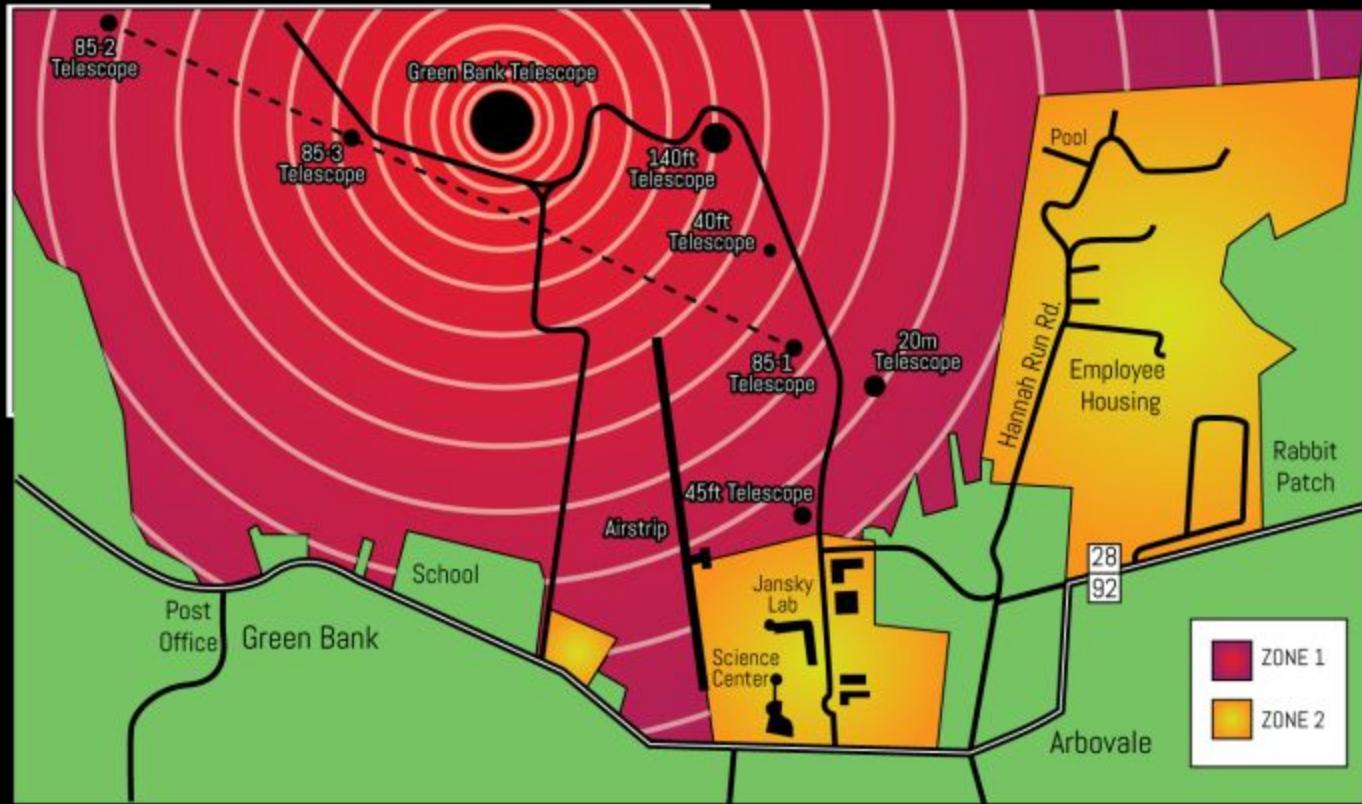


Astronomy Before the Telescope

ASYR 1600

Erica Meszaros



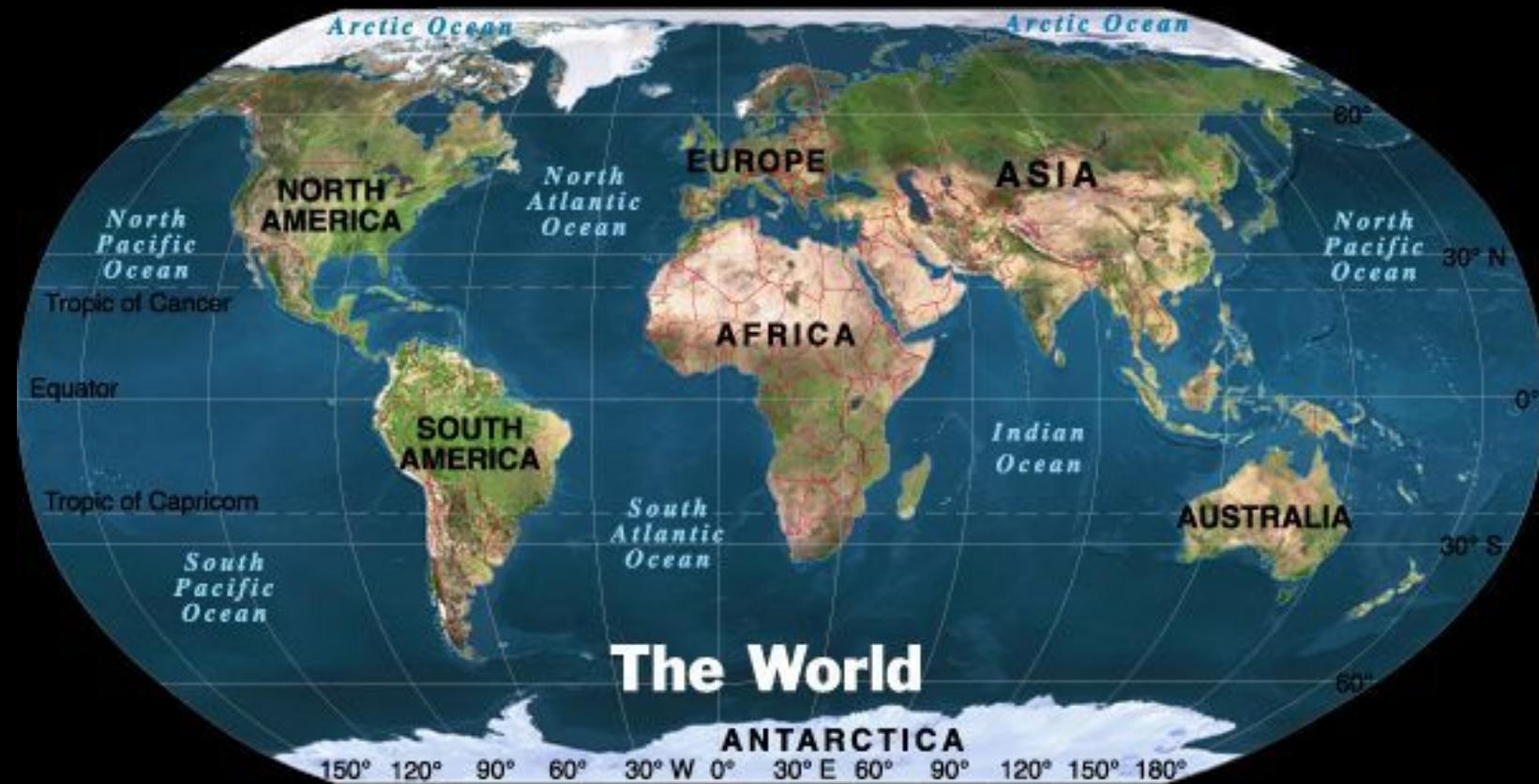




Course Overview

- An introduction to the history of astronomy from ancient times to (and including) the invention of the telescope
- Topics include:
 - Astronomical observations
 - Astronomical instruments
 - The development of cosmologies
 - The creation of astronomical theories
 - Why people did astronomy

