The Potential of Soil Micromorphology in Southeast Asian Archaeology: Preliminary Work at Niah Cave, Sarawak, Malaysia, and Ille Cave, Palawan, Philippines

— *Helen Lewis*[1]

Introduction

Soil micromorphology has great potential as a method applied to Southeast Asian archaeology, especially as part of a landscape archaeology approach that is focused on understanding settlement. A pilot study aiming to assess the potential for soil micromorphology to characterise ancient cultural deposits in tropical islands in Southeast Asia began this year by addressing cultural deposits in caves on Borneo and Palawan islands. The work focuses on the nature of occupation during the periods of early human dispersal and the later transition to farming in the region, characterising occupation sequences in caves in tropical environments. The work hopes to find remnant evidence of ancient local landscapes. This marks the first archaeological soil micromorphology study of ancient cultural deposits in caves in this environment and landscape, being carried out in collaboration with several ongoing excavations and other environmental archaeological and sedimentological investigations. The project currently includes material from Niah Cave, Sarawak, Malaysia, and Ille, to be possibly supplemented by evidence from Tabon Cave, and caves in the Gotok area, all in Palawan (Figure 1).

Background to the Research

The islands of Borneo and Palawan are particularly interesting with respect to prehistoric activity and the movements of people and cultures in the Southeast Asian landscape. Although sea level and eustatic histories from this region are still not totally clear, both islands are conventionally thought to have been part of the mainland during times of low sea level in the Pleistocene, representing the edge of "Sundaland," the

