No Dates

Wide World photo

"At the moment there is little question that Mesopotamia (above) was the site of the earliest and most completely accoutered civilization."

Theodore A. Wertime

The Search for Man's Origins

The site of Ban Chieng in northeast Thailand is now possibly the most exciting and controversial arena of archeology anywhere in the world. Excavated for three seasons by Pisit Charoenwongsa of the Thai Archeological Service and Chester Gorman of the University of Pennsylvania, it has opened a new frontier for the study of human civilization in Southeast Asia. Let us see in a moment how large a frontier it really is.

Contributing not least to the reputation of Ban Chieng has been the illegal flow of beautiful red-on-white "hot pots" from the site, detailed by William Honan in the New York Times Magazine of June 8, 1975.

Mr. Wertime, a research associate at the Smithsonian's Museum of Natural History, is a visiting scientist in the metallurgy and material science department at the University of Pennsylvania.

Ban Chieng is more than a mine for illicit pots, however. It is now a test case for most of the controversies in archeology over the rise of civilization throughout the world. I refer explicitly to Joseph Alsop's column in The Post of September 8 which speculates that much of human history will be rewritten around Ban Chieng. Alsop says the discoveries of Ban Chieng are like finding the origins of the English Industrial Revolution in Ceylon or Indonesia. He speculates that the roots of Chinese civilization may now be found in Southeast Asia. If, in fact, rice culture and the making of bronze are older in Thailand than they are in China, we may infer that these two basic elements of Asian civilization migrated northward into China.

Alsop does not subcribe fully to an even greater intellectual leap now being made by Froelich Rainey, Director of the University of Pennsylvania Museum and promoter of the Ban Chieng digs by Penn. In tin-rich Thailand, says Rainey, we shall find the origins of the world's bronze age. He also says that man's discovery of iron occurred in Thailand rather than in the Middle East and Turkey where scholars have usually placed it. This means that the traditional "first" civilization at Ur in Mesopotamia owes a great deal of its metallurgy to Southeast Asia.

I take exception to these interpretations. I think that both Alsop and Rainey have gone far beyond presently acknowledged facts. But let us look at those facts before getting into the kinds of conclusions that one may draw.

Archeological Service and the participation of universities in Australia and New Zealand. In due time, Chester Gorman and Don Bayard made substantial discoveries of what seemed to be early beans and one specimen of a pea at several caves in northwestern Thailand. They came up with the first bronzes at the site of Non Nok Tha, dated mid-third millennium B.C. One cave, the Banyan cave, also yielded multiple seeds of rice as well as chaff and stems.

Taking Exception

The University of Hawaii clearly was onto something new and exciting in Thailand, the first scent of the independent development of both food cultigens and metals.

Then came Gorman's digs of 1973 in the graveyard of Ban Chieng, the evidences of burials at nearly 3700 B.C., and Rainey's campaign to make Ban Chieng a major thrust of the University of Pennsylvania's archeology.

The main question dividing archeologists today is that put by the Smithsonian's Betty Meggers in the March 1975 issue of the American Anthropologist: Did civilization begin once in Mesopotamia and diffuse itself; or twice, once each in the Old and New Worlds; or repeatedly in both Worlds? By civilization, we mean that interconnecting body of institutions that enables a tribe or nation to move beyond subsistence to organized agriculture and to a regular food supply, the industrial uses of fire, working of metals, trade, urban densities of population, writing, timekeeping, and ultimately those two bonuses of the emergence of the state bureaucracy and war. At the moment there is little question that Mesopotamia was the site of the earliest and most completely accoutered civilization.

But archeologists in the past ten years have been busily nibbling away at the thought that Sumer was the "nuclear" area in agriculture and human civilization. Solheim's find of the incipient domestication of plants and spreading employment of fire, clays, and stones in Southeast Asia thus is not a novel one.

"Ban Chieng . . . is now a test case for most of the controversies in archeology over the rise of civilization throughout the world."

protesting *any* extravagant claims for Ban Chieng, including Rainey's:

There is a tendency today, shared by all too many scholars, to regard the latest theory as the best theory, to accept the most recent article on the subject in a completely uncritical fashion in order to be "up-to-date," and to consider all those who fail to do likewise as hidebound obstructionists. The fact is that there are good reasons for skepticism regarding the claims made for Thailand.

Today Gorman and Douglas Yen, his botanist, hedge on all the chief plant domesticates, the pea, the bean, and rice. They speak of "plant manipulation," meaning that the bean at least was on the slow genetic journey from a wild collecting variety to a horticultural plant. Rice they now put in the time period of 3000-2000 B.C., which is not substantially earlier than the first dated appearance of rice in China. Indeed, British scholars are saying that domesticated rice is a come lately, following on the heels of root crops and legumes.

As for bronze, the evidence has been hazy in the extreme. Until 1975, the oldest certain bronze at Ban Chieng was dated at around 1000 B.C. Earlier bronzes are now forthcoming from this year's excavations. Gorman today seems inclined to put his bronze age in the zone of 3500-3000 B.C., not substantially earlier than evidences of bronze in the Middle East.

"My own suspicion is that in time we shall find connections between bronze metallurgy in the Middle East and that in Thailand."

At Non Nok Tha, the bronzes contained substantial amounts of tin and lead. The famous "necklace of Bianca" at Ban Chieng, whose date is uncertain, has 25 per cent tin. These qualities make the bronzes look like the bronzes of Dongson in Vietnam or the advanced Shang-Chou bronzes of China. We have as yet no antecedent superstructure of metallurgical phases, as we have in the Middle East, to tell us how men got into the metallurgy of tin, a most obscure and difficult chemical art. Until one has this superstructure, the shaky edifice of dates at Ban Chieng really tells us little, as compared to the rich evidences of advanced mining and metallurgy in Turkey now attested around 3000 B.C.

So, despite all the journalistic hoohaha over Ban Chieng, we still do not know what role Thailand and the whole Malaysian peninsula really

acknowledged [illegible]
at those facts before getting into the kinds of conclusions that one may draw from them.

Some ten years ago, before Ambassador Ken Young's son stumbled over the first pot at Ban Chieng, a University of Hawaii team under Wilhelm Solheim began intensive archeological reconnaissances in Thailand. In an article in Science, Solheim was quite frank in admitting that the team hoped to find evidences of early pre-civilization in Southeast Asia. And find them he and his colleagues did.

Their sweeping searches of the old caves and mounds of northern Thailand gained the support of the Thai clays, and stones in Southeast [illegible] thus is not a novel one.

Even before Gorman's dig at Ban Chieng, however, there was a substantial retreat from Solheim's most ardent claims about cultivated plants. And the metallurgy of bronze remains a highly contested issue. In short, there are as yet few of those signs of the civilization that Mr. Alsop wishes to push up into China and Mr. Rainey into Mesopotamia and the old Middle East. The issue was summed up very nicely by James Muhly, associate professor of ancient history of the University of Pennsylvania in a letter to the New York Times Magazine of August 3, whole Malaysian peninsula [illegible] played as a possible zone of influence intermediate between the massive civilizations of Mesopotamia and the Indus and of China, or as the center of an independent civilization.

Did Thailand supply tin to the early bronze-founders of Turkey, Mesopotamia and Iran? I wish I knew. We are trying to develop techniques to find out.

My own suspicion—and it is only a suspicion—is that in time we shall find connections between bronze metallurgy in the Middle East and that in Thailand. There is every evidence that metallurgy in Turkey and Iran began about 5000 B.C. and that by 4000 B.C., men were beginning to experiment with complex alloys. Given this history and the lack of antecedents in Thailand, one must ask how Thai founders latched onto their advanced techniques of bronze founding. Eurasia in the late Neolithic was bridged by interlocking circles of trade in precious stones and other materials that brought men west to Cornwall for tin not much after 2000 B.C. Such events give rise to the suspicion that both prospectors and ideas were on the move, both east and west, giving us both subtle diffusion and multiple zones of innovation. Thanks to Solheim and Gorman we know that Thailand was such a zone of innovation in the east, with roots deep in Southeast Asia's search for its own plant domesticates.

Rod MacLeish

The Envelope-Steamers

The ways of security are dark. Those who protect the land of the free and the home of the brave are not like us. Our stalwart lads at the CIA and their glorious allies in the Mafia may not have nailed Fidel Castro but, by God, they have kept this great country safe from Senator Frank Church's mother-in-law.

As is known far, wide and nervously, the spook works on the other side of the river conducted an illegal mail-opening operation between 1952 and 1973. Included were letters of the great and the obscure like you and me.

James Angleton said, in testimony before the Senate Intelligence Committee, that the idea was to keep a beady eye on on contacts between U.S. citizens and Communist countries. Looking for conspiracies, one supposes.

But opening other people's mail is considered naughty in this country. It is, in fact, against the law.

Mr. Angleton, a former CIA counter-intelligence honcho who looks and talks like T.S. Eliot in cloak and dagger, said that, to him, it was "inconceivable that a secret intelligence arm of the government had to comply with all the overt orders of the government."

Let us, in deference to the rhapsodies of the other side's argument, concede that point for a moment—although it shouldn't be conceded until it is properly wired up with all sorts of qualifications.

However, *if* we conceded Mr. Angleton's point, we are still left with the Potomac dumb-dumb factor. That factor enters into the affairs of state when a procedure that was instituted to accomplish a specific purpose continues with no relationship to the specific purpose for which it was instituted.

In the matter of the CIA's envelope-steaming, the Potomac dumb-dumb factor was vigorously at work. For instance; Senator Church, while on a visit to Moscow, wrote a letter to his mother-in-law, Mrs. Chase Clark, of Boise. The glue-finger squad seized the letter, opened it, read it, copied it and then sent the original on to Mrs. Clark.

Following the inexorable logic that lay behind the CIA's mail-tampering operation, we can all sleep more soundly in our beds once the conspiratorial link has been established between the arch-fiends of the Kremlin and a frail, white-haired old lady in Boise. That was the original purpose, right?

