Interdisciplinary approaches to the early history of plants and animals in Southeast Asia: beyond archaeobotany

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What's the issue?

- The study of the early history of plants and animals in Southeast Asia has focused on archaeobotany and archaeozoology and has thus been dominated by salient macro-remains, particularly rice.
- This repertoire is slowly expanding, but ethnographic studies of plant production show farmers growing and exploiting a wide range of crops, including vegetative crops such as bananas and taro, and tree-crops, particularly fruits and oil-plants.
- Weak archaeozoology means that we still have little idea of the domestication and spread of various animal species, althogh genetics has begun to make valuable contributions
- The paper explores the different disciplines to hand to reconstruct their agrarian history and the subsistence matrices in which they are embedded.

What's the issue?

- It suggests that the major types of additional information are;

- Synchronic ethnography; detailed description of present agricultural systems
- Historical data; written, archival and epigraphic sources
- Iconography; representations of plants and animals in manuscripts, paintings and friezes
- Lexicography; the compilation and analysis of vernacular names
- Genetics; the analysis of DNA and consequent hypotheses about phylogenetic relationships
- Phenotypic description; botanical description of the characters of plants and cultigens, zoological characters of livestock
- Direct finds, for example, food offerings in Chinese tombs

What's the issue?

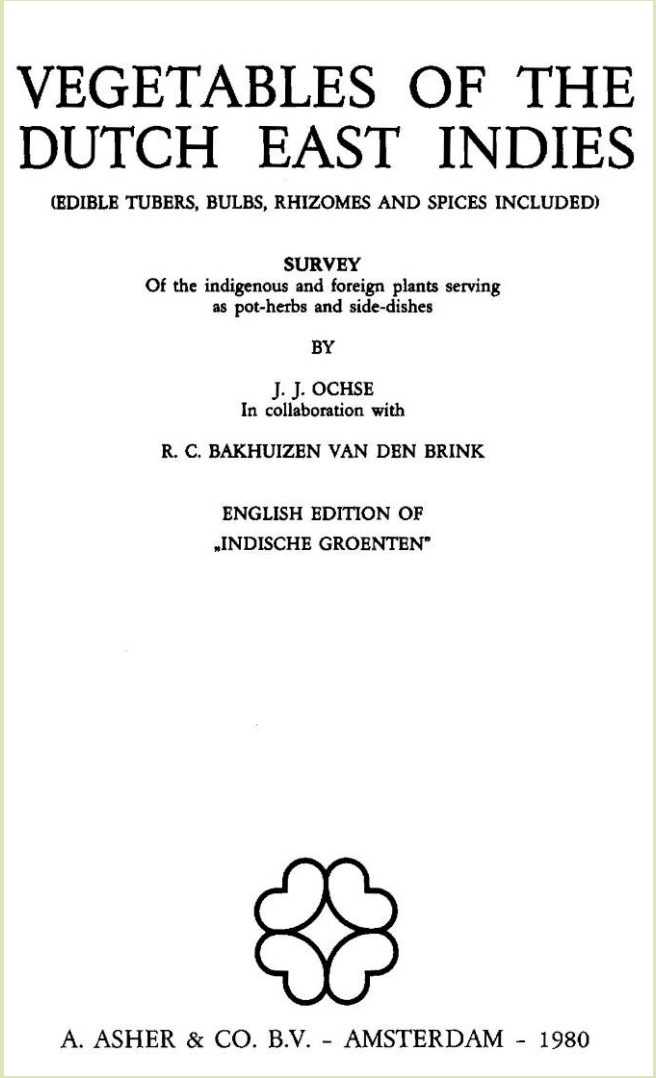
- I argue we have to reach the present from the past, in other to explain the current patterns of exploitation of plants and animals by reference to hypotheses about the past
- This paper looks at some examples of what materials are available and how we need to fit these into an enlarged narrative about subsistence

Synchronic ethnography I

- SE Asia is famed for the rich variety of economic plants used in its agricultural systems.
- One study of Javanese homegardens counted more than 500 species cultivated in these backyard farms
- New World crops brought by the Spanish and Portuguese from the sixteenth century onwards have substantially added to the repertoire
- Archaeobotany tends to privilege cereals and pulses, but vegetative crops, trees and green leaves constitute a major proportion of diet
- When reconstructing the agriculture and plant production in the past we need to build back from the present

Synchronic ethnography II

- A ‘positivist’ approach, i.e. we can only make statements about what we find in the ground leads to extremely misleading results.
- The key tools are thus conspectuses of useful plants as well as accounts of agriculture
- However, modern accounts of agriculture are dominated by rice cultivation and there is every reason to think this is misleading.


VEGETABLES OF THE DUTCH EAST INDIES

(EDIBLE TUBERS, BULBS, RHIZOMES AND SPICES INCLUDED)