[1] Department of Archaeology, University of Cambridge. hal1000@hermes.cam.ac.uk

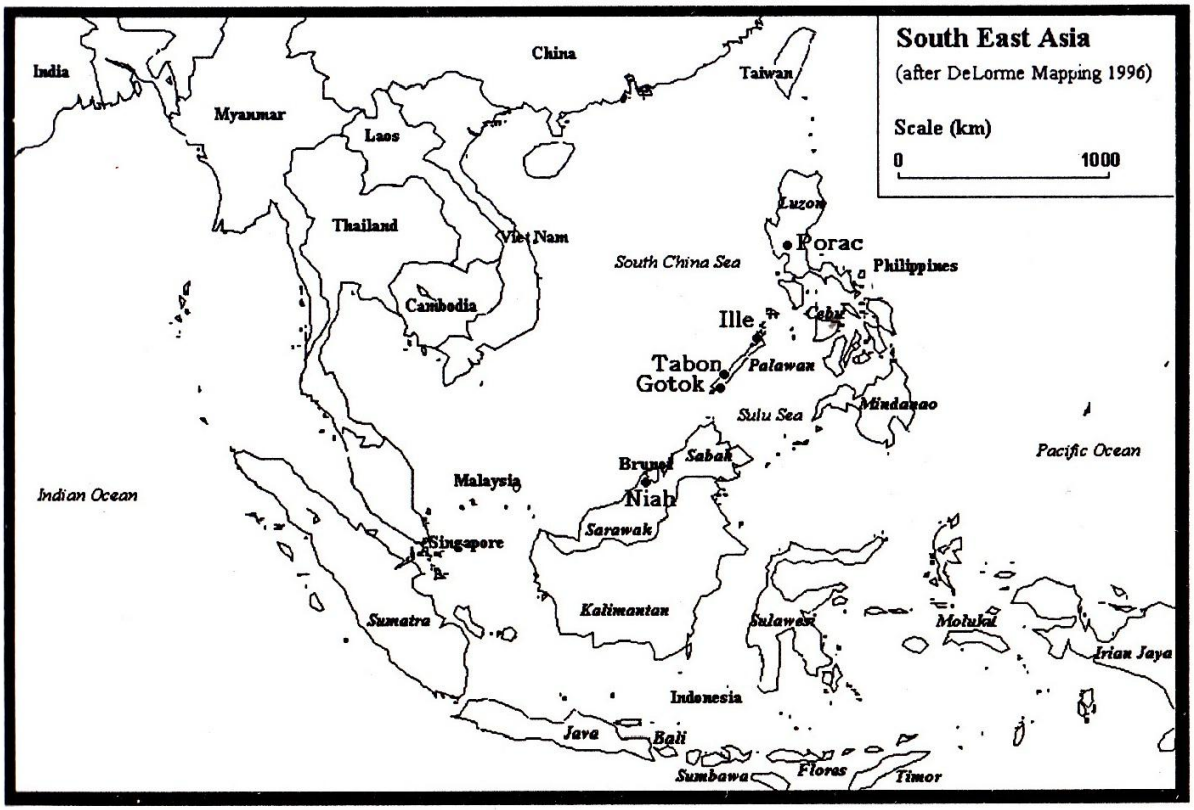

Figure 1
Map of the study area showing sites mentioned in the text

southeastern part of the Asian mainland on the Sunda continental shelf (Bellwood 1997; Haile 1971; Geyh, Kundrass, and Streif 1979; Whittaker 1998: 18). Although there is evidence for the presence of *Homo erectus* in the Indo-Malaysian archipelago area, there is no indication of this hominid in Borneo or Palawan, with all evidence from the present-day islands being related to the activities of anatomically modern humans (Bellwood 1997). Niah has the oldest dates for human remains in Island Southeast Asia, the "Deep Skull" find (38,000-40,000 years old), related to the early spread of people to this area (Brothwell 1960; Kennedy 1977). The expansion of people into this "mainland"area, and to the islands beyond, as well as the issues of where and how these people lived are major questions in the region's archaeology.

During the Holocene there are further issues regarding the impact of sea level rise, the expansion or local development of various types of agriculture and the dating of and social mechanisms involved in the spread of "Austronesian" cultures and, later, jar burial cultures and metallurgy. The question of geographic origins, direction of movement and dating of "Austronesian" cultures, in particular, has

been hotly debated based on linguistic, genetic and archaeological evidence (e.g., Bellwood 1997; Tsang 1995; Meacham 1988 & 1995; Solheim 1988; Blust 1976; Kayser et al. 2000).

The sites discussed here are thus located in an important area regarding both early human dispersal and the spread of neolithic farming and later metal cultures in Asia. The Niah cave system, for instance, contains a long and unique sequence of cultural deposits from the Late Pleistocene on, including occupation deposits reflecting activities of Palaeolithic and mesolithic foragers, as well as a series of prehistoric burial remains, including jar burials, which are a common feature in later prehistoric caves in the area (B. Harrisson 1967; T. Harrisson 1975; Fox 1970; Solheim 1960). An early date from Niah on pottery with rice inclusions has thrown up questions regarding the model of the spread of Neolithic rice-farming cultures in Southeast Asia, a matter of major debate in the region (Spriggs 1989; Doherty, Beavitt, and Kurui 2000; Datan & Bellwood 1991; Barker et al. 2000 & 2001; see Paz 2001 for a review of archaeobotanical contributions to the issue).

Ille Cave is located in Palawan, an island also known for early remains relating to human occupation of the region (the Tabon Skull, dated initially to 20,000-22,000 BP, since redated to *c.* 16,500—Fox 1970; Paz 2001). Palawan has been described as a "natural bridge" between the Philippine islands and Borneo, and thus mainland Asia, and many important comparative sites from all periods have been found there (Fox 1970; Bellwood 1997). Ille cave has seen excavation since 1999[2] thus far producing evidence of burials associated with metals and historic trade wares, a shell midden layer associated with earthenware pottery and pre-metal age strata with lithics (possibly Neolithic or earlier). It is expected to contain a long sequence, with cultural and sedimentological deposits comparable to those at Niah (V. Paz, pers. comm. 2002).

Soil Micromorphology Sampling at Niah and Ille Caves

Soil micromorphology is an approach that enables study of *in situ* site-specific cultural materials within a detailed stratigraphic and environmental framework. This method of analysis involves examining soil structure and components in their undisturbed state (Courty, Goldberg, and Macphail 1989: xvii), carried out by producing

[2] Excavations are being conducted by the Archaeological Studies Program, University of the Philippines, the National Museum of the Philippines, and South East Asian Institute of Culture and Environment (SEAICE).

thin sections, which are slices of deposits that retain the spatial and contextual relationships of materials to matrix, and of matrices to each other. The method was developed in the early 1900's, being used first on crushed soil samples, and then on undisturbed materials, including soils (Kubiena 1938: 70-74). It has been widely utilized in pedology and agronomy (see Kooistra, Tovey, and Pagliai 1996; Bullock 1983 for reviews), and has seen application in archaeological issues since the 1950's. In the past three decades, this line of research has seen increased popularity as an archaeological method. Although it remains an approach dominated by European scholars, with most work being conducted in Europe, North Africa and West Asia, the use of soil micromorphology in archaeology in other parts of the world has been increasing in recent years. Summaries of the history and applications of soil micromorphology in archaeology are given by Goldberg (1980, 1983); Courty (1992): Courty, Fedoroff, and Guilloré (1987); Courty, Goldberg, and Macphail (1989); Macphail, Courty, and Goldberg (1990); and Carter and Davidson (1998); among others.

