



The Joseph Needham Foundation for Science & Civilisation (Hong Kong)

李約瑟科技與文明基金會

and

Needham Research Institute

李約瑟研究所

present

The Twelfth Joseph Needham Memorial Lecture

Hong Kong Central Library, 5:00 PM, Friday 23 March 2018

and

Jointly with



香港中文大學

The Chinese University of Hong Kong



香港科技大學

THE HONG KONG UNIVERSITY OF
SCIENCE AND TECHNOLOGY

present

The Joseph Needham Symposium on Early Cultural and Scientific Transmission across Eurasia with China

Chinese University of Hong Kong and Hong Kong University of Science and Technology

26 – 27 March 2018



Dr. Joseph Needham
C.H., F.R.S., F.B.A., Sc.D., Hon. Litt.D.
(1900-1995)

The Chairman's Remarks

The Background of the Joseph Needham Memorial Lecture Series

In gratitude to the many benefactors from Hong Kong who responded to the appeal for funding the building of a permanent Needham Research Library in Cambridge in the early 80s, the East Asian History of Science foundation (EAHSF) established an annual lecture for the benefit of the local academic community, students and interested public. The inaugural lecture was presented by Dr. Needham in 1983. Upon his death on 24 March 1995, the series was renamed the “Joseph Needham Memorial Lecture”. Thus far, 16 lectures by distinguished scholars have been presented since 1983.

It is a great pleasure to welcome Professor Martin Jones, Chairman of the Needham Research Institute, and Vice-Master, Darwin College, Cambridge to deliver the 12th JN Memorial Lecture.

The Joseph Needham Foundation for Science & Civilisation Hong Kong

After almost 40 years and in response to the Needham legacy, EAHSF has finally adopted a new name that symbolizes the core values of the EAHSF. With this name change, we are firmly committed to bring the Foundation to the next level of excellence, from linking the local academic community to partnering with the SAR Education Bureau in making the STEM joint series as a “go-to” event among the secondary students. Moreover, our foundation together with the Needham Research Institute (NRI) will endeavour to perpetuate the Needham legacy with vigour.

The Joseph Needham Symposium on Early Cultural & Scientific Transmission across Eurasia with China

This Symposium is an outgrowth of the “Needham Intellectual Heritage Workshop” held at the NRI in July 2015. The title of this Symposium is adeptly selected in tandem with the JN Memorial Lecture to be presented by Prof Martin Jones, and to cover the related cultural and scientific transmission across Eurasia with China. This area is of fundamental importance to all those interested in probing deeper into cross-civilisations from Persia to China, and beyond.

On behalf of the Joseph Needham Foundation for Science and Civilisation and the other organizers, I thank you for your participation and for those of you traveling from overseas, wish you a happy memory of Hong Kong!

Peter L. Lee, Ph.D.

Chairman, Joseph Needham Foundation for Science & Civilisation (JNFSC)
Symposium Organizing Committee

The Twelfth Joseph Needham Memorial Lecture

23 March 2018 (Friday), 5:00 PM

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Hong Kong Central Library
66 Causeway Bay Road
Causeway Bay, Hong Kong

Food Globalization in Prehistory

By

Professor Martin JONES

*George Pitt-Rivers Professor of Archaeological Science, University of Cambridge
Vice-Master, Darwin College, Cambridge
Chairman, Needham Research Institute*

Abstract

After Christopher Columbus opened up the sea routes between the Old World and the New, the world's food supply was transformed, with major crops moving between continents. Several millennia earlier, an equally radical transformation opened up land routes across the Old World, and major crops moved between eastern and western Eurasia. However, this earlier episode of food globalization has only recently come to light, thanks to novel possibilities of scientific archaeology.

In this lecture, the results of those novel methods, and the various crop movements of the 3rd and 2nd millennia BC are explained. Professor Jones will go on to consider some key questions about those movements: first of all, how they happened and what were the corresponding movements of people; secondly, what were consequences of those movements, for the different societies emerging in different regions of the Old World.

Professor Martin Jones

Martin Jones is the first George Pitt-Rivers Professor of Archaeological Science at the University of Cambridge, Vice-Master of Darwin College, Cambridge, and Chairman of Trustees at the Needham Research Institute. For forty years he has published reports of his archaeobotanical research, into the nature and development of agriculture in different parts of the world. In the 1990s, his work expanded from archaeobotany to embrace the novel field of archaeogenetics, subsequently engaging with stable isotope palaeodietary studies. His research group has played a leading role in combining these three methodological strands to investigate the human food quest in the past, and address its implications for present and future food ways.

His early research addressed the development of later prehistoric and early historic agriculture in Europe, and the use of ecological indicators to understand the nature and form of early crop management, and how it was transformed by changing cross-continental connections. He was one of the pioneers in the 1970s of the systematic, site-wide application of flotation methods that subsequently became commonplace archaeological practice.

It was in the context of exploring the advance of molecular archaeology that Jones' group developed and refined a methodological triad bringing together i) the study of archaeological plant and animal remains; ii) stable isotope analysis of this material, for holistic food chain reconstruction; and iii) collated genetic analysis of ancient, historic and extant DNA, for analysis of biogeography and functional gene expression. The development of this methodological triad within Europe led Jones' interest to the early appearance in the European record of crops botanically associated with China, most notably the Asian millets.

Over the last decade, a series of projects led by Jones, and resourced primarily by the *Wellcome Trust*, the *Leverhulme Trust*, *Darwin College Cambridge*, and the *European Research Council* has allowed Jones to collaborate closely with international colleagues to explore and analyze the evidence for a major episode in world agriculture, characterized as '*food globalization in prehistory*'. This protracted episode of long distance contact between Eurasian communities culminates in a mid-2nd millennium BC network of cross-continental movement of primary resources, particularly agrarian resources, underpinning both the potential for multi-cropping that supported a range of states and complex societies, and the network that came to be known as the Silk Road. Much of our understanding of the early agrarian stages of this process has only come to light as a consequence of the methodological triad employed by Jones' group, and outlined above.

Joseph Needham, F.R.S., F.B.A.
Scientist, Humanist and a Great Intellectual

When Joseph Needham died on 24th March, 1995, at the age of 94, the world lost one of its greatest scholars.

Armed with self-taught linguistic skill in classical Chinese, he was the first Western scholar to conduct a comprehensive and comparative study of the history of Chinese science and technology relative to the rise of modern science. By citing many modern scientific and technological advances that originated in ancient China, he authoritatively dispelled a long-held view in the West that China had no science nor made any contribution to modern science.

Joseph Needham, together with his many distinguished collaborators, demonstrated that China and the Near East had made many outstanding contributions in the transformation of ancient to modern science. His monumental work "*Science and Civilisation in China*" has been characterized as "perhaps the greatest single act of historical synthesis and inter-cultural communication ever attempted ...".

Joseph Needham was born in London on 9th December, 1900, the only son of a highly successful Harley Street medical specialist in anesthesia, and an accomplished musician. He was destined for medicine when he entered Gonville and Caius College of Cambridge University. However, he was soon attracted to the evolving modern science of biochemistry, and received a Ph.D. in Chemical Embryology in 1924. His research in the subject was so widely acclaimed that it earned him recognition as the father of chemical embryology. A Foreign Service assignment to China in the early 1940s cemented his fascination with the history of science in China, the field that would dominate his research for the rest of his life.

After the War, he briefly served as the first Director of the Department of Natural Science at the newly formed UNESCO in Paris from 1946 to 1948. Thereafter, he returned to Cambridge, where he was Sir William Dunn Reader in Biochemistry until 1966, and Master of Caius College for 10 years until his retirement in 1976.

He and his wife, Dorothy Moyle, herself an authority in muscle chemistry, were both elected Fellows of the Royal Society in 1941, the first couple ever honored for their scientific contributions by the coveted organization.

Joseph Needham's association with the study of ancient Chinese science and technology was truly unique. In 1937 he met three young graduate students from China doing doctoral research in Biochemistry at Cambridge. Their arrival at the Laboratory completely changed his life. Of the three, Lu Gwei-Djen had the most profound influence on him. She challenged him to explore the tremendous advances and contributions of ancient Chinese medicine, science and technology to the rise of modern science, and encouraged him to study Chinese, which he followed and subsequently mastered so well that he could easily read classical Chinese texts without assistance. With his scientific knowledge and language ability, he was dispatched to China as the Scientific Counsellor at the British Embassy in Chongqing during the Second World War. In this position he provided scientific advice to the then Kuomintang government, and from this position, he rendered a wide range of assistance to scholars, doctors, and others in war-torn China between 1941 and 1945. In appreciation, many scholars gave him original manuscripts, scrolls, and classical Chinese texts that formed the bulk of his collection and reference materials for his work in the "*Science and Civilisation in China*" (SCC) series, and also served as the foundation for the East Asian History of Science Library in Cambridge.

In the meantime, Dr. Lu, after earning her doctorate in nutritional biochemistry at Cambridge, went on to further academic research in the United States during the Second World War and later in the Secretariat of UNESCO in Paris. She was equally influenced by Joseph Needham's new field of interest and eventually returned to Cambridge in 1957 to become his closest assistant and collaborator in the SCC series, and moreover, married him in 1989 after the death in 1987 of Dorothy Moyle Needham. This happy marriage, unfortunately, did not last long, as Dr. Lu-Needham herself passed away in 1991, leaving Joseph emotionally drained until his own death in March 1995.

