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# ZOOARCHAEOLOGY IN SARAWAK IN THE 21ST CENTURY

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***ABSTRACT.*** — This paper reviews the state of zooarchaeology in Sarawak in the new century and presents preliminary observations on the establishment of a database system to register and curate some 750,000 zoological specimens from archaeological digs in Sarawak. Following the initial exploration of caves in Sarawak by A. H. Everett in 1873–1879, there was a long hiatus until Banks reported on megaliths in the Kelabit country. Tom Harrisson arrived at the Sarawak Museum in 1947; he first visited the Niah Caves in that year but actual field excavations in Niah Caves only began in 1954 and were carried through to 1962 by Tom Harrisson himself. By 1957, Lord Medway, who started as technical assistant for the project, was so engrossed in the zooarchaeology of excavated materials from the Niah caves that he spent much of his time studying them. He has continued this work until today. The last research before the turn of the century was a study on the pre-ceramic levels of West Mouth Niah by Zuraina Majid. The shortage of data and difficulties in identification of our zooarchaeological materials, arising partly from the huge task of curating the archive of specimens, has resulted in the general disinterest of local Malaysian biologists to add research and cultural value to our archaeological resources.

***KEY WORDS.*** — zooarchaeology, museums, curation, Sarawak, Malaysia, Philippines, United Kingdom

## INTRODUCTION

Some years after Alfred R. Wallace's departure from Sarawak in 1855, A. H. Everett arrived in Sarawak in 1869 to gather natural history specimens for sale to the growing museum market. Later he was employed in looking for evidence of early man in the caves of Bau, Niah and Mulu, in a project that seems to have been promoted by Charles Darwin, Alfred Wallace and Thomas Huxley between 1873 and 1879. Then came a long silence in the zooarchaeology of Sarawak until E. Banks (1937) reported on the megaliths in the Kelabit country. Tom Harrisson became the curator of Sarawak Museum in 1947 and started to develop an archaeology programme with investigations at the Bau caves, Santubong, Sireh Cave, Kabong and Niah. In 1954, Harrisson returned to Niah Caves and, with the assistance of M. W. F. Tweedie from the Raffles Museum, Singapore, dug two trial pits at West Mouth, Niah. However no report was ever published on this first Niah excavation. There was little progress in cave archaeology until 1956–1957 when a major programme on archaeology was developed. This was managed by Tom Harrisson until 1962, and by Barbara Harrisson till 1967. During this period, Lord Medway became involved and he was originally employed as a technical assistant from 1956 to 1958. His original task was to study the swiftlets at Bau, Niah and Baram, but was soon actively involved in zooarchaeology at the invitation of Harrisson (Cranbrook & Leh, 1983; Piper et al., 2013). In fact, most of the plastic bags containing the excavated specimens were labelled by Medway himself, with the rest by Tom Harrisson. A total of 50 papers were published on this material in the *Sarawak Museum Journal* from 1950 to 1976 by Tom Harrisson himself and jointly with Medway, Tweedie and others, with half a dozen by Medway alone between 1960 and 1977.

Since the commencement of these world famous excavations at Niah Caves in 1954, the Sarawak Museum has maintained a store of zooarchaeological remains from Niah and other sites. Such is the importance of the zooarchaeology of Niah that a whole special issue of the *International Journal of Osteoarchaeology* (volume 10 number 4, 2009) was totally devoted to studies on vertebrate bones from Niah. Excavations conducted in Niah Cave by the Sarawak Museum from 1954 to 1965 have produced over 750,000 fragments of vertebrate bone (Barker et al., 2009a). Zooarchaeological items have been stored, while new digs have continued to provide source material for a growing number of reports, appearing both in the local and international scientific literature. Barker et al. (2009a) reviewed the zooarchaeological work conducted on the fauna of Niah and noted the significance of this site.