SURVEY
Of the indigenous and foreign plants serving as pot-herbs and side-dishes

BY

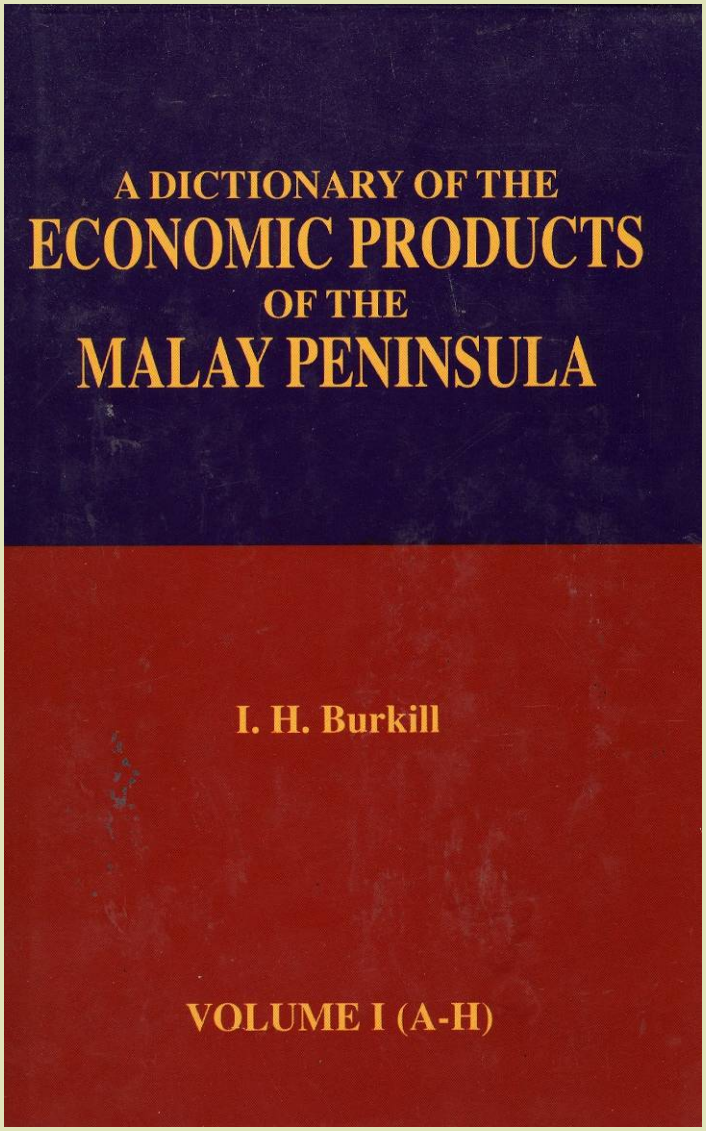
J. J. OCHSE
In collaboration with

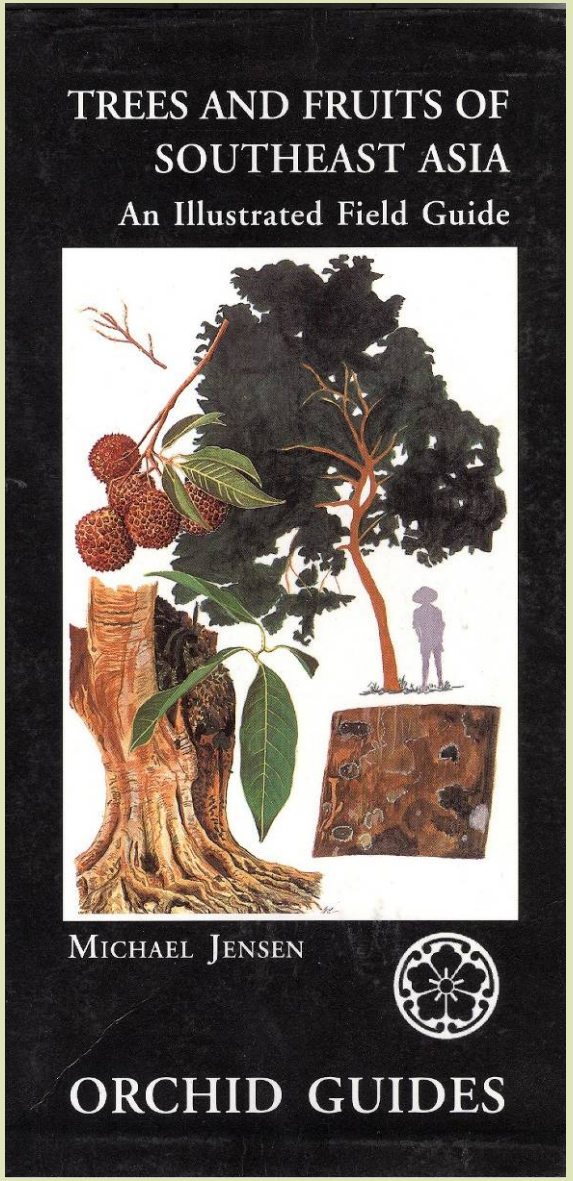
R. C. BAKHUIZEN VAN DEN BRINK

ENGLISH EDITION OF
„INDISCHE GROENTEN"

A. ASHER & CO. B.V. - AMSTERDAM - 1980

Reference books and field guides

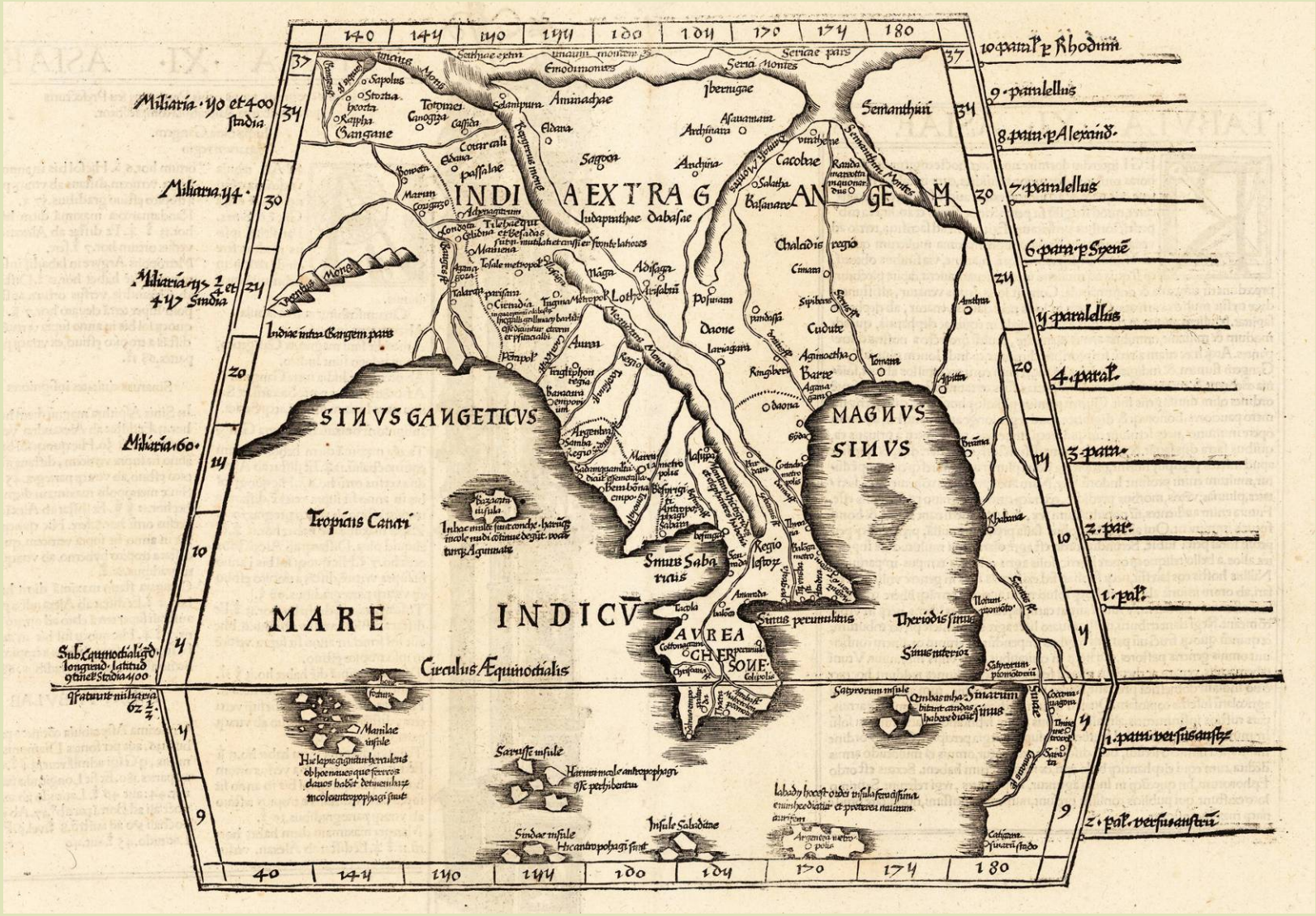




Historical data I

- Written resources for the SE Asian region are scarce and are typically contained in the records of outsiders, who provided overviews of the region for trade purposes
- Although in principle there could be Indian sources, in fact these contain almost no economic data
- However, the Geography of Ptolemy, which reaches as far as Java (150 AD though available recensions dated about 4th century)
- Ptolemy is aware ‘aromatics’, ‘resins’ and camphor are brought from SE Asia
- And even Pliny (Natural History ca. 70 AD) refers to this trade more vaguely