Joseph Needham was highly respected by both Beijing and Taipei, and received a host of honorary degrees too many to cite here. He was President of the International Union of the History of Science from 1972 to 1975; the first foreign member and Honorary Professor of the Chinese Academy of Sciences and the Chinese Academy of Social Sciences, respectively. He also received the Order of the Brilliant Star from Taiwan. Apart from being elected an FRS in 1941 he was also elected a Fellow of the British Academy in 1971. In 1992 he was elected a Companion of Honour, and was awarded the UNESCO Einstein Gold Medal in 1988.

A man of remarkable energy with an insatiable drive to learning, he could communicate readily in eight languages. A deeply religious Anglican and lay preacher, he will always be remembered as a bridge-builder between the East and the West.

The East Asian History of Science Trust, U.K.
(subsequently renamed the Needham Research Institute)

The East Asian History of Science Trust (subsequently renamed the Needham Research Institute) was set up in England in the 1960s to fund Joseph Needham's *Science and Civilisation in China*, and it continues to support the project and the work of the Needham Research Institute. In 1978, several of Joseph Needham's close friends and supporters in the United States led by the late Dr. Clifford Shillinglaw and Dr. Philip Talbot set up the East Asian History of Science Board, Inc. They worked tirelessly to secure funds from major corporations and non-profit foundations including the Ford Foundation, Carnegie Foundation, Henry Luce Foundation, Kresge Foundation, among others. Apart from the Kresge Foundation matching gift for the construction of the permanent Needham Library, the bulk of the contributions were for the smooth running of the Library. With the major objectives largely achieved over the years, the East Asian History of Science Foundation USA, after consultations with the Needham Research Institute in Cambridge, decided to disband in 2008.

A Hong Kong branch of the East Asian History of Science Trust was established in 1979. It was re-registered as the East Asian History of Science Foundation in 1981 and officially inaugurated by Dr. Joseph Needham in Hong Kong on 14th October, 1981. The Board also used this occasion to launch a series of fund raising activities for building a permanent library and the endowment of the Needham Research Institute. Between 1982 and 1988, the East Asian History of Science Foundation in Hong Kong was instrumental in raising most of the funds for the construction of both the main library building and the south wing addition of the Institute in Cambridge.

Although the fund-raising activities had focused mainly on the building of the library facilities and the endowment of the Institute, the Foundation has also been active in organizing lectures in Hong Kong to promote public interest in the history of Chinese science and technology. Travel grants have also been provided to scholars from China and Hong Kong to the Needham Research Institute. In 1995, EAHSF(HK) awarded a graduate fellowship to Mr. Mei Jianjun of China to attend Cambridge University, where he successfully completed his Ph.D. in archaeology in 1999. Dr. Mei has been the NRI Director since January 2014.

The Joseph Needham Foundation for Science & Civilisation Hong Kong
李約瑟科技與文明基金會

(Formerly the East Asian History of Science Foundation Hong Kong)
(東亞科學歷史基金會)

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The Needham Research Institute, U.K.
(formerly The East Asian History of Science Trust, U.K.)

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The Lord Browne of Madingley	Mr. Michael Womack
Dr. Christopher Hughes	Ms. Elizabeth Wright

The “*Science and Civilisation in China*” Series

In 1948 Joseph Needham approached the Cambridge University Press to publish a one-volume book that he was writing, called the “*Science and Civilisation in China*”, aimed at all educated people, whether scientifically trained or not, who were interested in the comparative history of civilisation, especially the comparative development of Asia and Europe.

One volume became seven, as more and more research became available and interest in the subject grew. The first introductory volume appeared in 1954. By now, about two-thirds of the thirty or so volumes or sub-volumes envisioned by Needham in his lifetime have appeared.

At this time, there are 25 published volumes in the *SCC* series. We have the whole or part of the introductory orientations, history of scientific thought, mathematics and the sciences of the heavens and the earth, physics and physical technology, mechanical engineering, engineering and nautics, paper and printing, alchemy and chemistry, military technology, textile technology, agriculture, agro-industries, forestry, mining, botany, biotechnical technology, language and logic in traditional China. Non-ferrous metallurgy, the salt industry, and loom (textile weaving machine) are forthcoming.

There are still a number of subjects that require much work before they are ready to be published and thus complete the project.

Following the passing of Dr. Needham in 1995, the planning and publication of new volumes to the “*Science and Civilisation in China*” series, has rested with the Publications Board of the Needham Research Institute in Cambridge.

The Needham Research Institute

The Needham Research Institute is devoted to the study of the history of science in East Asia. It houses the Institute's library, a unique resource for an international community of scholars, designed to provide an environment highly favourable to research and scholarly writing.

The Institute is situated on the grounds of Robinson College, Cambridge. It is the home of the "*Science and Civilisation in China*" project. Researchers from all over the world with an interest in the history of science, medicine and technology in East Asia are welcome to visit the Institute.

The Institute and its library offer scholars facilities for research and writing unrivalled by any other academic institution in its field. No other collection of its kind exists in the western world, and the only parallel is the Library of the Institute of the History of Natural Science, at the Chinese Academy of Sciences in Beijing.

The aim of the Institute and its East Asian History of Science Library is to enable specialists to pursue active research programmes in the history of medicine, science and technology in East Asia, particularly China. Not only will the Library provide a centre for visiting scholars, it will also undertake to sponsor suitable researches with grant-giving bodies.

Joseph Needham's vision for the Institute was that it should retain its autonomy but also have strong links with the University of Cambridge. This remains the vision of the Needham Research Institute today.

Prof. Mei Jianjun has been the NRI Director since January 2014 following the retirement of Prof. Christopher Cullen, who succeeded Prof. Ho Peng Yoke in December 2002.

Prof. Ho passed away in 2014. His long years of association with Dr. Needham in the SCC series will always be treasured and remembered.

Background of the Joseph Needham Memorial Lectureship

The Board of Directors of the EAHSF in Hong Kong agreed in 1982 to the establishment of a public lectureship in Hong Kong to provide a forum for international scholars specialized in the history of science, technology and medicine in China and / or East Asia. In this respect, many benefactors from Hong Kong can appreciate that funds raised here not only support the Needham Research Institute projects, but also generate public interest in Dr. Needham's work on a broader basis.

- 1983 Dr. Joseph Needham presented the first lecture, entitled "*Gunpowder as the Fourth Power, East and West*"
- 1984 Professor Nathan Sivan of the University of Pennsylvania, USA
- 1986 Professor Shigeru Nakayama of Tokyo University, Japan
- 1987 Professor Ke Jun of the University of Science and Technology, Beijing, China
- 1988 Professor Joseph C. Y. Chen of the University of California, San Diego, USA

In tribute to the late Joseph Needham who passed away in March 1995, the EASHF (HK) renamed the East Asian History of Science Lectureship the Joseph Needham Memorial Lectureship.

- 1995 Professor Wang Gungwu, Vice-Chancellor of the University of Hong Kong
- 1999 Professor Ho Peng Yoke, Director of the Needham Research Institute, Cambridge, United Kingdom
- 2001 Professor Lu Yongxiang, President, the Chinese Academy of Science, China
- 2003 Dr. Huang Hsing-Tsung, Former Deputy Director, The Needham Research Institute, Cambridge, United Kingdom
- 2006 Dr. Robert B. Oxnam, President, The Needham Research Institute, USA
- 2007 Mr. James C. Y. Watt, Brooks Russell Astor Chairman, Department of Asian Art, Metropolitan Museum of Art, New York, USA
- 2008 Professor Roel Sterckx, Joseph Needham Professor of Chinese History, Science and Civilisation, Chair, Department of East Asian Studies, University of Cambridge, Cambridge, United Kingdom
- 2013 Professor Mei Jianjun, Director-Designate of the Needham Research Institute, Cambridge, England, and Director of the Institute of Historical Metallurgy and Materials, University of Science and Technology Beijing, China
- 2014 Professor Francesca Bray, Professor of Social Anthropology, University of Edinburgh, Scotland, UK, and Visiting Professor, Hong Kong Institute for the Humanities and Social Sciences, The University of Hong Kong, Hong Kong
- 2015 Professor Christian Daniels, Professor of Humanities, The Hong Kong University of Science and Technology, Hong Kong
- 2017 Professor Vivian Taam Wong JP, Honorary Professor, The LKS Faculty of Medicine, The University of Hong Kong, Hong Kong
- 2018 Professor Martin Jones, George-Pitt Rivers Professor of Archaeological Science, University of Cambridge and Needham Research Institute, United Kingdom

**The Joseph Needham Professorship
of Chinese History, Science and Civilization**
(at The University of Cambridge, UK)

In further tribute to Dr. Needham, in 2008 the East Asian History of Science Foundation Hong Kong supported the endowment of a permanent Chair in Chinese History at the University of Cambridge. Professor Roel Sterckx, Chair of the Department of East Asian Studies at Cambridge and one of the leading experts on pre-modern China, is the first scholar to be appointed to the Chair. His contributions to the history of Chinese science include work on Chinese zoology, medical illustration, and natural environments. Professor Sterckx very kindly accepted our invitation and delivered the 7th Joseph Needham Memorial Lecture later that same year, speaking on “*Naturalist Illustration in Traditional China*”.