A contribution on the anthropic complexities of Niah was presented by Zuraina (1982), and the place of Niah in the history of zoology in Sarawak was discussed by Cranbrook & Leh (1983). Solheim (1993) reviewed the development of archaeology in Sarawak over the previous century, focusing mainly on the work done by the Sarawak Museum.

The 21st century has seen a revival of archaeological interest in Sarawak. Piper & Rabett (2009) worked on the bones recovered during the Harrissons' work at Niah and presented a taphonomic interpretation based on analysis of the spatio-temporal distribution of animal bones from the trenches using $C^{14}$ dating. Graeme Barker and his team from the Department of Archaeology, University of Cambridge, United Kingdom, has conducted three seasons of ethno-archaeology research on "the cultured rainforest" from 2007 to 2009 (Barker et al., 2008, 2009a, 2009b). This study focused on the relationship between anthropology, archaeology and the palaeo-environment of the Kelabit and Bario Highlands in northern Sarawak. Later, Lloyd-Smith et al. (2010) completed the third season and summarised the findings. Most notable were pollen studies from core samples in the highlands which provided a 50,000 year perspective of climatic changes and local vegetation. From the experience gained working with Barker, Lloyd-Smith went on to complete his PhD studies on the reclassification of later prehistoric burials in the West mouth of Niah Cave, Sarawak (Lloyd-Smith, 2011). This study offered a new perspective to the work of Barbara Harrisson in 1967.

Medway's work on zooarchaeology from 1957 onwards produced a large archive of archaeological materials that provided ample opportunity for later researchers. Phil Piper studied the zooarchaeological materials, earned his PhD and went on to publish several papers on the subject (Cranbrook & Piper, 2008, 2009), including a review of Medway's contributions to zooarchaeology (Piper et al., 2013). This influx of foreign researchers has further stimulated the already existing interest of local researchers in University Science Malaysia (USM) (e.g., Zuraina, 1982). Stephen Chia has had several research students and went on to work on zooarcheology in Bau (Gani et al., 2009), Niah (Bujeng & Chia, 2009) and Mulu (Chia et al., 2011). Based on the oral information obtained from the Sarawak Museum, Paul Tacon from Griffith University, Australia, went on to discover new stone engravings at Santubong, Sarawak, hence reigniting an interest in rock art studies (Tacon et al., 2010). This paper reviews the state of zooarchaeology in Sarawak in the new century and presents preliminary observations on the establishment of a database system to register and curate some 750,000 zoological specimens from archaeological digs in Sarawak.

However, this huge physical archive in the Sarawak Museum in Kuching poses tremendous challenges in accession, registration and long-term curation of specimens. We therefore review some examples of current practice in various nationally important collections as a guide that may encourage their increased use for research by Malaysian scientists.

## THE NATURE OF ZOOARCHAEOLOGICAL SPECIMENS

Zooarchaeological specimens are excavated in mixed assemblages, that can include representatives of several vertebrate classes, and invertebrate classes such as molluscs (gastropods and bivalves) or crustaceans (e.g., crab claws). These specimens sometimes occur in large numbers, e.g., mollusc shells, bat jaws, bat thoracic bones. Their size, in the case of specimens from Niah Caves in the collection of the Sarawak Museum, ranges from a large rhino humerus 30 cm long to the jaw of a pygmy shrew of less than 1 cm. These teeth and bones are often fragmentary and delicate; needing restoration and liable to deteriorate when exposed to uncontrolled atmosphere. Many of them are initially unidentified, requiring research by different specialists to put a name to them, maybe years later. Today we can utilise modern technologies such as $C^{14}$ dating, DNA reconstitution, or ancient DNA studies to unlock the nature of these bones. Some bones may show signs of cultural use, e.g., butchery marks, use as tools, conversion to ornaments such a beads, or carved to make utilitarian or decorative objects. There are also instances of animal remains being mixed with human remains in burials.

