

Old iron-producing furnaces in the eastern hinterland of Bagan, Myanmar.

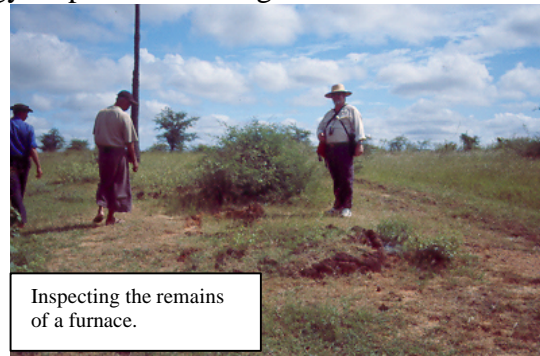
Field survey and initial excavation.

Bob Hudson & U Nyein Lwin.

2002.

In November 2001, an investigation was made of a number of sites known from local informants around the villages of Zi-o and Panidwin, east of Bagan, to contain remains of furnaces and what appeared to be large quantities of ironmaking debris. The group on the field trip included U Aung Kyaing, Deputy Director General of Archaeology for Upper Myanmar, U Win Maung (Tanpawady), a classical architect and antiquarian from Mandalay, U Nyein Lwin, archaeological research officer and excavator from Bagan, and Bob Hudson, from the Archaeology Department, University of Sydney, Australia. The outcome was the survey and mapping of 12 separate sites which between them contain hundreds of furnaces, and the subsequent excavation of a furnace to determine its structure. Samples were also recovered for future radiocarbon dating, and are held at the University of Sydney and at the Archaeology Department at Bagan.

The investigation grew out of an interest in identifying and locating sites claimed in the *Glass Palace Chronicle*¹ to be the founding villages of the first kingdom of Bagan in the 2nd century AD. Some of the results of this project are to be published internationally in 2002². But an offshoot of the research was a growing awareness that the area east of Bagan, strongly represented



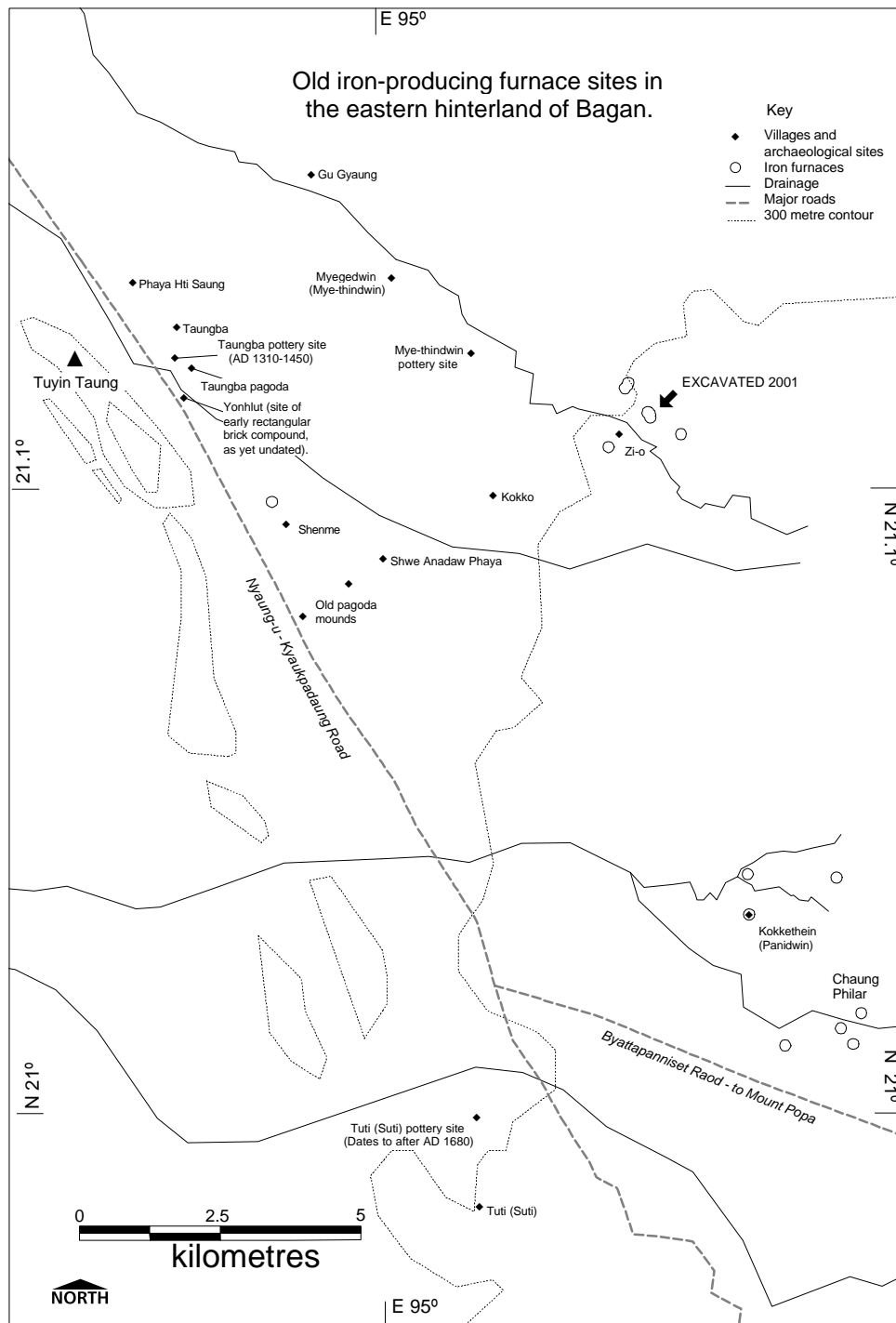
in the traditional accounts of the old chronicles, contained this substantial number of iron furnaces. While the most logical timescale for iron production near Bagan would be its main period of construction between the 11th to 13th centuries, the city also sits in the region of Upper Myanmar (formerly Burma) that in the first millennium AD was inhabited by an iron-using people known as the Pyu³. An early role for at least some of the furnaces east of Bagan could be hypothesised, in the light of evidence that now suggests settlement activity in Bagan itself well before the 11th century⁴.