The characterisation of *in situ* micro-indicators can enable identification of cultural activities not visible on a macroscopic scale, along with interpretation of complex contextual archaeological histories directly from the soil and sedimentary record. The method has been applied to archaeological cave deposit characterisation, microstratigraphy, use of space and the identification of fine archaeological components, mainly in Europe and the Levant area (Courty, Goldberg, and Macphail 1989; Goldberg 1979). It has yet to see systematic application to archaeological contexts in caves in tropical environments.

The method also provides a means of linking larger-scale landscape issues to local archaeological site deposits through the study of relict soil indicators (e.g., Courty, Goldberg, and Macphail 1989; Gebhardt 1995; Macphail et al. 1998). Ian Cornwall studied soils buried underneath archaeological monuments in England. He worked to reconstruct the immediate palaeoenvironment related to monuments, and to identify soil types associated with prehistoric land uses, such as ancient grassland soils and cultivated soils, by comparison with forest soils (Cornwall 1953; 1958). Since that time, despite some debate about the feasibility of the method to allow identification of ancient land use (e.g., Carter and Davidson 1998; Macphail 1998), this has been perhaps the most frequent application of soil micromorphology in archaeology. Regarding Southeast Asian cave deposits, evidence of the wider landscape may be located in colluvial and fluvial deposits, and through the study of buried soils found at the cave mouths and around the sites. This project aims to begin to develop a

geoarchaeological history of landscape and land use outside of the cave sites from such remains, for comparison to ongoing pollen and other landscape-scale approaches. Identifying micro-indicators relating to specific land uses such as clearing or cultivation is especially important with regard to the proposal of early rice use and farming at Niah and other sites in Sarawak (Doherty, Beavitt, and Kurui 2000).

Soil micromorphology sampling carried out at Niah in 2001[3] focused on spot sampling of specific feature fills and layers in the West Mouth entrance, with an aim to characterise pit fill deposits and possible archaeological surfaces. Sampling in the West Mouth in 2002 was more stratigraphic in focus, aiming to develop an understanding of the history of cultural use-of-space over time in the area of the prehistoric cemetery, to identify cultural surfaces and to explore deposits reflecting activities at the edge of and outside the cave. Samples were taken from the cemetery area, covering the entire sequence from modern surface through to pre-cemetery layers (excluding grave fill deposits), and from an enigmatic section (the "wasp section"). The potential for living or working surfaces will be assessed, and the depositional and post-depositional history of the fine layers associated with this area will be explored. Further samples were taken from a profile near the mouth of the cave that has produced archaeobotanical evidence of forager activity (Barker et al. 2001). Finally, a series of samples was taken through a section of cave mouth deposits (Figure 2). Although largely colluvial and visibly strongly reworked, this profile has the potential to represent the sequence of activities and local environment external to or at the edge of the cave from the Late Pleistocene to the present day. It shows a different cave sedimentary microenvironment, with colluvium from the edge of the cave mouth, evidence for standing water in the later history of the cave and probably *in situ* pedogenetic processes such as podzolisation. It is hoped that this profile will provide information that can be used to link the cave with the outside natural and cultural world. Significant complementary work is being carried out on the sedimentary and palaeoenvironmental sequence under the auspices of the Niah Cave Project led by Professor Graeme Barker (Barker et al. 2000, 2001). This work provides a strong backdrop for micromorphological study of these cultural deposits, as well as a good comparative record for work at Ille and other sites in the region, where palaeoenvironmental studies are just beginning.

[3] 2001 samples were taken by G. Barker and thin sections produced by M. Stephens at Royal Holloway College, University of London.

Figure 2
Soil micromorphology sampling near the entrance of Niah Cave, 2002
(Photo: Victor Paz)

With the aim of developing a detailed early occupation history for the cave entrance, sampling from Ille Cave in 2002[4] focused mainly on apparently pre-metal age occupation deposits from the platform at the cave mouth. It is anticipated that this will reflect cultural activities both inside and outside the cave, as well as provide information on the palaeoenvironmental history of the site and area. The results will be compared with those from phytolith and macrobotanical analyses.[5] There is potential for buried soil or colluvial material to be present further out on the platform, and this will be assessed in a future season.

[4] The Ille Cave samples mentioned here were taken by M. C. Swete Kelly.
[5] Currently being conducted by V. Paz and M. C. Swete Kelly.

