

Climate and Human History

Stephan Matthiesen

1. Climate and climate history
2. The Ice Age
3. Farming and City States
4. Rise and Fall of the Roman Empire
5. Tang and Maya in the 10th century
6. Mediaeval Optimum and Little Ice Age
7. El Niño through the ages
8. Miscellaneous topics
9. Current and future changes
10. Summary and re-cap

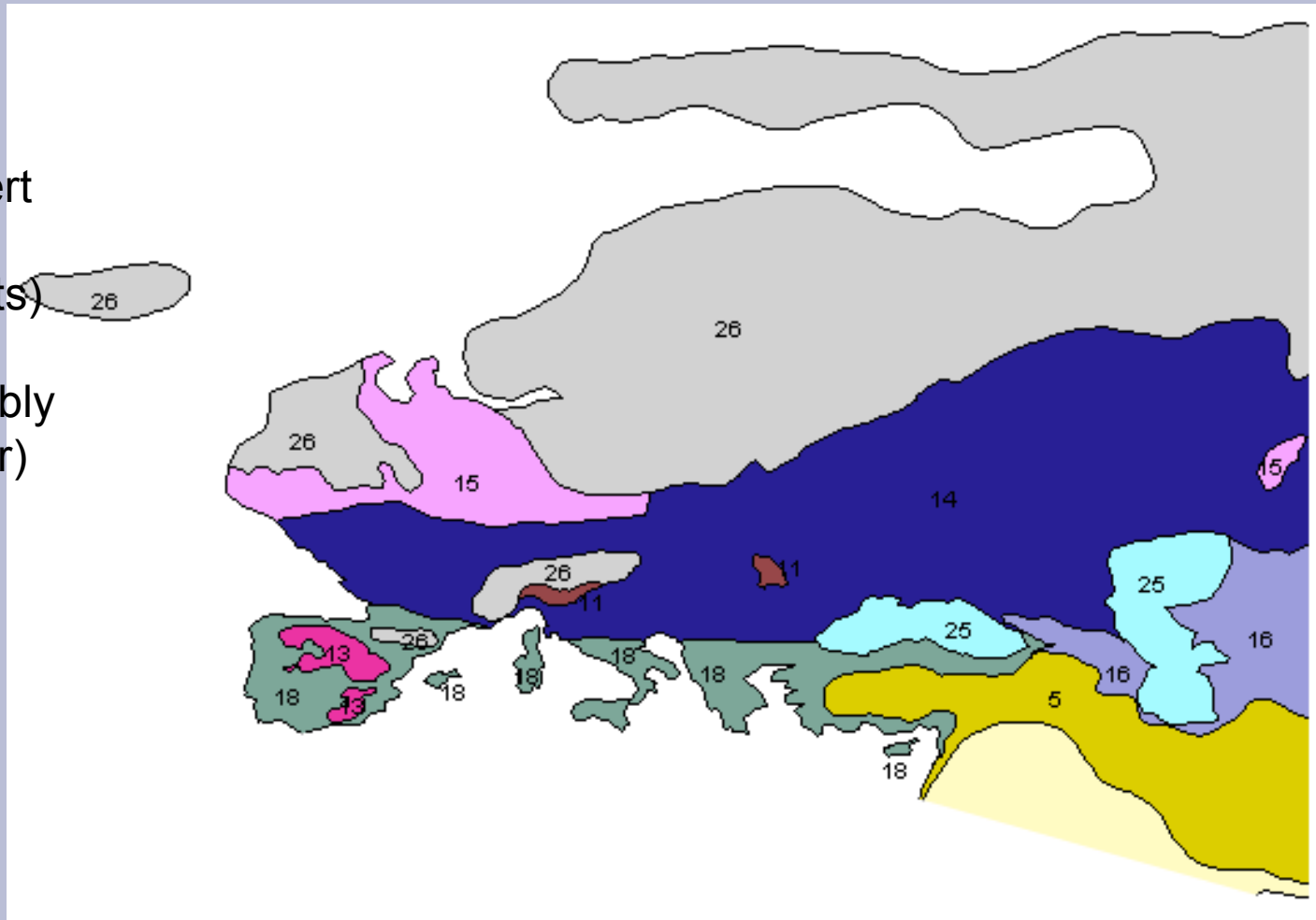
Europe in the LGM

26: Permanent ice

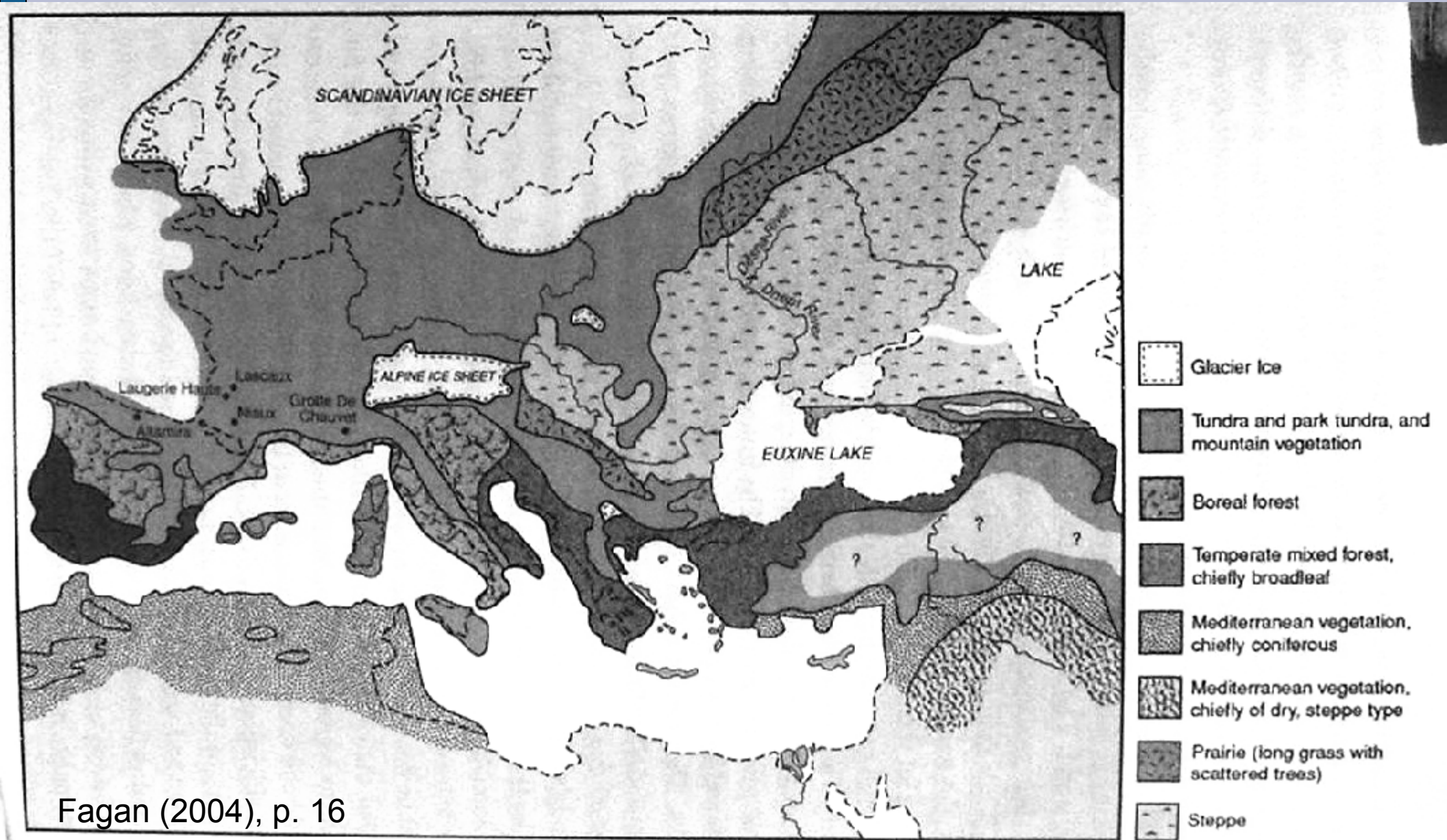
15: Polar and alpine desert
desert (less than 2%
covered by vascular plants)

14: Steppe-tundra (probably
around 50% ground cover)