Ptolemy’s map



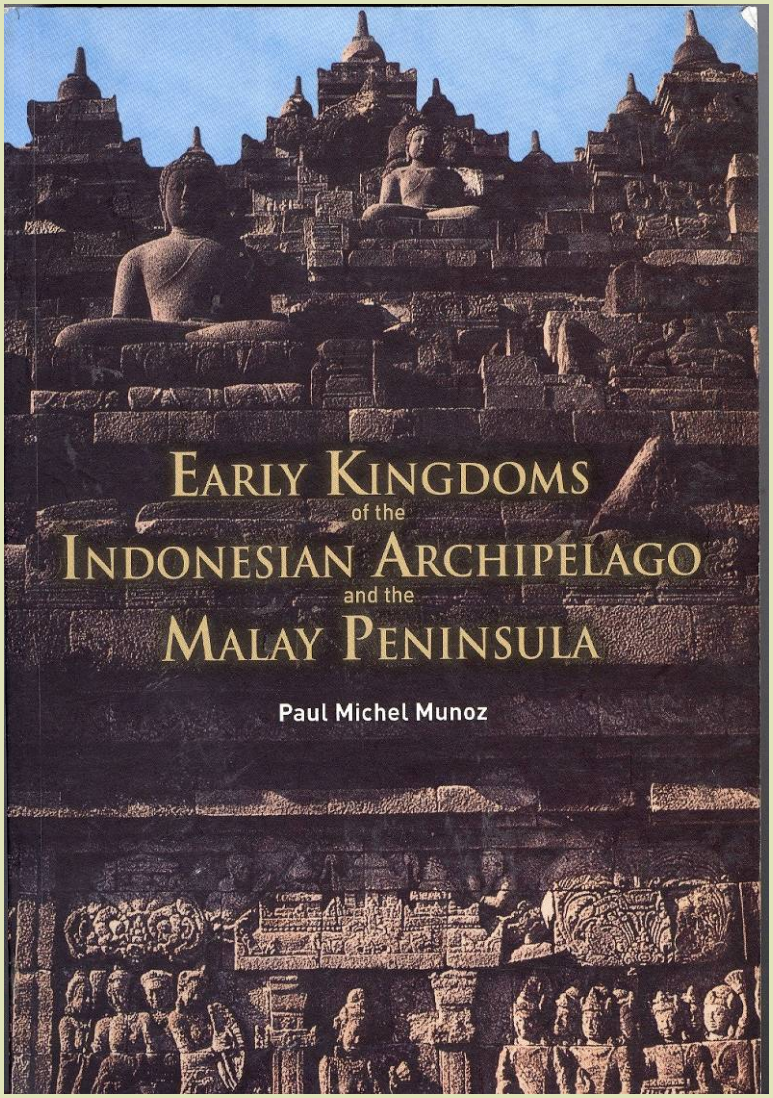
Al-Idrisi’s map

Historical data 2

- Although there are indigenous epigraphic records in SE Asia, but almost all are concerned with politics, and there is little economic information to be gained from them
- Arab geographers and travellers begin to describe SE Asia from 1000 AD onwards, notably Al-Idrisi (ca. 1200 AD), and Ibn Battuta (1325 AD) but the mixture of fantastical information and actual reports means we learn disappointingly little

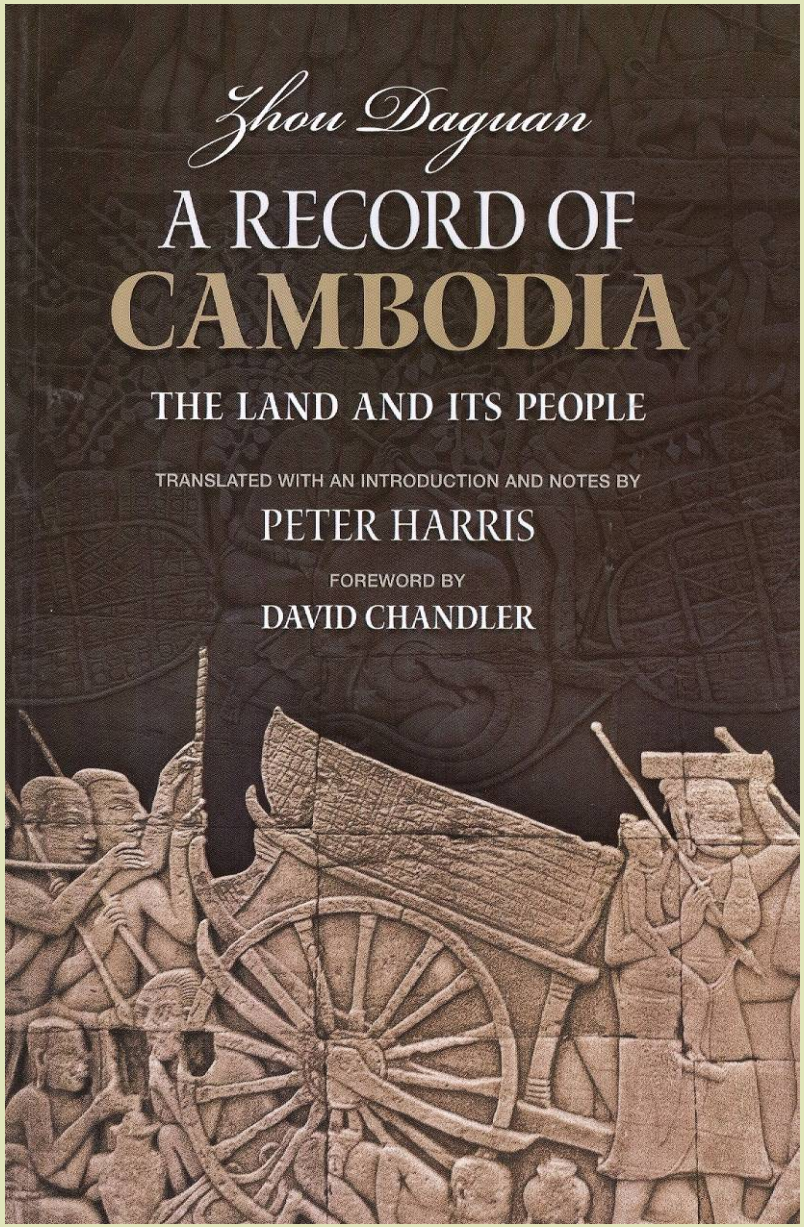
Historical data 3

- From the opposite direction we have the diplomatic reports of Chinese ambassadors, which begin around 200 BC.
- The are summarised, for example in the Han Shu (漢書)
- These are recently summarised in Munoz (2006)
- However, these focus on local politics, with passing mentions of the trade in aromatics and resins