Right. Beat a confession out of her.

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Joseph Alsop

Rewriting Human History

PHILADELPHIA—The first and most decisive chapter in the history of civilization is being briskly rewritten. The revision began in Thailand. It is being completed here in Philadelphia. It is not so drastic as the 19th-century scientists' rejection of Archbishop Usher's long-accepted proof that God created the universe in 4004 B.C. But it is quite drastic enough to be causing a major scholarly storm.

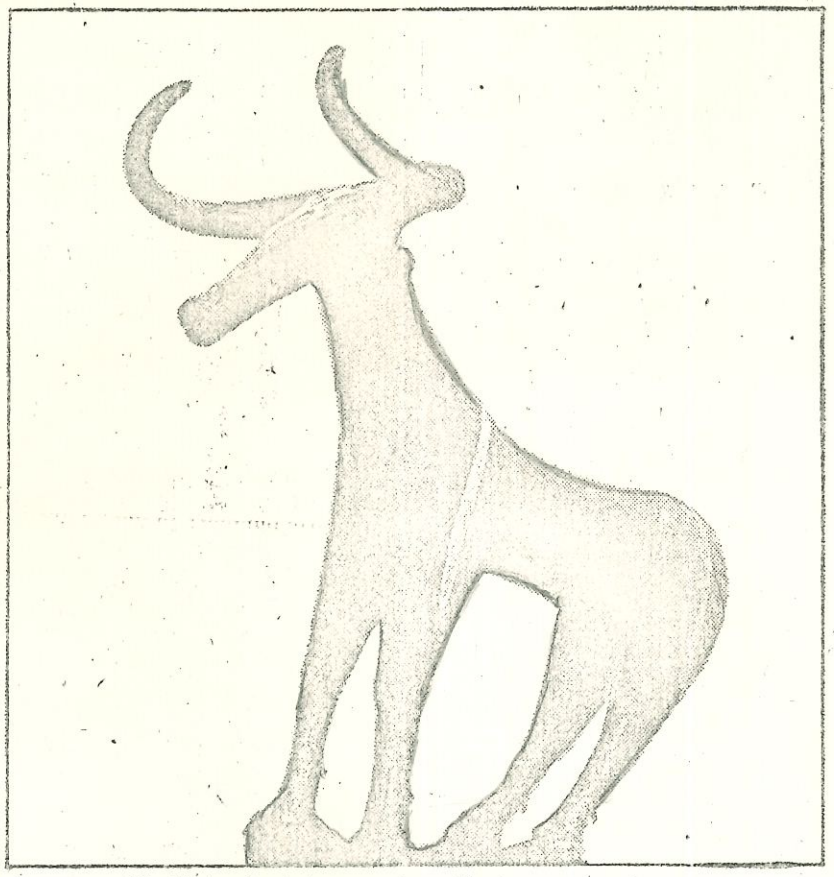
All this began at a large, low mound in northeast Thailand, where the little village of Ban Chieng sits on top of an enormous prehistoric graveyard. The countless ancient graves contain offerings to the dead. The most visually striking offerings are richly swelling

Mr. Alsop writes a monthly column.

pottery vessels of unique design, with a mauve-to-buff body decorated with swirling linear patterns in vermilion. But the sensational finds are the bronze bells, bracelets, axes and adzes that the Ban Chieng graves also contain.

The Ban Chieng graveyard is being excavated co-operatively by one of the Thai government's archaeologists, Dr. Pisit Charoenwongsa, and Dr. Chester Gorman of Philadelphia's University Museum. The museum's Applied Science Center is also doing the tests that date the material from Ban Chieng. It is the evidence of the tests, in turn, that makes the Ban Chieng material sensational; for the tests give the Ban Chieng bronzes dates between 3500 and 4300 B.C.

Reports on the Ban Chieng finds have begun to be published. But to understand why they are so sensational, you have to begin at the beginning—with the reconstruction of the human past that long ago replaced Archbishop Usher's Bible-based chronology. Before the industrial revolution, in brief, there were two other, vastly earlier revolutions that even more completely transformed the patterns of human life on earth.



A bull standard, bronze, from Turkey, circa 2400 B.C.

temples Mellaart found, for instance, there were recurrent pairs of rows of female breasts formed from mud-plaster around the jaws of carnivorous animals, whose fangs were visible through the enlarged apertures of the nipples! But even these fang-containing bosoms excited the prehistorians less than the small copper ornaments and a fragment of slag that indicated the Catal Huyuk people had actually smelted copper.

Finding a proto-city of the seventh millenium B.C., where people also worked copper, was just a bit like finding evidence for a nuclear power plant dating from the Middle Ages. Other archeologists digging in the Balkans then began to make further discoveries.

date for the bronzes from Ban Chieng.

The Ben Chieng site, it should be noted, was found by Thai excavators some years before American archaeologists joined the work there. The turning point occurred when the collector member of the Thai royal family, Princess Chumbhot, sent some of her Ban Chieng pottery to Philadelphia to be tested for dating at the museum. Thermoluminescence tests, which measure residual radioactivity, gave a date around 4500 B.C. for Princess Chumbhot's Ban Chieng pots—yet some of the pots had been found with bronzes inside them!

That sent the university museum's female [illegible] tender, Dr. Rodney Young, hurrying off to Bangkok to offer

dates. For many years, of course, scholars have agreed that rice cultivation came into China from the south and then spread northward to the earliest truly Chinese centers by the time of the Shang dynasty that began about 1700 B.C.

Now, however, confirmation of the Ban Chieng bronze dates will mean that bronze technology went north along with rice cultivation from the Southeast Asian area that all good Chinese have always regarded as barbarous. In sum, the Chinese scholars will be even more horrified by the new evidence than the Middle Easterners like Dr. Wertheim at the Smithsonian. But rear-guard actions against new facts are familiar dramas of scholarship; and no new historical truth has ever been established without much prior commotion.

tion," as the prehistorians now call the introduction of settled farming somewhere between 10,000 and 12,000 years ago. Without the food surpluses that farming produces, the entire human population of this planet could never have numbered more than the present population of a single medium-to-big city of the modern age.

The "metallurgical revolution" then followed after some thousands of years. Without worked metals, mankind could never have achieved all those improvements in war-making, tool-making, and kindred activities that have so vastly raised the quality of life for all of us. What we are pleased to call civilization was in fact born of the metallurgical revolution; and it is this part of the story of the human past that is being torn to bits and put together again in most unexpected ways by the bronzes from Ban Chieng.

To put the meaning of these bronzes in a more contemporary context, you need only think of the all-transforming industrial revolution that began in England and Western Europe. Then suppose that historians and archaeologists had come up with certain proof that, instead of being Western in origin, the industrial revolution really began in Ceylon or Java. The resulting changes in our picture of the past would surely take a bit of getting used to.

Until very recently, in fact, the world's archaeologists, prehistorians and cultural historians were just as sure they knew where the neolithic and metallurgical revolutions occurred as we are sure today about the scene of the industrial revolution. Civilization was universally supposed to have been invented in the Middle East. Here, it was believed, settled farming and serious metal-working both began for the first time in human history.

In the past couple of decades, however, unsettling new discoveries have begun to be made in more than one area, including the Middle East itself. Here, the most upsetting find was made by the British archaeologist, James Mellaart, at the Catal Huyuk mound in central Turkey. The mound contained the remains of what can only be called a proto-city dating from the seventh millenium B.C.

The proto-city at Catal Huyuk had a remarkably well-developed cult of a somewhat macabre character. Among the standard decorations of the many

[illegible] directly challenging the Middle East's proud place as civilization's source area—which Mellaart, of course, had never challenged.

The worst was yet to come, however, for the Middle East could still claim the earliest known bronze, dating from about 2500 B.C. The earliest bronze was so important because pure copper is a most unsatisfactory metal for anything but ornaments. The organization of more complex societies, fully dependent on metal tools and weapons, therefore had to wait until the Bronze Age opened. Even three years ago, the entire scholarly world would have been convulsed with roars of laughter if anyone had suggested that northeast Thailand was the first place where men added tin to copper to get bronze. Yet the region of Thailand around Ban Chieng is actually the only place on earth where ample tin deposits coexist with large copper deposits.

Some of the recent finds have been "a bit like finding evidence for a nuclear power plant dating from the Middle Ages."

Until three years ago, however, everyone *knew* that the Bronze Age began in the Middle East in the middle of the third millenium B.C. Everyone further *knew* that bronze only came to the Far East about half a millenium later, or a bit after 2000 B.C., when what we now call China began to develop from bronze-using centers in the Yellow River Valley. By some means or other — no one kenw quite how — Chinese bronze technology was further thought to have been borrowed from the Middle East.

This is the crucial chapter of past history that the Ban Chieng finds promise to rewrite in toto. One has to say "promise," as yet, for another winter of elaborate testing will probably be required before the Philadelphia University Museum's Applied Science Center can announce ironclad proofs of the very early dates for the material from Ban Chieng. But after this summer's digging season, the responsible American archaeologist, Dr. Gorman, announced in Bangkok a few days ago that he already regarded the evidence as "conclusive." And he added that he considered 3500 B.C. as a conservative

co-operative arrangement to the Thai government's archaeologists. The result was the joint dig at Ban Chieng, which has now been carried on for two successive seasons by Drs. Gorman and Pisit Charoenwongsa. Great quantities of new material have been found, including gold and silver ornaments. In Bangkok this summer, where I was permitted to see Princess Chumbhot's collection and other Ban Chieng material, the experts were already predicting great things for the future.

That does not mean that any coherent social picture can as yet be deduced from the Ban Chieng material. The mound is a graveyard, pure and simple. It is one of many such mounds, covering a huge area of northeast Thailand; so the Ban Chieng culture flourished over a wide area. No habitation site has been found, however, so their graves are the only evidence for the way of life of the Ban Chieng people.