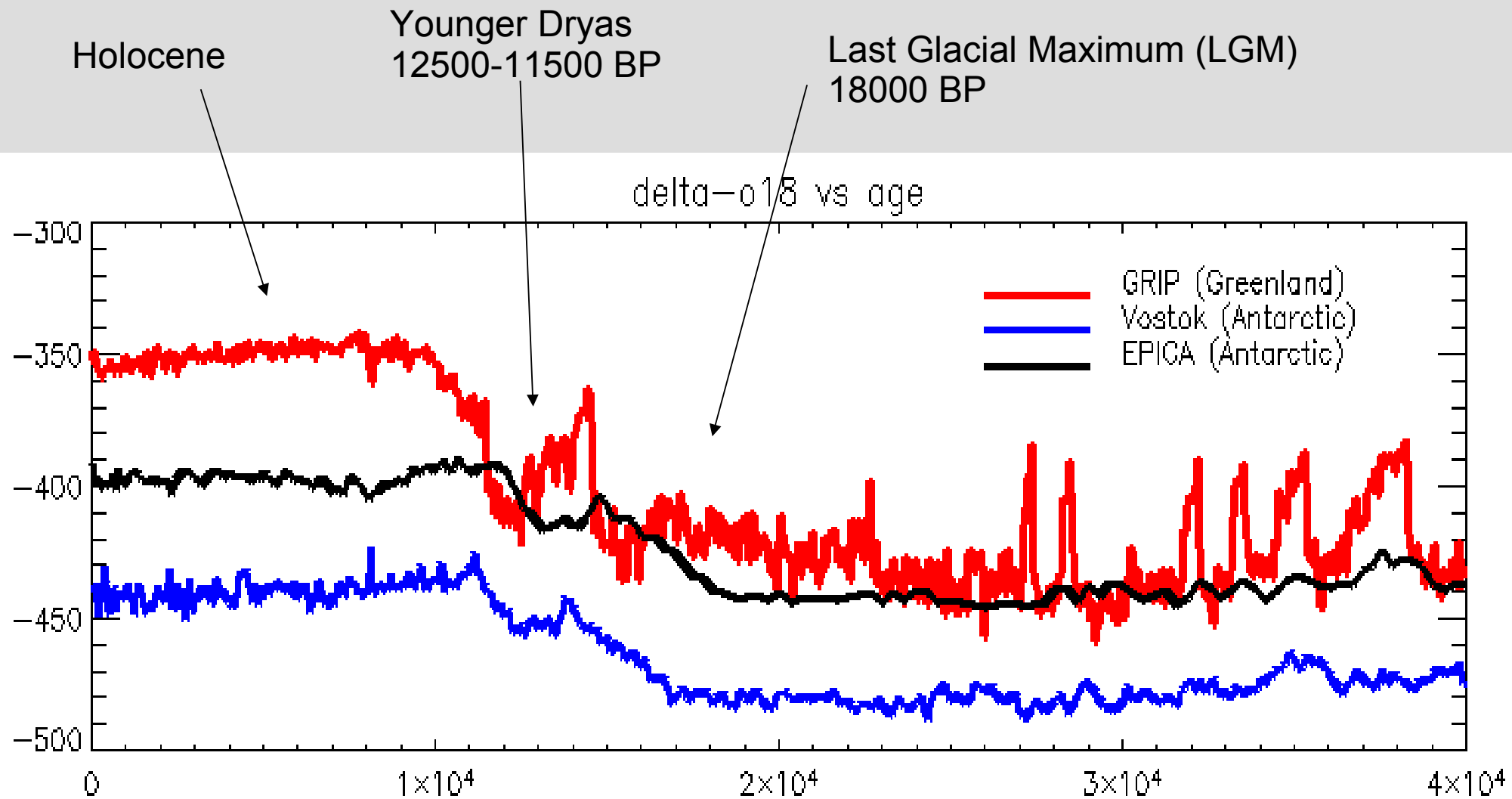
18: Forest steppe (5-20%
tree cover)



Europe in the Last Glacial Maximum (LGM, 18ka BP)