Historical data 4

- For the medieval period, most intriguing is the description of Angkor (1296-7) at its height by the Chinese trader Zhou Daguan, who specifically describes the domestic plants and animals in some detail as part of his account



Historical data 5

- So the next major wave of documentation is with European contact from the sixteenth century onwards
- Information is scattered and highly variable
- What begins to be really useful are the conspectuses of useful and economic plants, starting with Rumphius (1627 - 1702) who worked in the Molucccas.
- And continues with Dutch and Englis guides to useful plants

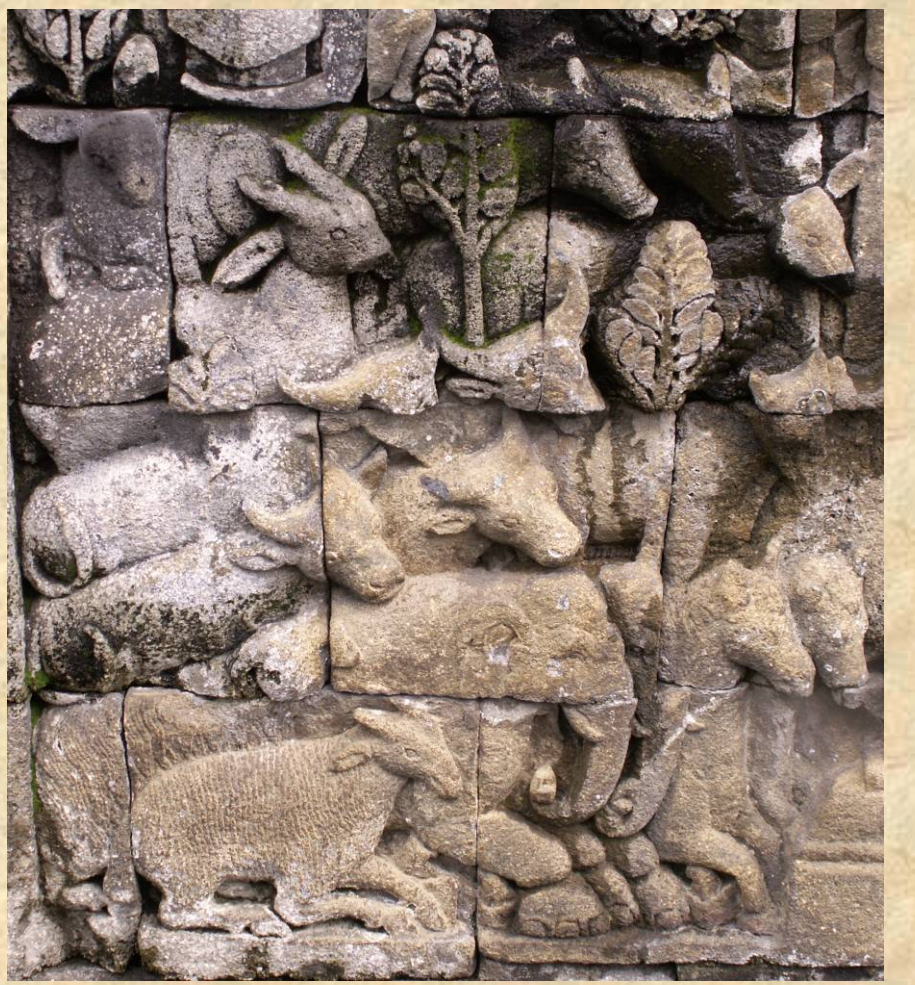
Iconography 1

- Iconography of plants and animals can be a very informative source when used with care
- Some large and impressive monuments can contain almost nothing of economic interest for example Bagan or the Champa friezes
- A little-exploited source are the Chinese picture bricks from Gansu from the 3rd century AD which depict early farming activities in great detail
- Borobudur (9th century) has a wide range of daily activities mixed in with religious scenes
- Unfortunately, most of the important representations are on the 'inner friezes' i.e. they cannot be seen, so we depend on images form the period when the monument was dismantled
- The Bayon at Angkor (11th century) is also known for its domestic and agricultural scenes