## SOME CURRENT INTERNATIONAL PRACTICES

***National Museum of the Philippines.*** — At the National Museum of the Philippines, all remains from an archaeological site receive a National Museum accession number. Individual archaeological sites are registered by their code, and this is included in the accession number. With animal bones, those excavated by context/layer are usually bagged together and given one accession number. As in the Sarawak Museum collections, one bag can contain several hundred bone fragments, all of which will therefore have a common accession number.

When the bones are sorted in the Archaeological Studies Program at the University of the Philippines, and important specimens are noted, it is possible to ask the National Museum for more accession numbers. Because this can be a slow and often bureaucratic process, in practice, the zooarchaeologists add a number to the existing accession number as the unique identifier and then bag the bones separately.

***Grahame Clark Laboratory of Zooarchaeology, University of Cambridge.*** — Strategies for on-site collection and inventory creation vary from project to project; but a system that has been found to be very helpful in handling recent collections from Vietnam is outlined here. During excavation, bone fragments, along with all other finds that are retrieved through trench-side collection or through dry- and wet-sieving, are bagged. Site code, full date, context number (and sample number if applicable) and preliminary description of contents are written on the outside of the bag. Every bag on the excavation is then numbered sequentially and entered into an electronic (Microsoft Excel) searchable inventory.

When all the bags are boxed up at the end of a field season, the boxes too are given a number, which is then also added to the spread sheet. This ensures that all material is readily accounted for and is immediately accessible during future analysis. Further comments can also be added and material tracked if, for example, samples are sent away for study at another institution. Ideally, this inventory is then available to other researchers.

During laboratory analysis, bones tend be analysed by bag to ensure that the potential for cross-mixing is kept to an absolute minimum, although when appropriate fragments from a particular trench and context number may be merged. In recent work, all material is entered into a Microsoft Access database where individual fragments (or collections of the same element from a given location and context) are given a unique database number. This consists of a site code and a sequential number. This identifier is then written on the outside of the bag from which the fragment(s) came to ensure it is easily retrievable in the future. The number will also be used in publications.

Sometimes, if the recovered assemblage is small or if there is a need to compare bones from different contexts in the same analysis—e.g., refitting elements—the bones themselves are coded. In this procedure a fragment is gently washed with mild detergent and left to dry, usually on absorbent cloth or tissue with the accession details pinned to it. Drying may take place in a fume cupboard. Following this, clear nail varnish is applied to an open area of the bone surface. This covers, usually, no more than a 10 × 5 mm patch and is placed away from any observable surface modification (such as cut-marks). Indelible ink is then used to record the following alpha-numeric sequence: Site code abbreviation (usually two or three letters) – excavation year (two digits) – bag no. – bone no. (i.e., number of bones within that bag). Sometimes the code will also include a four digit context number to assist with refitting fragments from different trench contexts, but with writing space often very limited the sequence is kept to a minimum. Example: Niah/57/1057/022 (Site/year/bag no./bone no.)

In terms of comparative material held at the Grahame Clark Laboratory—modern skeletons used primarily to compare and identify corresponding archaeological remains—all specimens are contained in robust, stackable plastic boxes with lids. Depending on the size of the animal, each box will contain all of the cleaned elements from a particular individual. Each specimen has a unique alpha-numeric code. This is written together with the common name and scientific name of the animal both on the outside of the box and (in the same way as above) written onto all large bones within the box. Smaller bones such as phalanges are bagged together within the box, usually without coding. All users of the comparative material are expected to avoid accidental mixing of material, though the bone coding helps further minimise the chances of this happening. All bone examination is required to take place over a work-bench (not whilst holding an archaeological fragment and comparative specimen in mid-air over the floor, for example). The bench surface should ideally be covered in a protective foam or plastic sheet to limit edge damage to the comparative and archaeological specimens alike.

Ultimately, the plan is to have the full register of comparative material accessible over the internet through the laboratory's website; something similar has been completed successfully by the Department of Zoology Museum, University of Cambridge. One could envisage a situation where this could be extended to include site archaeological databases or inventories as well; a situation that has been undertaken in The Netherlands among professional archaeological units. Rapid, accurate and remote accessibility appears to be an increasingly important feature of zooarchaeological (and other archaeological) assemblage curation.