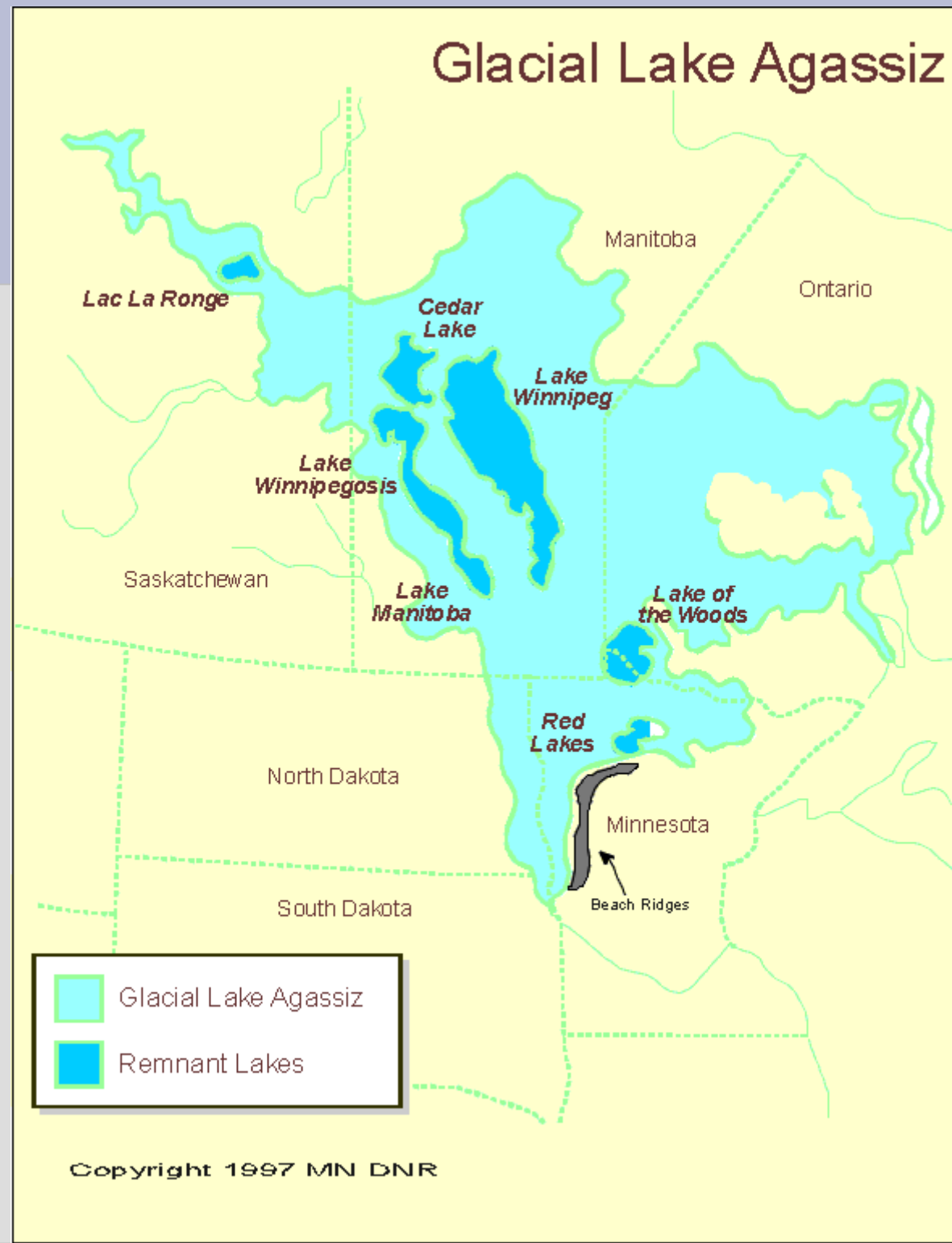
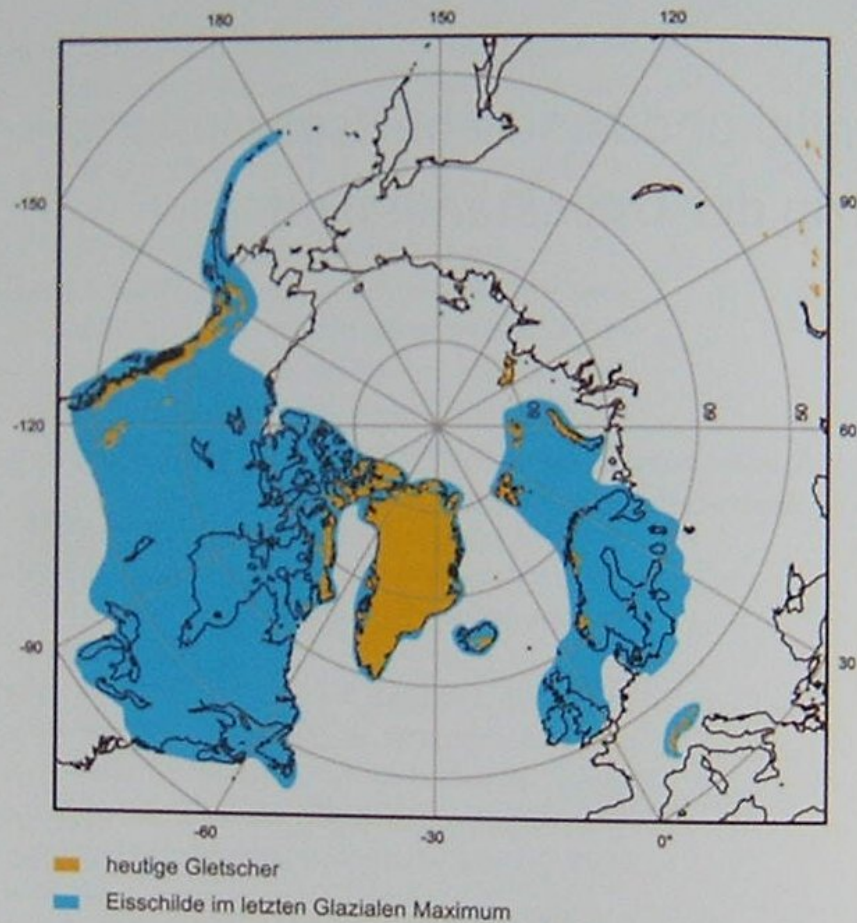
Pleistocene-Holocene transition



