Climate and Human History
Stephan Matthiesen

19/1	1. Climate and climate history
26/1	2. The Ice Age
2/2	3. Farming and City States
9/2	4. The Roman Empire
16/2	5. Tang and Maya in the 10th century
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The Maya

Pyramid in Tikal

Early and Middle Preclassic ca 3000 – 400BC

Early Preclassic (3000-900 BC)

- Development of agriculture
- Population growth

Middle Preclassic (900-400BC)

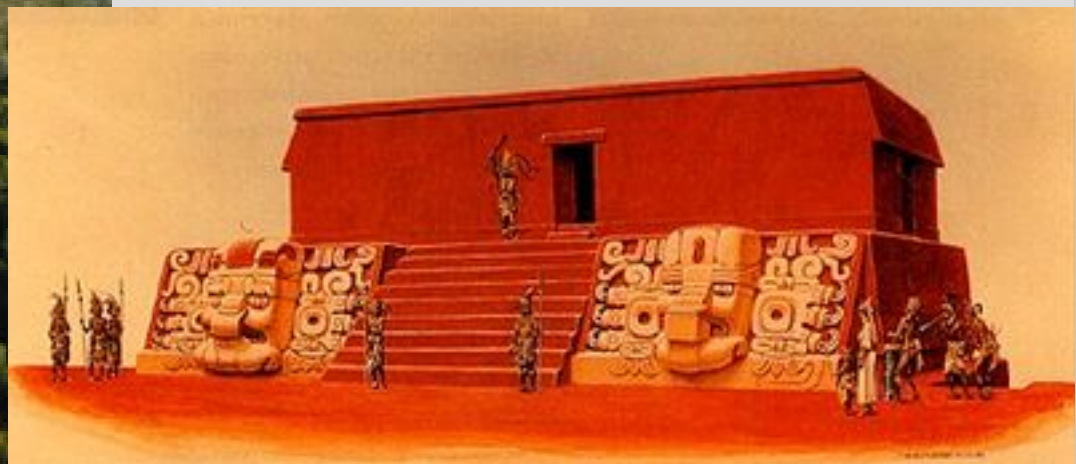
- Cities and ceremonial architecture
- Long distance trade
- Development of an elite, but still mostly egalitarian

Late Preclassic
ca 400BC – 250AD

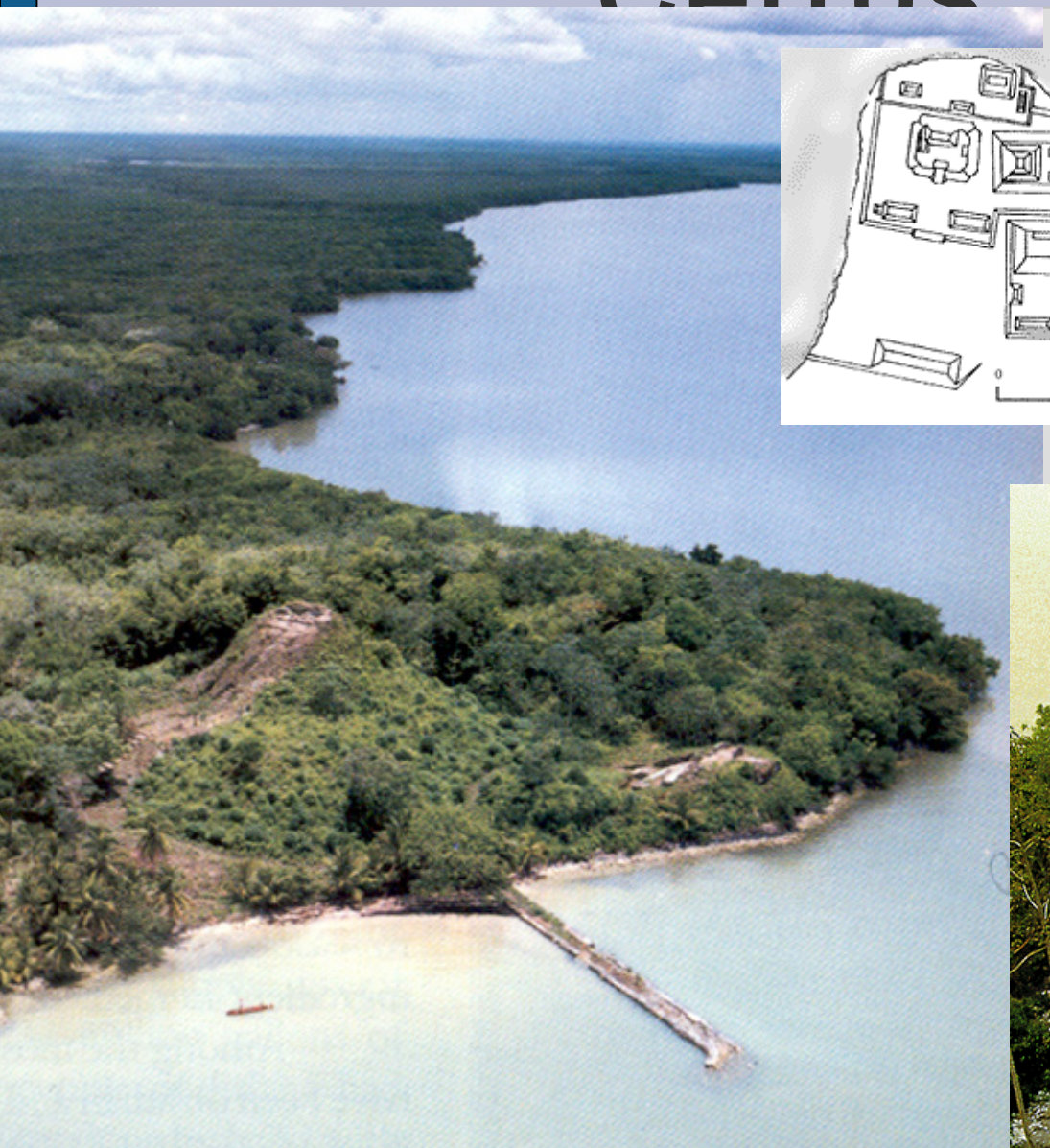
"Late Preclassic Transition" (200-50BC?)

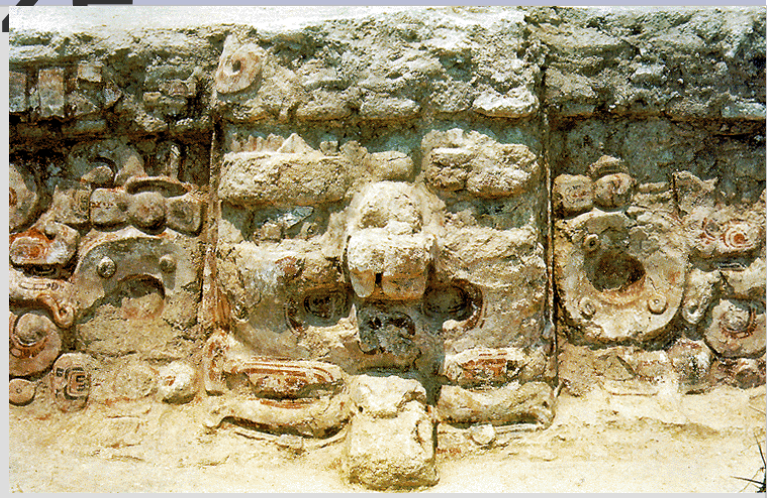
- Massive building programme
- Change in imagery: symbolic displays on the order of the Universe
- Kings

Structure 34, El Mirador, Late Preclassic



Late Preclassic Site (ca 50BC)
Cerros, Belize





Early Classic Period
ca 250-600 AD

- Population growth again
- Competing City States / Kingdoms
  - Tikal: dynasty founded by Lor Xac-Moch-Xoc (219AD); 360000 people (ca 500 AD)
  - Calakmul: king from ca 500 AD
- 562: War between Tikal and Calakmul

Late Classic Period
ca 600-900AD

- Cities with >10000 inhabitants
- Maya culture spreads North
- Foundation of new cities
  - Chichen Itza (650)
  - Uxmal (ca 700)