In some ways, the food offerings, showing that the Ban Chieng people cultivated rice, are just as important as the bronzes among their grave goods. Ban Chieng has in fact provided the earliest evidence of cultivated rice, that staple of the Asian diet.

A long time will be needed, moreover, before there is anything like a scholarly consensus about the meaning of the Ban Chieng finds. Passionate Middle Easterners like Dr. Theodore Wertheim of the Smithsonian Institution have thus far even refused to accept the dates provided by the University Museum's Applied Science Center. Thermoluminescence is unreliable, they say, and they also attack the more dependable carbon-14 dating of 3500 B.C. that was cited by Dr. Chester Gorman in his Bangkok interview the other day.

Dr. Rainey, meanwhile, like the buccaneer of archaeology that he has always been, is already suggesting that bronze-making traveled westward, from Thailand to the Middle East. In Ur of the Chaldeas, he points out, bronze was still a most uncommon metal; and its essential alloy, tin, was valued more highly than gold itself. This, he suggests, means that Ur depended on tin exports from the region around Ban Chieng.

This may be a bit overbold. But the total transformation of early Chinese history—no small matter in itself—will be an automatic sequel if further testing sustains the Ban Chieng bronze

N.Y. Times Magazine, June 8, 1975

THERMO LUMIN-ESCENCE

THE CASE OF THE HOT POTS

AN ARCHEOLOGICAL THRILLER

By William H. Honan

Several weeks ago, I was standing in one of the basement laboratories of the University of Pennsylvania Museum in Philadelphia cradling in my hands a prehistoric pot. About the size of a large pineapple and decorated with a hypnotically swirling spiral design, it was called a Ban Chieng ceremonial burial urn—the name comes from one of the villages in northeastern Thailand where such pots have recently been unearthed in great number. As I looked closely at the design, I could see points where the prehistoric potter had paused and lifted his painting instrument—perhaps for another dip of paint, maybe to set down his brush and throw a log on his fire, or—who knows?—perhaps to fight a skirmish against some unexpected intruder.

William H. Honan is editor of The Times's Sunday Arts and Leisure section.

In a moment or two, I caught myself staring out the laboratory window. My imagination had winged off to the Bronze Age.

Such daydreaming is one of the occupational hazards—and one of the delights, too—of an interest in antiquities. The temptation is especially strong in the case of Ban Chieng pots because these humble-looking, oddly shaped, mysteriously decorated vessels, besides possessing a strange enchantment which has aroused the interest of museum curators and art collectors, may have a revolutionary importance in the field of archeology. There is now considerable although still highly controversial evidence to suggest that these objects were made as early as 4500 B.C., or in what archeologists and prehistorians somewhat grandly call the Fifth Millenium. Much older pottery has been found in caves in Japan, but Ban Chieng pots are far more important because they have been discovered in graves along with bronze implements. At present, there is no direct way of telling the age of a very old piece of bronze (unless it bears a telltale inscription), but if the dates indicated by recent technical analysis are correct for Ban Chieng pottery, then, by inference, the bronze found in the same graves was made in 4500 B.C. too—and that's 1,500 years earlier than anybody ever suspected it could be made, and in a part of the world where no one expected to find metallurgy practiced at such an early time. The development of bronze making is especially important to prehistorians because the so-called Bronze Age was the stage at which mankind graduated from a hunting-and-gathering, Stone Age existence to a settled community life in which the relatively complex arts of what we call civilization could begin to be practiced.

The notion that the Bronze Age may have originated in Southeast Asia instead of the Near East, as has been long supposed, is particularly tantalizing because it could explain one of the great mysteries of archeology. No one has yet discovered the source of the tin (bronze is composed of copper and tin) which supplied the Bronze Age of the Near East.* Northern Thailand, however, happens

to be one of the rare places in the world with an abundant supply of tin as well as an adequate supply of copper—and the ores found there are rich enough for reduction by primitive smelting methods. Accordingly, some archeologists are now beginning to speculate that as early as 3000 B.C. the people living in what is now northern Thailand were exporting to the Near East and perhaps other parts of the world not merely the tin to supply early bronze industries, but also basic metallurgical technology and possibly even other arts and resources necessary for the beginning of civilized living. In short, the "cradle of civilization," so this revolutionary theory goes, was not the fertile crescent along the valleys of the Tigris and Euphrates Rivers as every schoolchild since the nineteen-thirties has been taught to believe, but northern Thailand.

That is heady stuff indeed—and enough to provoke an archeologist who earned his Ph.D. shoveling dirt through a strainer in Mesopotamia to rumble in protest like an ancient thunder god. And, to be sure, the Southeast Asian theory is a long way from being proved conclusively. Still, the case is intriguing, if frustrating, and one which is also of interest because it illuminates the often illicit and underhanded antiquities trade.

■

For years, Ban Chieng pots have been quite literally kicking around in northeastern Thailand where rice farmers have been indifferently picking them out of the soil, sometimes crushing them for cement mix and occasionally even using them to decorate their homes. In the summer of 1966, Stephen Young, the son of a former U.S. Ambassador to Thailand, happened to be in Ban Chieng on a Harvard grant to study the political culture of northeastern Thai villages. Walking along a pathway that had been deeply eroded by recent monsoons, Young tripped on a root, fell forward, caught himself with both hands and, as he lay on the ground, noticed under his fingers a number of clay rings in the soil. These rings were the tops of pots which had been buried vertically. Young presented the objects to the National Museum in Bangkok, urging further excavation. The museum did nothing, but Young also mentioned his discovery to a certain Princess Pantip Chumbhot, by all accounts a delightful member of the Thai royal family who amuses her Western visitors with her aristocratic way of looking down her nose at King Phumiphon as an upstart country cousin. She also has a passionate interest in art and archeology, and thus it was not long before she organized a private expedition to Ban Chieng. Princess Chumbhot collected potsherds there and at various other Thailand sites and dispatched them to the University of Pennsylvania Museum, which, she had learned through an American friend, was developing a promising technique for dating ancient pottery.

In Philadelphia, there was already a long line of samples awaiting the so-called thermoluminescent dosimetry (TLD) analysis, and so it was several months before Mark Han, a young Chinese-born research specialist, got around to the Thai potsherds. When he did, he was astounded. The fragment Princess Chumbhot had collected at Ban Chieng was dated 4630 B.C. (plus or minus 520 years). "We were amazed and we repeated the experiment," Han recalls with a grin.

Dr. Froelich Rainey, the tweedy, tanned and gravel-voiced director of the museum, was equally nonplused. "I couldn't believe it," Rainey says. "The amazing thing was that Princess Chumbhot had told us that this potsherd had been found in association with bronze implements. There was tremendous excitement, suspense and, of course, a good deal of healthy skepticism here. After all, we only had someone's word for it. And there had been no systematic digging."

An American student in Thailand tripped on a root, fell forward and landed on new clues to where and how civilization began.

Even in a state of feverish excitement, the world of archeology moves with dinosaurlike ponderousness, and thus it was not until 1973 that Rainey had managed to accomplish even the very first systematic digging at Ban Chieng. Back at the time of Stephen Young's fortuitous fall, an archeological team led by Prof. Wilhelm G. Solheim of the University of Hawaii was also on the prowl in northeastern Thailand. Solheim, rather like Heinrich Schliemann, who discovered ancient Troy, was following a mystical hunch. Sure enough, one of Solheim's students—Chester Gorman, who now heads the joint University of Pennsylvania-Thai Government dig at Ban Chieng—discovered pot fragments at the vertical edge of a mound near the village of Non Nok Tha, which is only a few miles away. An excavation at the site was commenced, and another of Solheim's students, Donald Bayard, eventually reported in a New Zealand publication that the Non Nok Tha dig had exposed as many as 115 prehistoric burials. These graves contained some 500 pots, a number of bronze artifacts and—to the delight of the archeologists—several small, socketed ax heads and two pairs of sandstone molds that fit perfectly over the ax heads. It seemed solid evidence indeed that these ancient people—whenever they might have lived—had manufactured rather than imported their bronze tools.

Dating this material, however, has proved difficult. To begin with, graves at Non Nok Tha had been dug down through older graves; during a period of many centuries the geological strata had become badly scrambled. In addition, there were technical problems. At one ponit, two charcoal samples sent to Florida State University for radiocarbon (C-14) analysis produced dates, thanks to an inexplicable foul-up, "some years in the future." Other excavated samples analyzed elsewhere indicated a confusing array of dates. Nevertheless, Bayard wrote in 1971 that he was convinced that highly developed bronze technology existed in northeastern Thailand "well before 2300 B.C.," although he said he recognized that others "may arrive at alternate conclusions." Later that year, Professor Solheim published his findings in the National Geographic, a sin his conservative colleagues considered shameless huckstering. In addition, by overstating his provable case, Solheim exposed himself to attack from all those with a stake in the anteriority of the Bronze Age of the Near East.

That same year the normally tranquil world of archeology was shaken by challenges from yet other quarters. T. A. Dayton, a researcher interested in the ancient Vinca culture of Yugoslavia, argued in World Archeology that some recent radiocarbon data demonstrated that the Bronze Age commenced in the Balkans long before its supposed ancestor in the Near East. And at the Eighth Congress of Pre- and Protohistory in Belgrade, Colin Renfrew, a widely published British archeologist, squared off with the Smithsonian's Theodore A. Wertime, who held the orthodox view that metallurgy came from the Near East; Renfrew maintained that European civilization took its original impetus from Near Eastern agriculture but then rapidly drew apart and ahead in developing metallurgy. Scholars tended to doubt the theories of Dayton and Renfrew, yet even Wertime soon acknowledged in Science that "early metallurgy has become a battleground."