**The Joseph Needham-Philip Mao Professorship
in Chinese History, Science and Civilization**
(at The University of Hong Kong, Hong Kong)

Subsequent to the establishment of the endowed professorship at Cambridge, The East Asian History of Science Foundation Hong Kong supported the endowment of the Joseph Needham–Philip Mao Professorship of Chinese History, Science and Civilisation at the University of Hong Kong, honouring both Dr. Needham and its founding chairman, the late Dr. Philip W.C. Mao. The Chair Professorship was inaugurated in 2012 and the first scholar appointed to this Professorship is Professor Angela Ki-che Leung, Chair Professor of History, Hong Kong Institute for the Humanities and Social Sciences, The University of Hong Kong. Professor Leung’s research focus is on diseases and medical culture in South China, in particular the Canton/Hong Kong region, in the global and colonial context in the late 19th and early 20th centuries. Her broader interests are on the history of science, medicine and technology in pre-modern and modern East Asia.

The JNFSC Welcomes Your Generous Support!

The JNFSC (formerly EAHSF) Hong Kong will continue to promote scholarly research and education in the history of medicine, science and technology in China.

If you are interested in supporting the work of the Foundation, or would like more information, please write to:

Mr. Herman H. C. Tsoi, Hon. Secretary,
Joseph Needham Foundation for Science & Civilisation,
P.O. Box 4021, General Post Office, Hong Kong; or by email: celine.lee@rondabosh.com



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Centre for Chinese History
Centre for Chinese Archaeology and Art



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THE HONG KONG UNIVERSITY OF
SCIENCE AND TECHNOLOGY

Division of Humanities

present

**The Joseph Needham Symposium on
Early Cultural and Scientific Transmission
across Eurasia with China**

Cho Yiu Conference Hall, The Chinese University of Hong Kong

and

The Hong Kong University of Science and Technology

26 – 27 March 2018

Advisory Committee

Professor Tony CHAN
President of HKUST

Professor Martin K. JONES
*Professor of Archaeological Science,
Cambridge University
Chairman, Needham Research Institute*

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Ms. WONG Wan-cheung

Session Moderators

Professor Gregory CLANCEY
*Associate Professor of History, Dept. of
History and Asia Research Institute (ARI)
Master of Tembusu College, NUS*

Mr. CHAU Hing Wah
*Curator, Intangible Cultural Heritage Office,
HKSAR Government
Adjunct Associate Professor, CUHK*

Dr. Eric CHONG
*Master of St. John's College, HKU
Director, JNFSC*

Professor Christian DANIELS
*Head, Division of Humanities, HKUST
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Professor LEUNG Yuen-sang
*Dean, Faculty of Arts, Professor of History
Director, Institute of Chinese Studies, CUHK*

Professor POO Mu-chou
Department of History, CUHK

Dr. WANG Aihe
Honorary Associate Professor, HKU

Symposium Programme

Monday 26th March, Cho Yiu Conference Hall, CUHK

08:30-09:00 Registration and Refreshment

**09:00-09:30 Welcoming Remarks – Vice-Chancellor and President, CUHK
Opening Remarks – Dr. Peter L. LEE, Chairman of JNFSC
Prof. Martin JONES, Chairman of NRI
Video Tribute to the Late Dr. Joseph Needham**

09:30-10:30 Session 1: Agriculture and Crops (Chairperson: Professor LEUNG Yuen-sang)

Professor Martin JONES, Cambridge University and Needham Research Institute

“Cultural Transmission between Farmers: New Scientific Approaches within Archaeology”

Professor ZHAO Zhijun, Institute of Archaeology, Chinese Academy of Social Sciences

“Archaeobotanical Data for the Research on the Introduction of Wheat into China”

10:30-10:50 Tea Break

10:50-11:50 Session 2: Archaeology (Chairperson: Professor Christian DANIELS)

Professor LIU Li, Stanford University

“Ceramic Forms, Beer Brewing, and Feasting Traditions in Prehistoric China”

Dr. SUN Zhouyong, Shaanxi Provincial Institute of Archaeology

“Bridging Eurasia with China: Archaeological Evidence from the Northern China during the Third Millennium BCE”

11:50-12:20 General Discussion (Chairperson: Dr. WANG Aihe)

“The Beginnings of Chinese Civilization”

12:20-12:30 Group Photo

12:30-14:00 Lunch Break

- 14:00-15:30** **Session 3: Metallurgy** (Chairperson: **Professor LAI Ming Chiu**)
- Professor MEI Jianjun, Needham Research Institute**
“The Development of Early Copper and Bronze Metallurgy in China and Its Connections with the Eurasian Steppe”
- Professor LAM Weng Cheong, The Chinese University of Hong Kong**
“Assimilation, Resistance, or Local Adaptation? Archaeometallurgical Analysis of Iron Objects from Guangzhou in the Han Period and the Sovereignty of the Han Empire in the South”
- Dr. Libby CHAN, Hong Kong Maritime Museum**
“Across Eurasia to China via Land and Sea: Transmission of Scientific Technology on Precious Metal (Bronzes, Gold and Silver) and Stones in Early China”
- 15:30-15:50** **Tea Break**
- 15:50-16:50** **Session 4: Cultural Transmission** (Chairperson: **Mr. CHAU Hing Wah**)
- Dr. Marco CABOARA, The Hong Kong University of Science and Technology**
“Chinese and Greco-Roman Geographical Thought and Maps: The Needham-Yee Debate Revisited”
- Professor CHEN Ming, Peking University**
“The Transmission of Persian and Indian Medicine into Pre-modern China”
- 16:50-17:20** **General Discussion** (Chairperson: **Professor HSIUNG Ping-chen**)
“Cultural and Technological Transmission across the World”
- 17:30-18:30** **Opening Ceremony of “Chinese Wartime Science through the Lens of Joseph Needham” Banner Exhibit**
Esther Lee Building, CUHK
- 18:30-21:00** **Welcoming Dinner**
Hyatt Regency Hong Kong, Sha Tin

Tuesday 27th March, Cho Yiu Conference Hall, CUHK

09:00-10:15 Session 5: Astronomy I (Chairperson: **Professor POO Mu-chou)**

Professor John STEELE, Brown University

“A Comparison of the Relationship between Mathematical Astronomy and the Calendar in China and Babylonia”

Professor GUAN Yuzhen, University of Science and Technology of China

“Meanings and Numbers: Units in Celestial Measurement in Mesopotamia and Early China”

Professor FUNG Kam-wing, The University of Hong Kong

“Zhang Heng and Ptolemy: Astronomy and Cartography in Early Imperial China and the Graeco-Roman World”

10:15-10:30 Tea Break

10:15-11:20 Session 6: Astronomy II (Chairperson: **Dr. Eric CHONG)**

Professor SUN Xiaochun, University of Chinese Academy of Science

“The Astronomical ‘Silk Road’: Medieval Astronomical Exchanges between China and Eurasia”

Professor Bill MAK, Kyoto University

“Gargasamhitā and Vedic Astral Science in China: Early Evidences of Foreign Transmission of the Science of the Heavens from the ‘West’”

11:20-11:45 **General Discussion (Chairperson: **Professor LEE Chack-fan**)**

“Astronomy/Astral Science in Ancient Civilizations”

11:45-12:30 Roundtable on Needham’s Legacy (Chairperson: **Professor Gregory CLANCEY)**

Professor Christian DANIELS, HKUST

Professor Martin JONES, Cambridge University and NRI

Dr. Peter L. LEE, Joseph Needham Foundation for Science & Civilisation

Professor MEI Jianjun, Needham Research Institute

Professor WANG Qianjin, University of Chinese Academy of Sciences

12:15-12:30 **Concluding Remarks and Closing Ceremony**

12:30-13:30 **Lunch Break**

14:00-21:30 **Cultural Visit courtesy of HKUST**

Closing Dinner hosted by Prof Wei SHYY, Acting President of HKUST, HKUST campus

Background of Invited Speakers

Dr. Marco CABOARA, The Hong Kong University of Science and Technology

CABOARA is Digital Scholarship and Archives Manager at the Lee Shau Kee Library, Hong Kong University of Science and Technology. As manager of the Archives he is also in charge of the Library Special Collections, most prominently of the Antique Maps of China Collection. He has presented the collection at the International Conference on Science and Civilization on the Silk Roads, United Nations Educational, Scientific and Cultural Organization (UNESCO), Beijing Friendship Hotel, Beijing, China, 10th-11th December 2015 and organized an exhibition of selected maps of China and Central Asia at the KPS Gallery (“‘Tartary’ from Marco Polo to the Enlightenment: Maps of Eastern Central Asia from the 16th to the 18th Century”, 26th May 2016 - 28th February 2017, <http://library.ust.hk/exhibitions/tartary/>).