¹ Pe Maung Tin and G. H. Luce. 1923. (trans) *The Glass Palace Chronicle of the Kings of Burma*. Rangoon University Press. (Reprinted 1960).

² Hudson, Bob; Nyein Lwin and Win Maung (Tanpawady). 2002 (In press.) Digging for myths: archaeological excavations and surveys among the legendary nineteen founding villages of Pagan. *The Silver Gong is Struck: New Research in the Art and Archaeology of Burma*. British Museum, London.

³ For background on the Pyu, see Stargardt, Janice. 1990 *The Ancient Pyu of Burma: early Pyu cities in a man-made landscape*. PACSEA Cambridge; Aung Myint, U. 1998 *Site Characteristics of Pyu and Pagan ruins*. A Comparative Study of the Dry Areas in Southeast Asia: International Seminar, Kyoto, Japan, October 14-16 (Conference paper). Gutman, Pamela and Hudson, Bob. 2002 (in press). The Archaeology of Burma, from the Neolithic to Pagan. In *The Archaeology of Southeast Asia* (eds Bellwood & Glover), Curzon, London.

⁴ Hudson, Bob; Nyein Lwin and Win Maung (Tanpawady). 2001 The Origins of Bagan; New Dates and Old Inhabitants. *Asian Perspectives* 40(1): 48-74.



The furnace sites fall into two main clusters, around the villages of Panidwin (which may be the Kokkethain of the chronicles) and Zi-o. They range in size from 7 furnaces along the side of a stream at Chaung Philar to mounds of iron and charcoal debris that are up to 100 metres long, which could each, on a rough count, contain more than 100 furnaces. The furnaces can often be distinguished by the remains of

their rectangular, fired-clay walls protruding above the slagheaps and redeposited topsoil.



Furnaces protrude from slagheaps.



Village elders display their traditional thigh tattoos to survey team leaders U Win Maung (left) and U Aung Kyaing (right). These experienced farmers also provided a wealth of information about archaeological sites surrounding their village.