Han picture bricks: ploughing

Han picture bricks: sowing seed

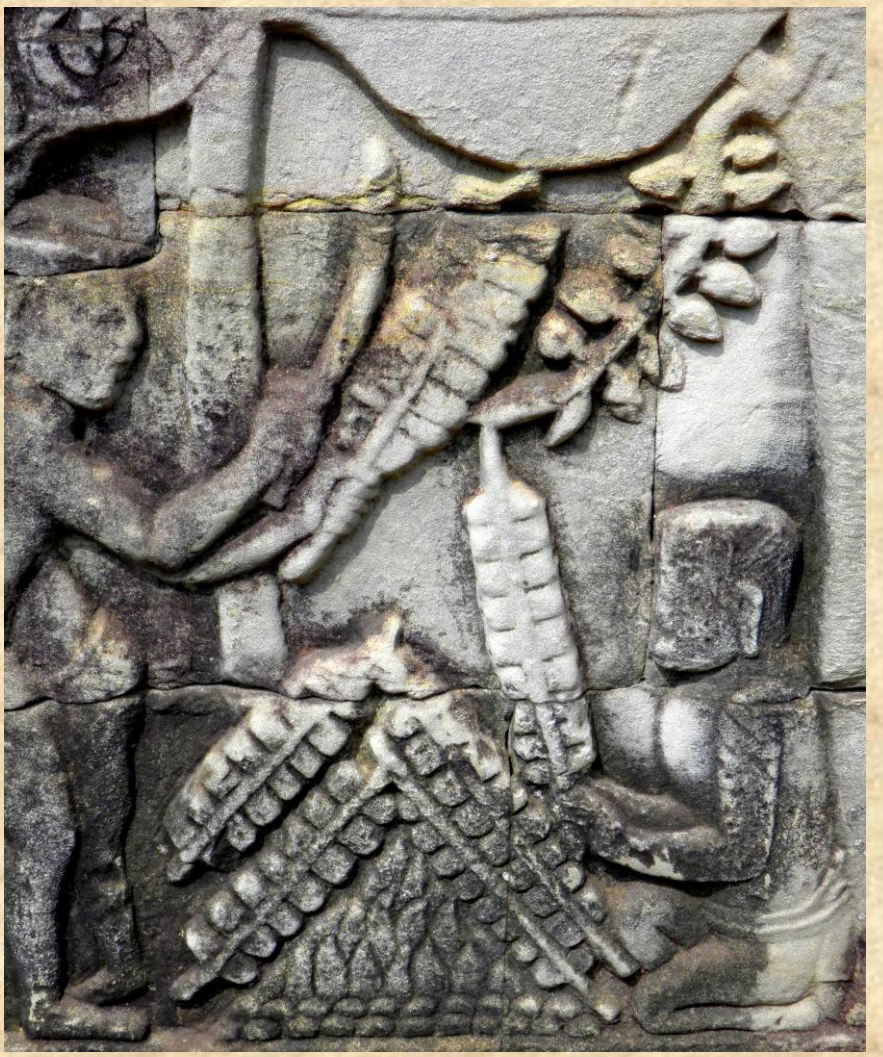
Borobudur: plants and animals

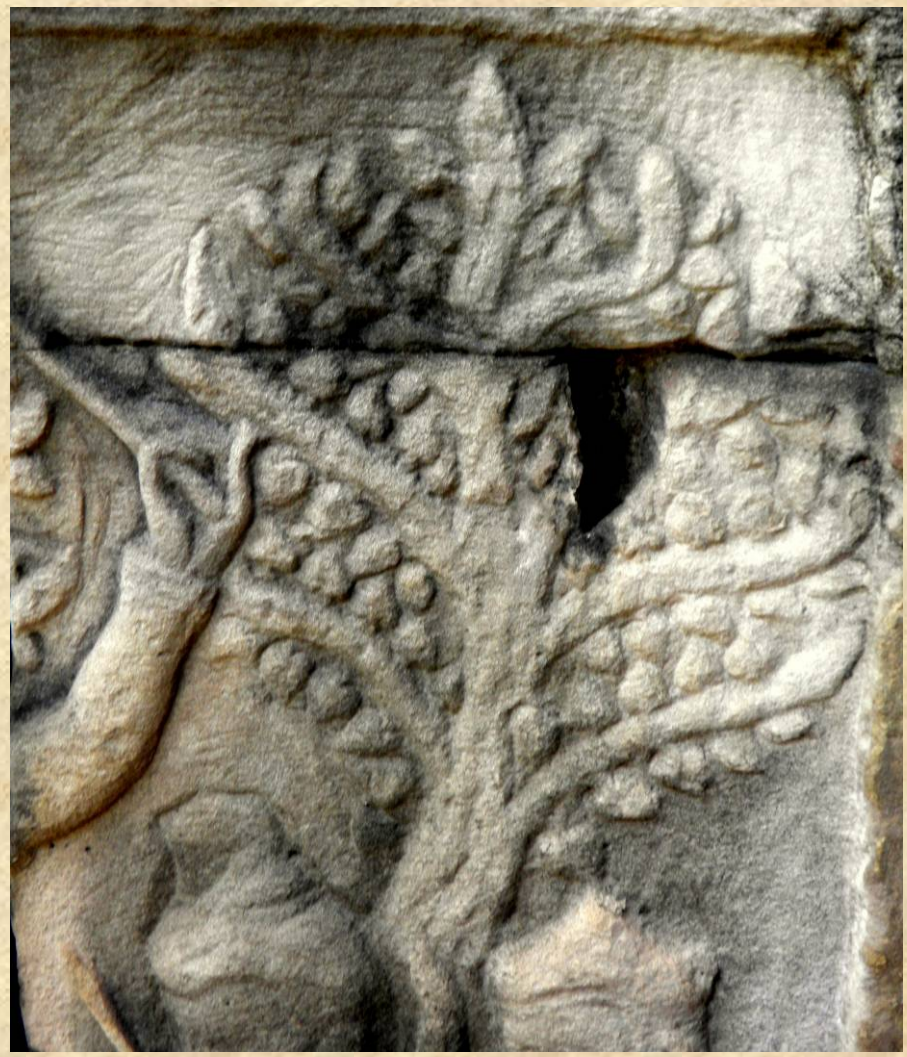


Iconography 2

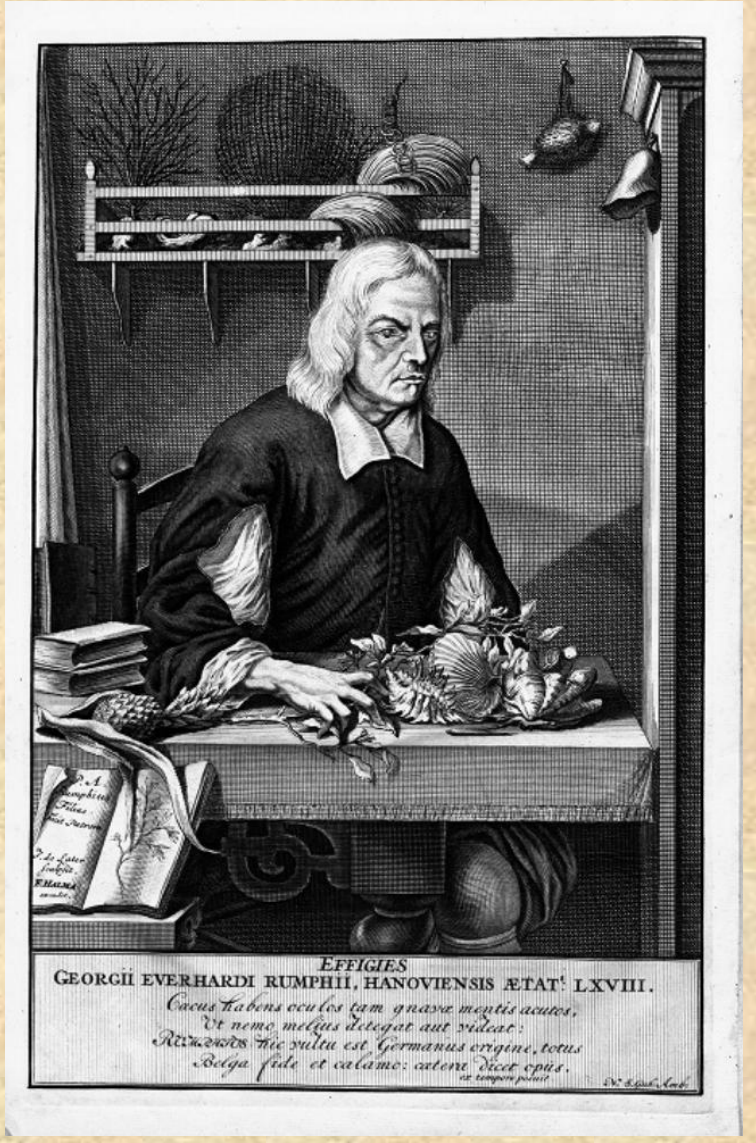
- The Bayon is not always accurate! Some plants depicted are impossible
- Following the period of European contact, naturalists such as Rumphius begin to illustrate plants with something like modern botanical accuracy
- These are not historical in themselves, but provide clues to current agricultural practice which help us interpret the past.

The Bayon





Rumphius


EFFIGIES
GEORGII EVERHARDI RUMPHII, HANOVIENSIS ÆTAT. LXVIII.
Cæcus habens oculos tam gnaros mentis acutos,
Vt nemo melius detegat aut videat:
Rumphius hic vultu est, Germanus origine, totus
Belga fide et calamo: cætera dicet opus.


Pag. 104.
Tab. XXIX.
A
B
Tom. I.