He studied in Italy, Taiwan, Beijing and Hong Kong, and received his Ph.D. from the University of Washington, Seattle with a study of the linguistic features of Classical Chinese Bamboo Manuscripts. He has been Research Fellow at Friedrich-Alexander-Universität Erlangen-Nürnberg and the Swedish Collegium for Advanced Studies, Uppsala, Sweden. His main research interests include historical cartography, classical Chinese phonology and syntax, Chinese manuscript studies and modern European History.

Dr. Libby CHAN, Hong Kong Maritime Museum

CHAN is currently Assistant Director (Exhibitions and Collections) at the Hong Kong Maritime Museum (HKMM), where she oversees the Museum’s curatorial and education departments, museum service, and is responsible for exhibition and collections development. Before joining HKMM, she was Senior Curator (China) at the Asian Civilisations Museum, National Heritage Board of Singapore, with particular oversight of the Chinese collection and the China gallery revamp project. Previously, she was Research Associate and Curator at the Art Museum, Institute of Chinese Studies and lectured at the Department of Fine Arts, The Chinese University of Hong Kong. She also served as J.S. Lee Memorial Curatorial Fellow at the Freer Gallery of Art and Arthur M. Sackler, Smithsonian Institution in Washington, DC and Curatorial Consultant at the San Antonio Museum of Art in Texas. Her research interests include underwater and land archaeology, Chinese decorative and export arts, cross-regional studies on material and cultural exchanges and trades between East and West, Maritime Silk Roads topics, as well as Hong Kong and Pearl River Delta history and heritage. She has authored numerous catalogues and articles on Chinese art exhibitions, archaeology and museum studies, such as *5,000 Years of Chinese Jade: Featuring Selections from the National Museum of History, Taipei and the Arthur M. Sackler Gallery, Smithsonian Institution* (2011) and the co-authored *Secrets of the Fallen Pagoda: The Famen Temple* (2014).

陳麗碧博士現為香港海事博物館副總監，主要負責策展及教育及公眾項目部、博物館服務、展覽策劃及館藏研究。前為新加坡亞洲文明博物館高級館長，負責策劃重組中國展館及管理中國藏品。她曾於香港中文大學中國文化研究所文物館擔任副研究員、藝術系兼任講師，亦曾任美國華盛頓史密森尼博物院轄下弗利爾暨賽克勒美術館的利榮森紀念訪問學人（展覽策劃）、得克薩斯州聖安東尼奧美術館策展顧問。研究興趣和專長包括

水下及陸上考古、中國禮儀及外銷藝術、中外物質文化交流和貿易之跨地域研究、海上絲路議題、以及香港與珠三角的歷史和文化遺產等。出版著作包括《中國玉器五千年：國立歷史博物館及史密森尼博物院賽克勒美術館藏品展》(2011年)、聯合撰寫《盛世遺珍：法門寺與大唐文化瑰寶》(2014年)，並在國內外出版論文多篇。

Professor CHEN Ming, Peking University

CHEN is currently Professor and Chair of the Department of South Asian Studies at Peking University. Since he was awarded a doctoral degree by Peking University in 1999, with a dissertation on Indian medical science, he has focused on the history of cultural communication between China and Central & South Asia in the Medieval Period, mainly but not exclusively in terms of medicine. His academic interests have also been extended to Buddhist literature in Sanskrit-Chinese, and the influence of ancient South Asian literature on China. He has published six books, all in Chinese, as follows:

- (1) *On the Sanskrit Medical Book Siddhasara* (2002, 2014);
- (2) *Medical Manuscripts Discovered in Dunhuang and Western Regions: Foreign Medicine in Medieval China* (2005),
- (3) *A Study on Sanskrit Medical Text of Jivaka-pustaka from Dunhuang* (2005).
- (4) *Foreign Medicine and Culture in Medieval China* (2013).
- (5) *Texts and Languages: A Comparative Study on Some Manuscripts Unearthed from the Silk Road and Early Chinese Buddhist Canon* (2013).
- (6) *Indian Buddhist Mythology: Its Writing and Transmission* (2015)

Professor FUNG Kam-wing, The University of Hong Kong

FUNG earned his D.Litt. from Kyoto University. He is currently Research Fellow at HKU-Shenzhen Institute of Research and Innovation, University of Hong Kong; Institute Fellow at Hong Kong Institute for the Humanities and Social Sciences, University of Hong Kong; Zhu Kezhen History of Science Professor at Chinese Academy of Sciences, Adviser of Committee for the Construction of World First-class Discipline, The University of Science and Technology Beijing; Professor at Nanjing University of Information Science and Technology; Visiting Scholar of the Year (2016), the Institute of Chinese Literature and Philosophy, Academia Sinica, Taiwan; Senior Research Fellow at the Asian Division, the Library of Congress, Washington D.C., U.S.A. He is Advisor to the International Advisory Committee for the Research Partner Group of the Max-Planck-Institut für Wissenschaftsgeschichte (Berlin) at the Institute for the History of Natural Sciences, Chinese Academy of Sciences; Advisor of Hong Kong Space Museum; Advisor of Hong Kong Maritime Museum; Executive Director of Chinese Society of the History of Science and Technology; Director of Joseph Needham Foundation for Science and Civilisation (Hong Kong). Professor Fung's research interests include: history of science and technology in East Asia (i.e. China, Japan, Korea and Ryukyu); history of scientific instruments and cartographical prints; history of Jesuit science; history of Syrian and Islamic science. His recent publications include *Mapping Ming China's Maritime World: The Selden Map and Other Treasures from the University of Oxford* (co-edited; Hong Kong, 2015), *New Research into the Maritime Trades, Seafaring and Underwater Archaeology of the Ming Dynasty* (co-edited; Hong Kong, 2015), *Mengxi bi tan yizhu* 夢溪筆談譯注 [A New Annotated Edition of Mengxi bi tan (Brush Talks from Dream

Brook) by 沈括 Shen Kuo (1031-1095)] (co-authored; Hong Kong, 2017).

Professor GUAN Yuzhen, University of Science and Technology of China

GUAN received his Ph.D. degree in the History of the Exact Sciences in Antiquity from the Department of Egyptology and Assyriology of Brown University. He is now Research Professor (Tenure Track) in the Department of the History of Science and Scientific Archaeology at the University of Science and Technology of China. He is also Candidate of the Chinese Academy of Sciences Pioneer Hundred Talents Program. Dr. Guan works in the field of the history of astronomy, has published several articles and translated the book *Zhongdong tianwenxue jianshi* 中東天文學簡史 (*A Brief Introduction to Astronomy in the Middle East*). His research interests include early Chinese astral sciences, ancient Mesopotamian astronomy and astrology, and mathematical astronomy in the Greek Middle East and Islam.

關瑜楨 2015 年獲美國布朗大學埃及學與亞述學系古代精密科學史專業博士學位。2016 年至今，在中國科技大學科技史與科技考古系擔任特任研究員，並以候選人身份入選中國科學院率先行動「百人計劃」C 類（青年俊才）項目。主要研究領域為中國天文學史和古代兩河流域天文學史，以中英文在國內外發表天文學史學術論文多篇。目前主持國家自然科學基金面上項目和教育部人文社科規劃項目各一項。現任中國科學技術史學會天文學史分會理事。

Professor Martin JONES, Cambridge University and Needham Research Institute

JONES is the first George Pitt-Rivers Professor of Archaeological Science at the University of Cambridge, Vice-Master of Darwin College, Cambridge, and Chairman of Trustees at the Needham Research Institute. For forty years he has published reports of his archaeobotanical research, into the nature and development of agriculture in different parts of the world. In the 1990s, his work expanded from archaeobotany to embrace the novel field of archaeogenetics, subsequently engaging with stable isotope palaeodietary studies. His research group has played a lead role in combining these three methodological strands to investigate the human food quest in the past, and address its implications for present and future foodways.

His early research addressed the development of later prehistoric and early historic agriculture in Europe, and the use of ecological indicators to understand the nature and form of early crop management, and how it was transformed by changing cross-continental connections. He was one of the pioneers in the 1970s of the systematic, site-wide application of flotation methods that subsequently became commonplace archaeological practice.

It was in the context of exploring the advance of molecular archaeology that Jones' group developed and refined a methodological triad bringing together i) the study of archaeological plant and animal remains; ii) stable isotope analysis of this material, for holistic food chain reconstruction; and iii) collated genetic analysis of ancient, historic and extant DNA, for analysis of biogeography and functional gene expression. The development of this

methodological triad within Europe led Jones' interest to the early appearance in the European record of crops botanically associated with China, most notably the Asian millets.

Over the last decade, a series of projects led by Jones, and resourced primarily by the Wellcome Trust, the Leverhulme Trust, Darwin College Cambridge, and the European Research Council has allowed Jones to collaborate closely with international colleagues to explore and analyze the evidence for a major episode in world agriculture, characterized as 'food globalization in prehistory'. This protracted episode of long distance contact between Eurasian communities culminates in a mid-2nd millennium BC network of cross-continental movement of primary resources, particularly agrarian resources, underpinning both the potential for multi-cropping that supported a range of states and complex societies, and the network that came to be known as the Silk Road. Much of our understanding of the early agrarian stages of this process have only come to light as a consequence of the methodological triad employed by Jones' group, and outlined above.