Uxmal

Collapse and Postclassic Period ca 900-1511

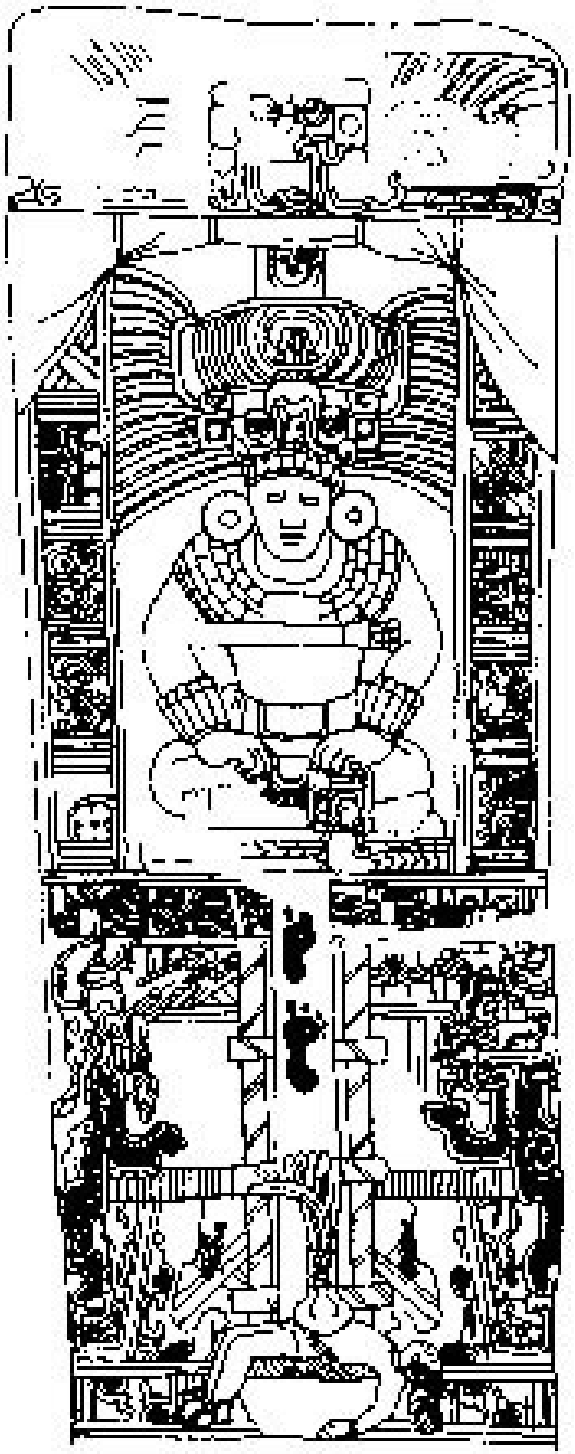
- Central Yucatan abandoned
- Immigration of Toltecs (from Mexico)