Other Sites and Observations of Potential

The anticipated results of this pilot study will form the basis for designing a further project linking the cave sites to their wider cultural and natural landscapes from the late Pleistocene on, through the location and characterisation of ancient land-use indicators. Future work will include further micromorphology sampling of cultural cave deposits, along with assessment of areas in the vicinity of cave sites, to locate and study materials that could provide comparisons to the cave deposits (e.g., buried soils, colluvium) and information on land use history. While cave deposits may provide indications of "outside" land use activities, major settlement and subsistence issues—such as whether or not rice tempered pottery from caves in the north-west Sarawak area represents Neolithic rice growing cultures—cannot be fully discussed from cave evidence alone.

During fieldwork in south Palawan, a cave system was visited at Station 6, Gotok, Bataraza[6] (see Figure 1 for location). This cave system is currently protected from access by a series of cave-ins, presumably preserving a great deal of material inside, while also restricting the buildup of recent guano deposits and other modern disturbances, thus giving it a great deal of potential as a comparative site. The area will soon be mined for limestone, and preliminary archaeological evaluation of the site is already underway. The site has additional potential, as the area around it is currently relatively cleared of rainforest, meaning that, unlike at Niah, it will be possible to carry out field survey for nearby ancient settlement remains and buried soil horizons for comparative sampling. This site could thus give us important information on the relationship between human activities seen in caves in this region and the cultural landscapes surrounding them.

There is strong support from local archaeologists to take samples from deposits at the famous Tabon Caves. There is also enthusiasm to sample Gangub Cave and the Kangkarang rock shelter site in Bataraza, south Palawan, and discussions are currently underway regarding sampling from cave sites in Thailand (e.g., Ban Chiang).

In order to discuss ancient landscapes and land use activities, especially farming, it is necessary to begin to characterise what impact cultural activities have on the soils in this region, and what potential there is for survival of ancient land use indicators. Recent investigations by V. Paz at Porac, Luzon (see Figure 1 for location),

[6] Thanks to V. Paz and the Rio Tuba Nickel Mine, Bataraza, Palawan, Philippines.

revealed buried horizons showing historic land use in the form of two sets of plough marks underlying Mt. Pinatubo ash dated to the 1991 eruption, and overlying ash thought to date to *c.* the 19th century AD (Figure 3). A sequence of soils and ash layers presumably exists at many sites in this part of the Philippines, providing good potential for settlement and geoarchaeological studies, although prospection for prehistoric sites will be difficult if overburden is deep. This issue needs to be addressed through further research, as does the question of comparability between volcanic deposits and those of the main limestone study area. It is also intended to sample modern exposed soils and house floor deposits in farmed and settlement areas near Niah and Ille Caves for comparative information. In addition, access to a large body of modern agricultural soil micromorphology samples from Malaysia, Indonesia and the Philippines held by several other researchers will be needed for comparative purposes regarding any future work with respect to ancient land use in the region.

Figure 3
Micromorphology sampling of plough marks at Porac, Luzon, 2002
(Photo: Victor Paz)

Conclusion

Little is understood about the land use and settlement patterns associated with either the early foragers or the later prehistoric cultures represented at these cave sites. One of the key purposes of this study is to address the issue of how it will be possible to link the types of archaeological and sedimentary deposits seen in cave environments with the very different types of deposits expected to be located outside of cave sites in the various geological and biological environments of this tropical region. The results of this study will allow detailed characterization and a more in-depth understanding of the types of ancient human activity seen in caves in tropical rainforest landscapes. This will generate detailed information on the nature of these occupations, enhancing the results of other comparative methods, and lead to a better understanding of the role of cave sites in ancient foraging and agricultural communities in the region. It is hoped that the results of this study will encourage other, especially local, researchers to develop the use of soil micromorphology as an archaeological method in the region.

Acknowledgements

Funding for this fieldwork was received from the British Academy Centre for Southeast Asian Studies, the Evans Fund, the Niah Cave project (AHRB & British Academy CSEAS grants) and the Rio Tuba Nickel Mine. I would like to thank my friend Victor Paz for his help and collaboration in the Philippines. I am extremely grateful to Graeme Barker, David Gilbertson, Peter Bellwood, Wilhelm Solheim II, Ipoi Datan and Edmund Kuroi of the Sarawak Museum, Wilfredo Ronquillo and the Archaeology Division of the National Museum of the Philippines, Mary Clare Swete Kelly, Mark Stephens, Charly French and the McBurney Geoarchaeology Laboratory at the University of Cambridge. Finally, for helping me get out of Sarawak and get by in Manila despite the passport nightmare, thanks for emotional, practical and financial support to everyone in the Niah team, to Lisa and Victor and the Paz family, and to Simon and Morag Roddy in Miri.

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