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Ground-Penetrating Radar as a Possible Method to Investigate Medieval Khmer Kiln Sites

Ground-penetrating radar (GPR) is a non-destructive geophysical method widely used in archaeological prospection that constructs a three dimensional image of the sub surface and is used prior to a potential excavation.

The archaeologist detects the extended site of a kiln by the accumulation of sherds in the area. As the size of medieval kilns is limited to a few meters and since their use over time might have lost their round shape, collapsed and overgrown, they might not be easily detectable by conventional methods. Additionally one kiln often implies other kilns close to it. Due to the high temperature when the kiln was fired the electromagnetic property of the earthen walls are altered and differ from the surroundings. A GPR survey should be done as a grid, by moving the radar antenna line by line over the extended kiln area. The antenna sends a radar signal which is reflected by features with an electromagnetic characteristic that differs from the overlaying surface and measured by the instrument. The processing of the received data produces a 3-dimensional image of the area's subsurface, which makes it superior to other geophysical 2-dimensional methods like magnetometers. The provided information helps the archaeologist to reduce the potential excavation area horizontally and vertically and to receive rapid results about certain features of the kiln. The fire pit, the hardened floor and any structural features should be detectable, so the extension and depth of the kiln can be defined. Larger grids can additionally define the extended working area around the kiln as the electromagnetic signal of ceramic sherds should differ from virgin soil. Therefore GPR surveys at kiln sites can lead to a better understanding of the ceramics industry of medieval Angkor.

Studies from Japan show that traditional kilns can be effectively mapped by GPR (*Goodman et al, 1994*). GPR has been used extensively in and around the Angkor area within the Greater Angkor Project (GAP) and this research will be continued in December 2008 until February 2009. The talk provides an overview of the method of GPR, survey results of its use at kiln sites, and its potential use and challenges on medieval Cambodian kiln sites. It is expected to present GPR survey results of a known medieval Khmer kiln as well.

Goodman, D., Nishimura, Y., Uno, T. and T. Yamamoto (1994): A ground radar survey of medieval kiln sites in Suzu City, Western Japan. Archaeometry 36, 2, 317-326.

Site Survey and Mapping at Choung Ek Kiln Site *Phon Kaseka*

In Cambodia, in-depth research on ancient kiln sites and Khmer ceramics has commenced only relatively recently. Ancient Khmer kilns are found at many sites and surveys have been conducted on kilns at Phnom Kulen, and at Sisakhet, Surin provinces in present-day Thailand. Some ancient kiln sites were recently found in the Angkor region. These include the Anlong Thom kiln site, the Sorsey kiln site and those at Tanu, Bakhong and Khna Po in Siem Reap. A new discovery of an ancient kiln site at Choeung Ek, 59 km south of Phnom Penh, may add to our understanding of ancient pottery techniques. This paper outlines research undertaken by the author at Choeung Ek. Some kilns still retain their small mound shape, but today have bushes growing from the side and the top. There are potsherd spread on the kilns and nearby pieces of kiln wall have also been found. The walls are yellowish brown on the outer wall and dark reddish brown on the inner wall, produced by the firing heat. There is also greenish glaze from ash which adheres on pieces of the brick wall.

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<http://www.khmerstudies.org/events/preabstracts.htm>

John Miksic (National University of Singapore, Singapore)

Recent research at stoneware kiln sites in the Angkor region, Cambodia

B.P. Groslier in an essay on comparative dating of Phnom Kulen ceramics (Groslier 1981), based on stratigraphic analysis from various excavations in the Angkor region, suggested that Kulen Ware might date back to the ninth century, contemporary with the reign of Indravarman, founder of the Bakong temple in the Roluos group.

Current improved accessibility to Phnom Kulen and awareness of looting at the kilns in the 1990s attracted more research interest. In 1995 APSARA in cooperation with Sophia University conducted the first research on Khmer kiln technology, at the Tani site. Since then, several RUFA theses have been dedicated to the study of ancient Khmer ceramics.. In January 2007, the Department of Monuments and Archaeology 1 (DMA 1) of APSARA authority in collaboration with the National University of Singapore (NUS) excavated at TMK. This excavation was designed to build a better understanding of Cambodian ceramic technology in the Angkor era. Another goal was to create a preliminary classification of ceramics which, it is hoped, will provide a resource for studies of Khmer ceramics.

In January 2008, a rescue excavation was undertaken in the Bakong area, Roluos. Results will be given in this presentation.