Astronomy Throughout the World



Astronomy Throughout the World



Timeline

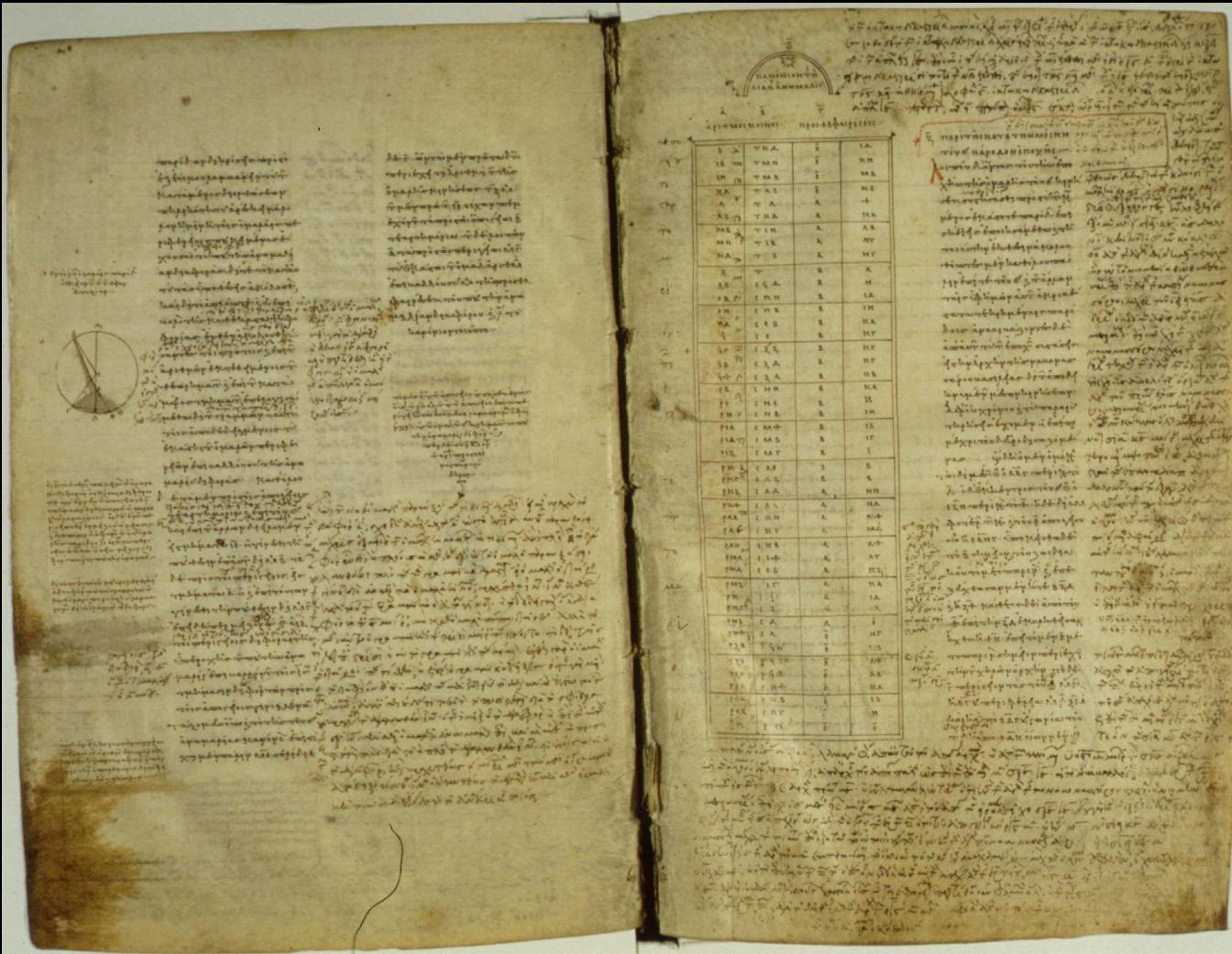
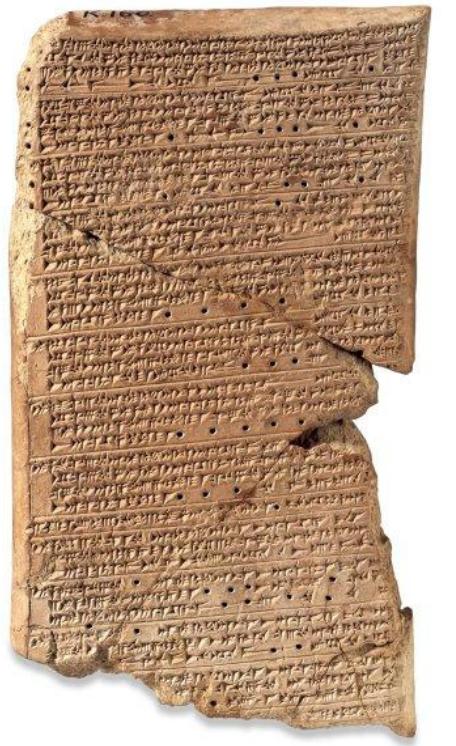
Mesopotamia	2500 BC - AD 100
China	1500 BC - AD 1900
Greece	600 BC - AD 400
India	500 BC - AD 1900
Islamic World	AD 700 - AD 1900
Medieval Europe	AD 600 - AD 1650
Mesoamerica	c. AD 200 - AD 1600

Studying the History of Astronomy

- Sources
 - Texts
 - Images
 - Instruments
 - Buildings (eg observatories)
 - Landscapes

Studying the History of Astronomy

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刻漏制度
契壻氏以百刻分

畫夜冬至畫漏四十刻春臘

夜六十刻夏至畫漏四十分

二分畫夜各五十刻

刻漏改為百二十刻

武帝大同十年又改

一百八十刻或增或減

類皆踈寥至

漢家改為百二十刻

其法有四圖

一遵古制

而其法有四圖

一遵古制

而其法有四圖

一遵古制

而其法有四圖

一遵古制

而其法有四圖

一遵古制

而其法有四圖

一遵古制

而其法有四圖

一遵古制

این بند احتمالی و این درس دو ماده‌اند که ممکن است در جمله مذکور ایجاد شوند اما این بند را در اینجا در نظر نمی‌گیریم و ممکن است در ماده‌های دیگر آنها مذکور شود.

