

Heritage Sites of Astronomy and Archaeoastronomy in the context of the UNESCO World Heritage Convention

A Thematic Study

Clive Ruggles and Michel Cotte

with contributions by

Margaret Austin, Juan Belmonte, Amanda Chadburn, Von Del Chamberlain, David DeVorkin, Eduardo Fayos-Solá, Danielle Fauque, Ivan Ghezzi, Ian Glass, He Nu, John Hearnshaw, Tofigh Heidarzadeh, Rebekah Higgitt, Jarita Holbrook, Manuela Incerti, Stanisław Iwaniszewski, Subhash Kak, Stéphane Le Gars, Stephen McCluskey, Giulio Magli, Cipriano Marín, Mikhail Marov, Ricardo Moyano, Casiana Muñoz-Tuñón, William Breen Murray, Efthymios Nicolaidis, Ray Norris, Park Jeong Eun, Juan Pérez Arencibia, Michael Rappenglück, Angel Rodriguez, Shi Yun-li, Malcolm Smith, John Steele, Richard Wainscoat, Richard Wielebinski, Tom Wilson, Gudrun Wolfschmidt, Günther Wuchterl, Michael Wright and Xu Fengxian



**International Council on
Monuments and Sites**

**Conseil International
des Monuments et des Sites**



Published by ICOMOS

Office: International Secretariat of ICOMOS,
49–51 rue de la Fédération, F–75015 Paris, France

and the International Astronomical Union

IAU–UAI Secretariat,
98-bis Blvd Arago, F–75014 Paris, France

ISBN 978-2-918086-01-7 (e-book)

© The individual authors, 2010
All rights reserved

Front cover photographs:

Stonehenge, United Kingdom. © UNESCO / Francesco Bandarin

Ulugh Beg's Observatory, Uzbekistan. © Our Place, the World Heritage Collection

The McClean Building at Cape Observatory, South Africa. © Ian Glass

The Caracol at Chichen Itza, Mexico. © Emmanuel Pivard

Supported by



Instituto de Astrofísica de Canarias (IAC) and Starlight Initiative
C/ Vía Láctea, s/n, E–38205 La Laguna (Tenerife). Spain

Contents

Preface	v
Acknowledgements	vi
Further information	vii
List of authors	viii
Introduction <i>Michel Cotte and Clive Ruggles</i>	1
Background to the ICOMOS–IAU Thematic Study	1
Aims, objectives and broad methodology	2
Some preliminaries about the nature of astronomical and archaeoastronomical heritage ...	3
Management: general considerations	12
Chapter 1 Earlier prehistory <i>Michael Rappenglück</i>	13
Case Study 1.1 The Thaïs bone, France	16
Case Study 1.2 The decorated plate of the Geißenklösterle, Germany	19
Case Study 1.3 The Ishango bone, Democratic Republic of the Congo	21
Case Study 1.4 The astronomical rock panels in the Lascaux Cave, France	24
Chapter 2 Later prehistoric Europe <i>Clive Ruggles</i>	28
Case Study 2.1 Stonehenge World Heritage Site, United Kingdom <i>Amanda Chadburn</i>	36
Case Study 2.2 Seven-stone antas, Portugal and Spain	41
Case Study 2.3 The stone circles at Odry, Poland <i>Stanisław Iwaniszewski</i>	43
Chapter 3 Pre-Columbian America <i>Stanisław Iwaniszewski</i>	46
Case Study 3.1 Boca de Potrerillos, Mexico <i>Stanisław Iwaniszewski and William Breen Murray</i>	54
Case Study 3.2 Caguana, Puerto Rico <i>Angel Rodriguez</i>	57
Case Study 3.3 Chankillo, Peru <i>Ivan Ghezzi</i>	59
Case Study 3.4 The metallurgical centre of Viña del Cerro, Chile <i>Ricardo Moyano</i>	62
Chapter 4 Indigenous uses of astronomy <i>Jarita Holbrook, Stephen McCluskey and Clive Ruggles</i>	65
Case Study 4.1 Navajo star ceilings, USA <i>Stephen McCluskey and Von Del Chamberlain</i>	71
Case Study 4.2 Atituiti Ruga, Mangareva, French Polynesia <i>Clive Ruggles</i>	74
Case Study 4.3 Wurdi Youang, Australia <i>Ray Norris</i>	76
Chapter 5 Ancient and medieval Far East <i>Shi Yun-li and Clive Ruggles</i>	80
Case Study 5.1 Taosi observatory, China <i>Xu Fengxian and He Nu</i>	86
Case Study 5.2 Denfeng observatory, China <i>Xu Fengxian</i>	90
Case Study 5.3 Beijing ancient observatory, China <i>Shi Yun-li</i>	94
Case Study 5.4 Cheomseongdae observatory, Republic of Korea <i>Park Jeong Eun</i> ...	96
Chapter 6 India <i>Subhash Kak</i>	99
Case Study 6.1 The Jantar Mantar at Jaipur, India <i>Michel Cotte</i>	108