Moreover, within the broader controversy, there now developed a rivalry among the Thailand investigators themselves, with Solheim's University of Hawaii team on one side and Rainey's University of Pennsylvania group on the other. Froelich Rainey, a respected leader in his profession who for many years has had the prestigious job of writing the annual entries on archeology for the Yearbook of the Encyclopaedia Britannica, sensed the need for some diplomatic pulling together if a substantial excavating project was to be undertaken. Accordingly, he traveled to Thailand and looked up Solheim's enterprising but level-headed student, Chester Gorman, who by then had drifted off to a paleolithic dig along the Burmese border. Much as if he were making peace by arranging a marriage between two medieval royal families, Rainey had Gorman appointed a professor at the University of Pennsylvania and put him in charge of the Ban Chieng excavation, which was jointly undertaken by Thai Department of Fine Arts and the University of Pennsylvania, operating under a grant from the National Science Foundation. That way, everybody, even the Thais, got a piece of the action. And, by January, 1973, Chester Gorman had uncovered a grave at Ban Chieng, in which he found an undisturbed skeleton with clay pots near the skull and a bronze ax head and other bronze tools beside one hand. Back in Philadelphia, under TLD analysis, the samples from these pots were dated by Mark Han at 3570 B.C. (plus or minus 480 years) and 3590 B.C. (plus or minus 275 years). That was significantly earlier than the Bronze Age of the Near East.

To Gorman and Rainey, the evidence was intriguing yet still not conclusive. Their caution was prompted by the fact that TLD dating is still in its infancy. The technique, first developed in the late fifties by George Kennedy, a U.C.L.A. geologist, is based on the fact that certain minerals contained in clay will, when exposed to high temperature, emit a faint light (called thermoluminescence) in addition to the normal "red-hot" glow. This faint light represents a discharge of the atomic energy accumulated through various natural processes since the material's original firing. Because such firing would have caused *(Continued on Page 59)*

*The very earliest 'bronzes" of the Near East contain arsenic instead of tin, but since arsenic occurs naturally with copper in sulfide ores, archeologists believe that it was not until the introduction of tin (or unnaturally large amounts of arsenic or other impurities) that the conscious alloying characteristic of the Bronze Age may be said to have been practiced.

Hot pots

Continued from Page 15

a discharge of the material's previous energy accumulation, the "atomic clock" would have been set at zero. Accordingly, by measuring the amount of thermoluminescence in a pottery sample, a scientist can tell how much time has elapsed since it was manufactured.

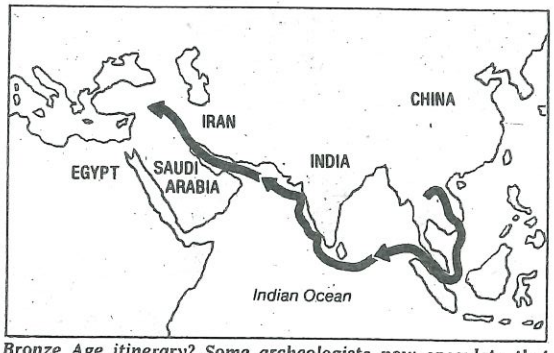
It sounds relatively simple but in practice TLD is enormously complicated, and the effort to perfect the technique has been beset with difficulties. There is, for instance, the baffling case of the Acámbaro clay figures. A German hardware merchant by the name of Waldemar Julsrud, who settled in Acámbaro, a city in central Mexico, collected clay figures —32,000 of them—which the natives who sold them to him claimed they had dug up from secret prehistoric graves. But art historians now believe the smiling faces on the figures were laughing at Herr Julsrud, whose leg was being pulled and pocket fleeced. The clay figures are thought to be fakes, probably made within the last 100 years. When tested in 1970 at the University of Pennsylvania Museum, however, they yielded TLD dates from 200 B.C. to 2500 B.C. The mystery thickened a few months ago when the Acámbaro samples were tested again. Because these samples had been fired in the process of testing, the atomic clock in the material should have been turned back to zero, but instead the samples were found to have accumulated 10 per cent of their earlier age indications. At that rate, in just 50 years some of these samples seemed capable of indicating an age of up to 2500 B.C. Obviously, something had to be wrong. University of Pennsylvania scientists now suspect that this particular type of clay may be highly susceptible to ultraviolet radiation and that this property causes it to emit a signal which is misleading. But no one knows for sure.

Does the clay at Ban Chieng also possess some unknown property which gives erroneously old dates? Or is it possible that such ancient pottery was fired at a relatively low temperature which somehow did not turn the atomic clock all the way back to zero, leaving in it a deceptive remnant of geologic time? There are no answers at present.

"We perform hundreds and hundreds of TLD tests which we know are accurate," Rainey says now, "and yet we can't explain these occasional mistakes. And that's why I don't want to draw any absolute conclusions about Ban Chieng until we can confirm our TLD dates with C-14 dates."

Last summer, he had gone to Ban Chieng and come back with a quantity of charcoal Gorman had found embedded with red-painted pottery, bronze tools and a prehistoric skeleton. At that time, Rainey stated in print that TLD dating had pegged Ban Chieng pottery as early as 4500 B.C., and then had declared exuberantly: "By the end of this year [1974], conclusive evidence should be in." But, instead, there had been frustration. Much of the charcoal Rainey brought back had turned out to be nothing but black dirt. Then the museum's C-14 counter had to be rebuilt in order to handle a series of very small samples. And then the earliest date produced was about 1900 B.C.

"It was a terrific disappointment," Rainey told me



Bronze Age itinerary? Some archeologists now speculate that civilization was exported from east to west—not vice versa.

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after he decided that although the charcoal dating was still in progress he would return to Ban Chieng once again. He did so early this year and this time got the Thai Government's permission to bring out about two pounds of human bones from a grave at Ban Chieng. The organic material inside the bones would then be subjected to C-14 tests. "This time," he said, "I think we'll have it."

Rainey returned to Philadelphia in March. The bones had gotten no farther than the University of Hawaii (they are still there being painstakingly measured by a physical anthropologist), and, even when they finally do reach Philadelphia, there will be many months if not years of testing ahead. Still, there was an unmistakable note of triumph in Rainey's voice when he told me: "I've got a C-14 date, anyhow!" Rainey explained that during his recent trip to Ban Chieng he received a joyous cable from Philadelphia reporting that one of the charcoal samples had produced a date of 3660 B.C. (plus or minus 330 years) and that another was dated 3380 B.C. (plus or minus 320).

"We're still puzzled that we can't get an exact correspondence between TLD and C-14 dating," he said. "We think the difficulty may be because we've been digging into some sort of mass grave in which things got jumbled. In any case, as of this time, after four separate, systematic excavations, I can say that C-14 dates show that the mound at Ban Chieng was occupied between at least 3500 B.C. and 200 B.C., and that very advanced bronze metallurgy was practiced there throughout that period. Now, that's much earlier than the Bronze Age of the Near East. The earliest bronze in the Near East is around 3000 B.C. and samples that early are very rare. Here, we're finding very old bronze virtually everywhere we look. In addition, at Ban Chieng the bronze we find is technically advanced bronze—bronze with a high tin content that was cast in molds. When we find that we know there also has to be earlier and less sophisticated bronze—the stuff that is almost pure copper and was shaped by hammering. And that, when we find it, will tend to confirm the earlier TLD dates from the pottery.

"But this is going to take years," he continued. "You see, we've found that there are literally scores of prehistoric burial sites all around northeastern Thailand. The villagers are digging them up—it's impossible to police—but we've learned that all of these sites contain bronze and different sorts of pottery."

Later, after corresponding again with Gorman, who is still at Ban Chieng, Rainey went even further. He reminded me that Gorman had discovered seeds and rice husks at a paleolithic site called the Spirit Cave along the Thai-Burmese border, and that this organic material produced C-14 dates of around 10,000 B.C.—perhaps the earliest indication of agriculture. "When this discovery is put together with the earliest pottery which has been found in Japan, and with the Ban Chieng bronze," Rainey said, "you have evidence that all the basic arts of civilization—agriculture, pottery and bronze making—may have begun in this part of the world. In addition, there's another site in southern Thailand—Lopburi—where we are finding evidence suggesting that the very earliest iron was produced there. In other

Lot 440: One of the pots offered at Parke-Bernet's controversial Ban Chieng auction.

Telltale bones and pots, newly discovered in Ban Chieng, Thailand. They may place the start of civilization at 4500 B.C.—1,500 years earlier than archeologists had generally supposed.

words, we've come across indications of phenomenal creativity in a wide range of the bases for civilization. The implications are extraordinary, to say the least."

To get another perspective, I reported Rainey's conclusions to the Smithsonian's Theodore Wertime, who has visited both the Vinca and Ban Chieng sites as well as having logged nearly 50,000 miles reconnoitering the Near East studying geological formations and panning rivers in search of an ancient source of tin in that area (he has a hunch he may find it in eastern Iran on his next field trip).

The notion of Vinca anteriority, to Wertime, is wholly unfounded. As regards the Thailand theory, he is more open-minded, although still fundamentally unconvinced. "It's possible," Wertime said, "that the close juxtaposition of high-grade copper and tin resources in Thailand led to an early and independent efflorescence of copper smelting and bronze making, but you can't establish that just by finding the metals. You have to discover the ways in which these metals were extracted from their ores in ancient times. That's been accomplished in the Near East. We've found the whole sequence—how, at first, naturally occurring copper was discovered in the earth and worked, then how this native copper began to be annealed, and finally how men organized the smelting of copper ore and chose among the various impurities they wished to retain or add, which is the process characteristic of the Bronze Age. Now, in Thailand, they haven't found these earlier sequences but only the very advanced bronze. And so the question arises of *where* those earlier sequences took place. I believe they took place in the Near East where we've found the evidence, and that ancient prospectors, who ranged very widely looking for tin because it was so rare, got as far as Thailand and of course brought with them knowledge of an already highly developed metallurgy. On the other hand, it could be that we'll find evidence of the earlier sequences in Thailand, or that in Thailand men started with tin since it was abundant there and only later added copper. In other words, we may discover that whereas metallurgy started in the Near East with copper, gradually adding tin to make bronze, metallurgy started independently in Thailand with tin, gradually adding copper. That's possible, although I believe the weight of present evidence argues against it."