Chichen Itza

Stela 11
Piedras Negras
22 Aug. 731

- Accession of “Ruler 4” of Piedras Negras

Piedras Negras

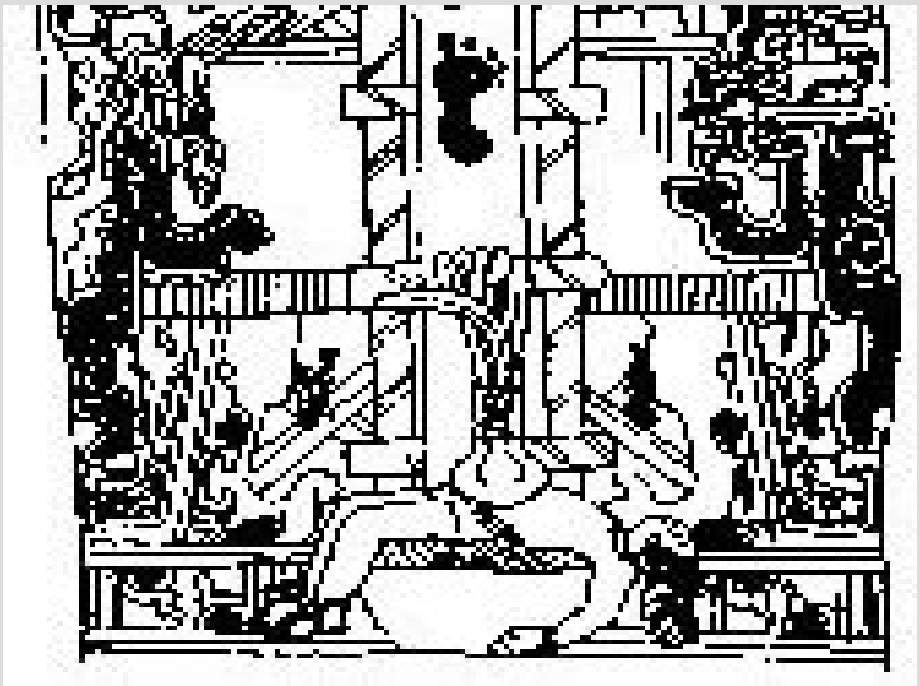


Stela 11
Piedras Negras
22 Aug. 731

Human sacrifice

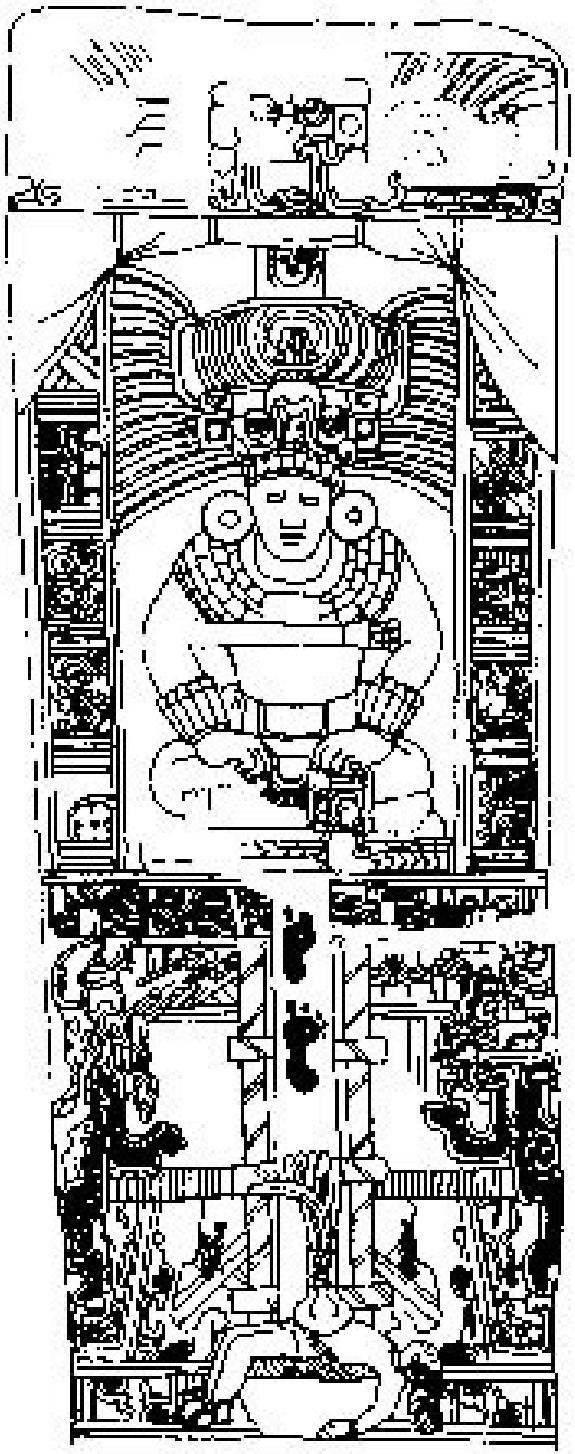
Sky band

Cloth with bloody footprints



Blood stream

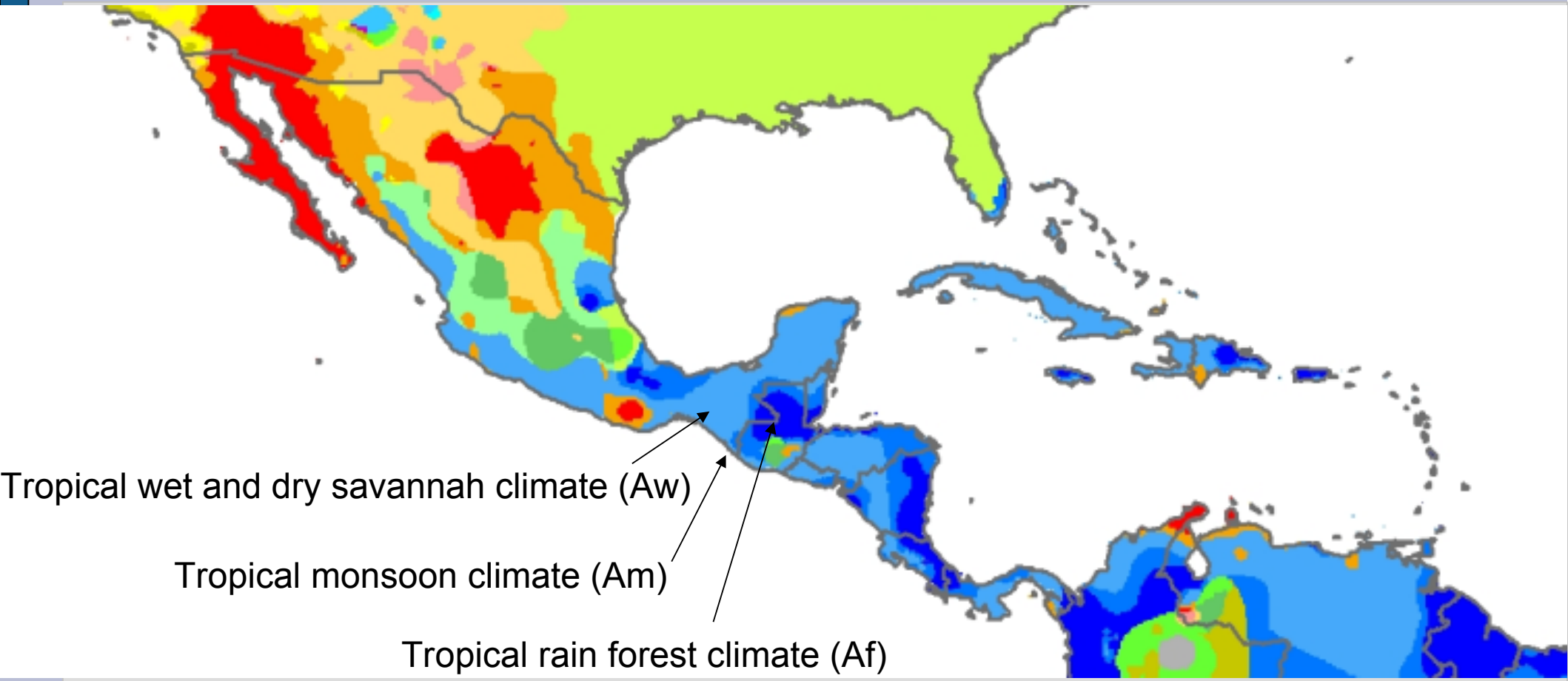
Sacrificial victim on Altar



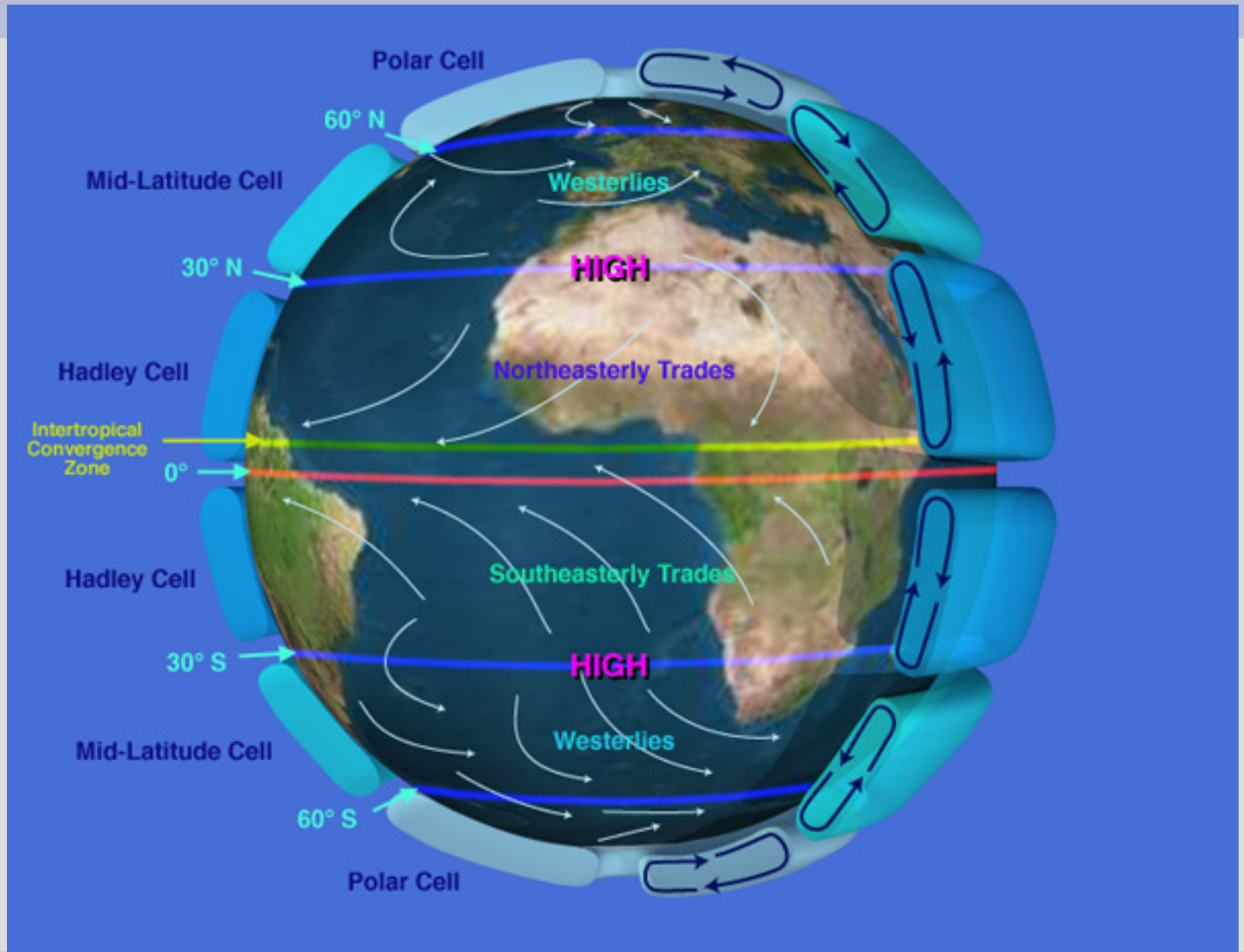
Maya History

- 3000BC – 400BC Early&Middle Preclassic
  Growth and development of Cities
- 400BC – 250AD Late Preclassic
  Crisis and Transition
- 250AD – 600AD Early Classic
  Growth
- 600AD – 900AD Late Classic
  Building activity, but decline
- 900AD – 1511AD Postclassic
  Central Yucatan abandoned