Professor LAM Weng Cheong, The Chinese University of Hong Kong

LAM is Assistant Professor of Anthropological Archaeology working in Mainland China. His research currently focuses on the economic system and social development during the Bronze Age and the Han Empire. His research incorporates interests in various archaeological techniques including metallurgy, zooarchaeology and GIS (Geographic Information System) to study the craft production and exchange network during one of the most critical periods in Chinese history. He latest research is focused on the Han exchange network in provincial centres and imperial expansion of the Han dynasty.

Professor LIU Li, Stanford University

LIU received a BA degree in History from the Department of History at Northwestern University, Xi'an, in 1982, and worked at the Shaanxi Provincial Institute of Archaeology from 1982 to 1983. She received an MA degree in Anthropology at Temple University in 1987 and a Ph.D. degree in Anthropology at Harvard University in 1994, both in the USA. She then taught in the Department of Archaeology at La Trobe University in Australia from 1996 to 2010, and elected Fellow of the Academy of Humanities in Australia in 2008. Since 2010, she has been the Sir Robert Ho Tung Professor in Chinese Archaeology in the Department of East Asian Languages and Cultures at Stanford University in the USA.

Professor Bill MAK, Kyoto University

MAK completed his linguistic training at McGill University (B.A., Hons.) specializing in Sanskrit and East Asian languages and received his Ph.D. in Indian Literature and Buddhist Philology from Peking University. Mak held a number of research and teaching positions at Hamburg University, University of Hong Kong and Kyoto Sangyo University, before his current appointment as Associate Professor at Kyoto University. Among Mak's academic interests are Sanskrit Buddhist literature, historical Sino-Indian relation and Indian astral science (*jyotiṣa*). Since 2012, Mak has been invited to present over thirty papers and lectures

in topics related to Sino-Indian and Buddhist culture and Indian astronomy in India, China, Taiwan, Belgium, France, Germany, Italy and Japan.

Professor MEI Jianjun, Needham Research Institute

MEI studied physical chemistry in metallurgical processes and the history of science and technology at the University of Science and Technology Beijing (USTB) in the 1980s. He first visited Cambridge in 1994, as a one-year Li Foundation Scholar working at the Needham Research Institute, then began his Ph.D. study in Archaeology at the University of Cambridge with a scholarship offered by the East Asian History of Science Foundation, Hong Kong. After postdoctoral work in Tokyo and Cambridge he returned to China in 2004 as a professor at the USTB and Director of the Institute of Historical Metallurgy and Materials. In January 2014, he joined the Needham Research Institute as its Director. He is also a Fellow of Churchill College, University of Cambridge.

Professor John STEELE, Brown University

STEELE is Professor of the History of the Exact Sciences in Antiquity and Chair of the Department of Egyptology and Assyriology at Brown University. He is the editor of the book series *Scientific Writings from the Ancient and Medieval World*, and serves on the editorial board of several book series and journals including *Time, Astronomy, and Calendars* and the *Journal for the History of Astronomy*. He is the author of four books, editor of ten volumes, and author or co-author of around ninety journal articles and book chapters. His research is into the history of astronomy with a particular focus on Babylonian astronomy. His recent books include *Rising Time Schemes in Babylonian Astronomy* (Springer 2017) and the edited volume *The Circulation of Astronomical Knowledge in the Ancient World* (Brill 2016).

Professor SUN Xiaochun, University of Chinese Academy of Science

SUN is one of the leading scholars of China in the field of the history of science, particularly of the history of astronomy. He received his Ph.D. in History of Astronomy from the Chinese Academy of Sciences in 1993 and his second Ph.D. in History and Sociology of Science from the University of Pennsylvania in 2007. His co-authored book *The Chinese Sky during the Han* (Leiden: Brill, 1997) presents a reconstruction of the Chinese constellations based on the study of the earliest Chinese star catalogue (ca. 100 BC), which is comparable in its historical significance to that of Ptolemy of the Greek. He has published extensively on the history of Chinese astronomy, including more than 60 articles and several co-edited volumes on the subject. He has led several research projects, each producing important results. His work on the Taosi site provides convincing evidence for the Taosi pre-historic astronomical observatory (ca. 2000 BC). He and his team's work on Su Song's Astronomical Clock Tower of the 11th Century China presents a new reconstruction of the Clock's "escapement mechanism", throwing new light on the history of astronomical instrumentation and mechanical clocks.

Currently he serves as President of Chinese Society for the History of Science and Technology, President of History of Astronomy Commission of International Astronomical Union (IAU), Executive Member of International Council for Philosophy and Human Sciences (CIPSH). He is Executive Dean of School of Humanities, University of Chinese Academy of Sciences (UCAS). He is Effective Member of the International Academy of History of Science.

Dr. SUN Zhouyong, Shaanxi Provincial Institute of Archaeology

SUN studied Chinese archaeology at Xiamen University in 1991 and served as an archaeologist at the Shaanxi Provincial Institute of Archaeology since 1995. He obtained his Ph.D. from La Trobe University in Australia with a scholarship offered by the ARC in 2007. He has been engaged in archaeological surveys and excavations for more than 50 projects. The Shimao Archaeology Project directed by Dr. Sun has made great contribution to the origin of the Chinese early civilization, and also was awarded the titles of “World Archaeological Discovery” and “Top Ten Archaeological Discovery in China in 2012”. With a broad international perspective, Dr. Sun is committed to promoting the exchanges and cooperation between Shaanxi archaeology and cultural institutions overseas.

Professor ZHAO Zhijun, Institute of Archaeology, Chinese Academy of Social Sciences

ZHAO is Professor at the Institute of Archaeology, Chinese Academy of Social Sciences. He received his Ph.D. degree in Anthropology in 1996 from the University of Missouri-Columbia in USA, with advanced work emphasizing archaeology, principally in archaeobotany. His research interest is focused on the origin of Chinese agriculture and economic background of the formation of Chinese civilization. This involves a range of approaches from fieldwork to laboratory experiments. In the past years, he has participated in archaeological fieldworks to carry out flotation that involved hundreds of archaeological sites distributed all over China. Zhao has published about 90 publications including articles and archaeological reports. His book entitled *Paleoethnobotany: Theories, Methods and Practice* was published by Science Press in Beijing.

趙志軍是中國社會科學院考古研究所的研究員、博士生導師、中國考古學會常務理事。1982年畢業於北京大學考古系，後赴美國密蘇里大學攻讀植物考古，獲人類學博士學位。1997年考入美國史密森尼博物院（Smithsonian Institution）做博士後。1999年回國到中國社會科學院考古研究所工作。主要研究興趣是農業起源和史前農作物的傳播，以及中華文明形成與古代農業發展之間的互動關係。承擔並主持過十餘項科研項目，包括美國自然科學基金項目、中國國家自然科學基金項目、中國社會科學院重大研究項目、國家科技支撐計劃課題、國家文物局指南針計劃專項項目等。截至目前，在國內外學術刊物上或文集中發表學術文章九十餘篇，並著有《植物考古學：理論、方法和實踐》一書。

Abstracts

Day 1: Monday 26th March

09:10-10:10 Session 1: Agriculture and Crops

**“Cultural Transmission between Farmers:
New Scientific Approaches within Archaeology”**

Professor Martin JONES, Cambridge University and Needham Research Institute

Our understanding of the earliest cultural transmissions across Eurasia was initially stimulated by various descriptions of the ‘other’ in the earliest historical texts from the east and the west. These narratives were deepened by archaeological evidence of shared material culture, often in graves, indicating how elites represented themselves. New methods of archaeological science allow us to go beyond the durable material goods of the elite, to the perishable agricultural goods of the ordinary farmer. By bringing those new methods, of archaeobotany, archaeogenetics, and stable isotope studies, to Eurasian prehistory, we learn the earliest cultural transmissions of all may have been along a chain of neighboring farmers and herders. This paper looks at those approaches and their application to Eurasian prehistory.

“Archaeobotanical Data for the Research on the Introduction of Wheat into China”

Professor ZHAO Zhijun, Institute of Archaeology, Chinese Academy of Social Sciences

After being introduced into China from West Asia, wheat gradually replaced such varieties of millet as *Setaria italica* and *Panicum miliaceum* to become the main dry-land farming crop in northern China, forming China’s current agricultural production pattern of rice in the south and wheat in the north. To date, there have been dozens of reported archaeological discoveries about early wheat remains. According to those newly unearthed findings, wheat was introduced into China through at least two routes between 4500 and 4000 years ago. One is the grassland route from West Asia, through Central Asia, the Bronze Age cultures of the Eurasian Steppe, Northern Cultural Zone in northern China to the middle and lower reaches of the Yellow River. The other is the oasis route from West Asia, through Central Asia, the Pamir's, oases on both sides of the Tarim Basin, Hexi Corridor and to the Loess Plateau of northern China.