Giving Rainey a chance to reply, I reported Wertime's remarks to him. "In the first place," Rainey said, "it seems to me that we will unquestionably demonstrate that advanced bronze manufacture is considerably older in the Far East than in the Near East. In the second place, we already have discovered great deposits of ancient slag in northern Thailand which we are beginning to analyze in

an attempt to work out the development of bronze manufacture. We can't date that slag at the present time, but we expect to be able to do so. Thus, the potential for working out the earlier stages of metallurgy is there. They've done all of that in the Near East because they've been working much longer over there. We're really only getting started in Thailand."

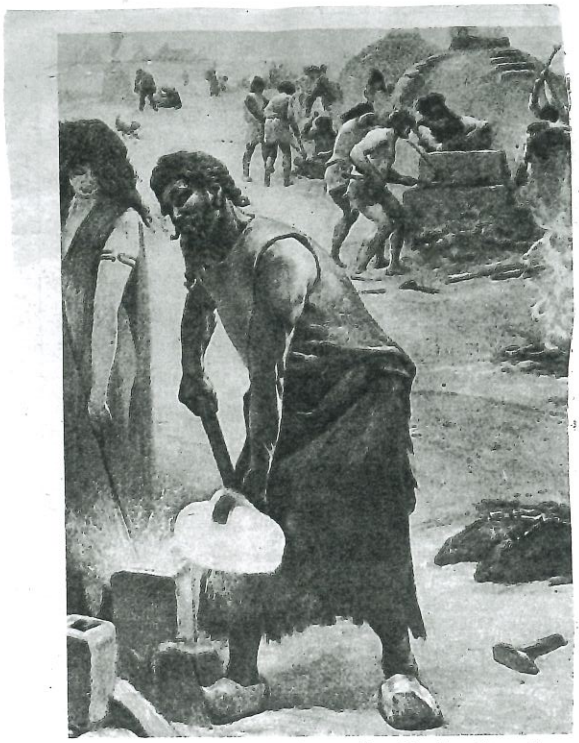
■

Every stride forward in the archeological investigation of Ban Chieng pots has been accompanied by an intensification of the zeal with which they have been traded on the antiquities market. And not surprisingly, as their significance becomes increasingly well understood, the price of the pots goes up. As that escalation occurs—the antiquities trade being what it is—underhandedness of many kinds becomes commonplace. The present character of this trade was well exemplified last January by a major sale of Ban Chieng pots at New York City's leading auction gallery, Sotheby Parke-Bernet.

It was uncanny to see as many as 43 pots so openly displayed and even pictured in a glossy catalogue. Two years before, in an effort to stop the plundering of an archeological treasure, the Government of Thailand outlawed the digging up, selling or export of antiques and even threatened to impose the death penalty against violators. Accordingly, these 43 pots had to have been slipped out just before the ban went into effect, or else smuggled more recently by persons willing to gamble with their lives.

Stranger still, once the auction at Parke-Bernet got under way, some fast-paced bidding appeared to propel the sale price of some pots up to $1,900. The fact was, however, that very few sales were really being made. The manner in which the auctioneer called out the escalating series of prices made it impossible to tell whether the last price announced was in fact a successful bid from the floor or instead the declaration of the so-called reserve price of the consignor who was refusing to let his pots go for less than he thought them worth. The result was that a series of relatively modest bids, and failures to consummate sales, took on the appearance of land-office buying.

Strangest of all, some of the pots which actually did change hands that day were



Bronze Age technology: Early metallurgists alloy tin and cop per to make bronze. Some archeologists now think Southeas Asians were the first to master the arts of community life

later discovered to be fakes. The high-toned auction house never accepted the contention that some of the pots may have been 6,000 years younger than its catalogue had specified, but finally allowed that the decorations on some had been freshly painted, and that the repainting had been artfully disguised by means of mud which had been baked over the fresh paint in an effort to create a patina of seemingly great antiquity. On the strength of that, at least a couple of sales were rescinded.

■

Plundering, illegal trafficking, a sham (although legal) auction and forgery—it is a seamy business. And yet, none of these practices is unusual in the antiquities trade. Indeed, the manner in which Ban Chieng pots are being removed from prehistoric burial sites in a far-off corner of the world, sometimes falsified, and eventually placed on the mantlepieces of well-to-do Americans, and in the display cases of museums, is characteristic of a trade only rarely exposed to public view.

By about 1970, word was circulating among the more well-connected art and antiquities dealers in Bangkok that the red-painted pottery excavated in the northeast had been made as early as the Fifth Millenium. As a result these dealers began to amas collections. Villagers in th northern provinces soo learned that they could ear more money digging up ol pots than they could farmin rice or weaving cotton, an so a sizable amateur excavat ing industry developed. It pai off, too. A recent visitor t Thailand reports that a num ber of new houses have been built in Ban Chieng in the last two years on the proceeds of pottery digging.

The pots were not hard to find. The village of Ban Chieng consists of several thousand wooden cottages propped up on stilts on a mound of earth which is roughly a mile square and 10 to 15 feet high. To an archeologist, quite clearly, this elevation is an ancient burial mound. And sure enough, just beneath the surface, prehistoric graves are found in large number. Typically, the skeletons in them are remarkably complete. Ceremonial pots are found to either side of the skull and sometimes clustered in a "nest." Glass beads, bronze bracelets and bronze ax heads are discovered as well.

The pots come in a marvelous variety of shapes and sizes but the most interesting aspect is the red decoration. Some of the designs look like greatly magnified fingerprints. Some are more complex, combining swirling designs with geometric shapes and patterns —all of which are believed to have had some magical significance. Other designs are thought to be zoomorphic—derived from the shapes of animals. Still others have a strong sexual suggestiveness. Indeed, these prehistoric potters were not the least bit shy about sexual expression. One female skeleton was found at Ban Chieng with a terra cotta phallus placed between the legs.

Despite the Thai Government's 1972 ban, the digging and trade have continued unabated, for several reasons. Many Thai villagers found they could dig profitably at night directly under their own homes. Today, a number of the stilt-supported cottages at Ban Chieng have curtains draped around the exterior for the obvious purpose of concealing excavations. Clandestine trade proved equally impossible to police. In addition, since there is a tradition of bribing local officials as a means of clearing the way for the smuggling of antiquities, it was most unlikely that the practice could be interrupted by a high-minded but unenforceable Government regulation. Finally, the United States, among other rich countries, has done practically nothing to prevent the bring ing of illicit antiquities to its shores. A 1970 UNESCO treaty which would curb the importing of looted art has been signed by 22 nations, including the United States, but still awaits the necessary implementing legislation of the U.S. Congress. One reason for the delay, as reported in The Times last December by Grace Glueck, is the effectiveness of a recently formed organization called the American Association of Dealers in Ancient, Primitive and Oriental Art, which hired the prestigious Washington law firm rnold & Porter to lobby against this legislation.

Here is a typical case illustrating the way in which a couple of Ban Chieng pots made their way into the hands of an American collector. Two or three years ago, Joel Ullman, a jovial, wise-cracking part owner of the Madison Avenue gallery Art Asia, Inc., who has been making collecting trips to Thailand for some 12 years, happened to be invited by a Thai dealer he knows who lives on the outskirts of Bangkok to inspect "some unusual objects." Ull-

man, who takes a wry delight in the "Terry and the Pirates" intrigues into which his work leads him, recalls that the Thai dealer, before displaying the objects, furtively closed his shutters and then produced a box of Ban Chieng pots that he had kept hidden under his bed. Ullman bought two for $400.

Rather than entrust the pots to a professional smuggler, Ullman decided to risk bringing them out himself. Just before catching a plane to Hawaii, he went to a local tourist shop, purchased about $20 worth of wooden salad bowls, paper umbrellas and cheap teakwood carvings, had them all rather sloppily packed, then tucked the pots underneath, finally outfitted himself with a loud floral sport shirt, slung a tourist-type camera around his neck, and in this garish attire proceeded to the airport. "They took one look at me at the bomb-inspection counter," he recalls with a chuckle, "and told me to get on the airplane. They weren't *about* to dig through all of that junk." In New York City, he stored the pots in the basement of his gallery.

Enter Mrs. Doris K. Rubin, a genteel Park Avenue matron who fancies Oriental art. She had read about Ban Chieng pots in a technical journal and she had discussed them with Martin Lerner of the Metropolitan Museum of Art while she and her husband were traveling through India, Nepal and Sikkim on an art tour for which Lerner had served as a lecturer. Thus, it was with great delight that Mrs. Rubin learned Joel Ullman had a couple of these oddities stashed away, and when he produced them she snapped them up for $900. The pots are now on a shelf in Mr. Rubin's study surrounded by Indian miniatures, a Khmer bronze and a Tibetan prayer rug.

In the short while since Mrs. Rubin's acquisition, the price of Ban Chieng pots has nearly doubled. The best examples are beginning to fetch prices approaching those of the better-known Chinese neolithic pottery, and they may go higher still. In such a market, forgeries become common and difficult to detect. One American dealer now estimates that 90 per cent of the pots coming out of Thailand today are fakes.

Lerner of the Metropolitan explains one of the ways in which Ban Chieng pots are doctored. The farmers who supply the Bangkok dealers, he says, "learned that they got paid better for the nicely decorated pots than for the plain ones, and so they became very adept at 'improving' faded coloring and actually painting on their own fanciful designs."