فُوست القَمَر

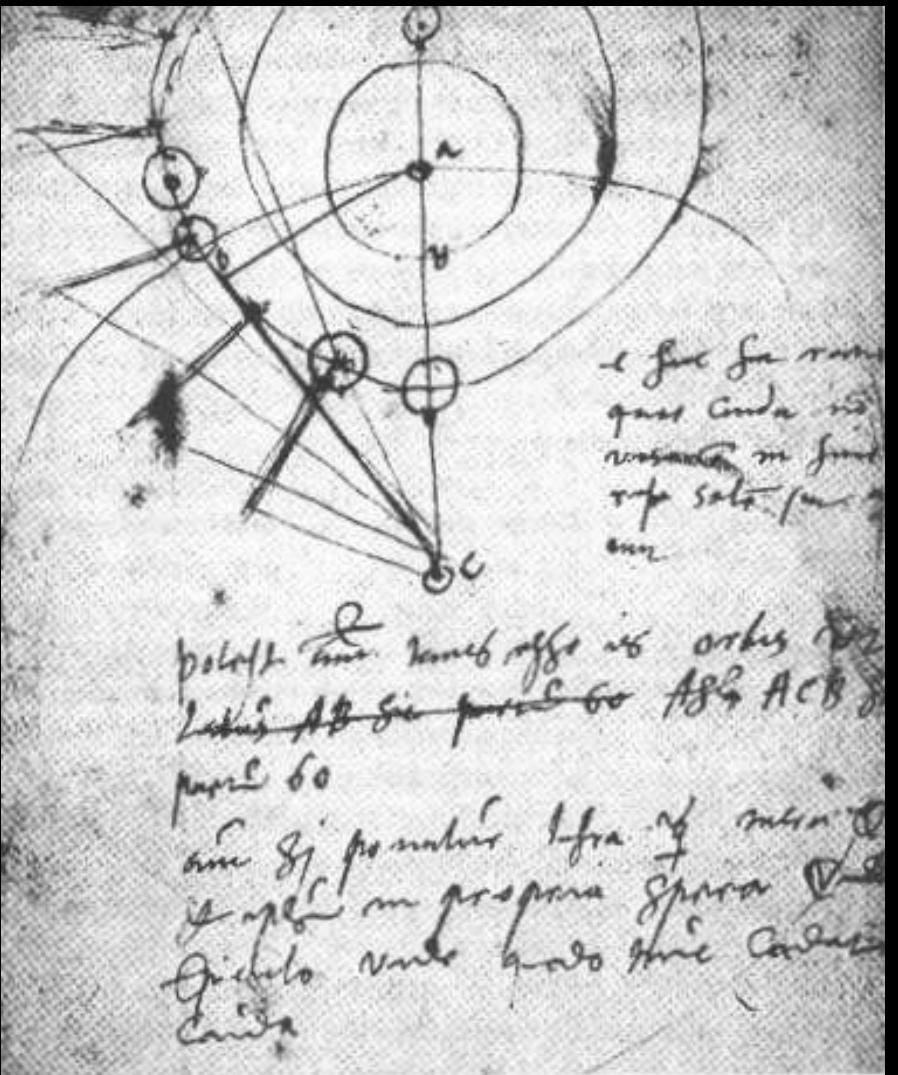
نَادِي الْجَمَانِ

Reading and Understanding Texts

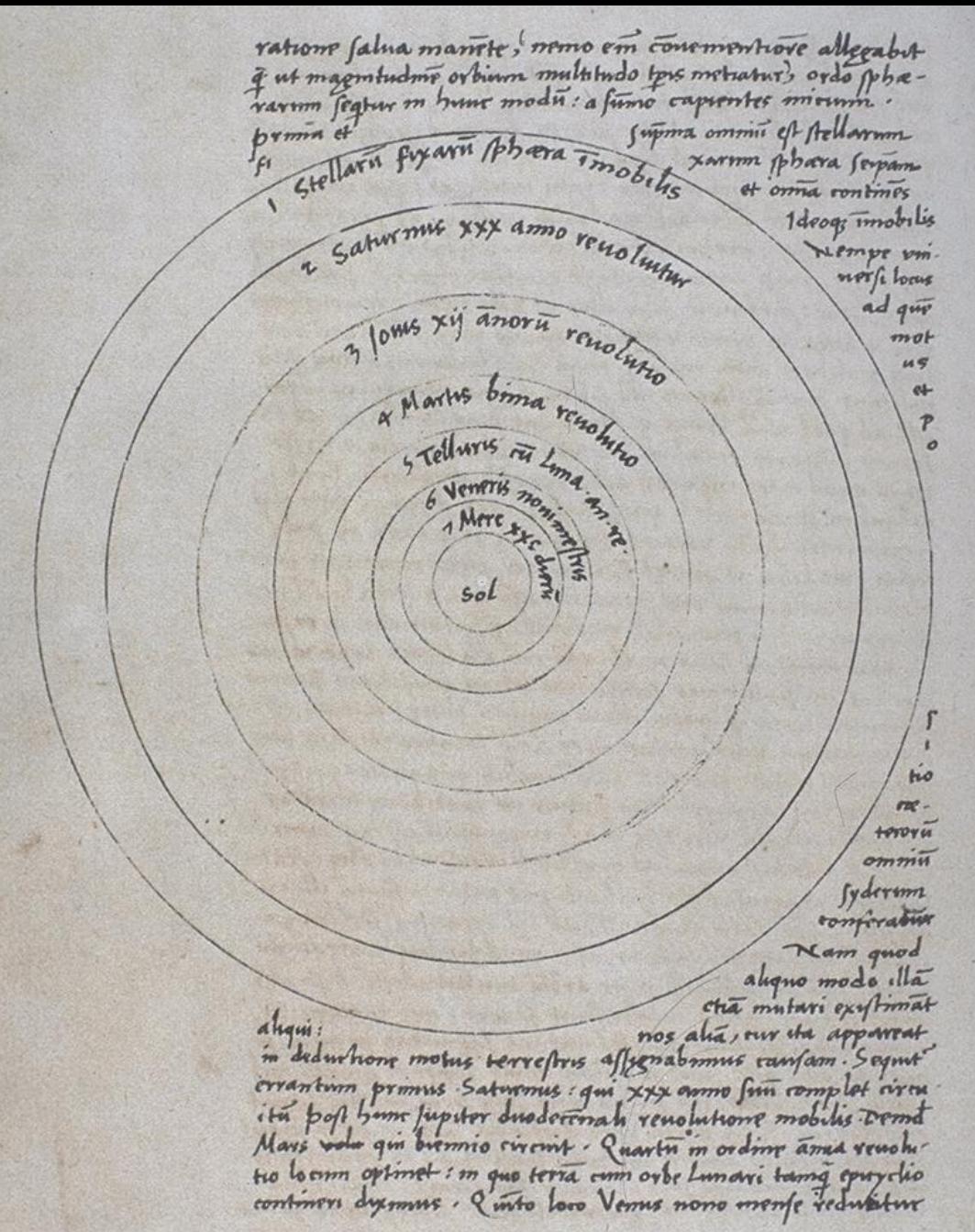
- Language and translation
- Context
- Reliability
- Nature of text (eg educational, theoretical treatise, result of practice)
- Avoiding modern preconceptions

Studying the History of Astronomy

- Sources
 - Texts
 - Images
 - Instruments
 - Buildings (eg observatories)
 - Landscapes



annis 8j pro motu infra. qd' subin' qd' aplo in propria spira qd' Quidam vero quod hinc Cauda Cinda.



Studying the History of Astronomy

- Sources
 - Texts
 - Images
 - Instruments
 - Buildings (eg observatories)
 - Landscapes



Studying the History of Astronomy

- Sources
 - Texts
 - Images
 - Instruments
 - Buildings (eg observatories)
 - Landscapes

Types of Questions

- Scientific
 - What astronomy was being done?
 - How was it being done?
 - Reconstructing the science
- Cultural
 - Who was doing it?
 - Why was it being done?
 - How does it link to other subjects?
 - Understanding the place of the science in society

Astronomy and Society

- The calendar
- Predicting the future / interpreting the present (astrology)
- Time measurement
- Assisting religious practice
- Rituals
- Navigation

Some Preliminary Definitions

Astronomy: *The observation, analysis and development of predictive methods of celestial phenomena*

Astrology / Celestial Divination: *The prediction of events on the earth from observed or calculated astronomical phenomena*

Observational Astronomy: *Observing the sky and recording what is observed*

Mathematical or Theoretical Astronomy: *Mathematical methods to calculate astronomical phenomena using some general rule*

Cosmology: *Constructing a physical/philosophical model of the universe*

Some Preliminary Definitions

Day/Night	Astronomy: <i>The observation, analysis and development of predictive methods of celestial phenomena</i>
Day	Astrology / Celestial Divination: <i>The prediction of events on the earth from observed or calculated astronomical phenomena</i>
Night	Observational Astronomy: <i>Observing the sky and recording what is observed</i>
Day	Mathematical or Theoretical Astronomy: <i>Mathematical methods to calculate astronomical phenomena using some general rule</i>
Day	Cosmology: <i>Constructing a physical/philosophical model of the universe</i>

What did ancient astronomers observe?