***Natural History Museum (NHM), United Kingdom.*** — Since bone collections from archaeological digs can be very large, totalling hundreds of thousands of bone fragments, there is a need for a large storage space to spread out the specimens for long-term curation and accession.

Past practice has sometimes been to discard fragments deemed "unidentifiable". This should be discouraged as these material could still contain important information of the environment in the past. Many old collections in the NHM have suffered due to disposal of post crania, making it impossible to study aspects of taphonomy. This information is often critical when using archaeological bone assemblages to interpret past human behaviour.

Labelling is the way information is written on the polythene bags using indelible pens or on acid-free paper labels. For the latter, it is better to use Tyvek labels as these are virtually indestructible and inedible to pests. Individual bones can be labelled using pen and ink (with site code, context and/or batch number). This approach is used on most archaeological sites in the United Kingdom, but could be too time-consuming for a very large bone assemblage.

An accessions register now typically contains the following additional information: A record of loans, when specimens are loaned to and returned from other institutions; notes when specimens are used as the basis for illustrations or otherwise used in published research, with information on the relevant publication; records of destructive sampling (dating, isotopes, aDNA etc.) making use of the specimen

Most museums in the United Kingdom have a Digital Register using the MODES software system developed by the Museums Documentation Association. There is now also a MODES Users' Association. The NHM did try to write its own software, but with undesirable consequences as the files could not be transferred to other commercially designed database packages; MODES or Microsoft Access would have been better. The MODES package allows concurrent multi-user access to the same database, import and export of data, multi-media attachments such as images, sound and videos, and links to text and documents, sending data by email, different user access levels, the creation of barcodes and QR codes, mapping of localities, generation of reports, and various other applications.

***Sarawak Museum Archaeology Collections.*** — Much of the zooarchaeological material presently in the Sarawak Museum is still in its original plastic bags, with excavation labels attached. It is to be expected that future material will be received in similar form. The label information is absolutely vital and must never be separated from the specimens. At the first opportunity, this information should be transcribed from the original field labels to a permanent record. There is a need to double-check all transcriptions during the relabeling process. The primary store therefore needs to keep the bagged material as it is received, until it progresses to curatorial attention and expert study. The atmosphere should be controlled, particularly for humidity at about 65–70%, but at the moment there are no facilities for this. Attention should be paid to fungal infestation that can easily destroy labels as well as organic matter in the bones. Similarly, specific storage conditions must pay attention to pest infestation, e.g., by cockroaches and termites.

Initial curation will involve opening the bags, inspecting the contents to check on their condition, e.g., moisture content, fragility, and obvious breaks that have occurred during excavation. For this operation, there should be a bench or table in the primary store, with good light and simple tools. To avoid DNA contamination, specimens should not be touched by naked hands. Handling equipment should include gloves (washable cotton, or disposable plastic), broad and narrow tweezers, soft and hard brushes. Initial curation is likely to require dividing original bags into sub-sets on the laboratory assistant's judgement. Each subset must be accompanied by a label with sufficient information to recover the original archaeological data. A day-book must be kept, in order to record all curatorial activity. If the specimens are cleaned at this stage, material such as soil brushed off should be retained, and labelled with excavation data for possible research use, e.g., microfossils, soil studies.

Subsequent curation is likely to result in further sub-setting. Different subsets will require different forms of storage, e.g. small items in glass tubes, larger items in other storage, perhaps cardboard boxes. Post-primary curation storage facilities must therefore be versatile for the accommodation of large and small items, bulked groups and single items. Appreciating the importance of the collection, the Sarawak State Government has now agreed to build a new collection centre to house it in the near future.