What lies ahead for the Ban Chieng pots? The archeological investigation, of course, is continuing, and there may well be important announcements forthcoming from Rainey, Gorman and others. Some of the pottery itself is on display now at the Brooklyn Museum, the Newark Museum and the Cleveland Museum, among others. Martin Lerner has acquired a couple of examples for research purposes at the Metropolitan, and he says he is on the lookout for four or five superb (and legal) Ban Chieng pots for display. When he finds them, considering the fact that the Metropolitan recently sold a prominent linen manufacturer the right to reproduce patterns from its collection on sheets and pillow cases, it may well be that at least a few Americans will find themselves being lulled to sleep by the swirling, magical markings of early man. ■

Archeologist Chester Gorman with some of his team's pottery discoveries on display in Ban Chieng, one of the Thai villages that may have been the birthplace of civilization.

N.Y.T. Magazine; Aug. 3, 1975

Letters

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try] dates and C-14 [radiocarbon] dates and some agreements between the two. We also need such dates in well-stratified association with objects of bronze. The dates themselves are of little use if we cannot relate them to archeological contexts and use them to date actual assemblages of material. This is not yet possible in Thailand.

Then, assuming that the early development of tin bronze in Thailand becomes an established fact, it will be necessary to relate this development to the rest of the ancient world. Is Thailand to be seen as a central area, in touch with and exchanging ideas and influences with other parts of the world, or were developments in Thailand only of local significance and of no importance for the wider world? If there was contact between Thailand, the Persian Gulf, and even the Mediterranean, then where is the archeological and historical evidence for such contacts?

Finally, there is the question of priority. There is still no evidence whatsoever for the theory that tin bronze in Thailand is as early as the fifth millennium B.C. But, on the basis of a long-established archeological sequence for prehistoric Anatolia, tin bronze was present at Mersin, in southeastern Turkey, by about 4300 B.C.

Mr. Honan has an enviable ability to master complex material and describe it in an intelligent fashion, but J. E. (not T. A.) Dayton and his article in World Archeology have nothing to do with the dating of the Vinca culture. Colin Renfrew does, but even Renfrew was not the first to suggest that something was wrong with the accepted dating of cultures in prehistoric Europe and that the European material was probably much earlier than commonly assumed. If any one person is to be given credit for that, it should be James Mellaart and his article in Antiquity for 1960.

The key sentence in Honan's article is the quote from Rainey to the effect that: We're really only getting started in Thailand. I hope that Honan returns to the subject of Ban Chieng and the prehistory of Thailand in about five years. The controversies and scholarly disagreements will still be in full force, but at least by then we should have a better idea of what we are arguing about.

J. D. MUHLY
Associate Professor of
Ancient Near Eastern History,
University of Pennsylvania
Philadelphia

Wait a while

William H. Honan's article
on "The case of the hot
pots — an archeological
thriller" (June 8) is an excel-
lent presentation of some very
complex problems and con-
troversies. I hope that it will
call attention to the potential
importance of Thailand in
world prehistory and to the
disastrous effects of the ille-
gal trade in antiquities that
exists in Thailand, as well
as in many other parts of
the world. Regarding the his-
tory of early metallurgy and
the possibility that bronze
metallurgy was first devel-
oped at a site such as Ban
Chieng, it is necessary to clar-
ify several points in Mr. Ho-
nan's presentation.

There is a tendency today,
shared by all too many schol-
ars, to regard the latest theo-
ry as the best theory, , ac-
cept the most recent article
on the subject in a completely
uncritical fashion in order to
be "up-to-date," and to con-
sider all those who fail to do
likewise as hidebound ob-
structionists. The fact is that
there are good reasons for
skepticism regarding the
claims made for Thailand. The
first is the lack of control
over the dating of material
from Southeast Asia. We still
cannot tell, just by looking at
the pottery or other artifacts,
whether the material is from
3000 B.C. or 300 B.C. We
know almost nothing about
the prehistory of the area.
What is important about the
current excavations of Ches-
ter Gorman is that they hold
out the possibility of provid-
ing our first stratified chrono-
logical sequence for an ex-
tended period of Thai prehis-
tory.

The second problem is that
we need more than TLD
[thermoluminescent dosime-

(Continued on Page 46)

Bronze objects and a pottery vase found in Northeast Thailand

New Bronze Age Date Reported

By JOHN NOBLE WILFORD
Special to The New York Times

PHILADELPHIA, May 13—A lively, prosperous Bronze Age culture has been found to have flourished on a remote plateau of northeastern Thailand more than 5,600 years ago—a surprising discovery that, archeologists believe, challenges many long-held assumptions about the beginnings of technology and civilization.

A team of American and Thai archeologists displayed here today bronze implements and jewelry, unearthed over the last two years at the Thai village of Ban Chiang and other sites, that have been dated as far back as 3,600 B.C. That is about 600 years earlier than the established dates for the oldest known Bronze Age artifacts in the Middle East and perhaps as much as 2,500 years before bronze came into use in India and China.

Codirectors of Project

Moreover, the bronze spearheads, anklets and bracelets were said to be sufficiently sophisticated, indicating evidence of smelting and suggesting that the people of Ban Chiang culture had developed an advanced metallurgy long before 3,600 B.C. The scholars have generally regarded the Tigris-Euphrates Valley as the exclusive birthplace of the Bronze Bronze Age.

The codirectors of the archeological expedition were Dr. Chester Gorman, an assistant professor of the University Museum of the University of Pennsylvania, and Pifit Charoenwongsa, curator of the National Museum of Bangkok. In a statement yesterday they said:

"If our picture of prehistoric man in Thailand is still far from mirror clear, we do have enough evidence to know we are uncovering the remains of a technically innovative society."

The New York Times/May 14, 1976

The decisive evidence came from radiocarbon and thermoluminescence dating techniques, which were applied by scientists at the University Museum. Using the radiocarbon method it is possible to determine the age of an organic material, something that once lived, like bones or cloth, by the amount of carbon-14 still in the material. The thermoluminescence method is applied to inorganic artifacts, such as pottery, to measure the radiocarbon decay of thorium and uranium in the clays since the pottery was fired.

Dr. Froelich Rainey, director of the University Museum, said that the "exciting discovery really makes some specific changes in our ideas about the origin of technology."

Dr. Gorman and Mr. Charoenwongsa said the Ban Chiang discovery should upset the assumption that Southeast Asia played only "a minor and derivative role in prehistoric development." It had been thought that the earliest and dominant technological cultures in Asia were India and China.

Archeologists are also expected to debate for several years other questions raised by the discovery. Did this remote culture really develop bronze metallurgy before the Middle Eastern people? Could the source of the tin—bronze is an alloy of copper and 10 percent tin or less—for the Middle Eastern bronze have been Southeast Asia? It is not known where the early artisans of the Middle East got their tin to make bronze.

Ban Chiang began to intrigue archeologists in the early 1960's. It is a poor farming village populated by emigrants from Laos, who arrived about 200 years ago and who are assumed to bear no relation to the Bronze-Age Ban Chiang people.

A visitor from the Thai Fine Arts Department noticed in 1961 a number of small potshards around the village. They were stacked up in the villagers' houses or even casually used as food dishes in the chicken yards. The initial tests on the materials yielded an incredible age — 4,000 B. C., which was met with disbelief in many archeological circles.

Then the Thai Government and the University Museum organized the Northeast Thailand archeological expedition, and the diggings began in earnest. More than 300 sites have been identified over a 200-mile-wide area of the Khorat Plateau.

At Ban Chiang, the most revealing site, the archeologists dug 22 feet down, exposing artifacts from six distinct periods ranging from 3,600 B.C. to 250 B.C.

The Roots of Man

Scientists are constantly pushing back the frontiers of archeology and anthropology. Last week, researchers in Thailand and at the National Cancer Institute in Maryland were pondering theories that could produce a dramatic re-evaluation of one of science's oldest questions: the origin of man.

DAWN OF THE BRONZE AGE?

For archeologists, Southeast Asia has always been something of a cultural backwater—nothing to compare with Egypt, Greece or the lands once nurtured by the Tigris and Euphrates rivers. Then, just ten years ago, a vacationing Harvard student found some curiously painted pots in a road cut near the dusty village of Ban Chiang in northeast Thailand.

Today, scientists at Ban Chiang are working round the clock to keep ahead of looters. They are convinced that they have found the remnants of one of the most ancient centers of civilization yet unearthed—the dwelling place of a Bronze Age people whose metallurgy may eventually establish them as even more advanced than were the inhabitants of Mesopotamia 5,000 years ago. Just where these antique Asiatic people came from is a mystery. But from spearheads, pottery and other artifacts discovered in their burial mounds, there is no question that their civilization is at least as old as that of the Middle East.

The area of excavation covers a wide arc of Thailand's Khorat Plateau, extending for about 200 miles from the east to the southwest of Ban Chiang (map). Archeologists think that the region contains as many as 300 ancient burial mounds and habitations. Ban Chiang is the largest and deepest of the 60 sites located to date, and contains the remains of more than 15,000 individuals.

At first, most scientists were chary of the new finds, and even after the new technique called thermoluminescence* indicated the extraordinary date of 4,000 B.C. for some fragments, the experts thought that it was the method that had gone awry.

But when further dating confirmed the ages and new digging yielded a cornucopia of pots of different varieties, it became clear that Ban Chiang was an archeological treasure house. Two years ago, an international team headed by Chet Gorman of the University of Pennsylvania Museum and Pisit Charoenwongsa of the National Museum of Bangkok began a major dig in the area.

Thus far, the excavation has produced 18 tons of pottery, stone and metal items, 126 human skeletons, many animal fossils—and a picture of an extraordinarily sophisticated ancient society that occupied the region from about 3600 to 250 B.C. The prize item of the collection is a 5,600-year-old bronze spear point that is almost certainly the oldest artifact of this particular alloy ever found anywhere.

Ib Ohlsson

The major difference between the spear point and more ancient Mesopotamian bronze artifacts is the content of tin in association with copper. Middle East bronze older than 5,500 years inevitably consisted of copper and arsenic, because the Mesopotamians of the time had no ready source of tin. Written records indicate that they happened on a supply of the metal "from the east" somewhat before 3000 B.C. The Ban Chiang discovery thus raises the possibility that Thailand gave the Middle East its tin at least 2,000 years before any known contacts between these parts of the world.