Chapter 7	Mesopotamia and the Middle East	<i>John Steele</i>	113
Chapter 8	Ancient Egypt	<i>Juan Belmonte</i>	117
Case Study 8.1	The tomb of Senenmut at western Thebes, Egypt		127
Case Study 8.2	The temple of Amun at Karnak, Egypt		129
Case Study 8.3	The temple of Hathor at Dandara, Egypt		131
Case Study 8.4	The pyramids of Giza and related buildings, Egypt		133
Case Study 8.5	Napata, Sudan, including the temples of Djebel Barkal and the Nuri necropolis		136
Chapter 9	The Classical World	<i>Efthymios Nicolaidis, Giulio Magli and Clive Ruggles</i>	139
Case Study 9.1	The Pnyx, Athens, Greece	<i>Michael Wright</i>	146
Case Study 9.2	The acropolis of Alatri, Italy	<i>Giulio Magli</i>	148
Case Study 9.3	The Pantheon, Rome, Italy	<i>Giulio Magli</i>	151
Chapter 10	Islamic astronomy	<i>Tofiq Heidarzadeh</i>	155
Case Study 10.1	The Maragheh observatory, Iran		163
Case Study 10.2	Ulugh Beg’s observatory, Uzbekistan		166
Chapter 11	Medieval astronomy in Europe	<i>Stephen McCluskey</i>	169
Case Study 11.1	Monkwearmouth–Jarrow, United Kingdom		177
Case Study 11.2	The Baptistery of Parma, Italy	<i>Manuela Incerti</i>	180
Case Study 11.3	Strasbourg cathedral, France, and astronomical time		184
Chapter 12	Astronomy from the Renaissance to the mid-twentieth century	<i>Michel Cotte, Danielle Fauque and Clive Ruggles</i>	188
Case Study 12.1	The Royal Observatory, Greenwich, United Kingdom	<i>Rebekah Higgitt</i>	195
Case Study 12.2	The Royal Observatory, Cape of Good Hope, Republic of South Africa	<i>Ian Glass</i>	199
Case Study 12.3	Meudon observatory, France	<i>Stéphane Le Gars</i>	204
Case Study 12.4	Mount Wilson observatory, USA	<i>Gudrun Wolfschmidt and Clive Ruggles</i>	206
Case Study 12.5	The Einstein Tower, Potsdam, Germany	<i>Gudrun Wolfschmidt and Michel Cotte</i>	209
Chapter 13	The development of radio astronomy	<i>Richard Wielebinski and Tom Wilson</i>	213
Case Study 13.1	The Stockert radio telescope, Germany	<i>Richard Wielebinski</i>	221
Chapter 14	Applied astronomy in modern times	<i>Michel Cotte</i>	224
Case Study 14.1	The Struve geodetic arc, Belarus, Estonia, Finland, Latvia, Lithuania, Moldova, Norway, Russian Federation, Sweden, and Ukraine		226
Chapter 15	Space heritage	<i>David DeVorkin and Mikhail Marov</i>	229
Chapter 16	‘Windows to the universe’—starlight, dark-sky areas and observatory sites	<i>Cipriano Marín, Richard Wainscoat and Eduardo Fayos-Solá</i>	238
Case Study 16.1	Lake Tekapo – Aoraki – Mount Cook Starlight Reserve, New Zealand	<i>Margaret Austin and John Hearnshaw</i>	246
Case Study 16.2	Eastern Alpine Starlight Reserve and Großmugl Starlight Oasis, Austria	<i>Günther Wuchterl</i>	249
Case Study 16.3	AURA Observatory, Chile	<i>Malcolm Smith</i>	252
Case Study 16.4	Mauna Kea Observatory, Hawaii, USA	<i>Richard Wainscoat</i>	255
Case Study 16.5	Canarian observatories, Spain	<i>Casiana Muñoz-Tuñón and Juan Carlos Pérez Arencibia</i>	257
Conclusion	Astronomical heritage in the context of the UNESCO World Heritage Convention: developing a professional and rational approach	<i>Michel Cotte and Clive Ruggles</i>	260