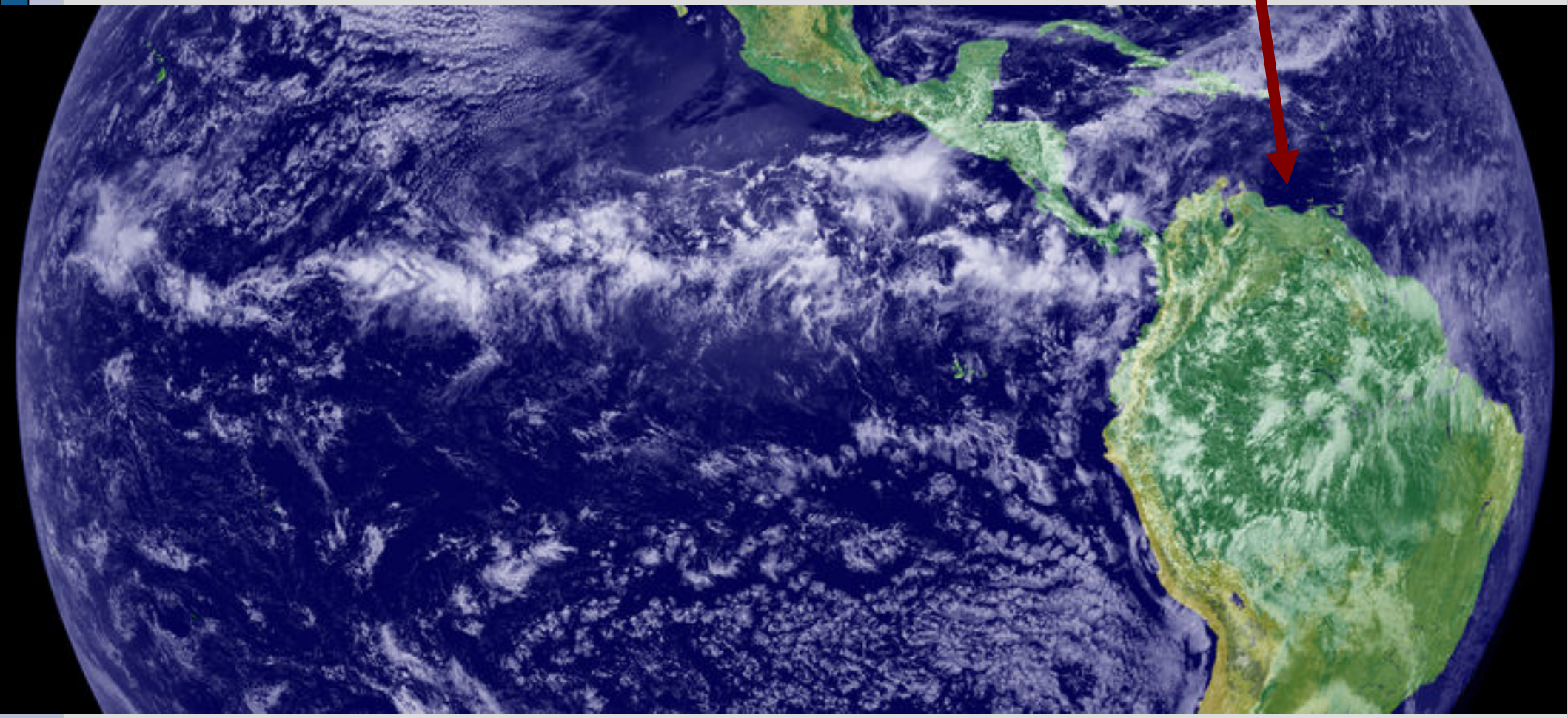
Climate in Mesoamerica

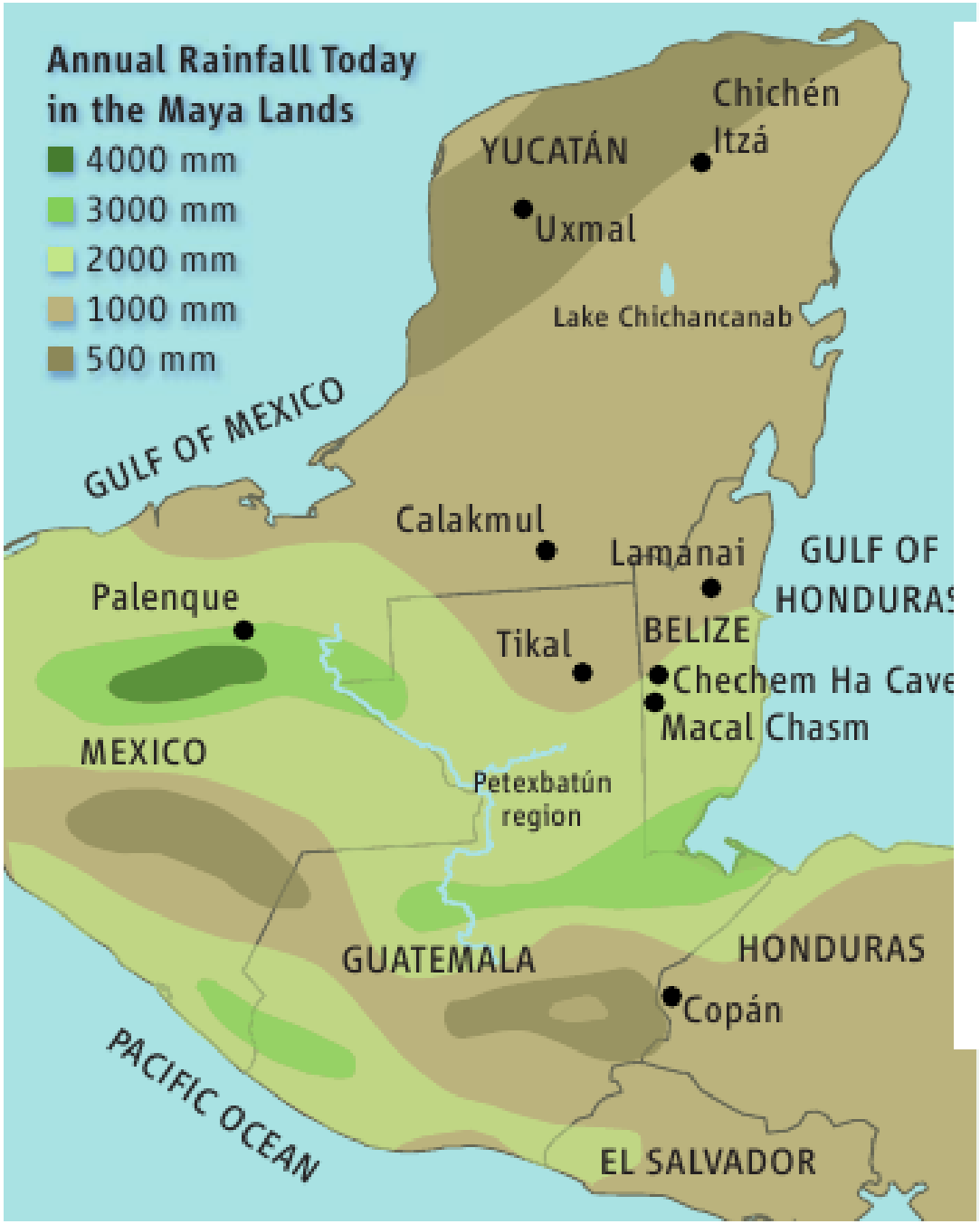


Atmospheric Circulation



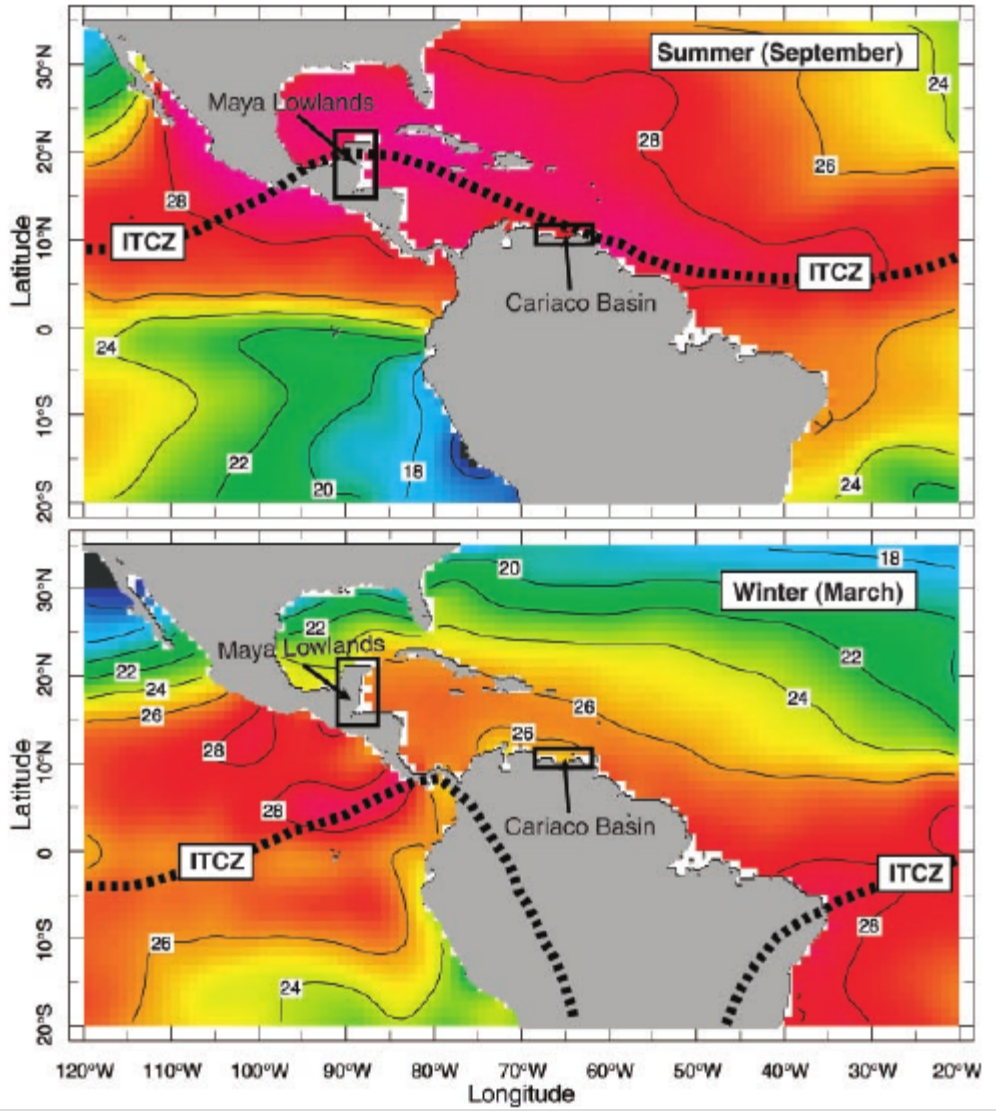
The Intertropical Convergence Zone (ITCZ)





Wet and dry. The Maya lived in a patchwork of environments, and some cities in wet areas collapsed before drier ones.