- Phenomena visible with the naked-eye
 - Stars
 - The moon
 - The planets
 - 5 planets: Mercury, Venus, Mars, Jupiter, Saturn
- The fixed stars and constellations
- Regular phenomena
 - The appearance and movement of the sun, moon and planets
- Irregular phenomena
 - Comets
 - Meteors

The night sky



Stars and Constellations

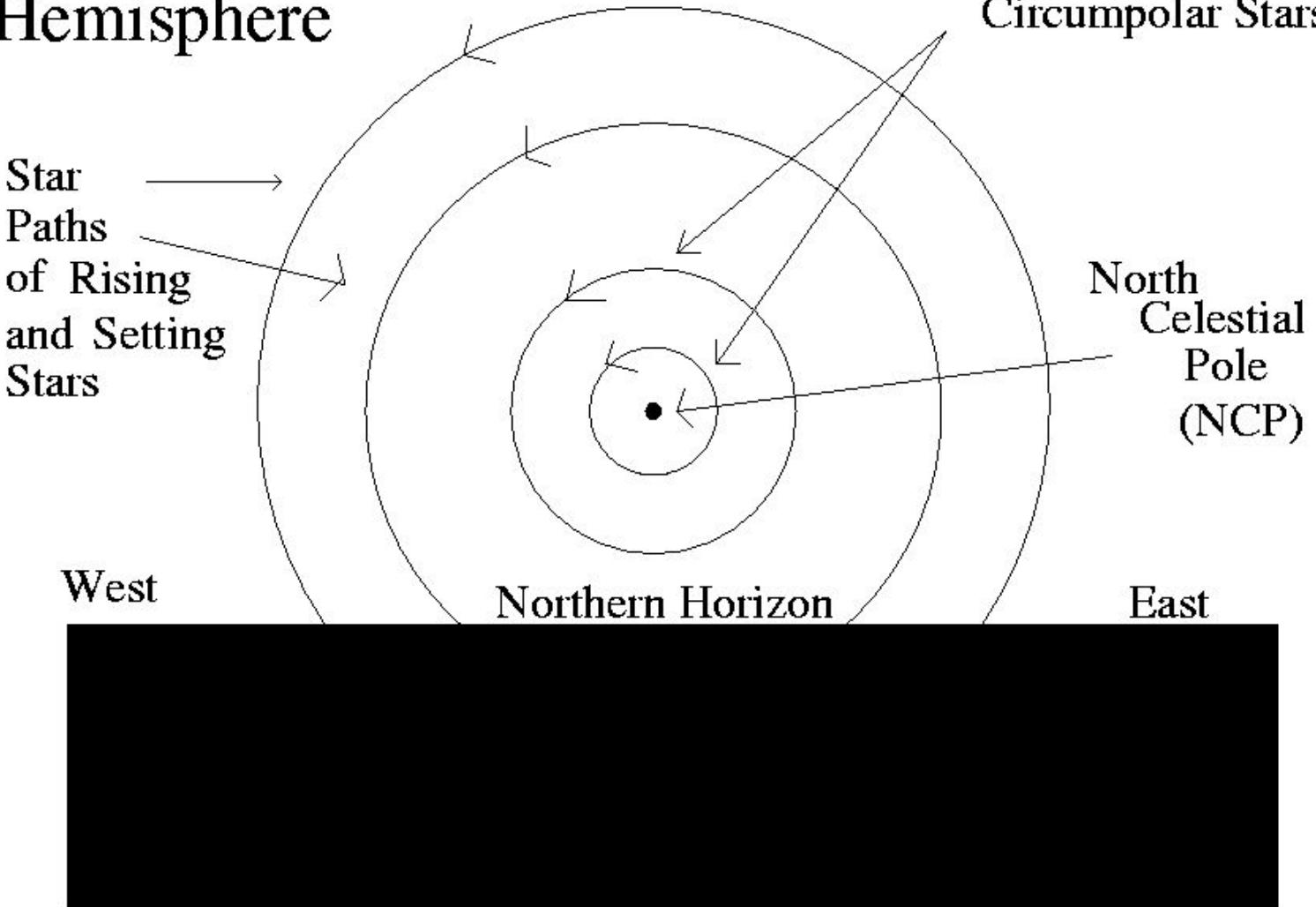




Star Paths Looking Due North in the Northern Hemisphere

DJ Jeffery
UNLV 2003

Star paths of
Circumpolar Stars



The Planets



The Moon



The Cycle of the Moon



The Cycle of the Moon



Syllabus

Prehistoric Astronomy



A Tomb in Mallorca



Orientation of tombs in Portugal and Southern Spain

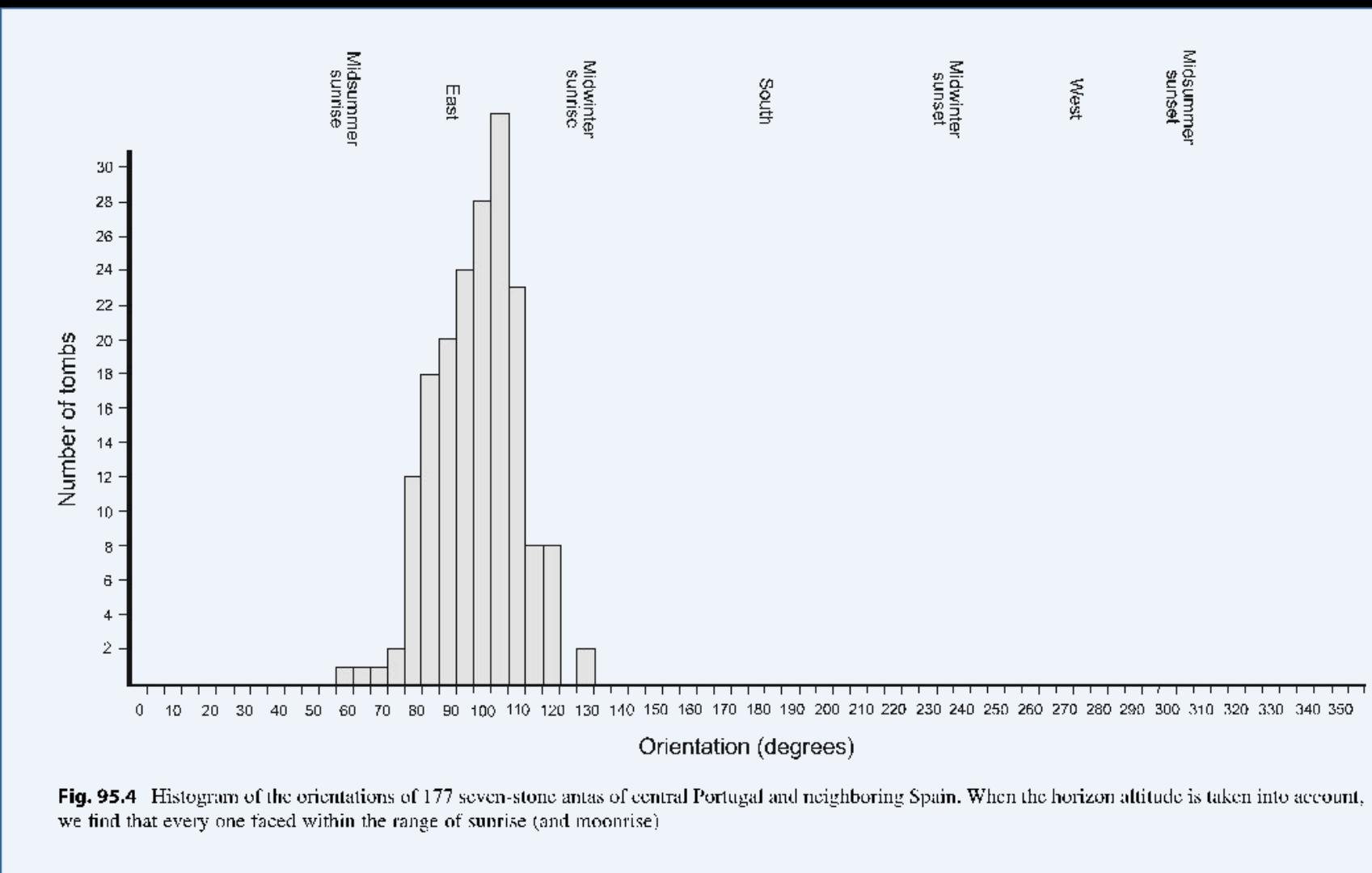


Fig. 95.4 Histogram of the orientations of 177 seven-stone antas of central Portugal and neighboring Spain. When the horizon altitude is taken into account, we find that every one faced within the range of sunrise (and moonrise)