Preface

This Thematic Study results from a collaborative project between the International Council on Monuments and Sites (ICOMOS), an advisory body to UNESCO for cultural heritage, and the International Astronomical Union (IAU), the world's foremost professional organization for astronomy, through its Working Group on Astronomy and World Heritage. It is published jointly by ICOMOS and the IAU

The main aims of the project are to gain an improved understanding of the character and composition of different forms of astronomical heritage and to identify optimal methods for, and potential problems in, defining this type of heritage in the context of the World Heritage Convention. As a result of the collaboration, the international team of authors is drawn from two complementary scientific and professional communities both of whom have provided invaluable input and expertise. The need to combine methodologies and develop common lines of approach has presented a range of challenges and each of the contributing authors named on various chapters and case studies has played a vital role in helping us to rise to them. Where no author is named on a case study, it has been provided by the author of the chapter that contains it.

These contributing authors provided the first drafts of their articles working to a common specification that we had supplied. Subsequently we assessed these contributions in detail and, in some cases, heavily reorganized and amended them in order to impose a suitable degree of consistency of approach and style and depth of analysis (as well as of length).

Where substantial cuts have been made to the individual authors' reports and case studies, it is our intention to make fuller versions available on the website of the Astronomy and World Heritage Initiative <http://www.astronomicalheritage.net/> following the publication of this Thematic Study. Updates, together with and further reports and case studies, will also be posted on the Initiative's website in due course, forming part of an electronic resource that will continue to be developed into the future.

As with all ICOMOS Thematic Studies, the case studies presented do not in any sense constitute a 'provisional list'. They include a mixture of properties already inscribed on the World Heritage List, sites included on national Tentative Lists, and others. It must be emphasized, especially in the last case, that the presence or absence of any property as a case study in this volume carries no implications whatsoever regarding the outcome of the nomination process should it ever be put forward for inscription to the List, either alone or through a serial nomination.

CR and MC, June 2010

Acknowledgements

The principal authors wish to thank the staff at ICOMOS International and the International Astronomical Union for the guidance and support they have given throughout this project. Particular thanks are due to the members of the ICOMOS World Heritage Working Group and the IAU Working Group on Astronomy and World Heritage, as to all their fellow authors, for working so hard to bring this project to a timely completion.

Financial sponsors

The publication has been made possible by the financial support of

- Instituto de Astrofísica de Canarias (IAC), Spain
- The Starlight Initiative

We are also grateful to the Hon. Margaret Austin for obtaining financial support from sources in New Zealand.

Illustrative materials

While every effort has been made to identify copyright owners and to obtain their permission to use their material in this book, the publishers apologise for any errors and omissions and would welcome these being brought to their attention.