Pringle, H. (2009) Science , 324 (5926), 454-456

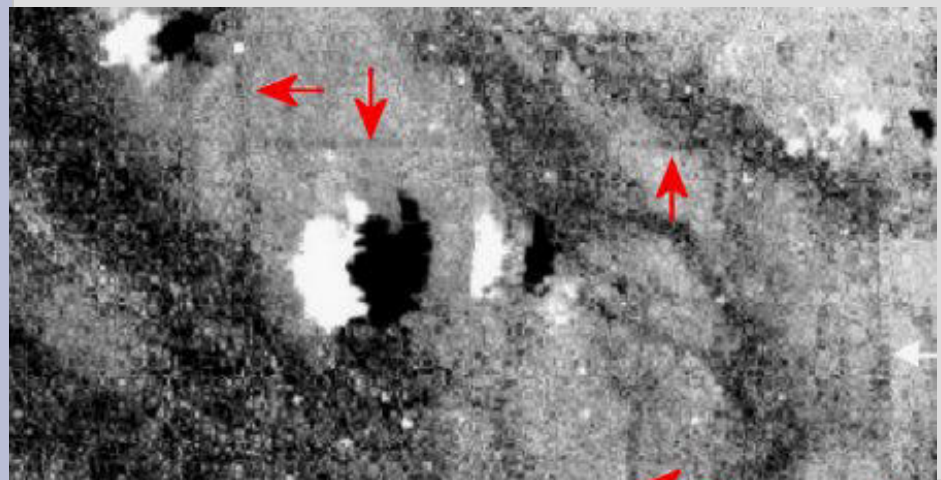


Haug et al. (2003). Climate and the collapse of Maya civilization. Science , 299 (5613), 1731-1735.

Agriculture

Slash-and-burn
Milpa system
- Maize
- Beans (nitrogen)
- Gourd (reduces erosion)

Artificial irrigation with basins and canals

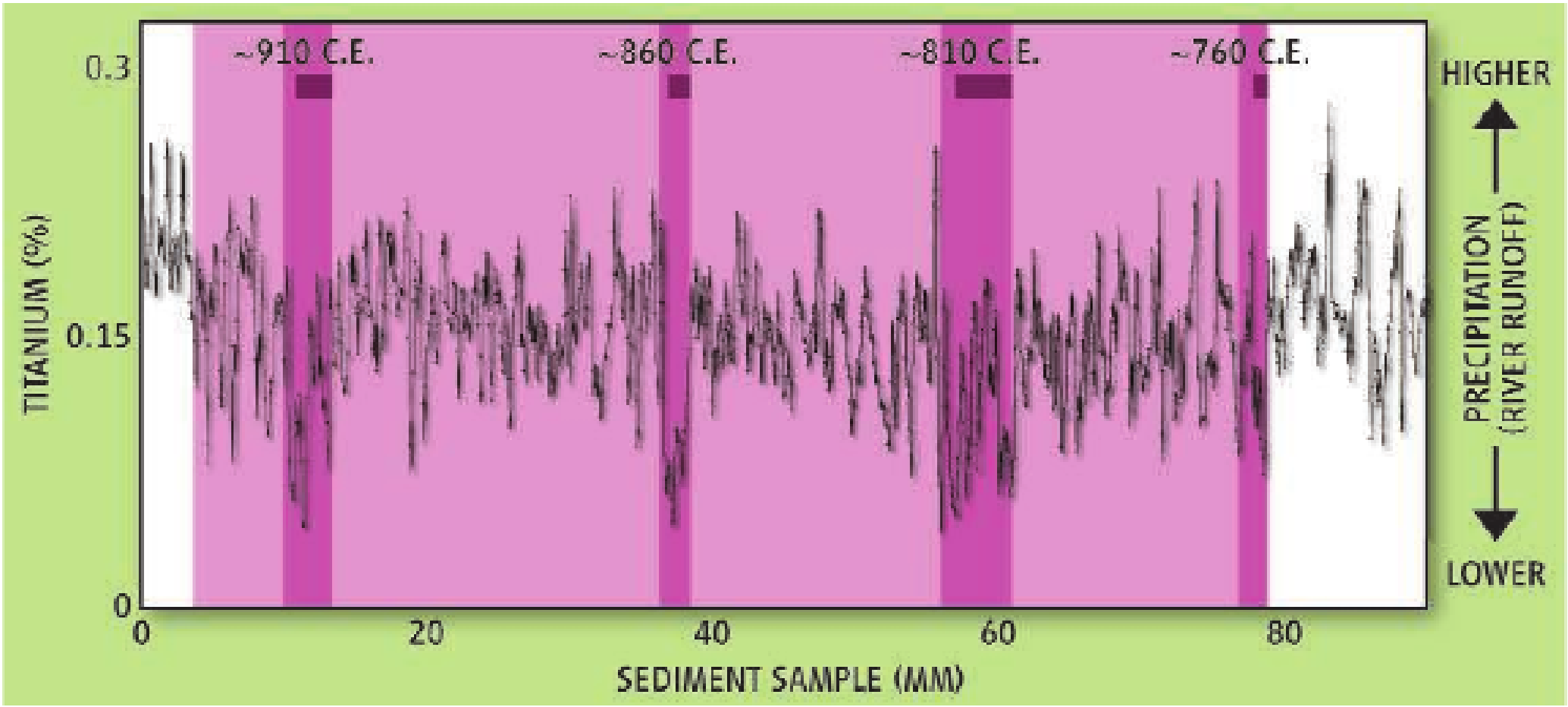


Satellite image from El Mirador, Preclassic

Irrigation systems

Mascarelli, A. (2010). Mayans converted wetlands to farmland. Nature 5 Nov 2010.

Evidence for droughts



Sign of the times. The amount of titanium in sediment drops when rainfall and water erosion decline. These data from the Cariaco Basin spotlight four dry periods that may have affected the Maya lands.

A New Look at the Mayas' End

Climate researchers have fingered drought in the collapse of the great Maya civilization, but many archaeologists say it doesn't fit their data. Ultralocal paleoclimate indicators may spark a resolution

Pringle, H. (2009). A new look at the Mayas' end. Science, 324 (5926), 454-456.

Chinese History

- 1122 – 221 BC: Zhou dynasty
- 771 – 221 BC: Eastern Zhou dynasty
  at the end: Warring Period, Confucius
- 221 – 206 BC: Qin dynasty
  Emperor Qin Shihuang Di
  Great Wall, Terracotta Army
- 206BC – 220 AD: Han dynasty
  wars against the huns in the West
- 220 – 581 AD: Period of Division (“Disunity”)
- 581 – 618 AD: Sui dynasty
- 618 – 907 AD: Tang dynasty
  “Golden age of civil and artistic development”

Tang Dynasty (618-907)

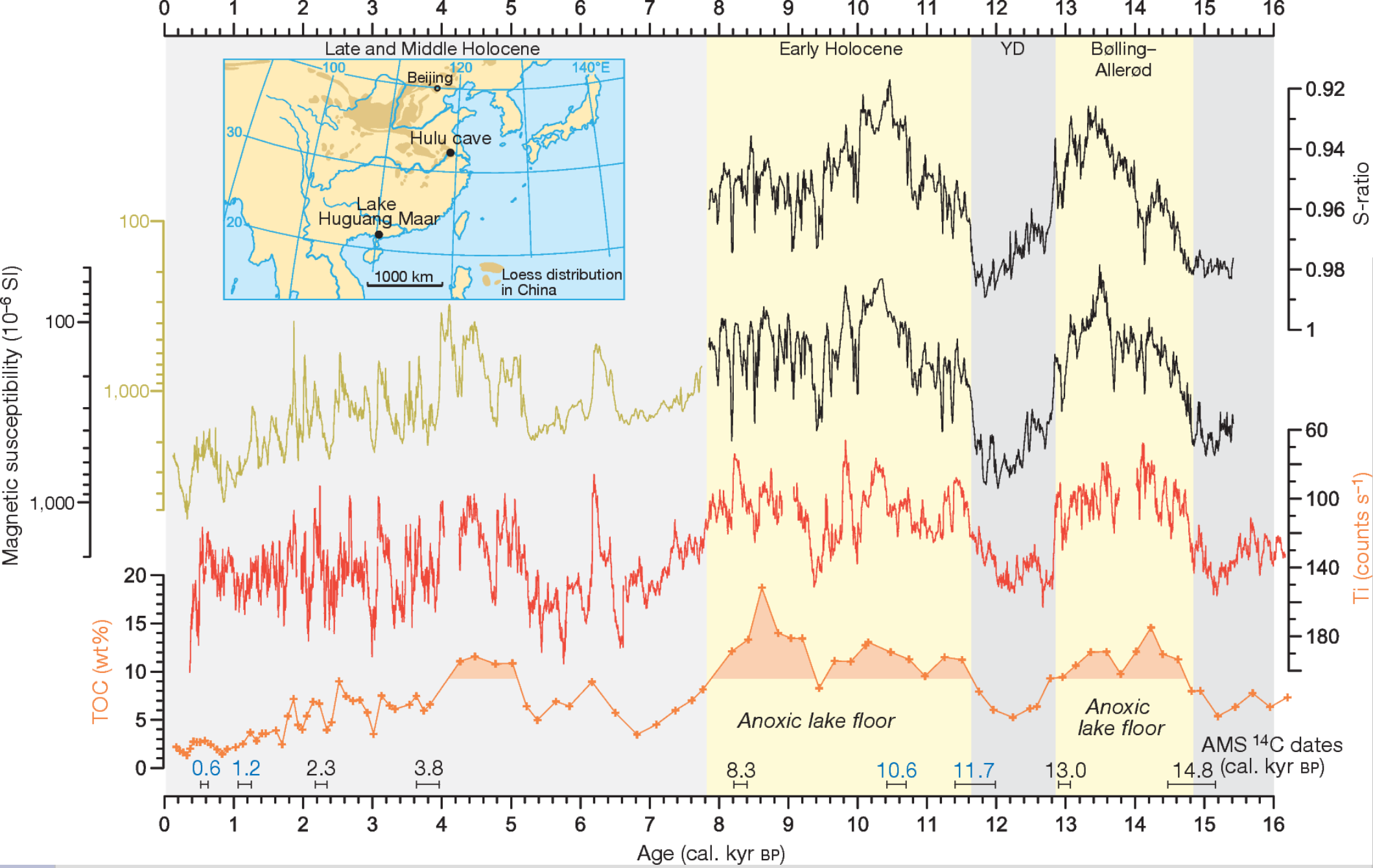
- International connections
  - Buddhism
  - Islam
  - ...
- Literature and arts
- Inventions
  - Printing
  - Gunpowder