Smelters: The ingenuity of the Ban Chiang civilization, which according to Gorman came to the area at least 7,000 years ago, did not end with bronze making. Its metallurgists were smelting iron before 1500 B.C., at the same time as the Hittites of Asia Minor, and its artists were fashioning painted pottery in many ways superior to contemporary Chinese art work. "I believe we have only begun to appreciate just how advanced these people were," said Gorman last week. "This was a very vibrant and sophisticated society. In terms of metallurgical skill, it seems to be unparalleled anywhere in the world." Gorman thinks that the people of Ban Chiang possessed all the skills, materials and social order necessary for urbanization—and he now plans to start looking for evidence of ancient cities in the area.

If the finds at Ban Chiang lead to the discovery of a still older society, archeologists may decide that Southeast Asia is a more fruitful area for research on ancient man than any place yet studied.

*Thermoluminescence gauges the age of pottery by heating fragments and measuring their radioactivity.

Grave at Ban Chiang: The tin connection

ASIAN GENESIS?

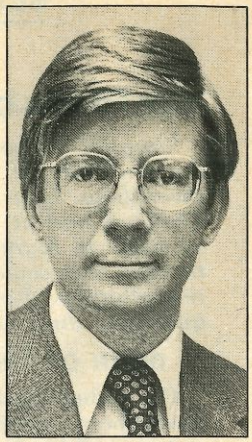
Where did mankind originate? Fossil studies by Richard Leakey and other anthropologists suggest that early man emerged in Africa more than 3 million years ago, but two virologists have now produced evidence for an Asian genesis of the human race.

Raoul E. Benveniste and George J. Todaro of the National Cancer Institute came up with the new theory after analyzing small lengths of DNA, the stuff of life, known as viral genes. The viral genes of modern man, they found, resemble those of Asian apes more closely than they do the viral genes of African primates. The researchers conclude in Nature magazine that man probably evolved from his nearest primate relatives about 14 million years ago in Asia. Not until 11 million years later, they suggest, did man establish himself in Africa.

So far, anthropologists have treated the new theory with restraint. "It's a single piece of evidence, and I'm not sure how much can be made of it," said Donald C. Johanson of the Cleveland Museum of Natural History, who has made extensive fossil finds in Ethiopia. "But I personally would not rule out Asia as the prime area for the beginning of man." Todaro and Benveniste meanwhile are furthering their laboratory studies, in hopes that they may also provide clues to man's susceptibility to cancer.

—PETER GWYNNE with STEPHEN G. MICHAUD in Philadelphia and bureau reports

By George F. Will



Taking a Ride With Ronnie

Ronald Reagan recently found himself in Detroit, in front of a spiffy audience, the Economic Club. With the insouciance that makes politicians do daring deeds with careless smiles, he praised the automobile. His words were well received, especially those deploring the yoke of government oppression under which the automobile industry labors. Then his listeners went home to cold stone slabs in Grosse Pointe dungeons, or wherever the oppressed lay their weary heads.

Reagan's Detroit message is worth pondering, and not just because one in ten American jobs is related to the manufacture, maintenance or operation of automobiles. His words display a troubling aspect of his brand of conservatism.

Reagan warned that "the automobile and the men and women who make it are under constant attack from Washington." The attackers are "elitists . . . some of whom seem obsessed with the need to substitute government control in place of individual decision making." He cited the Energy Policy and Conservation Act of 1975:

". . . It mandated gasoline mileage standards which by 1985 will have the effect of forcing Detroit to make some 80 to 90 per cent of its autombiles subcompacts or smaller . . . The bill regulates the marketplace, dictates to the consumer and, in the process, will make Detroit's unemployment problem worse than it already is. In fact, because it takes less manpower to make these small cars . . . the unrealistic fuel-use standards . . . would cost at least 200,000 Michigan workers their jobs . . ."

OFFENSIVE STANDARDS

Today the booming automobile industry does *not* resemble a patient etherized upon a table. The law that Reagan believes may etherize Detroit mandates a 50 per cent increase (based on the 1973 average) in fuel efficiency by 1980.

In 1973, the new-car average was 13.2 miles per gallon. The new law requires a 1980 average of 20 mpg. The industry's compliance will "produce" 2 million barrels of oil a day. That is like constructing another Alaska pipeline. The lash of the law, not market pressures, will accomplish this. And it makes economic sense. The cost to the industry of complying with the law will be passed on to car buyers. But that cost will be much less than the higher fuel costs consumers would have paid to operate the less economical cars which, but for the new law, Detroit would have produced.

The 1985 standards that offend Reagan require a 27.5 mpg new-car average. The standards petrify General Motors, which guesses that "85 per cent of all the new cars built in 1985 and after can be no heavier than today's Chevrolet Vega."

GM is underestimating itself. Performance standards will continue to stimulate technological innovations; the Vega is not the last word in combining size and efficiency. And new technologies may not cause unemployment. They may be especially labor intensive. Anyway, the labor content of automobiles varies less with their size than with the optional equipment that adorns them.

The national interest in oil conservation is patent. Domestic production is in the sixth year of decline, a million barrels a day below the level when the embargo began in 1973. We are importing 42 per cent of the oil we use, up from 29 per cent in 1972. One week this spring we set a dismal record: imported oil, and products, exceeded domestic production.

THE BIG-CAR COMEBACK

Automobile efficiency is the heart of the matter. We burn 50 per cent of our oil on highways. In the first eight days of July 1975, vacation travel days, Americans used as much oil as the U.S. Armed Forces used in 1944, the most strenuous year of World War II. But there remains the unassailable core of Reagan's case against the new law: it "regulates the marketplace, dictates to the consumer . . ." Indeed it does.

Everything we know about past and present consumer preferences, and the American psyche, supports Reagan's judgment that unfettered consumer demand would cause Detroit to produce different cars—heavier and more powerful—than Detroit must produce to comply with the law. Big cars are staging a strong comeback. *Vox populi, vox Dei.* Then the voice of God is the voice of the Detroit woman who, when car shopping in May, declared: "I want to buy a car when it's still a car, and not one of those small things."

Volumes of U.S. history are packed into that woman's disdain for "small things." And the essence of Reagan's conservatism is in his defense of her sovereign right to indulge her disdain.

Of course, a government must be generally predisposed to respect the ordinary desires of ordinary people; otherwise it cannot live in harmony with the governed. But Reagan seems more than just generally predisposed. In his enthusiasm for the market mechanism is an unsettling indiscriminateness, a breath of dogmatism and perhaps a confusion about the purpose of government.

There are sober people of understanding and goodwill who believe the new fuel-efficiency standards are mistaken. Reagan's criticism *is* defensible. But the fact that the standards interfere with market choices is not itself a sufficient ground for defense.

At birth (say, for fun, in 1776: the publication of Adam Smith's "Wealth of Nations") the free-market doctrine was utilitarian. It subsequently has become, in some circles, slightly mystical. Some conservatives cling to it with the unreasoning intensity of swimmers clinging to rocks in a riptide.

A free market is a nifty arrangement for recording preferences and allocating resources accordingly. But there is a point at which the obeisance of political persons before market decisions is, like other forms of populism, an excuse for not leading. At that point free-market principles are less an aspect of their political philosophy than a substitute for political philosophy.

A RESPONSIBLE STATE

The state is more than a device for serving the immediate preferences of its citizens. Its purpose is to achieve collective objectives, and the collectivity—the nation—includes a constituency of generations not yet born. That is why the state, unlike an economic market, has *responsibilities*, and must look down the road farther than citizens generally look in their private pursuits. Thus the state's legitimate purposes are more complex than the sum of citizens' private purposes; the public interest is not just the automatic, unguided outcome of the maelstrom of private interests. A conservativism that cannot comfortably accommodate these elementary truths is unserious, and irrelevant to the *political* economy of our nation.

Surely the art, the drama of democratic government derives from this fact: the long-term interests of the nation frequently are not the short-term desires of the majority. Reagan's Detroit remarks, including the tiresome, reflexive denunciation of "elitists," raise doubts about his understanding of that.

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A thermoluminescence series from Thailand

A series of 26 potsherds from six early sites in Thailand has recently been subjected to thermoluminescence analysis by the Museum of Applied Science Centre for Archaeology at the University of Pennsylvania Museum. Of these 26 sherds, 22 proved to be datable, yielding a sequence of considerable interest. In this note Bennet Bronson, of the Field Museum of Natural History, Chicago, and Mark Han, of the University of Pennsylvania Museum, list and discuss these dates.

The sample from which the sequence derives was comparatively large and well-stratified. Such samples are as yet unusual in the history of archaeological thermoluminescence dating (cf. Aitken, 1968; Ralph and Han, 1969). Furthermore, the results were reasonably satisfactory, being consistent both mutually and with published radiocarbon dates for the area in question; attempts at using thermoluminescence are not always so successful. And finally, the sequence pertains to a rather new and poorly dated archaeological region where, in spite of the great apparent antiquity of agriculture, metallurgy, and pottery-making (cf. Solheim, 1969), the local chronology depends almost entirely on a handful of radiocarbon dates and tenuous stylistic parallels with other, better-dated parts of the world. The dates presented here increase by more than a quarter the total number of dates of any kind that are available for the prehistory and protohistory of Thailand.

The dates are presented in Table 1. The sherds in the sample come from these sites:

Ban Chiang. A cemetery site in north-east Thailand, excavated in the mid-sixties by Vidhya Intakosai of the National Museum of Thailand and subsequently by various amateur archaeologists. Although unpublished, Ban Chiang has acquired some fame as the source of a red-on-white painted ware that resembles the Yang Shao pottery of China. The site is rumoured to contain copper or bronze artifacts.