Iconography 3

- Pottery models of plants, animal and processing equipment, and sometimes agricultural tools are recovered, especially in China
- For example, the dating of the earliest chicken bones are disputed but difficult to argue with a terracotta model of a chicken
- Similarly, models of processing equipment or even fields and storehouses all help enrich the picture we can develop

Terracotta models, Shijiahe culture

陶狗、陶鸡
1987年天门石家河邓家湾出土
Pottery dog and chicken
Unearthed at Dengjiawan, Shijiahe, Tianmen in 1987

Ca. 4500 BP, Hubei

Terracotta models of processing equipment, Tang Dynasty

陶磨、碾、碓和井栏

唐（公元618－907年）
1954年山西长治王琛墓出土

Pottery Millstone, Roller, Grain Huller, and Wellhead

Tang Dynasty (618–907 AD)
Unearthed at Changzhi, Shanxi Province, 1954

Linguistics 1

- The basic tool is the compilation of vernacular names for plants and animals in the languages of the region
- In some language phyla, for example Austroasiatic and Daic, agriculture appears to reconstruct back to the proto-family, and we can therefore attribute a specific repertoire of crops and domestic animals to that family, and even possibly attribute a date to it.
- The advantage is that it gives us a handle on all cultigens, including those hard ot find in the archaeobotanical record.
- In some cases, individual crops, such as foxtail millet, were probably domesticated prior to the establishment of the current language phyla (according to archaeobotany)
- But we can track them as they spread from one area to another

Daic lexicon illustrative of subsistence

Item	Quasi-reconstruction
taro	#pɣaak
cooked rice	#mpuŋ
husked rice	#saan
white rice	#rɔp
millet	#pfeeŋ
ginger	#kʰiŋ
buffalo	#kwaay
goose	#ɣaan

Austroasiatic subsistence terms

Gloss	Reconstruction	Comment
rice (general)	#ɓaːʔ	Found in seven branches
rice-grain	*sŋɔːʔ	Reconstructs only to Proto-Mon-Khmer
paddy rice	#srɔ	Found in three branches but includes Munda
husked rice	#rəkau	Found in seven branches
foxtail millet	#səŋkɔɔy	Found in seven branches
taro	#trawʔ	all branches except Aslian
sesame	#ləŋa	Found in six branches
banana	#tVlVy	Found in six branches
betel pepper	#mpluw	Found in six branches

Austroasiatic livestock terms

Gloss	Reconstruction	Comment
bovid	#ŋwV	widespread but does not necessarily apply to domestic species
cow	#[rə]mɔɔk	Found in six branches including Munda
buffalo	#krəpaaw	Found in all branches excluding Munda
buffalo	#triik	Found in six branches with possible Muṇḍā cognate
pig	#kliik	Found in six branches
pig	#kruul	Found in six branches
goat	#bɛɛŋ	Found in ten branches with doubtful Muṇḍā cognate
dog	#atʃɔ:k	all branches
cat	#miaw	Found in eight branches
chicken	#syiar	Found in six branches
goose/duck	#ŋaŋ	Found in nine branches but referent varies
duck	#tʃaa[k]	Found in nine branches

Foxtail millet I

- There is an extremely widespread root which can be reconstructed as #*tʃɔk*, which resembles Old Chinese **sok* closely.
- It appears as an early borrowing into proto-Mienic (**tsyəi*A), with the loss of the final velar, but also into Austronesian (Atayal *basag*).
- This is consistent with an early domestication in the region of North-Central China and an eastward spread into the Austronesian world.

Foxtail millet II

- However, Austroasiatic languages have a quite distinctive root, *#səŋkɔɔy*, spread across the phylum and not showing borrowing from Sino-Tibetan.
- This argues either for a second domestication in the Austroasiatic area, or else a very early borrowing of the crop without a transfer of the name.
- This name is then borrowed into late Austronesian languages, such as Malay, which had ceased growing foxtail millet of Taiwanese origin.
- Another term in Austroasiatic for millet is *#sapiʔ* which has probably shifted from the original term for Job's tears.

Reflexes of #*tʃɔk* for ‘foxtail millet’ in SE Asian languages

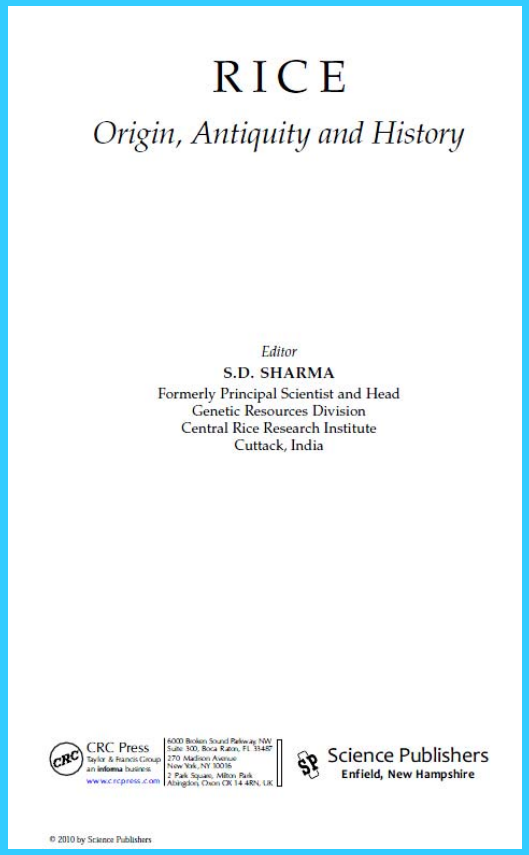
Sino-Tibetan	Sinitic	Chinese	sù (粟)
Sino-Tibetan	Sinitic	Chinese	shǔ (黍)
Sino-Tibetan	Sinitic	MC	syowk
Sino-Tibetan	Sinitic	OCM	*sok
Sino-Tibetan	Tujia	Tujia	wu^{1} suo^{1}
Sino-Tibetan	Nungish	T’rung	tɕaʔ^{55}
Sino-Tibetan	Loloish	Lisu	tʃøʔ^{21}
Sino-Tibetan	Burmic	Burmese	ʃaʔ^{5}
Sino-Tibetan	Tibetic	Lhokpu	cək
Sino-Tibetan	Tibetic	Tshangla	jaŋ^{55}ra^{13}
Sino-Tibetan	Luish	Cak	jwari
Sino-Tibetan	Tani	Bokar	ta-jak
Hmong-Mien	Mien	P-Mienic	tsyəi^{A}
Austronesian	Formosan	Atayal	basag
Austronesian	Philippines	Bontok	sabog

Reflexes of #*səŋkɔɔy*, ‘foxtail millet’

Austroasiatic	Monic	Nyah Kur S.	phəyóok
Austroasiatic	Khmeric	Khmer	sku:əy
Austroasiatic	Vietic	PV	*s-kɔ ː j
Austroasiatic	Vietic	Vietnamese	kê
Austroasiatic	Vietic	Malieng	səkɔ ː j
Austroasiatic	Pearic	Chong [Chantaburi]	ha ː j kəno ː ʔj
Austroasiatic	Palaungic	Rianglang	¯khuay
Austroasiatic	Katuic	Pacoh	ʔayuəʔ
Austroasiatic	Khmuic	Kammu Yuan	həŋkɔ:y
Austroasiatic	Khasian	Khasi	kra ː y
Austronesian	Malayic	Malay	sěkoï
Austronesian	Chamic	Cham	hako:y
Daic	Tai	Shan	kʰaw^{3} kɔy^{1}

Genetics

- The genetics of domestic plants and animals in SE Asia is in its infancy
- The focus has been, as usual, on rice, with a small amount of work on other crops, such as foxtail millet, buckwheat etc.