The End

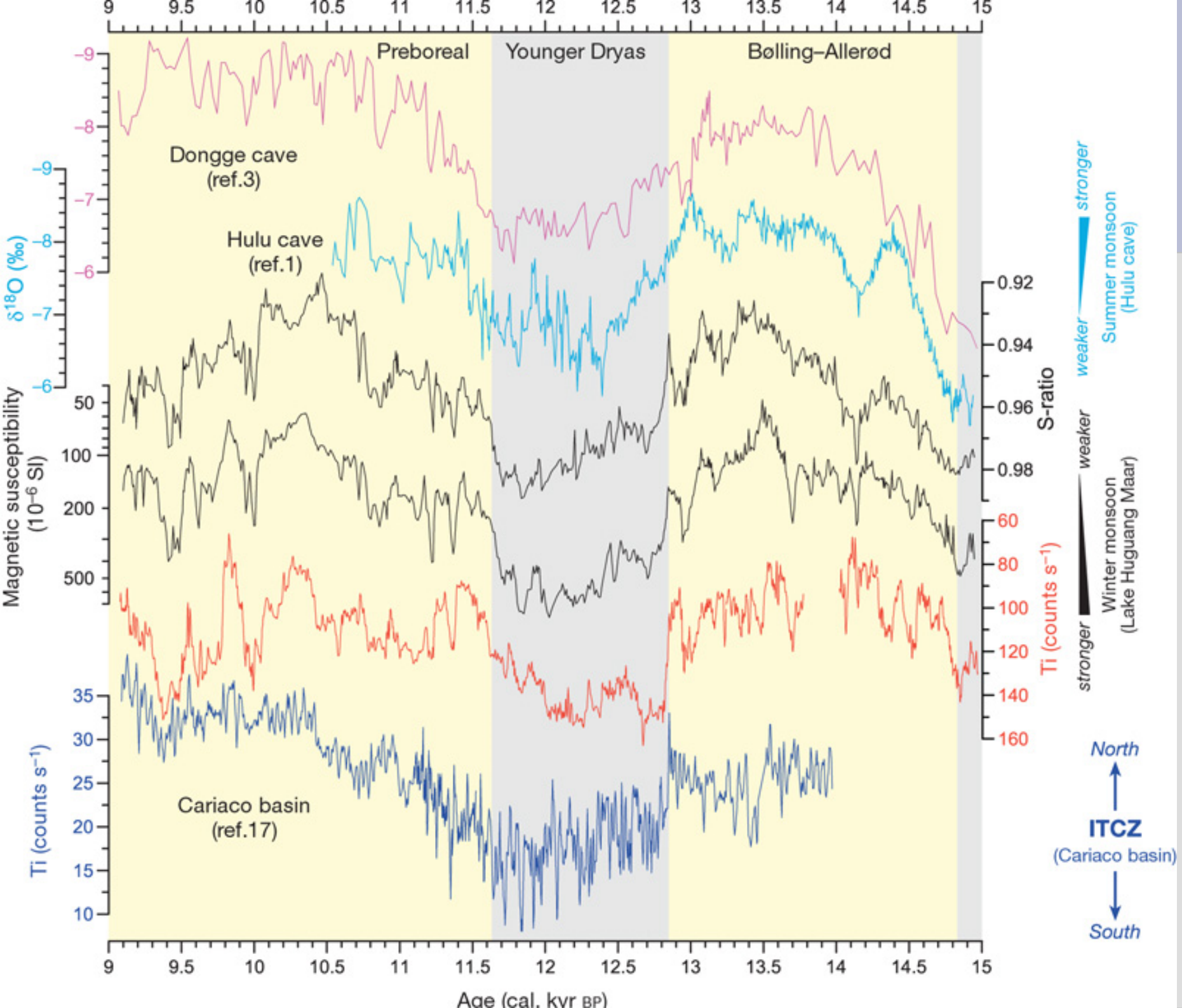
- 751: Arabs win the battle of Taras
- Defeat in the South West
- 755: Revolt
- 805-820: Stability under Xianzong
- 820: Xianzong murdered
- 840-846: Wuzong
  - Fanatical Daoist
  - Destruction of Buddhist monasteries (4600)
- Last emperors powerless; military commanders have real power

Measuring the Monsoon Lake Huguang Maar

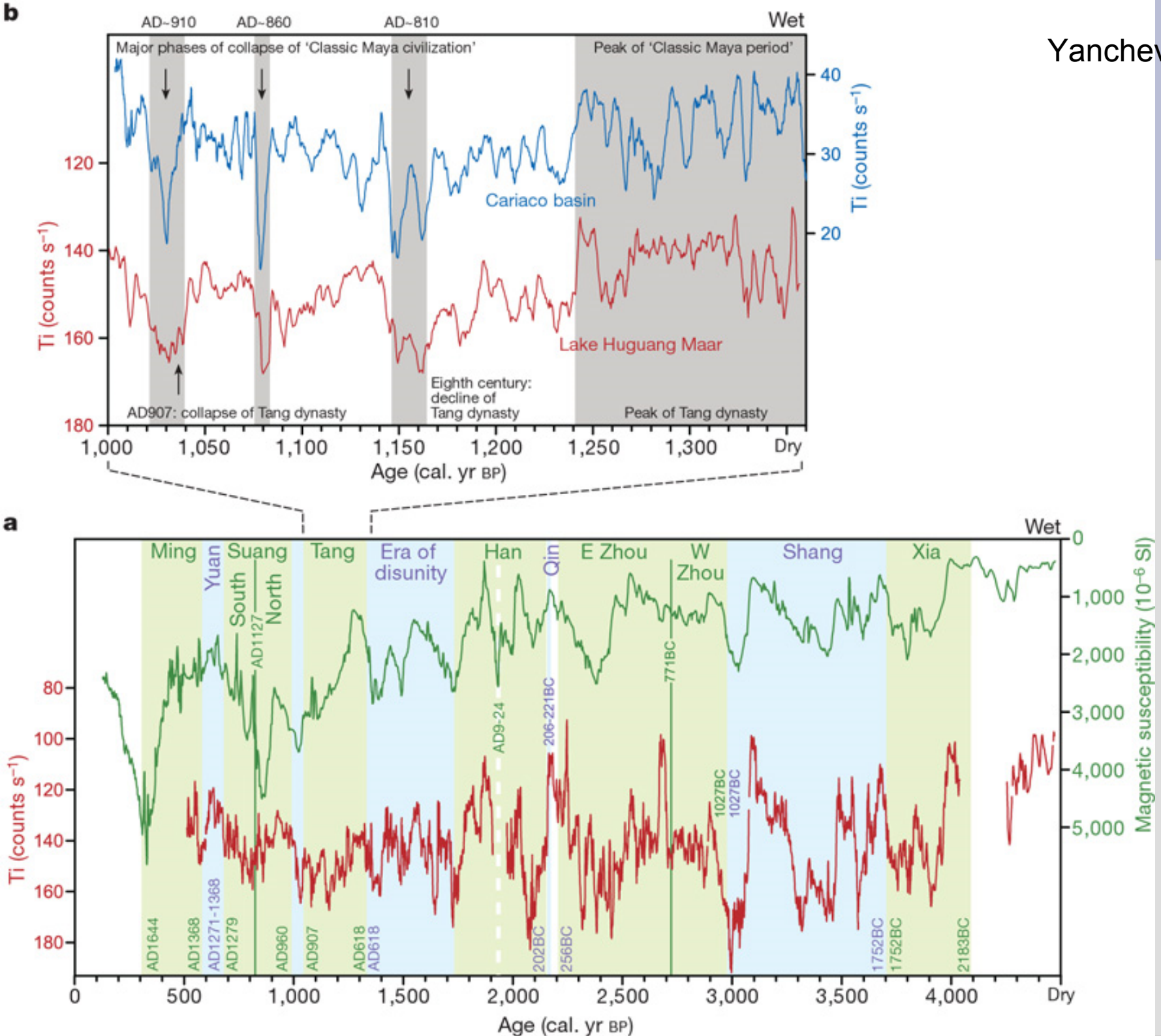
- Accumulation of wind-blown material:
  - Titanium content (dust from deserts in the north)
- Indicators of water-column mixing (wind stress):
  - S-ratio (abundance of magnetite): high when oxygen is available at lake bottom
  - TOC (total organic carbon): low in oxic conditions
- Combination of both:
  - magnetic susceptibility (iron input from dust, but also chemical redox conditions)