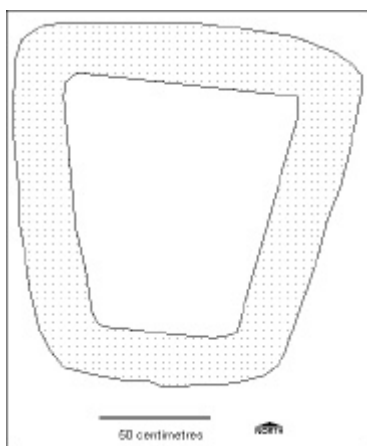
A member of the survey team displays a characteristic perforated brick of a kind found at many of the furnace sites. The perforations are formed by separate, pre-shaped clay tubes.

The excavation at Zi-o.

Furnaces of this type had not, as far as the investigators could tell, been excavated before in Myanmar. It was therefore decided that U Nyein Lwin and Bob Hudson would excavate one of the sites, outside Zi-o.



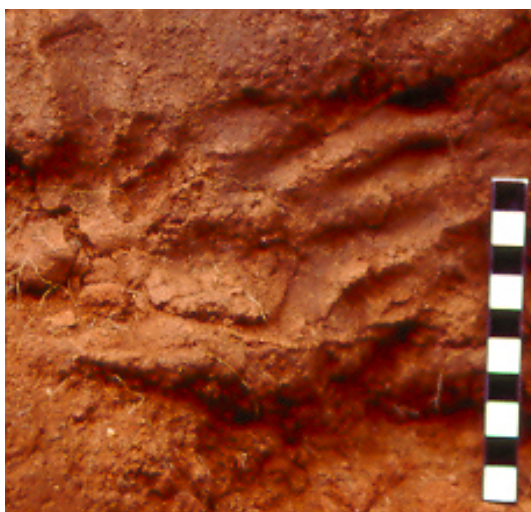
Excavating around the furnace. The trench in front (pictured on the right) was dug in order to examine the debris that was strewn about. The material inside the furnace was a mixture of soil, charcoal and nodules of natural iron.



Outline of the Zi-o furnace, viewed from the top.



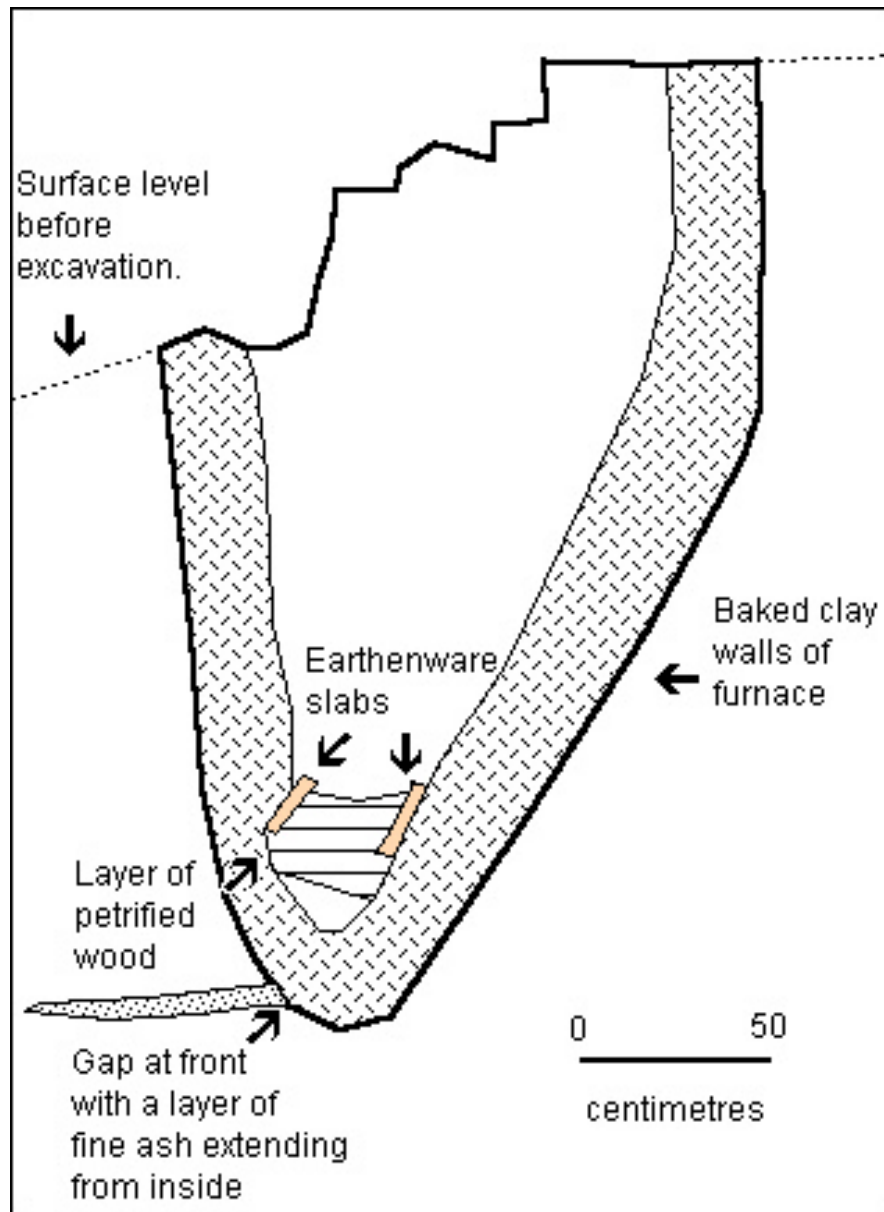
Inside, the heavily burnt back and front walls of the furnace taper into a wedge shape. The side walls taper outward toward the bottom, forming a long, narrow base, which was covered with a layer of petrified wood.