Orientation of tombs in southern France

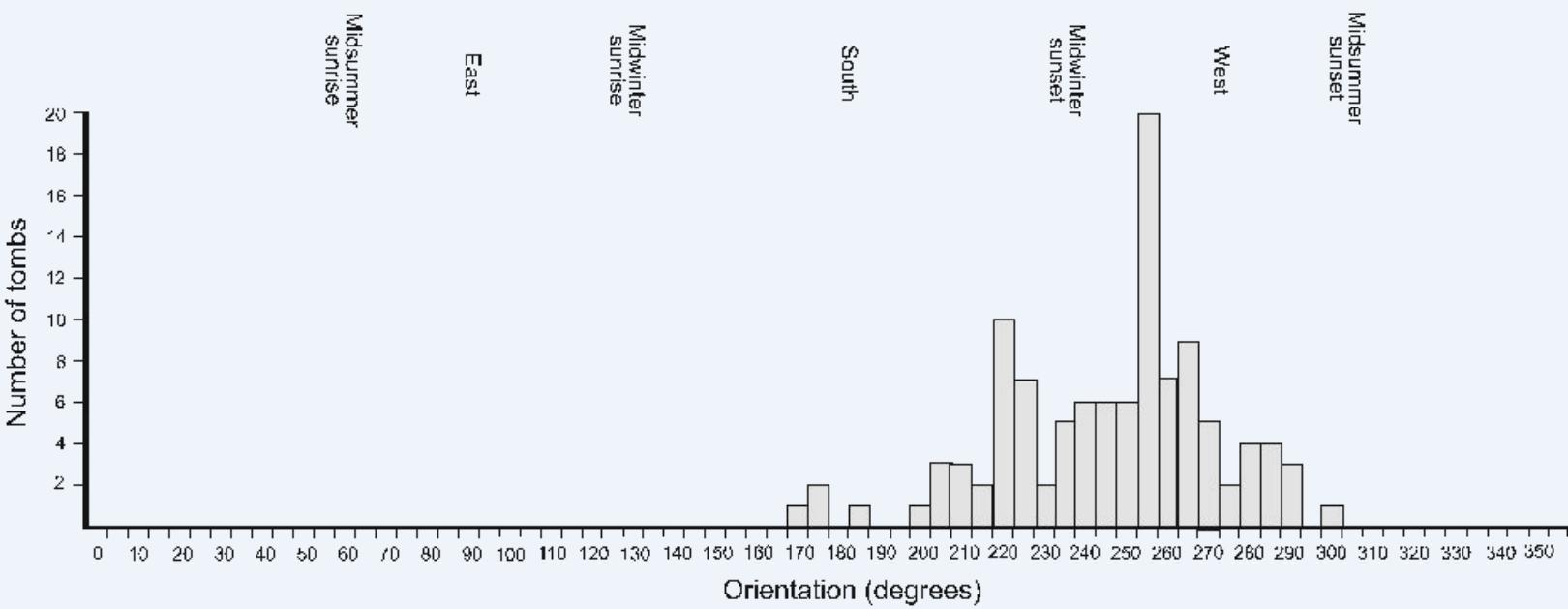
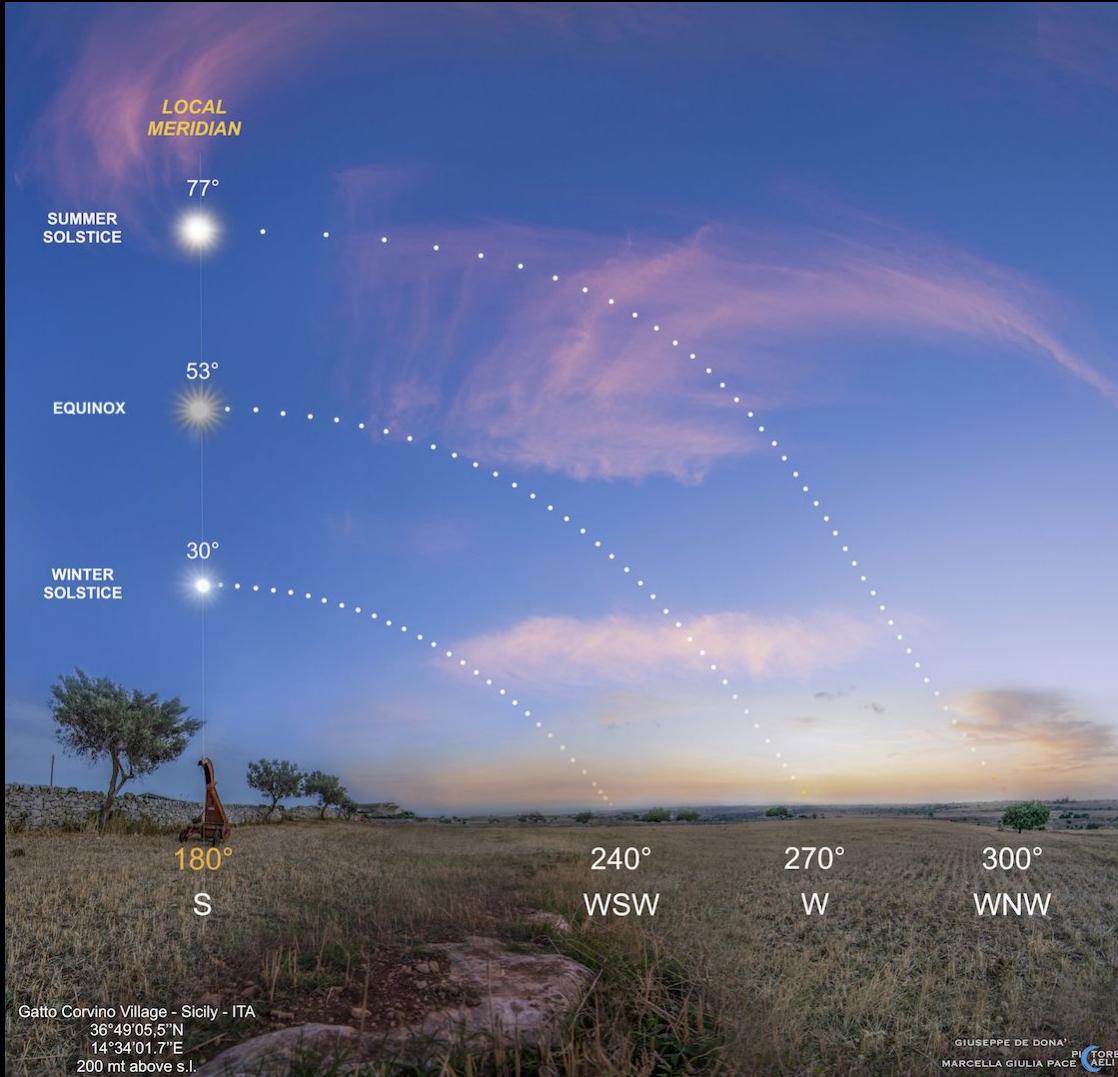


Fig. 95.9 Histogram showing the orientations of 110 tombs of Provence and east Languedoc. Nearly all the tombs faced the setting sun (SS), or the sun when it was descending in the sky (SD)