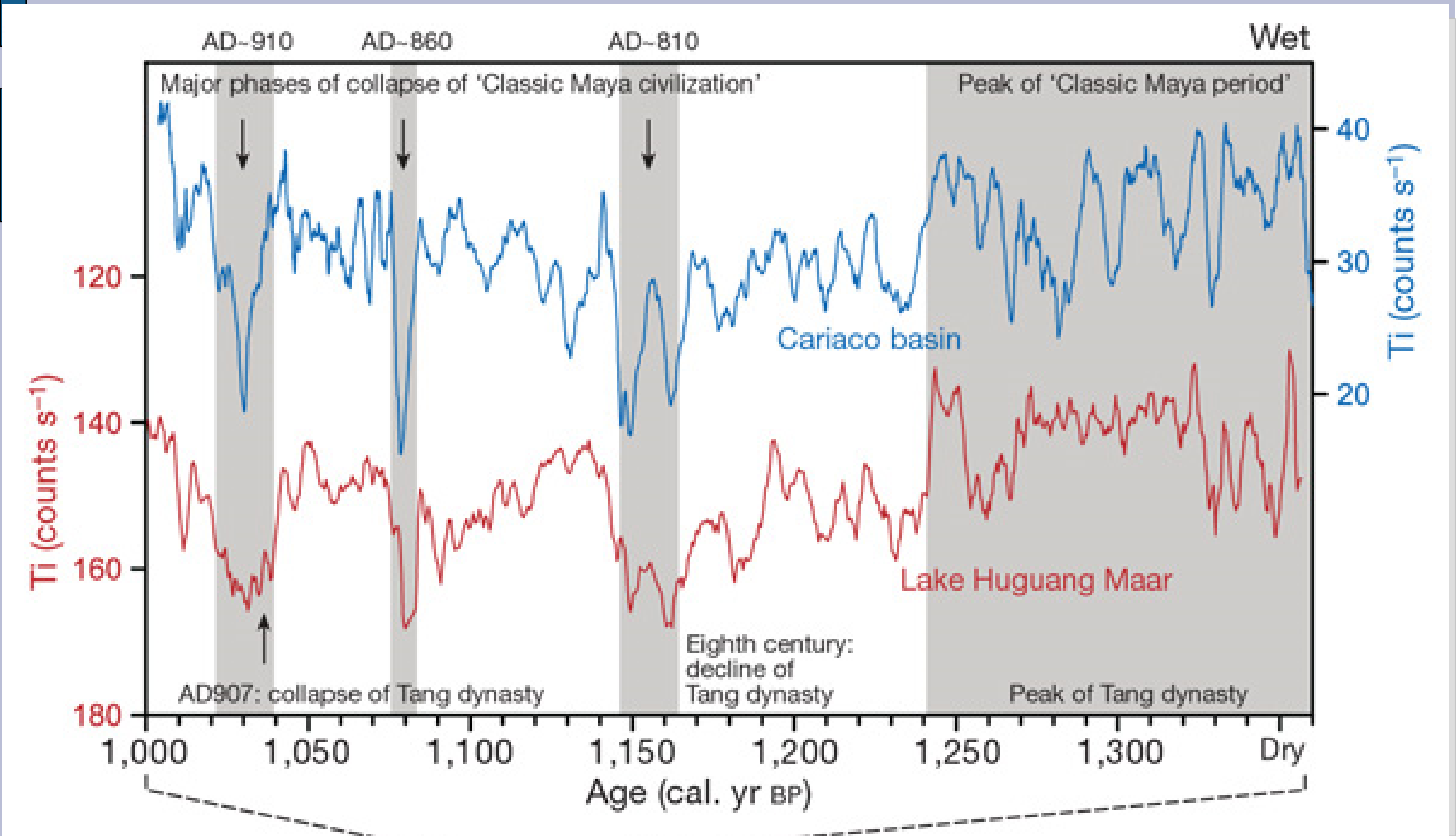
Yancheva et al. (2007):Influence of the intertropical convergence zone on the East Asian monsoon. Nature 445, p. 74-75


Preboreal
Younger Dryas
Bølling–Allerød
Dongge cave
(ref.3)
Hulu cave
(ref.1)
Cariaco basin
(ref.17)
δ18O (‰)
Magnetic susceptibility
(10−6 SI)
S-ratio
Ti (counts s−1)
Ti (counts s−1)
Summer monsoon
(Hulu cave)
weaker
stronger
Winter monsoon
(Lake Huguang Maar)
stronger
weaker
North
ITCZ
(Cariaco basin)
South
Age (cal. kyr BP)

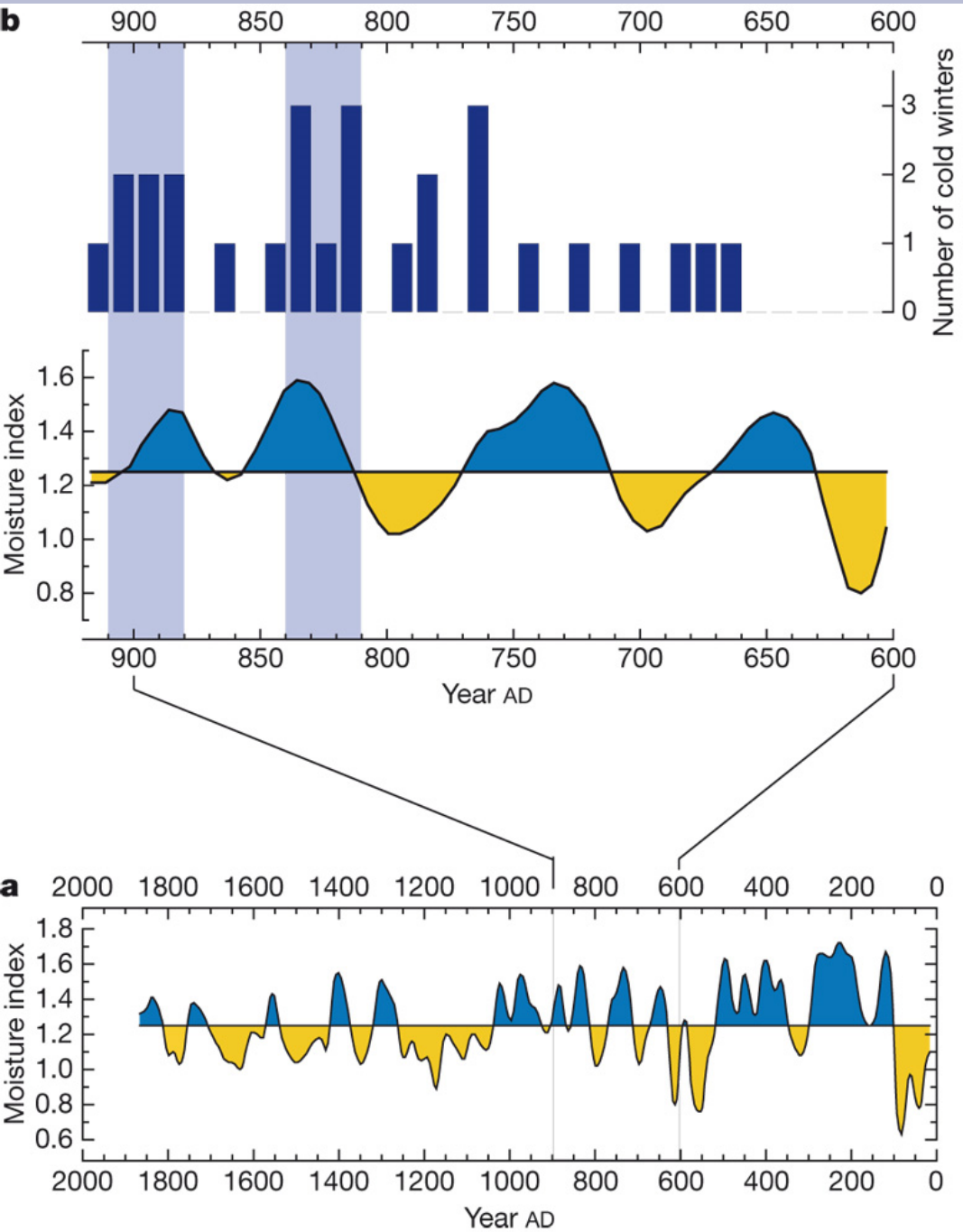
Yancheva et al (2007)