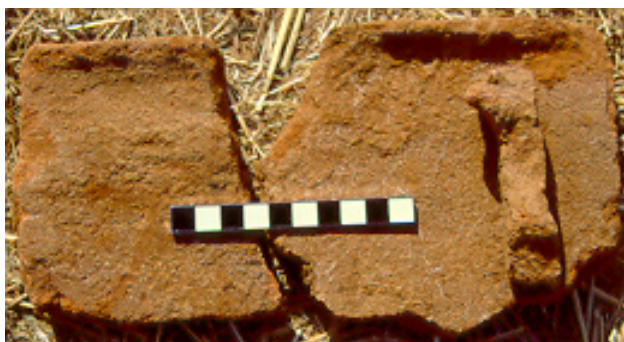
The furnace was not made from brick, but hand-shaped from slabs of clay. Handprints can be easily distinguished. The lower part of the furnace was dug into the ground, while the upper part appeared to have been shaped above ground



The layer of fossilised wood from the bottom of the furnace is shown against a 1 metre ruler at the top of the picture. The rest of the wood was lying in front of the furnace.



Section of the furnace, viewed from the eastern side.



Earthenware slabs with a lip along one side were found wedged along the side of the layer of petrified wood.



Pieces of brick or brick slab with slag adhering to one side were found around the furnace.



Several pieces of pottery with beaten "cordmark" patterns were excavated.

As the excavators reached the bottom of the furnace, the loose material in front of the base virtually fell away, suggesting that this was a permanent opening when the furnace was in use. A layer of fine ash can be seen at the bottom. The division is also apparent between the handmade top section of the furnace, and the lower part, dug into the ground. A large slab of petrified wood can be seen outside the opening, at the bottom right of the picture.

Conclusion and future prospects.

This is a preliminary report, and a more substantial document with site drawings and measurements will come later. However it seemed appropriate to bring this interesting discovery to the notice of scholars as quickly as possible.

The Zi-o furnace appears to be part of an extensive complex that was extracting iron from natural sources. Many of the charcoal pieces were neatly cut, suggesting that the charcoal had been prepared beforehand as fuel. The earthenware slabs found in the bottom of the furnace and the perforated clay slabs, with pre-manufactured clay tubes forming the perforations, are further indications of well-organised technology.

The actual functioning of the furnace is not yet clear, nor is its age. Several more excavations, and radiocarbon dating of the charcoal found, would help place this site chronologically in relation to Bagan and technologically in relation to the broader region.