Further Information

Further information relating to astronomy and archaeoastronomy and/or the context of the World Heritage Convention can be found on the following websites:

UNESCO World Heritage Centre	whc.unesco.org
International Council on Monuments and Sites (ICOMOS)	www.icomos.org
International Astronomical Union (IAU)	www.iau.org
UNESCO Astronomy and World Heritage Initiative	www.astronomicalheritage.net
IAU Working Group on Astronomy and World Heritage	www.astronomicalheritage.org
Inter-Union Commission on the History of Astronomy	www.historyofastronomy.org
International Union for the Conservation of Nature (IUCN)	www.iucn.org
International Society for Archaeoastronomy and Astronomy in Culture (ISAAC)	www.archaeoastronomy.org

List of Authors

COTTE, Michel, Emeritus Professor of the History of Technology, Centre François Viète for the History of Science and Technology, University of Nantes, France; Advisor to ICOMOS international for the World Heritage List.

RUGGLES, Clive, Emeritus Professor of Archaeoastronomy, School of Archaeology and Ancient History, University of Leicester, United Kingdom; Chair, International Astronomical Union Working Group on Astronomy and World Heritage.

AUSTIN, Margaret, Vice-President Royal Society of New Zealand, Christchurch; Honorary Chancellor at Lincoln University; Starlight Reserve Working Group – New Zealand.

BELMONTE, Juan, Instituto de Astrofísica de Canarias, 38200 La Laguna, Tenerife, Spain.

CHADBURN, Amanda, Archaeologist and Anthropologist; Inspector at English Heritage, United Kingdom.

CHAMBERLAIN, Von Del, formerly Director of the Hansen Planetarium, Salt Lake City, USA.

DEVORKIN, David, Senior Curator, Astronomy and the Space Sciences Division of Space History, National Air and Space Museum, Washington DC, USA.

FAYOS-SOLÁ, Eduardo, Regional Representative for Europe and Executive Secretary of the Education and Science Council, United Nations World Tourism Organization (UNWTO).

FAUQUE, Danielle, GHDSO Laboratory for the History of Sciences, University of Orsay – Paris Sud; Chair of the ‘Club d’Histoire de la Chimie’, France.

GLASS, Ian, Senior Astronomer, South African Astronomical Observatory, Cape Town, South Africa; Adjunct Professor, James Cook University, Queensland, Australia.

GHEZZI, Iván, Proyecto Chankillo, Instituto de Investigaciones Arqueológicas, Pontificia Universidad Católica del Perú, Lima, Peru.

HE Nu, Professor, Archaeology Institute, Chinese Academy of Social Sciences, Beijing, China .

HEARNSHAW, John, Professor of Astronomy, University of Canterbury, Christchurch, New Zealand.

HEIDARZADEH, Tofigh, Lecturer of History of Sciences, Department of History, University of California, Riverside; History of Science Educator, The Huntington Library, San Marino, California, USA.

HIGGITT, Rebekah, Curator of History of Science and Technology, National Maritime Museum, London, United Kingdom.

HOLBROOK, Jarita, Assistant Research Scientist, College of Science, University of Arizona, Tucson, Arizona, USA.