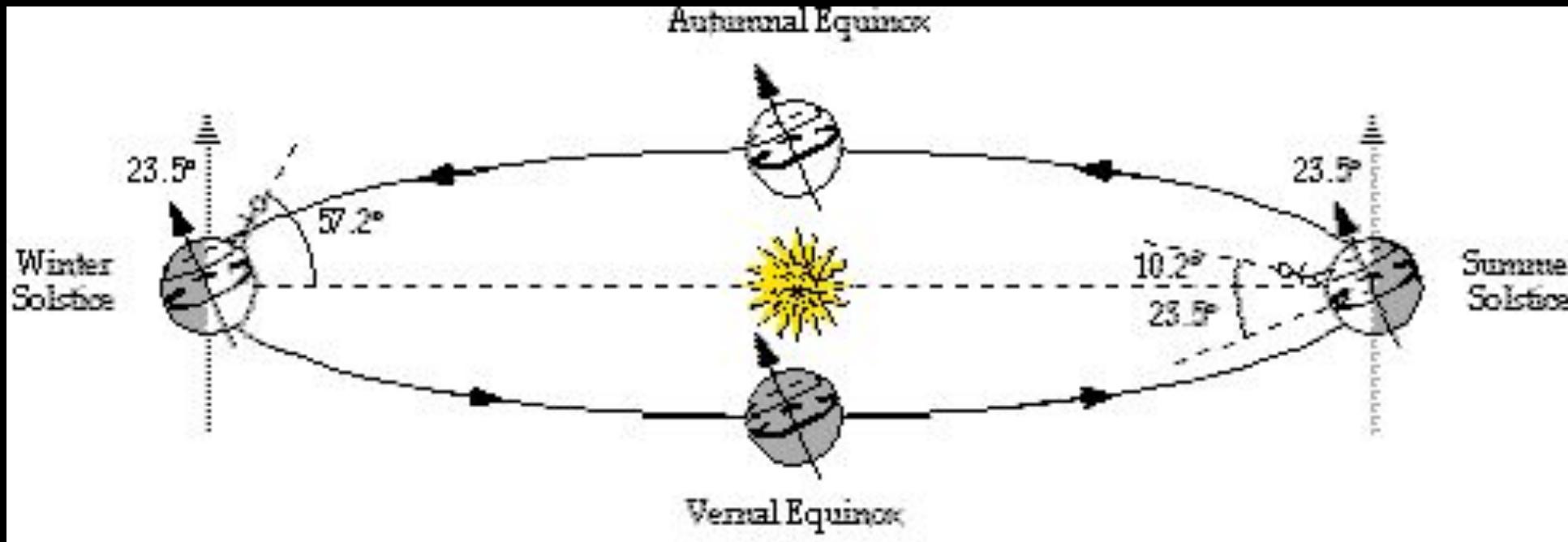
The path of the Sun



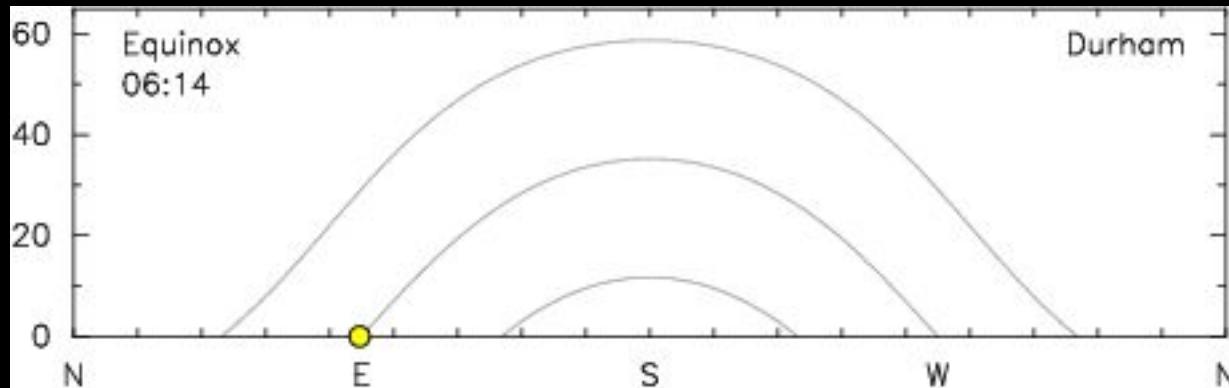
The Observed Path of the Sun



Tilt of the Earth's Axis



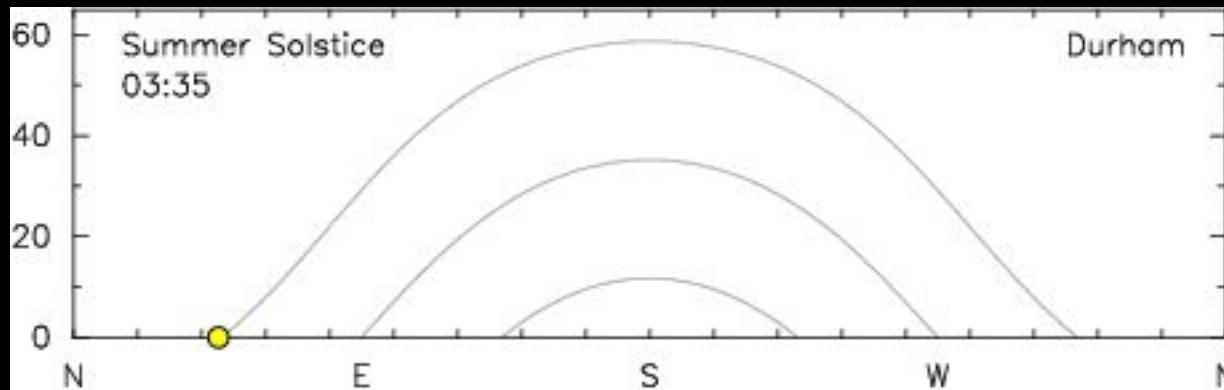
The daily path of the Sun



Equinox

- Day and night of equal length
- Sun rises due east and sets due west
- Spring equinox: Sun at the vernal point on the ecliptic (= 0 degrees)
- Fall (autumnal) equinox: Sun 180 degrees from the vernal point (= 180 degrees)

The daily path of the Sun



Solstice

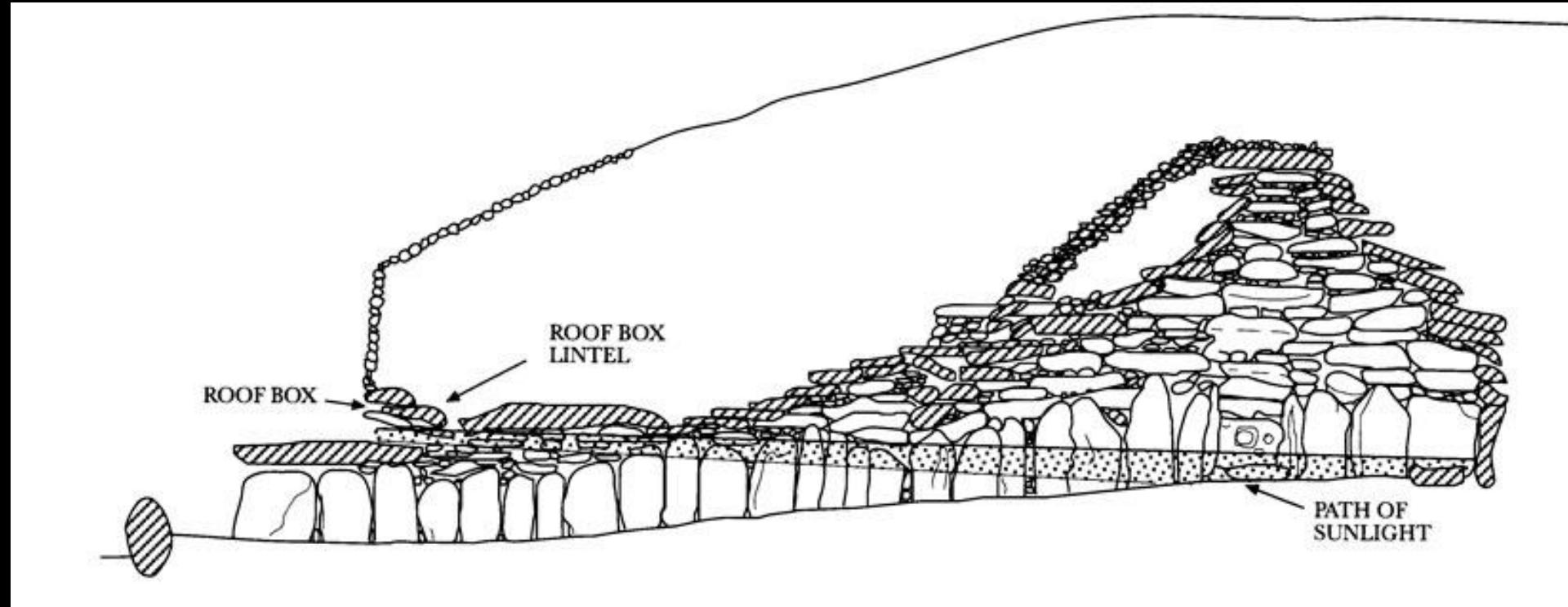
- Longest or shortest day
- Sun rises at its furthest north or south
- [Summer solstice: Sun at 90 degrees on the ecliptic]
- [Winter solstice: Sun at 270 degrees on the ecliptic]

