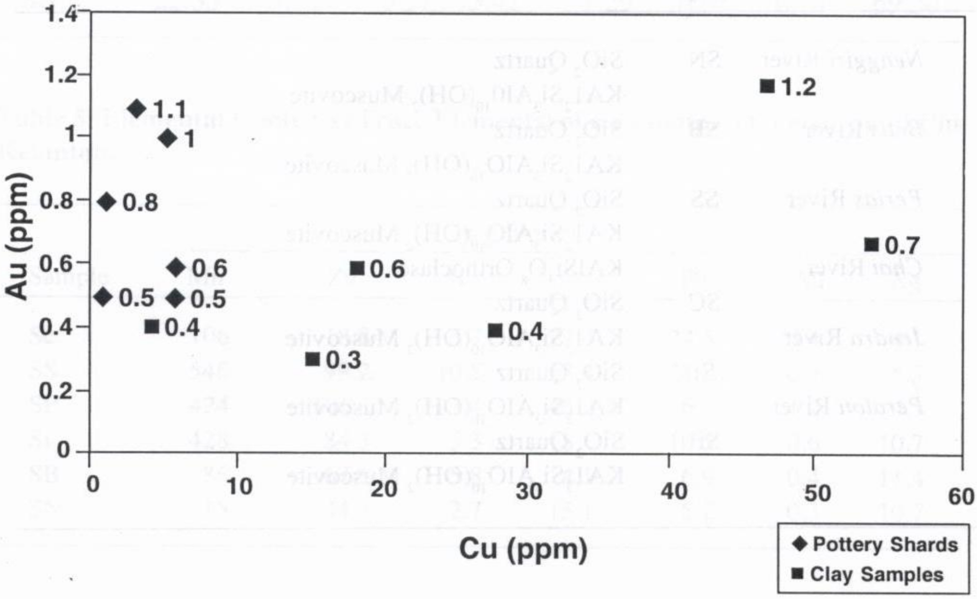
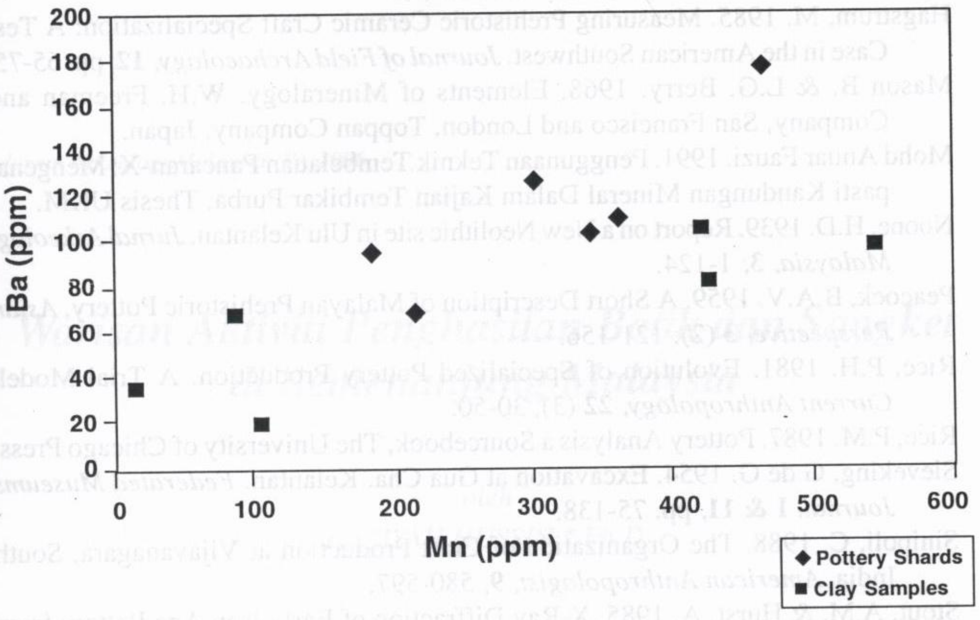


Figure 3: Amount of Ba (ppm) versus amount of Mn (ppm).



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