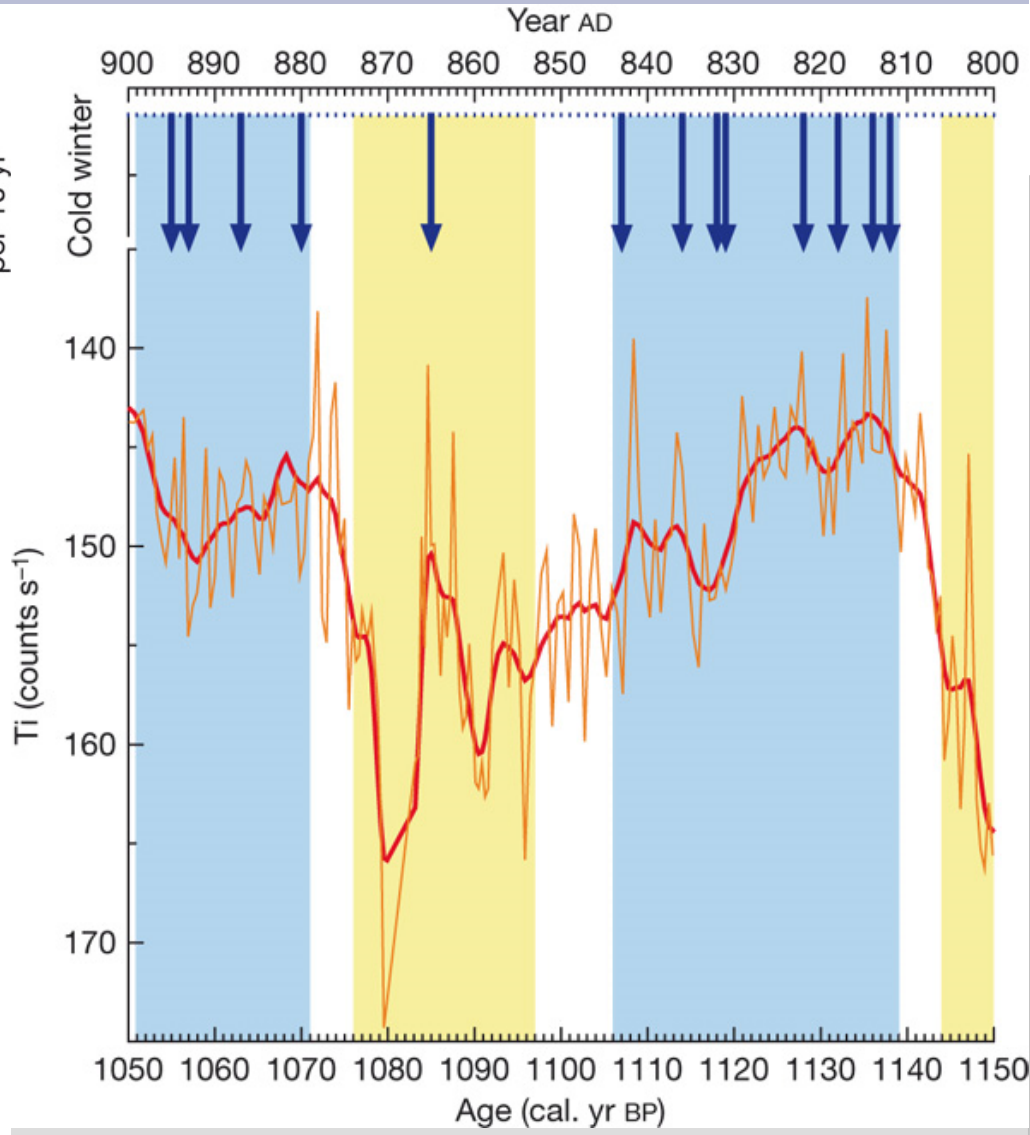


Maya, Tang and the Monsoon

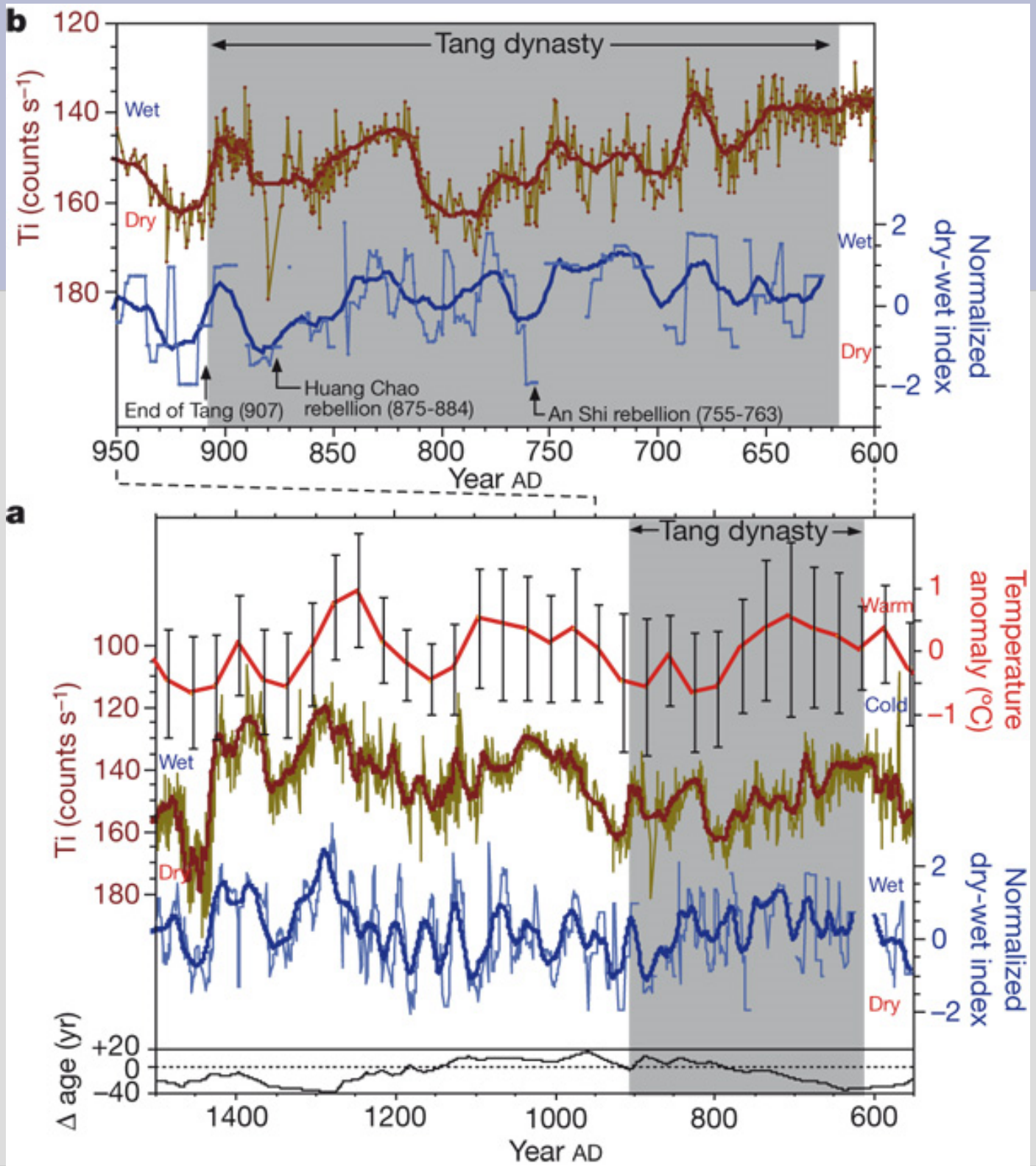


Or cold winters in China?





Zhang, Lu (2007): Nature 450, E7



Yancheva et al. (2007), Nature 450, E8-E9

Song dynasty 960 – 1279 AD

- Population doubled during 10-11th century
- Standing navy
- Banknotes
- ....

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