## DISCUSSION AND CONCLUSIONS

Zooarchaeology is an important field of study for the identification, interpretation and analysis of faunal remains from archaeological sites. Its importance has been recognised as a tool in the interpretation of ancient environments. The physical remains of fauna (and flora) at a site can assist the interpretation of their social role in the lives of ancient society (Landon, 2005). Zooarchaeology is also important in the study of the correlation between past and present biodiversity of a site (Reitz et al., 2009). Reitz & Wing (2008) presented standard zooarchaeological methods for the recovery, identification and analysis of animal remains from archaeological sites and several volumes of the *Cambridge Manuals in Archaeology* offer standardisation of the various disciplines (Lyman, 2008). Even more complex is the system of identification employed by different zooarchaeologists in different parts of the world, using different classification systems to describe, name and identify animal specimens from archaeological sites (Driver, 1992). In the existing literature, there is often little information on the methods that have been used in documenting, storing and accessing faunal remains from particular excavations.

Proper curation procedures are an integral part of the science of zooarchaeology (Emery, 2004; Reitz & Wing, 2008: Appendix 3), and an extensive literature has now been assembled concerning the methods, theories and practice of curation (e.g., Henry, 1991; Lyman, 2008; Landon, 2009). As the Sarawak Museum continues to improve its curation procedures, an important step will be the establishment of an Accessions Register. The objective of a register of accessions (past and future) is to provide a permanent record and trail, following from original entry of the specimen into the museum (probably as a bulked group of specimens) through to the final identification. Current international standards require a register in digital form, but also printable in hard copy. Every new entry or altered entry in the register should be followed by a revised print of hard copy. All museums demand that the registration number be permanently linked to the original archaeological data, i.e., the excavator's records: site and context. The registration number must also be capable of sub-setting, perhaps more than once, as research proceeds and more detailed identifications are made. The register must also contain notification of the location of the specimen(s) in the storage area of the museum, e.g., room number, cupboard number and shelf number. Through digital means, the register can also be linked to published or unpublished reports on the specimens. Once established, a digital register can be made available on line through the websites that most museums (including the Sarawak Museum, and virtually all those with collections of international importance) typically maintain.

In the course of systematic work on the zoological specimens from archaeological excavations, materials need to be stored in an orderly fashion. It is normal to deposit and label materials from each layer (either as depth from the surface of the topography or simply as a context) in plastic bags and then transport these back to the laboratory for further study. There may be over 30 pieces of bones in each bag. When these bones are identified by a specialist, each identified bone should carry a site code, an identification number of the bag, bone number, year, and an identifier name. We are reassured that practices similar to those outlined in this strategy are part of normal procedures in other research institutions such as Cambridge. The implementation of a register in this form always requires sound planning, and the allocation of resources. Any museum wishing to set up such a system will find it advisable to set up an ad hoc management team involving external members as well as museum staff.

As discussed above, existing museum collections management software is commercially available, but modifications could be needed to meet specific requirements. A first step for any museum could be to engage an Information Technology (IT) specialist contractor (or recruit a staff member with IT qualification), to design the framework of the digital register which must be compatible with existing software outside for future migration purposes. For museums in Southeast Asia, study visits to local and regional vertebrate museum collections, e.g., Raffles Museum of Biodiversity Research in Singapore, or the Museum Zoologicum at Bogor and LIPI collections in Indonesia, and even the Cambridge Centre for Archaeology, provide a broader perspective on what is possible and useful.

The initial tasks of registering material already held in any museum are typically within the capability of existing assistants in charge of the zooarchaeological store. It would not be difficult to link the registration process with a series of small research projects, to be offered to students or school sixth forms. To assist such research, a parallel strategy should be developed for recent zoological collections in a museum, especially for the skeletons of vertebrates and reference collections of molluscs, which provide essential comparative material for the identification of zooarchaeological specimens. The whole purpose of systematic classification and storage is to provide an easy accession format for all excavated materials in the museum or related institute. With this system, future researchers do not have to re-identify materials which have already been worked on by previous researchers, related information should be easily retrieved, and the value of the material will be greatly enhanced.

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