Non Nok Tha. A slightly later cemetery and residential site, also in the north-east, extensively excavated by the University of Hawaii in the late sixties (Solheim, 1968). It has produced evidence for both tin bronze metallurgy and (?dry) rice cultivation at a surprisingly early date—according to the earlier of two radiocarbon sequences, the 3rd millennium bc (Bayard, 1971b).

Ban Kao. A cemetery and residential site in western Central Thailand, of somewhat uncertain date. Said by the excavator (Sorensen and Hatting, 1967) to be Neolithic and to have connexions with the Chinese Lungshanoid complex.

Lopburi Army Camp. A bronze- and perhaps iron-containing cemetery site in Central Thailand, tested by Vidhya in the early sixties.

Chansen. A moated town site just north of Lopburi, excavated jointly by the University Museum and the National Museum of Thailand in the late sixties (Bronson, n.d.). The upper levels of the site contain a protohistoric and early historic sequence that extends from Phase II (dated by C14 to AD 0–250) to Phase VI (dated indirectly to about AD 800–1000). The lowest strata represent a Metal Age occupation, designated Phase I, with bronze and iron implements and inhumation burials.

Ban Dai. A cemetery site currently being excavated by Vidhya some 50 km. north-west of Chansen. The graves produce both bronze and iron.

Site	*Sample No.*	*Provenience*	*Date*
Ban Chiang	104	Surface?	BC 4630 ± 520
	271	70–80 cm. level	BC 3570 ± 480
	273	130 cm level	BC 3590 ± 275
Non Nok Tha	276	Burial 90, Level III	BC 2420 ± 200
	277	Burial 14, Level ?	BC 2995 ± 320
	278	Burial 73, Level IV	BC 2535 ± 200
	279	Burial 73, Level IV	BC 2350 ± 150
Ban Kao	102	Excavated? Surface?	BC 290 ± 255
Lopburi	103	Burial. Nr not known	BC 700 ± 166
	259	Burial. Nr not known	BC 1224 ± 300
Chansen I	280	Trench Eb, Lot 9	BC 1340 ± 200
	281	Trench P, Lto 8	BC 650 ± 200
Ban Dai	261	0–30 cm. below surface	AD 173 ± 150
	262	0–30 cm. below surface	AD 714 ± 120
	263	0–30 cm. below surface	AD 1 ± 100
	264	0–30 cm. below surface	AD 1166 ± 100
	274	Surface find	AD 395 ± 150
	275	Surface find	AD 35 ± 110
Chansen VI	283	Trench Dg, Lot 2	AD 300 ± 120
	284	Trench Ka, Lot 1	AD 1210 ± 100
	285	Trench M, Lot 2	AD 1340 ± 100

Table 1. Thermoluminescence dates

The estimates for Ban Chiang fit well with the hypothesis, arrived at through typological analysis (Solheim, pers. comm.), that the site is contemporary with or earlier than the lowest strata at Non Nok Tha. A 4th- or even 5th-millennium date is also not inconsistent with the Yang Shao parallels mentioned above. The fact that copper or bronze may be present at Ban Chiang increases the interest of this early dating.

Along with the evidence for rice cultivation and the smelting and casting of tin bronze, the soils of Non Nok Tha have produced no fewer than 26 radiocarbon dates. These fall into two conflicting sequences, one indicating a span of occupation that covers the 3rd and 2nd millennia

bc, and the other indicating that the occupation began and ended about a thousand years later. Bayard's (1971a) suggestion that the latter sequence may represent contamination from a modern source is supported by the thermoluminescence results.

The single Ban Kao date is probably not to be trusted—not only is the provenience of the tested sample uncertain (it may be a surface find) but there are solid grounds for believing that Ban Kao is earlier than the 3rd century BC. Although copper or bronze artifacts are known to occur in at least some burials at related Kanchanaburi 'Neolithic' sites (Sood Sangvichien, pers. comm.), Ban Kao probably contains no iron. Thus, considering that iron seems on present evidence to have become generally diffused throughout Central Thailand at about 1000 BC (the point is discussed below), it would be unwarranted to push this complex down further than the terminal 2nd millennium.

Chansen I, the Lopburi Army Camp, and Ban Dai all belong to a group of sites (the others include the lower levels of Phimai, Huai Duk near Phitsanulok, and perhaps Phong Tuk) which can be called Late Metal Age—that is, they contain (1) iron as well as bronze artifacts, and (2) inhumation burials, showing that they antedate the diffusion of those Indian-derived cultural traits (including cremation) which mark the beginning of the protohistoric period in the area. The exact dating of these sites is problematical. Considering that Indian influences reached Chansen at about the time of Christ (Bronson, n.d.) and that none of the sites is geographically isolated or, indeed, more than a few-score kilometres distant, it seems to follow that all of them have a BC date. The year AD 1, however, is only a late limit; at some sites, the late Metal Age occupations must have begun and ended long before then.

The main reason for thinking so is that iron-containing cemetery sites are so numerous (in view of the very small amount of exploration that has been done) and so different from each other—different enough in terms of the artifacts they contain for one to postulate that they stretch out over several millennia. Since Non Nok Tha contains no iron and lasts until at least 2000 BC, a several-thousand-year time-span for the Late Metal Age is clearly excessive; moreover, there are other pure bronze sites—Kok Charoen (Watson, 1968) and possibly Ban Kao—which must be squeezed into the interval between terminal Non Nok Tha and the introduction of iron. It seems that the best solution is to accept the Chansen I and Lopburi thermoluminescence dates at face value and to place the beginning of the late Metal Age in the very late 2nd millennium BC. This would mean assuming that two sites, geographically close and culturally quite distinct, are contemporary with each other, but such an assumption makes sense. Any interpretation must take account of the apparent fact that Central Thailand during the late prehistoric period was a region of extraordinary cultural diversity.

The Ban Dai dates are less convincing than those of the other two iron inhumation sites. Three of the six determinations (AD 395, 714, and 1166) are improbably late. While it is vaguely possible that the practice of inhumation may have lingered on at Ban Dai for one or two centuries after the beginning of the Christian era, AD 300 is the outside limit. The ceramics of the later part of the protohistoric period (between AD 300 and 600) have a very wide distribution in the neighbourhood of Ban Dai (they are found for instance, at Chansen, U Thong, Huai Duk, Muang Bon, and U Ta Phao-Chainat) and are easily recognized. They do not at all resemble the vessels found in the graves at Ban Dai. The three earlier dates (AD 1, 35, and 173) may be all right but should be accepted only with the reservation that their stratigraphic provenience is none too good. The samples in question came from the fill of very shallow graves with bottoms less than 30 cm. below the surface; moreover, none of them belonged to vessels which could be definitely identified as part of the actual grave furniture. There is thus a clear chance that all the samples are intrusive. The presence of a large earthwork-surrounded early historic period (AD 600–1000) town site about 1 km. distant suggests that a good deal of activity took place at the cemetery area long after the graves were dug.

The Chansen VI datings are also too late,

though not so far off as those of Ban Dai. Various lines of reasoning that will not be gone into here (Bronson, n.d.) make it seem that the sixth phase at Chansen cannot have lasted much beyond AD 1100 and cannot have begun earlier than AD 800. Sample 283 was a rather nondescript sherd, and its early dating can perhaps be explained by assuming it was redeposited from a lower stratum. But samples 284 and 285 were both from highly characteristic Phase VI vessels making their 13th- and 14th-century datings difficult to explain. Either the above-mentioned lines of reasoning are quite wrong or there is an error-producing factor involved (later re-heating?) which the analytic methods cannot yet control.

Neither the Chansen VI nor the Ban Dai results, however, are wildly unreasonable. Only the Ban Kao date is so far from what one expects it to be as to cast doubt on the credibility of the thermoluminescence technique itself. In general, and especially with regard to those samples which are from deep, well-stratified sites (Non Nok Tha and Chansen) and from highly distinctive vessels (Ban Chiang), the dates shown in Table 1 are consistent and believable. They are at least as confidence-inspiring as most comparable series of radiocarbon dates.

The fact that thermoluminescence dating seems to work here has two important consequences. First, it increases the likelihood that the technique can be trusted in other cases as well, that it will produce a passably accurate chronology even in parts of the world like South East Asia where corroborative radiocarbon and historical datings are nonexistent. Judging by this one set of results, thermoluminescence in archaeology has begun to come of age and need no longer be considered an experimental method suited mainly to the authentication of museum artifacts. When and if laboratory facilities and technicians become available, excavators should be able to use it as a standard dating tool.

Second, one is encouraged to accept these particular dates with only a normal amount of caution. The thermoluminescence determinations for Non Nok Tha and Ban Chiang fit so well with the radiocarbon datings that one feels some confidence in the hitherto controversial assertions about the 3rd or 4th millennium origins of South East Asian rice and bronze-using. And the late 2nd millennium dates for Chansen I and the Lopburi Army site, although far from solidly established, must be taken seriously. They are the first evidence obtained, by any method, that bears on the problem of when the use of iron arrived or was discovered in South East Asia. That this seems to have happened so early, a half-millennium before iron is generally supposed to have appeared in China and India, is surprising but not incredible. It is merely one more element in the pattern of remarkable precocity that is currently emerging as the leading theme of South East Asian prehistory.

Postscript. Since the writing of this article, it has come to the authors' attention that five other T-L dates exist (see Zimmerman and Huxtable 1969, 106) which are relevant to the Central Thailand sequence. Three are from Tha Muang at U Thong, a protohistoric and early historic site in western Central Thailand; they cluster neatly in the time range ad 800–1100. Two are from Kok Charoen in the north central part of the country; the dates are given as 170 bc and 980 bc. Since Tha Muang is stylistically connected with the later phases at Chansen (i.e., Chansen III-VI) and since Kok Charoen, as already stated, appears to be a late Early Metal Age site, neither of these groups of determinations conflicts seriously with the dates presented above.

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