小麥起源於西亞，後傳入中國，並逐步地取代了粟和黍兩種小米，成為了中國北方旱作農業的主體農作物，形成了現今中國「南稻北麥」的農業生產格局。目前已見報道的有關早期小麥遺存的考古發現多達數十例，這些新發現的考古證據顯示，至遲在距今 4000 年以前小麥已經傳入到中國境內，而且很有可能早至距今 4500 年。考古證據還揭示，小麥傳入中國至少有兩個途徑，即草原通道和綠洲通道。草原通道的傳播路線是：西亞—中亞—歐亞草原諸青銅文化—中國北方文化區—黃河中下游地區；綠洲通道的傳播路線是：西亞—中亞—帕米爾高原—塔里木盆地南北兩側的綠洲—河西走廊—黃土高原地區。

“Ceramic Forms, Beer Brewing, and Feasting Traditions in Prehistoric China”

Professor LIU Li, Stanford University

Ceramic vessel technology had two independent origins in the Old World: China (c. 20,000-16,000 cal BP) and northern Africa (c. 11,400 cal BP). There are some parallel developments from the two regions in terms of vessel forms and functions, which are characterized by changing from cooking porridge to brewing alcohol. In this talk, I discuss the interrelationships between changing forms of ceramic vessels, origins of cereal-based beer-making techniques, emergence of ritualized drinking traditions, and development of civilization in ancient China.

In the early Holocene (11,000-9000 cal BP), pottery vessels (bowls) were often concurrent with grinding stones, and various plant foods including cereals were processed and cooked, probably to make porridge. During the period of 9000-7000 cal BP, pottery types increased and grinding stones were also present in abundance. A particular vessel form, globular pot (*hu*), became widespread across a broad region over the Yellow and Yangzi River valleys. Residue analyses indicate that some globular pots were used for making cereal-based fermented beverages, as the first appearance of beer brewing in China.

During the period of 7000-4500 cal BP, two broadly defined regional ceramic traditions in north China are observable. One is the Dawenkou assemblage in the East, in which ceramic vessels show great varieties in form, represented by *gaobingbei* goblets and *gui* pitchers. Both vessel forms were related to serving and drinking alcohol, as confirmed by residue analyses. The second regional ceramic tradition is the Yangshao culture in Northwest China, in which the pottery assemblages normally consist of *jiandiping* amphora, funnels, and open-mouth jars, together formed a set of millet-based beer-brewing equipment. Some *Jiandiping* also served as drinking vessels for communal siphoning, probably using straws made of reeds or bamboo. Such a drinking method was widely used in ancient Mesopotamia and Egypt, and is still practiced in Africa, Southeast Asia, and by many ethnic groups in southwest China today. The northwest-style communal siphoning drinking tradition, which emphasized group solidarity and alliance forming, disappeared when the Yangshao culture vanished. On the other hand, the eastern-style drinking tradition, which helped to elaborate personal status and establish social hierarchy, prevailed. This individualized drinking method also formed the ritual foundation of the Bronze Age dynasties, and became a core cultural value in Chinese civilization.

“Bridging Eurasia with China: Archaeological Evidence from the Northern China during the Third Millennium BCE”

Dr. SUN Zhouyong, Shaanxi Provincial Institute of Archaeology

Recent years saw considerable progress on the understanding of interactions between China and Eurasia during the 3rd millennium BCE with the increasing archaeological evidence, among which the site of Shimao is the most significant and representative one.

This paper reviews the copper/bronze artefacts, stone sculptures, murals and stone walled sites in Neolithic northern China and compares their counterparts from south edges of the Early

Bronze Age Eurasia to see their similarities and diversities in terms of typology, technology and craftsmanship. It is noticed that the construction of baffled and flanked gates and bastions along city walls in Shimao may indicate the knowledge exchange with Central and West Asia. The polychrome murals of Shimao and the technique that applies pigments according to draft lines are notably comparable to the ones from Late Bronze Age Greek. The earliest use of “weaving wood” (*renmu*) in the construction of masonry walls identified in northern China may have contributed to the technologies of similar masonry walls in the Iron Age Europe around the beginning of the Common Era. Both scientific analysis and typological research suggest the potential spread of early metallurgy from the Hexi Corridor into Central Plain though the Ordos Area.

Based on the aforementioned observations, it is then concluded that the interaction between northern China and Eurasia had been mutual, manifold and frequent and northern China had played crucial role for bridging the early civilizations among Eurasia and China.

近年來，隨著中國北方地區考古學資料的日益豐富及以石峁遺址為代表的考古成果的刊布，公元前第三千紀中國與歐亞大陸之間的文化互動和交流變得愈發清晰。

本報告以中國北方地區新石器時代遺址出土的青銅製品、石雕人像、壁畫以及砌築石城傳統等文化因素為出發點，從建築技術、冶金技術及藝術創造等方面比較了其與歐亞大陸南緣早期青銅時代遺址出土同類器物在形態、技術及工藝上的差異及共同特點。在大型城址建設中構築甕城、設置馬面等現象與中亞、西亞地區的城建技術存在着某種交流和影響。就壁畫製作和使用而言，以希臘青銅時代晚期壁畫為代表，其使用起稿線的繪製方式與以石峁為代表的中國北方地區早期壁畫表現出較強的一致性。建築技術中使用「紆木」在中國北方地區首次得以確認，這種技術或許影響了公元前後歐洲鐵器時代石砌城牆的構築方式。科學檢測分析及形制比較的結果，暗示著中國早期冶金技術的傳播可能存在着由河西走廊經河套地區進入中原腹地這樣一條自西向東的線路。

本報告認為，中國新石器時代晚期以來，中國北方地區與歐亞大陸之間的技術交流和文化互動是雙向的、多重的、頻繁的。中國北方地區是橋接歐亞大陸與中國早期文明不容忽視的重要區域。

14:00-15:30 Session 3: Metallurgy

“The Development of Early Copper and Bronze Metallurgy in China and Its Connections with the Eurasian Steppe”

Professor MEI Jianjun, Needham Research Institute

(with CHEN Kunlong and WANG Lu, University of Science and Technology Beijing)

Over the past three decades, there have been a large number of archaeological discoveries and research on the beginnings and early development of copper and bronze metallurgy in China. Although some scholars still support the view that copper and bronze metallurgy originated and developed independently in China, an increasing body of archaeological evidence from northwestern and northern China indicates that the beginnings of copper and bronze metallurgy in China were closely linked to the eastwards transmission of metallurgy across the

Eurasian steppe. As early as 2005, some scholars had already proposed a transmission route originating from southern Siberia to northern Xinjiang, then further eastwards to eastern Xinjiang, through the Hexi Corridor reaching the Central Plains of China. Meanwhile, others noted the possible existence of regional technological innovations in northwestern China.

In recent years, a number of important new archaeological discoveries, such as the Xichengyi site in Zhangye, the Mogou site in Lintan, both in Gansu, and the Shimao site in northern Shaanxi, have not only revealed new evidence for demonstrating the development of early copper and bronze metallurgy in the region, but have also raised some new questions concerning the material characteristics as well as the transmission directions and routes of early metallurgy. On the basis of the results of the recent scientific examination of metallurgical remains excavated from archaeological sites in northwestern and northern China, this paper will discuss the appearance of local metallurgical production in northwestern China as well as the early links between China and the Eurasian steppe, offering some new understandings of the development of copper and bronze metallurgy in China.

近三十多年來，關於銅和青銅冶金在中國的初現和早期發展，已有大量的考古新發現和新研究。儘管仍有不少學者主張銅和青銅冶金在中國是獨立發生和發展的，但在中國西北和北方地區已有越來越多的考古證據表明，銅和青銅冶金在中國的開始與冶金術在歐亞草原地區由西向東的傳播存在密切的聯繫。早在 2005 年前後，已有學者提出冶金術由南西伯利亞到新疆北部，再經新疆東部、河西走廊抵達中原的傳播路線；也有學者注意到中國西北地區存在區域技術創新的可能性。近年來，一些重要的考古新發現，包括河西走廊的張掖西城驛遺址、甘肅東部洮河流域的臨潭磨溝遺址、以及陝西北部的神木石峁遺址，不僅都揭示出了早期銅和青銅冶金發展的新證據，而且也提出了一系列新的問題，尤其是在早期銅器的材質特徵以及早期冶金技術的傳播方向和路線方面。基於近年來的考古新發現和科學分析檢測的最新結果，本報告將主要討論中國西北地區當地冶金生產的出現和中國與歐亞草原地區的早期聯繫通道，並就中國早期銅和青銅冶金的發展提出幾點新的認識。

“Assimilation, Resistance, or Local Adaptation?

Archaeometallurgical Analysis of Iron Objects from Guangzhou in the Han Period and the Sovereignty of the Han Empire in the South”

Professor LAM Weng Cheong, The Chinese University of Hong Kong

The presence of Han-style artifacts in present-day Guangzhou after Emperor Wu’s conquest and its implication for understanding the ruling strategy of the Han Empire in the South have attracted broad attentions in previous literature. Among the material package of Han-influence, the introduction and widespread of iron objects were often considered as one critical component. Nonetheless, the types of manufacturing techniques, and to what extent the iron technology of objects from Guangzhou is similar to that in the Central Plains region, have yet been comprehensively addressed and analysed. This paper introduces latest results of our metallurgical project collaborated with Guangzhou municipal institute of archaeology and cultural relics to study Han-period iron objects. The results show that, even though the majority of iron objects show a technological tradition (cast iron tradition) similar to that in the Central Plains regions, some collected samples were very likely to be manufactured via the process of bloomery iron, a technique that might have been related to local iron manufacturing.