European Association of Southeast Asian Archaeologists, 12th International Conference (EurASEAA12)

<http://www.ias.nl/euraseaa12/index.php?q=book/export/html/19>

Miriam Lambrecht (Curator of the Collection India and Southeast Asia of the Royal Museums of Art and History in Brussels, Belgium- Art historian and project manager for the excavation program with Vietnam), Ann Degraeve (Archaeologist. Direction of Monuments and Sites of the Brussels Capital Region, Department of Archaeology)

Archaeological excavation of the old Cham kiln site of Go Hoi in Vietnam

The ancient glazed ceramics from Binh Dinh are known since 1974, however the kiln sites were not clearly identified. The excavation of the Go Sanh kilns in 1992 establishes for the first time their importance in the history of the Vietnamese ceramics in particular and of the world of trade ceramics in general.

To clarify further questions concerning the Binh Dinh ceramics and their contribution to world ceramics, the Royal Museums of Art and History in Brussels (Belgium) set up a collaboration program with the Institute of Archaeology in Hanoi. In 2002 a first excavation took place with the Institute of Archaeology in Hanoi at the old kiln site of Go Hoi in the Binh Dinh province in Central Vietnam, in collaboration with the Binh Dinh Museum from Quy Nhon.

The site of Go Hoi is located along one of the affluents of the Côn river, about 10 km from the ancient Cham capital of Vijaya, and about 2 km from the Cham towers of Duong Long (12th-13th century). In this kiln site complex, of the tumulus-type and transformed into a cemetery by the local people, only the largest kiln has been excavated.

Two tunnel kilns were discovered, constructed one into another. The 1 m thick foundations of the kilns are made of fragments of saggars and ceramics, originating from another disused Go Hoi kiln or from the nearby Go Ké kiln site. Remarkable construction details are the walls of tamped earth with the back wall pierced by 4 chimneys, and a second wall, in front of the back wall, avoiding the wind from blowing into the kiln.

The main production consists of green-glazed stoneware (bowls, dishes, teacups, powder boxes) and some brown-glazed stoneware (jarlets, beaker). Although the majority of shards are undecorated, some show incised or scraped motifs (e.g. various styles of lotus petals). Other artefacts like glazed leave-shaped roof tiles, construction bricks and architectural ornaments prove the kiln to belong to the Cham civilization. This production together with the presence of some Chinese Longquan celadons and South-China white ware date these kilns to the 14th - beginning 15th century AD.

Chhay Rachna (Authority for Protection and and Management of Angkor and the Region of Siem Reap, Cambodia)

Khmer ceramic technology: a case study from Thnal Mrech kiln site (TMK), Phnom Kulen

Thnal Mrech Kiln site located on Phnom Kulean approximately 35 km northeast of Siem Reap in the famed Angkor Region. The mapping, excavations and analyses of a kiln, pottery, kiln morphology, and chronology of the TMK site was designed to build a better understanding of Cambodian ceramic technology, particularly in the Angkor era when the so-called Kulen ware was developed.

In January 2007, the Department of Monuments and Archaeology 1 (DMA 1) of APSARA national authority inaugurated a collaboration with the National University of Singapore (NUS) to conduct an archaeological excavation of TMK site. The excavations uncovered two ancient kilns structures that had the different in side and structures (TMK 01 and TMK02), and base on TMK 02 belonging to two different phases. Five charcoal samples collected from this kiln yielded absolute dates which suggest that TMK 02 was in use during a period of approximately fifty years, in the early eleventh century.

Amount the surface collection and the total of 10,009 artifacts were recovered from TMK 02 excavation. All the artifacts can be classified according to Khmer linguistic terms for ceramics, defined by both shape and function, such as Kpoeurng, Danlap, Kotth, Khuoch, Krala, Phoeng, Peang, Ak kambor, Ka-am, Chhnang, Chan, and unidentifiable pieces.

Evidences on ceramic walls suggest three techniques used in making pottery at Thnal Mrech and the decoration of ceramics consists of profiles cut into the vessel wall and of combination of lines, motifs incised or impressed, and molding. In general, glaze observed on ceramics taken from TMK 02 comes in four varieties: common Kulen green, hay yellow, milky white, and light brown.

The kilns structure and large quantity of artifacts from TMK provide important new datas on Khmer ceramic technology, and leading to an improved understanding of the ancient Khmer industry.