RICE

Origin, Antiquity and History

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Molecular Evidence on the Origin and Evolution of Glutinous Rice

Kenneth M. Olsen[1] and Michael D. Purugganan

Department of Genetics, North Carolina State University, Raleigh, North Carolina 27695

Manuscript received June 19, 2002
Accepted for publication July 26, 2002

Genetic Structure and Diversity in *Oryza sativa* L.

Amanda J. Garris,*,[1] Thomas H. Tai,†,[2] Jason Coburn,* Steve Kresovich* and Susan McCouch*,[3]

**Plant Breeding Department, Cornell University, Ithaca, New York 14853-1901 and †U.S. Department of Agriculture-Agricultural Research Service Dale Bumpers National Rice Research Center, Stuttgart, Arizona 72160*

Genetics 2

- There has been more work on domestic animals, notably pigs, dogs and chickens
- Especially for pigs, the results have caused a major rethink of the routes by which pigs reached ISEA

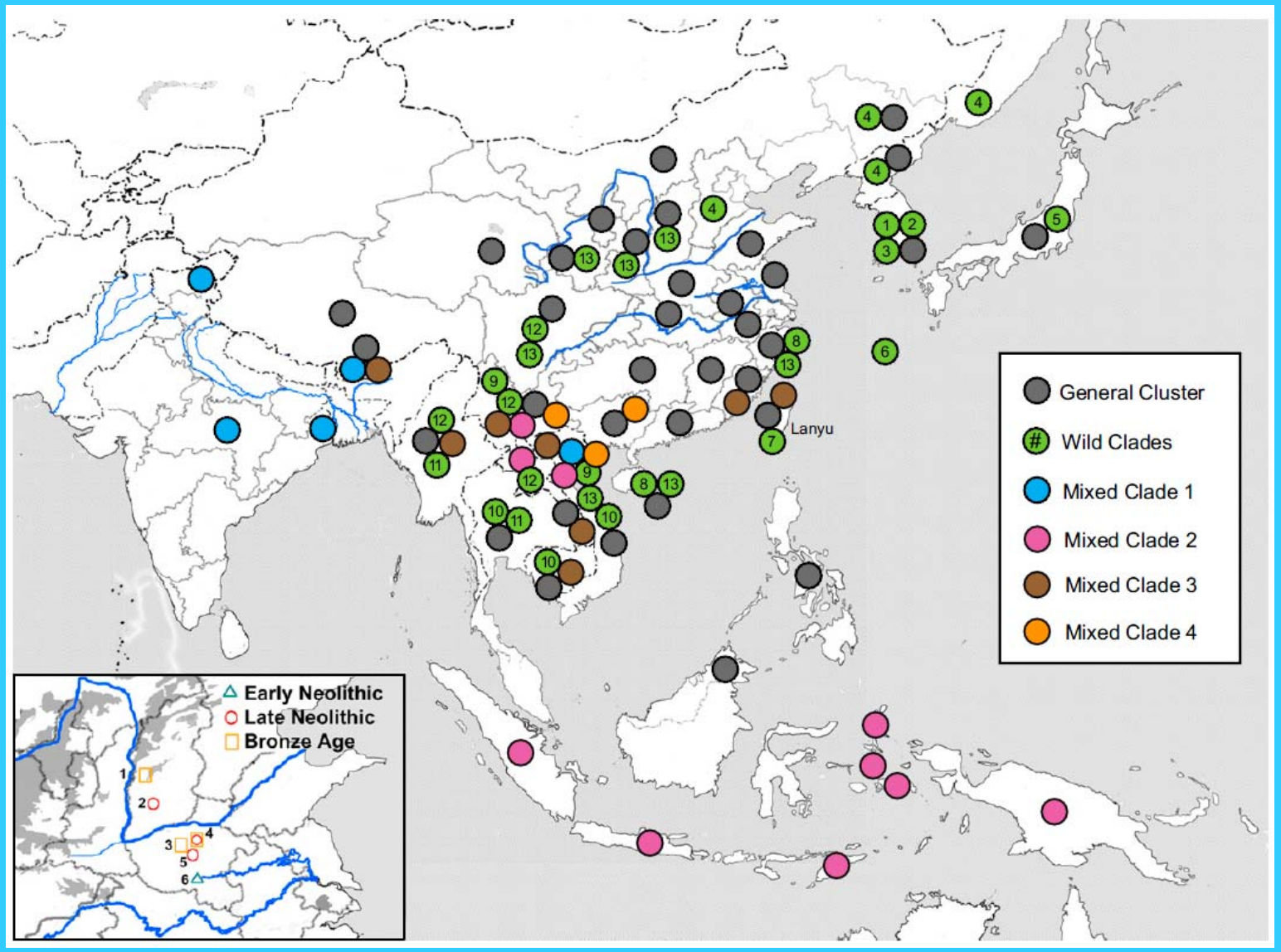
Rethinking dog domestication by integrating genetics, archeology, and biogeography

Greger Larson[a,1], Elinor K. Karlsson[b,c], Angela Perri[a], Matthew T. Webster[d], Simon Y. W. Ho[e], Joris Peters[f], Peter W. Stahl[g], Philip J. Piper[h,i], Frode Lingaas[j], Merete Fredholm[k], Kenine E. Comstock[l], Jaime F. Modiano[m,n], Claude Schelling[o], Alexander I. Agoulnik[p], Peter A. Leegwater[q], Keith Dobney[r], Jean-Denis Vigne[s], Carles Vilà[t], Leif Andersson[d,u], and Kerstin Lindblad-Toh[b,d]

Patterns of East Asian pig domestication, migration, and turnover revealed by modern and ancient DNA

Greger Larson[a,b,1,2], Ranran Liu[c,1], Xingbo Zhao[c], Jing Yuan[d], Dorian Fuller[e], Loukas Barton[f,g,h], Keith Dobney[i], Qipeng Fan[c], Zhiliang Gu[c], Xiao-Hui Liu[c], Yunbing Luo[j], Peng Lv[d], Leif Andersson[b], and Ning Li[c,2]

Pig genetics SE Asia



Dated finds

- Apart from classic archaeobotany, there are claims, for China at least, that some finds go back to the early Palaeolithic
- However, tombs in China, in particular, have good preservation and are sometimes dated precisely
- Specific offerings in the tombs focus on fruits and other food plants with hard kernels