Therefore, the archaeometallurgical analysis might shed a new light on the complex interaction between Han government and local people, no matter they were Han immigrants or assimilated indigenous, represented by material evidence.

**“Across Eurasia to China via Land and Sea:
Transmission of Scientific Technology on Precious Metal (Bronzes, Gold and Silver) and
Stones in Early China”**

Dr. Libby CHAN, Hong Kong Maritime Museum

This presentation will investigate transmission of scientific technology on two types of precious media, i.e., metal and jade in early China, and focusing on the periods of the Western Zhou and the Warring States (i.e. 1046 BCE- 221 BCE). The case study would be extended to King Nanyue of the Western Han dynasty in Guangzhou.

As an alloy of copper and tin, the metallurgy of bronzes in China has highly developed since the second millennium BC. The usage of bronze was also inspired by metal practice from the nomadic Eurasian Steppes. Gold used in China, on the other hand, was also originated from the Eurasian Steppe. It has been discovered in Troy in Asia Minor, Bulgaria, Egypt and Mesopotamia as early as the fifth or fourth millennium BCE. This presentation will not only explore the interexchange of different metal manufacturing techniques on bronze and gold/silver such as casting, granulating and hammering techniques, but also use case studies to understand the metallurgy of cross-influenced bronze and gold/silver as well as precious stones such as jade used in the Zhou dynasty, that were inspired from various regions and continents.

15:50-16:50 Session 4: Cultural Transmission

**“Chinese and Greco-Roman Geographical Thought and Maps:
The Needham-Yee Debate Revisited”**

Dr. Marco CABOARA, The Hong Kong University of Science and Technology

In the past 20 years the comparison between Greco-Roman and Chinese Science has been extended to a wide range of fields, but geography and cartography have not become part of the mainstream dialogue.

The Greco-Roman world had since at least Eratosthenes (276-195 BCE) a very developed theoretical geographical literature, but maps were very seldom used and almost none has been preserved (the only extant being a 13th century copy of a 4th century CE itinerary map, the so-called Tabula Peutingeriana). The Chinese world instead used maps extensively and many manuscript maps dating from the fourth to the second century BCE are extant, but only with Pei Xiu (223–271 CE) came a set of abstract principles necessary to produce accurate maps.

When one compares the two traditions, as Needham first did in 1959, one finds a strong Chinese advantage in map making, which survives up until the Ming dynasty. On the other hand, the other major historian of the Chinese mapping tradition Cordell Yee in 1994 criticized

Needham for analyzing the earliest extant examples as too easily recognizable forerunners of modern measured map and pointed out how mapmaking in pre-twentieth-century China did never develop into a distinct specialty of learning as it did in Europe.

I will review their positions in light of the new data coming from the recent surge in Warring State excavated sources and the vast recent literature on maps, visuality and cultural cartography.

“The Transmission of Persian and Indian Medicine into Pre-modern China”

Professor CHEN Ming, Peking University

Cultural exchanges among China, Persia and India have a deep-rooted history, the earliest traces of which date back to the Warring States, Qin and Han dynasties. During the medieval period, the transmission of Indian and Persian medicine into China gradually became one of important parts of cultural exchanges among these three kingdoms. Beside the records of *materia medica*, medical doctrines, recipes, therapeutic methods and related medical or religious customs from India and Persia in Chinese handed-down texts and Chinese translations of Buddhist scriptures, a lot of manuscripts along the Silk Road have also included records of the Persian and Indian *materia medica*. Because medieval Persian and Indian cultures were more closely interrelated at the time, Indian medicaments and their use were also transmitted into Persia, and thence into China, and in this way Persian medicine exerted a particular type of influence on medieval China. The soup of *Triphalā* (*Skt.* for “three fruits,” Ch. *sanle jiang*) was a famous case. The *bhallātaka* (*Skt.* for “making-nut”) for renewing hair and improving memory, a so-called drug “from Persia beside Western Ocean” also was widely used in the Indian, Persian and Chinese pharmacological works.

In pre-modern period, there was a new way of the transmission of Indian and Persian medical knowledge into China. Even more deserving of notice are the studies of by Western scholars of the plants used in Persian and Indian medicine, their treatment methods and customs, the translations of which into Chinese have had further influence on the field of medicine in China. Although this knowledge only represents a second-hand influence of Persian and Indian medicine in China, it should still not be overlooked. For example, *A Manual of Materia Medica and Therapeutics*, co-authored by the English medical doctors John Forbes Royle and Frederick William Headland, recorded quite a few ancient Persian, Arabic and Indian doctors, *materia medica* and related medical knowledge. Therefore, from the perspective of global history, the mutual influence of Persia, India and China should be the subject of further research, in order to bring to light the complex and rich history of cultural exchanges among these three lands.

“A Comparison of the Relationship between Mathematical Astronomy and the Calendar in China and Babylonia”

Professor John STEELE, Brown University

The calendars used in China and Babylonia were both luni-solar calendars, i.e., calendars in which the length of the month could be either 29 or 30 days depending upon the lunar cycle, and the year normally contained 12 months but every three or occasionally two years an extra “intercalary” month was inserted into the calendar to bring the count of months for that year up to 13. However, the way these calendars operated differed between the two cultures: in Babylon, for example, the month began on the evening of first visibility of the new moon crescent, whereas in China the beginning of the month was determined by the moment of conjunction of the sun and the moon. More importantly, whereas the Chinese calendar operated with mean synodic months, in Babylon, the length of the month was determined either by observation or by calculating the expected day of first visibility of the moon using the true length of the synodic taking into account the variable lunar and solar anomalies. Thus, while both the Chinese and Babylonian calendars relied upon mathematical astronomy in order to function, the way in which they did so differed considerably. My aim in this paper is to compare these two approaches to the operation of the calendar and to consider the possible cultural (practical and ideological) factors which may have been responsible for this difference.

“Meanings and Numbers:

Units in Celestial Measurement in Mesopotamia and Early China”

Professor GUAN Yuzhen, University of Science and Technology of China

The celestial measurement systems are different in Mesopotamia and China, but they both use basic units to record the positions and movements of astronomical bodies, such as the sun, the moon, the planets, fix stars and other astronomical phenomena. This paper examines the value and meanings of the Mesopotamian units, with a reflection on the early Chinese ones, particularly on how the value and meanings of units affect the development of the celestial measurement systems. The similarities between the Chinese and the Mesopotamian systems will be explored, for example, whether to record the positions of celestial bodies by coordinates or not? Whether the data are recorded in angular degrees or by terminologies of distance? The diversities of terminologies in Chinese and Mesopotamian astral sciences will also be investigated. After examining a selection of sources, this paper attempts to show that the meanings of units in Mesopotamian celestial measurement reflect the consideration of time and space at the same time.

儘管古代兩河流域和古代中國所使用的天體測量體系並不相同，但它們都利用基本單位建構測量體系，並記錄太陽、月亮、行星、恆星等天體的位置和運動。本文將考察古代兩河流域天文測量中單位的數值和意義，同時與中國早期相對應的測量單位作對比研究，並着重關注單位的數值和意義如何影響天文測量體系的發展這一問題。中國與古代兩河

流域的測量體系既有相似之處，也有不同的地方。本文擬以如下問題為例着手考察：是否用坐標記錄天體的位置？數據是以角度記錄還是按長度記錄？中國與古代兩河流域天文學所用術語的多樣性也是本文的考察範圍。通過對原始文獻的考察，本文將嘗試證明，古代兩河流域天文測量中使用的術語和基本單位同時考慮了時間測量與空間測量。

**“Zhang Heng and Ptolemy:
Astronomy and Cartography in Early Imperial China and the Graeco-Roman World”**
Professor FUNG Kam-wing, The University of Hong Kong

Zhang Heng (78-139) and Ptolemy (c.100-178) are prominent figures of scientific creativity at the beginning of the first millennium. They investigated the heavens and the earth and designed scientific instruments to present their studies. Head of the Royal Observatory and well accomplished in astronomy and seismic study, Zhang Heng of Han China prepared a topographical map and invented a water-driven mechanical celestial globe. Claudius Ptolemy of Roman Alexandria described the construction of an armillary sphere comprising graduated rings in his influential work *Almagest* and made a map of the world known to the Hellenistic period. This paper will demonstrate the different ways of scientific thinking in ancient China and the Graeco-Roman world.

10:15-11:20 Session 6: Astronomy II
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**“The Astronomical ‘Silk Road’:
Medieval Astronomical Exchanges between China and Eurasia”**
Professor SUN Xiaochun, University of Chinese Academy of Science

The astronomical “silk road” may be symbolized by two ancient observatories: one is the Dengfeng Observatory in Henan, China; the other is the Ulugh Beg Observatory in Samarkand. Since the 13th century, transmission of astronomical knowledge has been going on between China and Central Asia and beyond. In 1220, Yelü Chucai introduced the concept of *lica* (league distance correction, equivalent to geographical longitude) into his calendrical computation after he had observed a lunar eclipse in Samarkand: the time difference between the Chinese prediction and the actual occurrence made him invent the concept. Our analysis shows that he might have consulted Ptolemaic geographical data in determining the value of *lica*.