Newgrange, Ireland





Sunrise at Winter Solstice





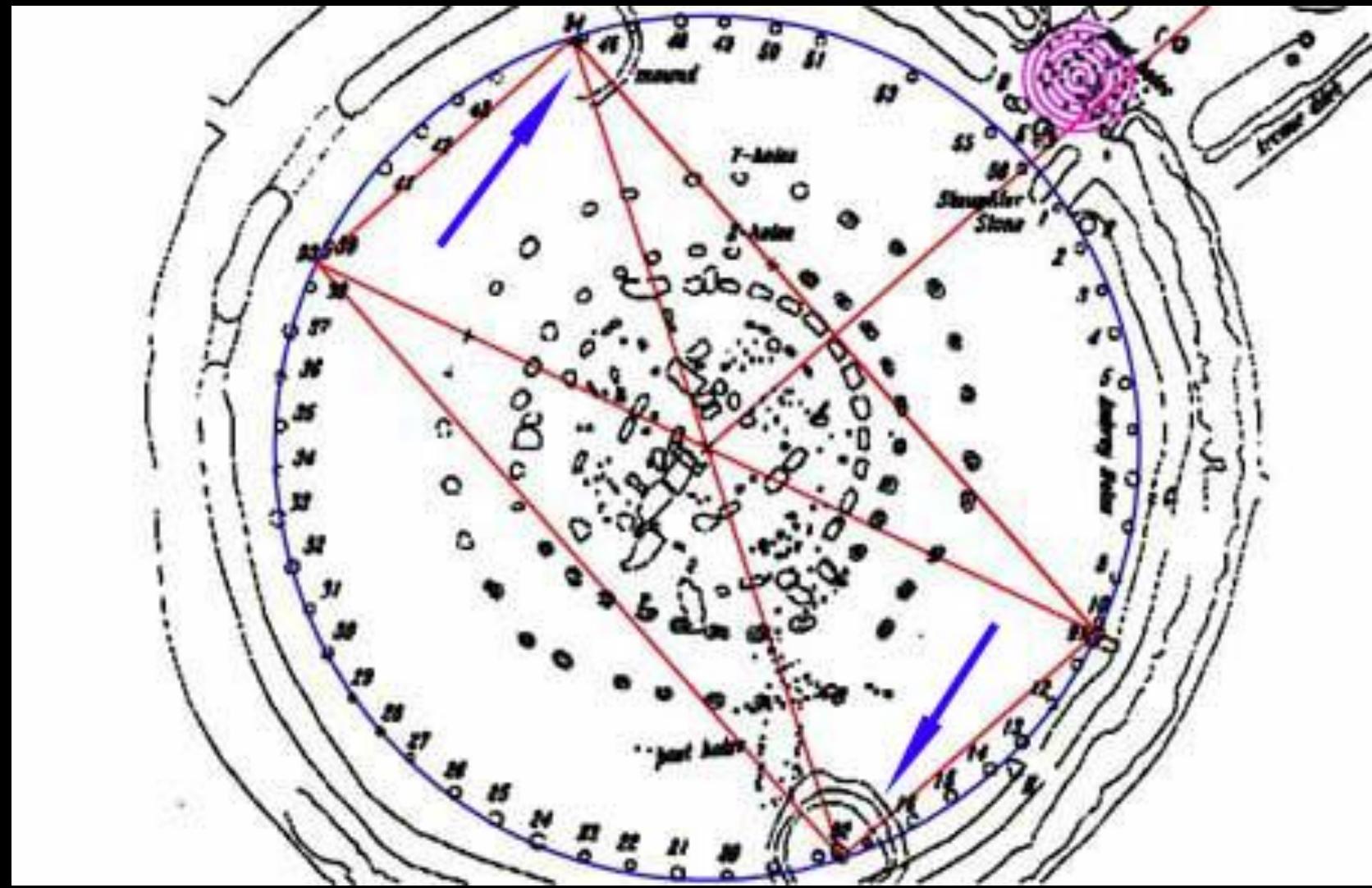


© Department of the Environment, Heritage and Local Government

Stonehenge





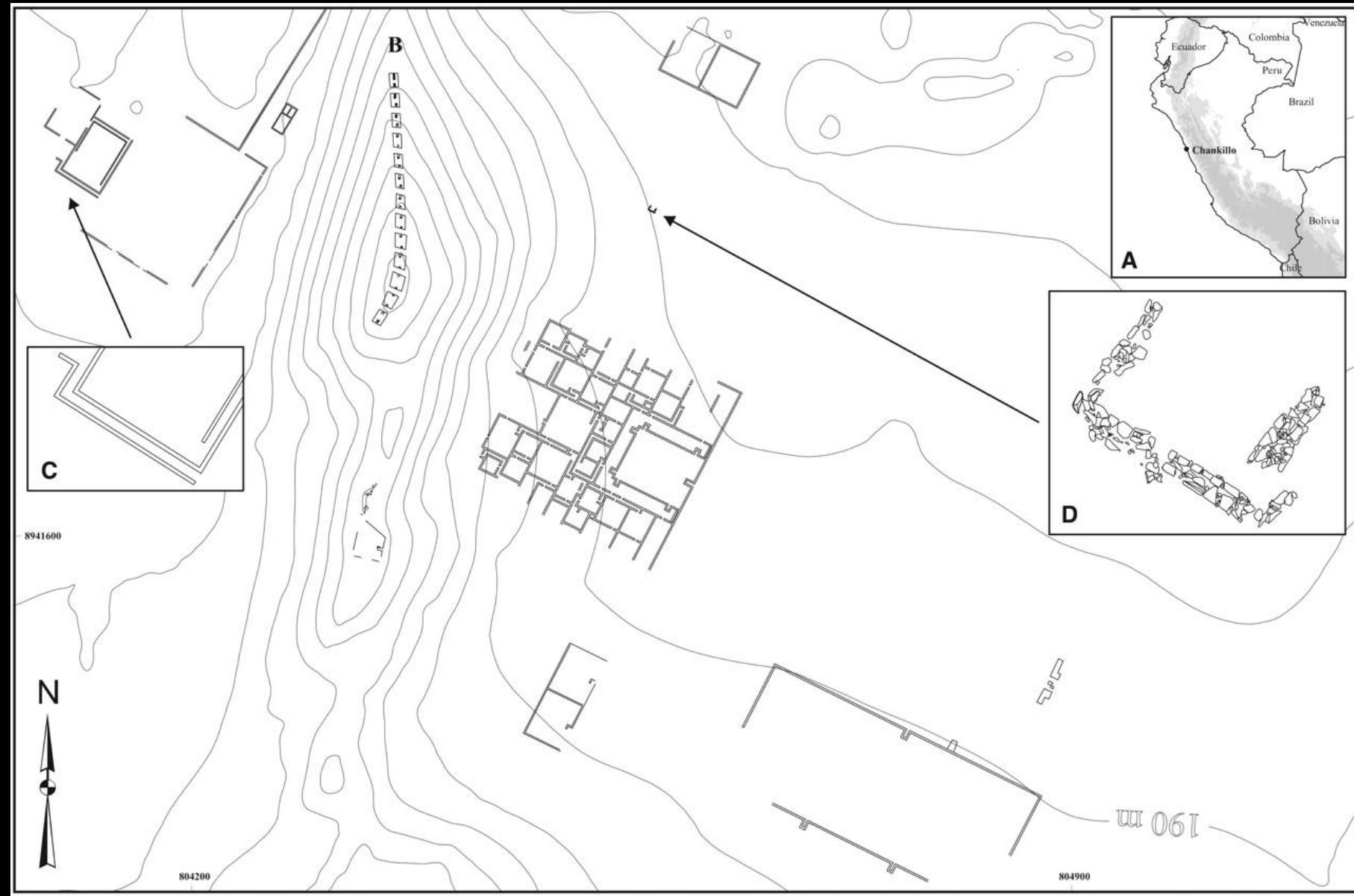


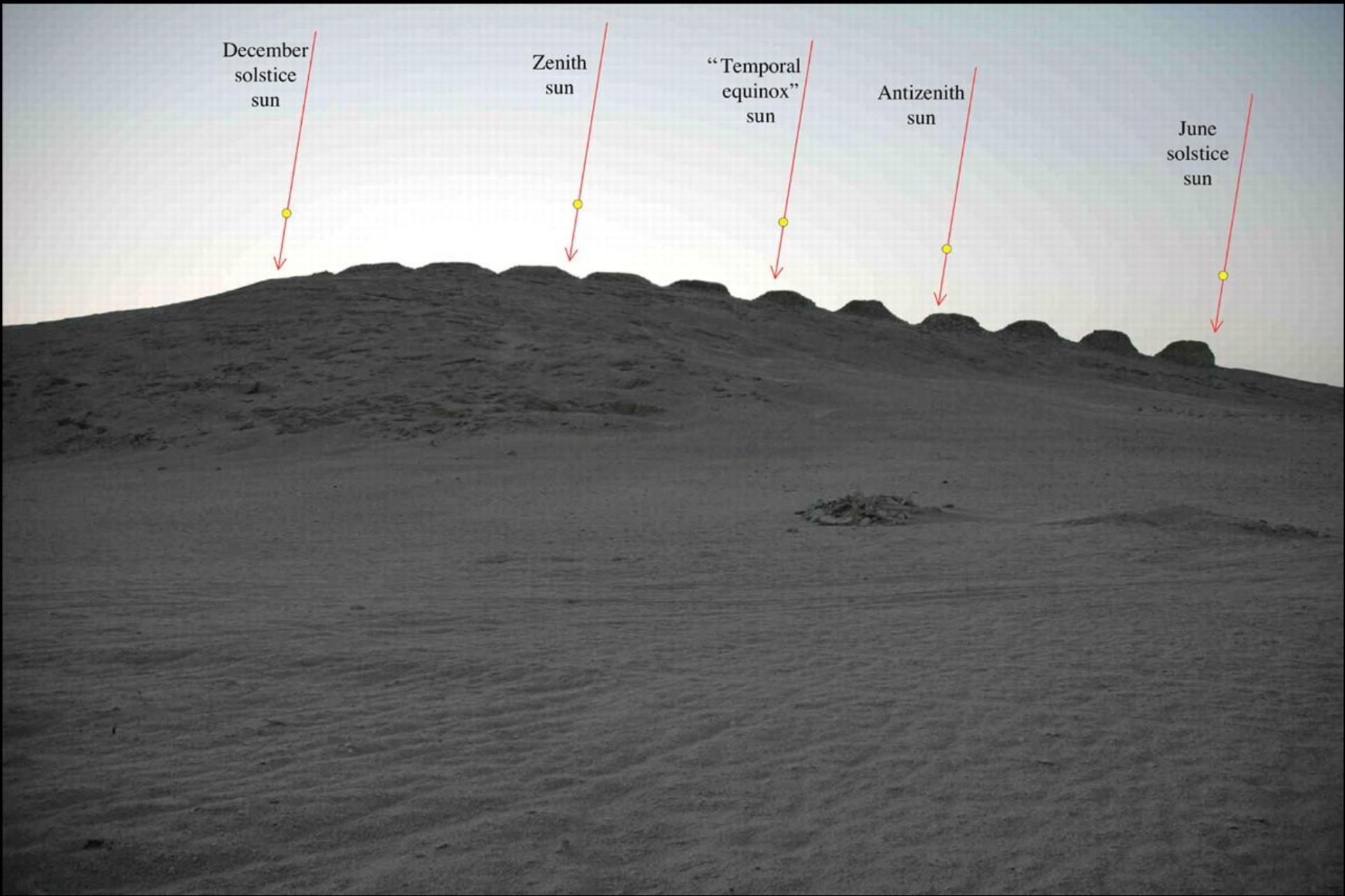


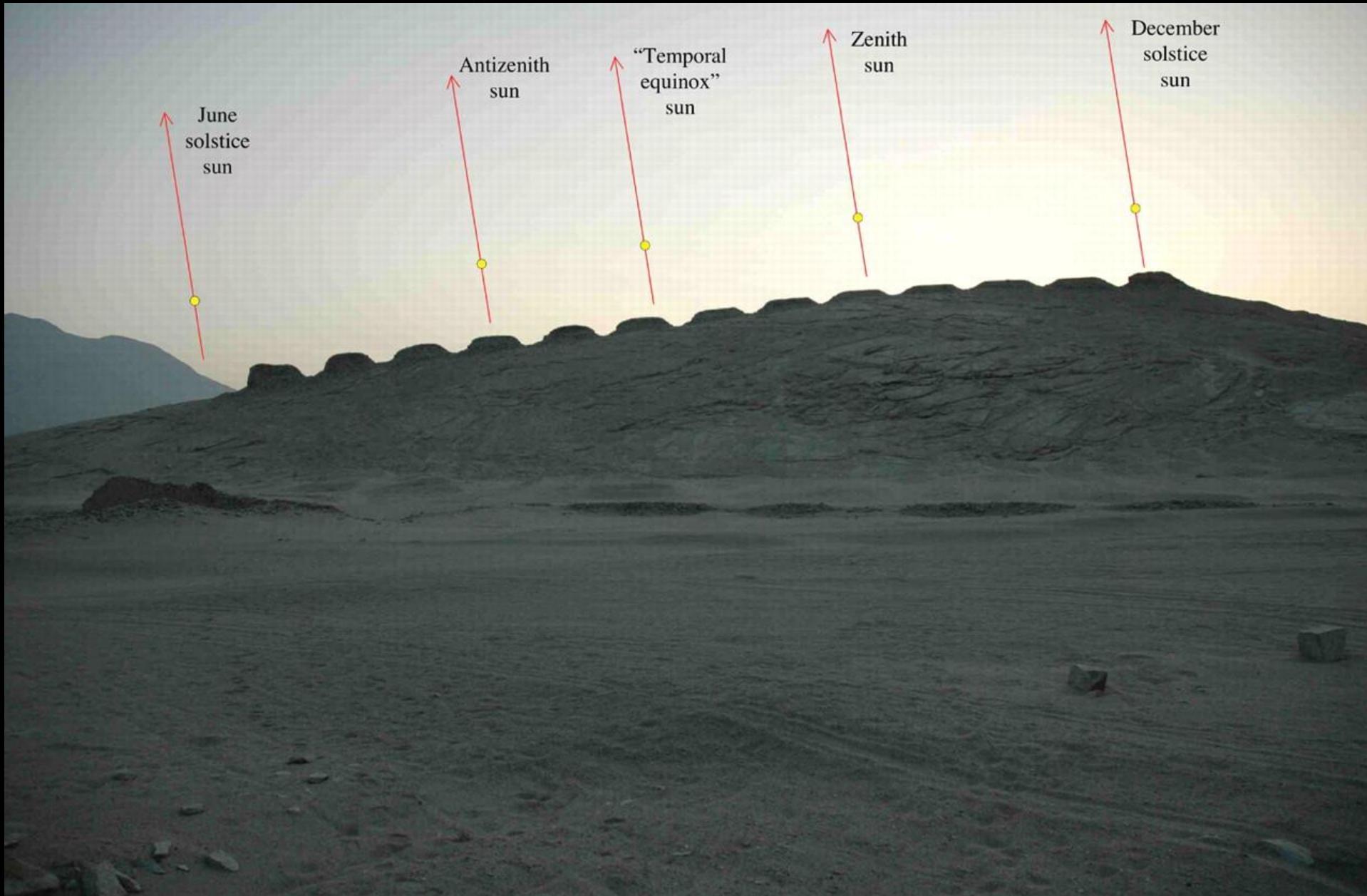


Chankillo (northern Peru)









Prehistoric Astronomy

- Difficulty of interpretation
 - Avoiding presuppositions
 - Just because astronomical phenomena are important or obvious to us does not mean that they were important to ancient people
 - Are astronomical alignments intentional?
 - Statistical tests, context, etc
 - What does it all mean?
- Evidence for widespread incorporation of astronomical phenomena (particularly the position of the sun) in ancient peoples' view of the world.

Next lecture

- Astronomy in Mesopotamia