Palaeolithic hackberry seeds

朴树籽

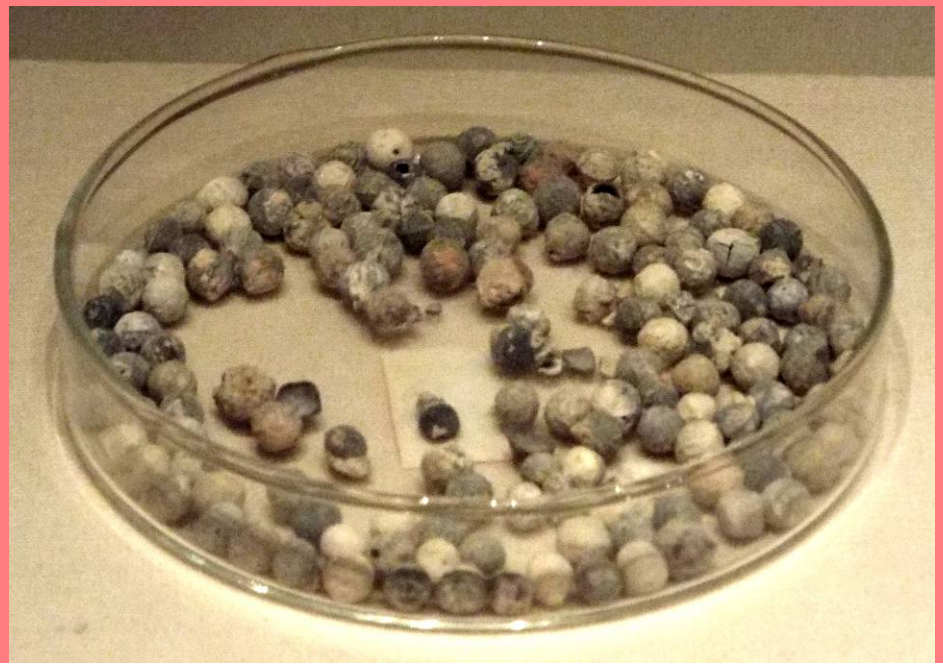
旧石器时代早期（距今约200万年–20余万年）

1958年北京房山周口店第一地点出土

Hackberry Seeds

Lower Palaeolithic (c. 2 million–200,000 years ago)

Unearthed at Locality 1, Zhoukoudian, Beijing, 1958



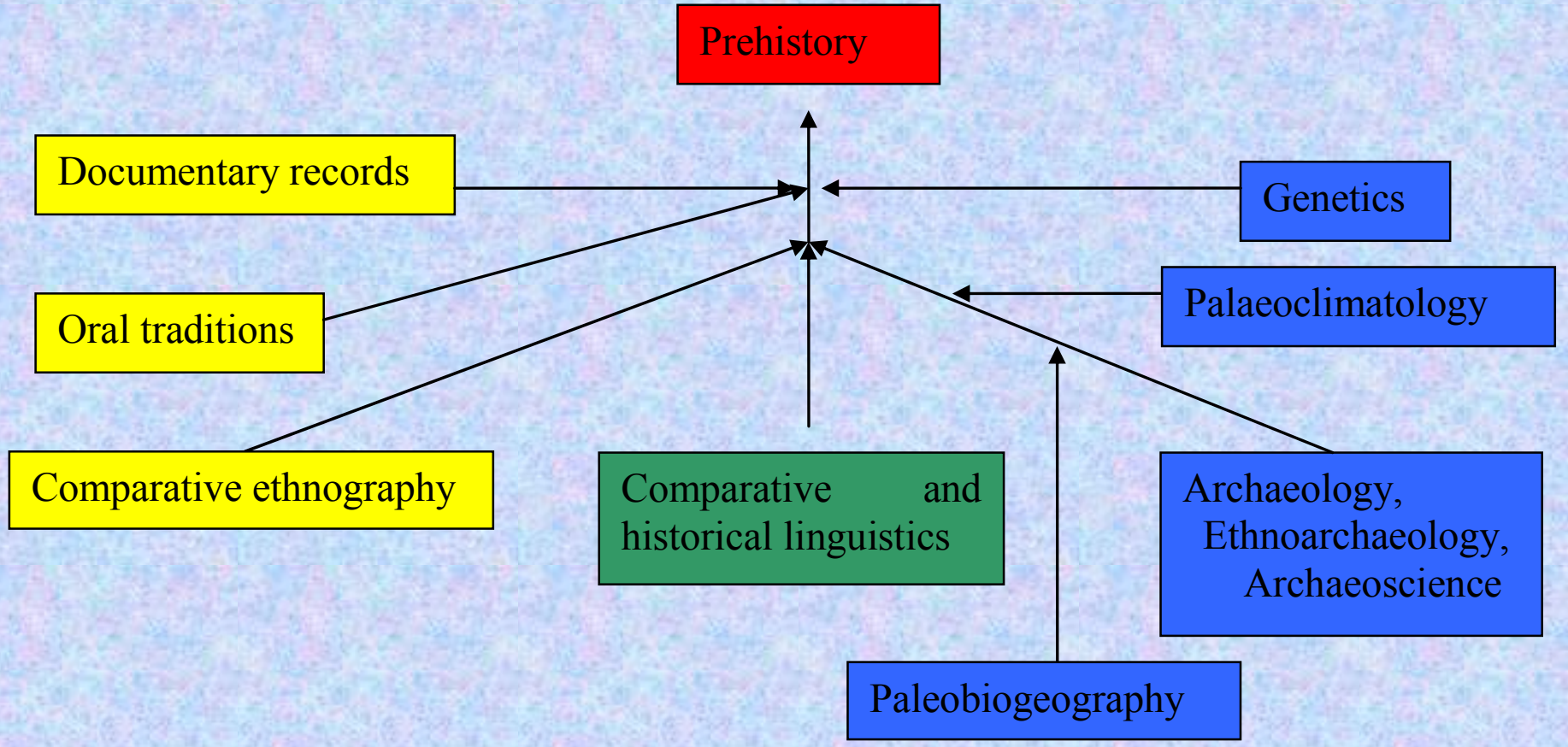
Hackberry seeds gathered for food and a large cache of animal remains were discovered at the Peking Man site. The fossils of over 2,000 individual thick-jawed deer and over 1,000 individual *Pseudaxis grayi* deer indicate that these two species were primary hunting targets for Peking Man. The *Pseudaxis grayi* were hunted in late summer/early autumn, while the thick-jawed deer were hunted in late autumn/early winter.

Tomb offerings in Hubei Province

The concept of integrated prehistory

- Human interaction with plants and animals is clearly a major element of prehistory
- Yet for SE Asia our understanding remains extremely weak for a variety of reasons
- Beyond a positivist archaeobotany we need to begin to bring in a wide variety of other sources of information in order to being the construction of integrated prehistory
- Which might look like this;

Integrated prehistory: a model



Above all..

- Reconstructing the history of interaction with plants and animals is *not* a scientific experiment
- The archaeobotanical record will always be extremely patchy
- We need to approach the topic with a broad range of reference and some imagination to do justice to the past

THANKS

- To the many individuals and museums who have contributed to this talk