In the second half of the 13th century, Zama Luding, probably an astronomer from Maraghah Observatory, came to China to serve at Kublai Khan’s court. He brought seven astronomical instruments to China, all of them are of Arabic origin and style. He also brought many books from the west, including the Euclidean *Element* and the *Almagest*. He also served as Director of the Muslim Huihui Observatory of the Yuan Dynasty.

The flow of astronomical knowledge was in both directions. Our analysis of two star catalogues—one is the Chinese star catalogue by Guo Shoujing (1231-1316) which contained equatorial coordinates of 678 stars; the other is Ulugh Beg’s (1394-1449) star catalogue which

was based on Ulugh Beg’s independent observations and contained the positions of 1018 stars—suggests that Ulugh Beg’s catalogue might be first measured equatorially and then converted to ecliptic coordinates, following the Ptolemaic tradition. There was a 3 arc minute systematic error in the declinations which was presumably caused by the misalignment of the instrument's pole respecting the celestial north-pole. If this was the case, we may conclude that the Chinese observational techniques using equatorial instruments might have been used by Ulugh Beg in his observation of stars.

“*Gargasamhitā* and Vedic Astral Science in China: Early Evidences of Foreign Transmission of the Science of the Heavens from the ‘West’”

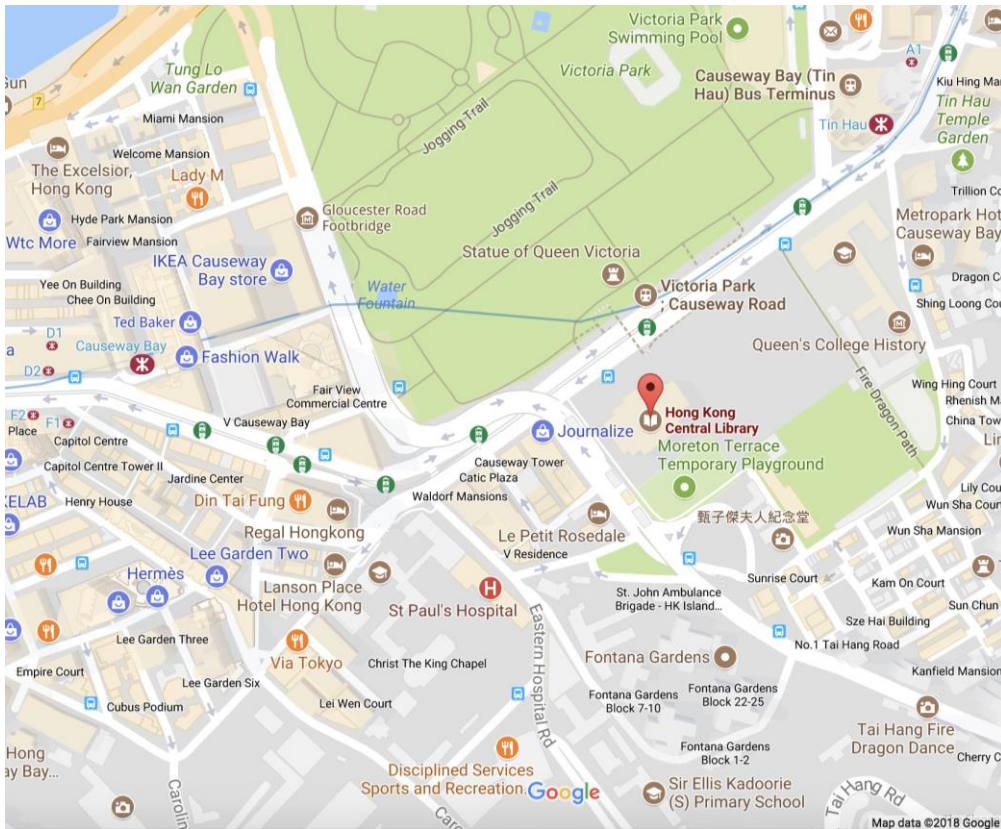
Professor Bill MAK, Kyoto University

Hard evidences of transmission of foreign astral science in China are scanty. During the early centuries of the first millennium CE, the Buddhist missionaries from Central Asia and India doubtless played an important role in the transfer of scientific knowledge across Eurasia. Among the most important materials from the Chinese side are a number of Buddhist sūtras including the *Modengjia jing* 摩登伽經 (*Śārdūlakarṇāvadāna*) attributed to Zhu Lüyan 竺律炎 and Zhi Qian 志謙 dated to 230 CE. From the Indian side, one of the most important sources is the *Gargasamhitā*, which was known to the Chinese both within and outside the Buddhist circles during this early period, along with other texts of the Vedic astral lineage. The *Gargasamhitā*, described by David Pingree to be a vast and important work, remains however unpublished. This paper draws on the latest discoveries from the hitherto unedited manuscripts of the Sanskrit text and a critical comparison with the extant Chinese materials. Topics include the conception of *nakṣatras* (lunar mansions) and special time units such as *tithi* and *muhūrta*.

Reference Maps

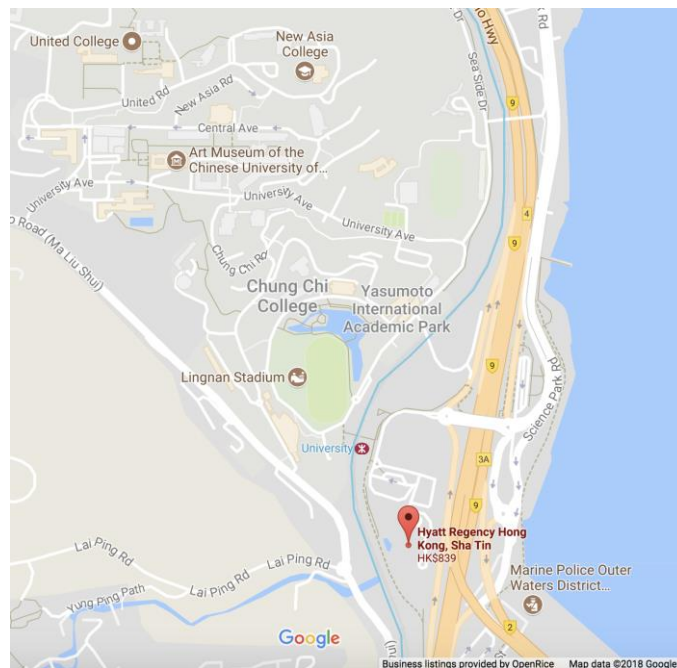
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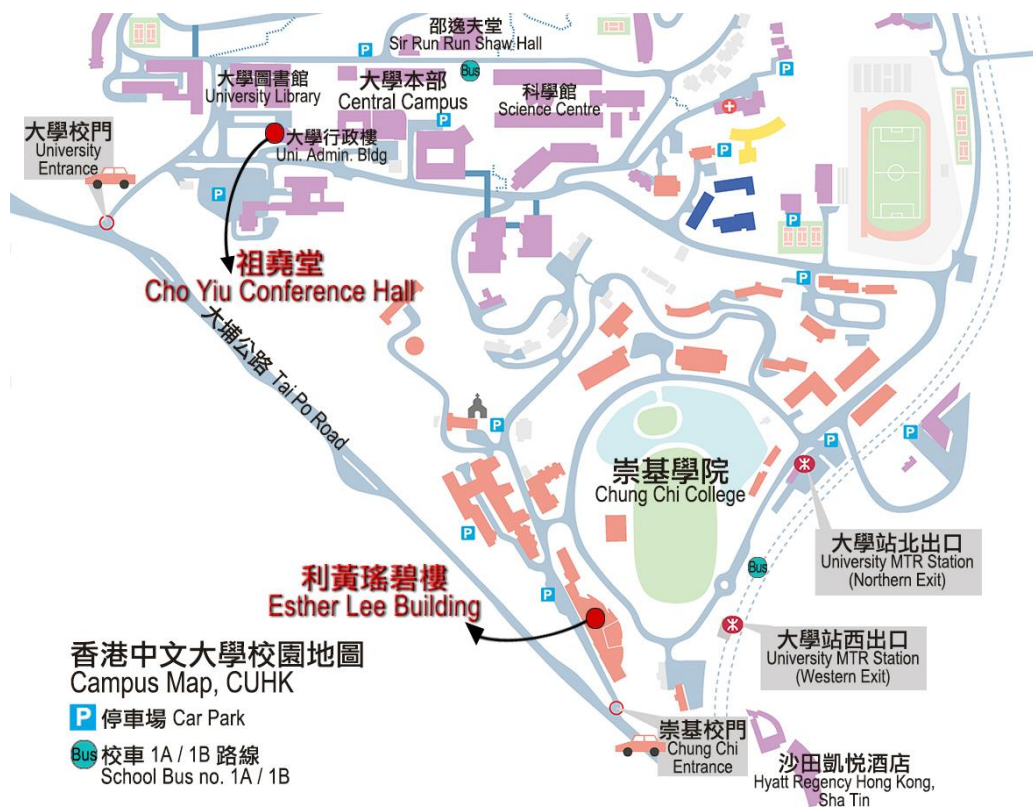


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