- INCERTI Manuela, Department of Architecture, Università degli Studi di Ferrara, Ferrara, Italy.
- IWANISZEWSKI, Stanisław, Professor-Researcher, Division of Postgraduate Studies in Archaeology, National School of Anthropology and History, Mexico City; State Archaeological Museum, Warsaw, Poland.
- KAK, Subhash, Emeritus Professor of Electrical Engineering and Professor in the Asian Studies and Cognitive Science Programs, Louisiana State University, Baton Rouge, Louisiana, USA.
- LE GARS, Stéphane, Centre François Viète for the History of Science and Technology, University of Nantes, France.
- MCCLUSKEY, Stephen C., Emeritus Professor of History, West Virginia University, Morgantown, West Virginia, USA.
- MAGLI, Giulio, Faculty of Civil Architecture, Politecnico di Milano, Milano, Italy.
- MARÍN, Cipriano, Co-ordinator Starlight Initiative – Instituto de Astrofísica de Canarias (IAC) / Starlight Foundation; Secretary-General of the UNESCO Centre, Canary Islands, Spain.
- MAROV, Mikhail, Member of the Russian Academy of Sciences; Head of the Vernadsky Institute for Geochemistry; Scientific Director of Keldysh Institute of Applied Mathematics, Russia.
- MOYANO, Ricardo, Archaeologist, Chile; Graduate Student, Escuela Nacional de Antropología e Historia, Mexico City, Mexico.
- MUÑOZ-TUÑÓN, Casiana, Instituto de Astrofísica de Canarias (IAC), Spain.
- MURRAY, William Breen, Professor Emeritus, Dept. of Social Sciences, University of Monterrey, San Pedro Garza, Garza, Nuevo León, Mexico.
- NICOLAIDIS, Efthymios, Secretary General of the International Union of the History and Philosophy of Science, Division of History of Science and Technology; member of the Board of the International Academy of History of Science; National Research Foundation, Athens, Greece.
- NORRIS, Ray, Head of the CSIRO Australia Telescope National Facility; Adjunct Professor in the Department of Indigenous Studies at Macquarie University, Australia.
- PARK Jeong Eun, Cultural Heritage Administration, Seoul, Republic of Korea.
- PÉREZ ARENCIBIA, Juan Carlos, Instituto de Astrofísica de Canarias (IAC), Spain.
- RAPPENGLÜCK, Michael, Secretary of the Société Européenne pour l’Astronomie dans la Culture (SEAC), Germany.
- RODRIGUEZ, Angel, Archaeologist and Historian, Centro de Estudios Históricos, Puerto Rico.
- SHI Yun-li, Institute of Natural Science History, University of Science and Technology of China, Hefei, China.
- SMITH, Malcolm, Cerro Tololo Interamerican Observatory (CTIO), Chile.
- STEELE, John, Associate Professor of Egyptology and Ancient Western Asian Studies Brown University, Providence, Rhode Island, USA.
- WAINSCOAT, Richard, Institute for Astronomy, University of Hawaii, USA; Chair, International Astronomical Union Working Group on Controlling Light Pollution.
- WIELEBINSKI, Richard, Emeritus Director, Max-Planck-Institut für Radioastronomie, Bonn, Germany.

WILSON, Tom, Head of Radio, Infra-Red and Optical Sensor Branch at the US Naval Research Laboratory, Washington DC, USA.

WOLFSCHMIDT, Gudrun, Head of the Institute for History of Science and Technology, Faculty of Mathematics, Informatics and Natural Sciences (MIN), Hamburg University, Germany.

WUCHTERL, Günther, Thüringer Landessternwarte, Tautenburg, Germany; Director of the Observatory of the Kuffner-Sternwarte, Vienna, Austria.

WRIGHT, Michael, Mechanician and Historian of Mechanics Honorary Research Associate, Centre for the History of Science, Technology and Medicine, Imperial College, London, United Kingdom.

XU Fengxian, Institute for the History of Natural Science, Chinese Academy of Sciences, Beijing, China.

Start by marking "Heritage Sites of Astronomy and Archaeoastronomy in the Context of the UNESCO World Heritage Convention" as Want to Read: Want to Read saving... Want to Read. An e-version of the Thematic Study was published in June 2010 in time to be presented to the 2010 meeting of UNESCO's World Heritage Committee, where it was duly approved. It has been circulated officially by the WHC to all of UNESCO's National Commissions. This full-colour paperback edition with some updates, and reformatted to new ICOMOS standards, was published in 2011 and is now offered for public sale. ...more. Get A Copy. Amazon. Heritage Sites of Astronomy and Archaeoastronomy in the Context of the World Heritage Convention: Thematic Study no. 2 was published as an e-book in June, in time for the 2017 UNESCO World Heritage Committee meeting in Kraków, and as a paperback in November, in time for the ICOMOS General Assembly in Delhi. All of the activities listed above form part of the IAU's contribution to the UNESCO-IAU Astronomy and World Heritage Initiative, which in the longer term, directly or indirectly, influence and encourage State Parties to put forward World Heritage nominations relating to astronomical heritage. This long-term process is now beginning to bear significant fruit.