Dryas octopetala (mountain avens, white dryas)

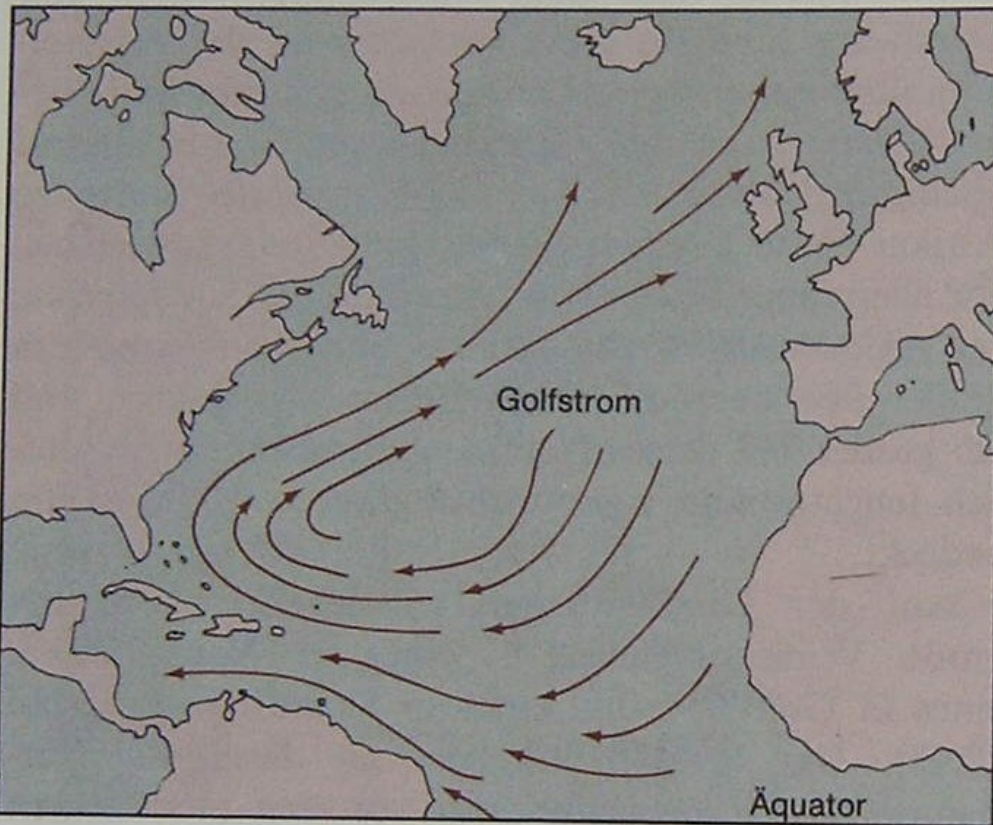


Lake Agassiz

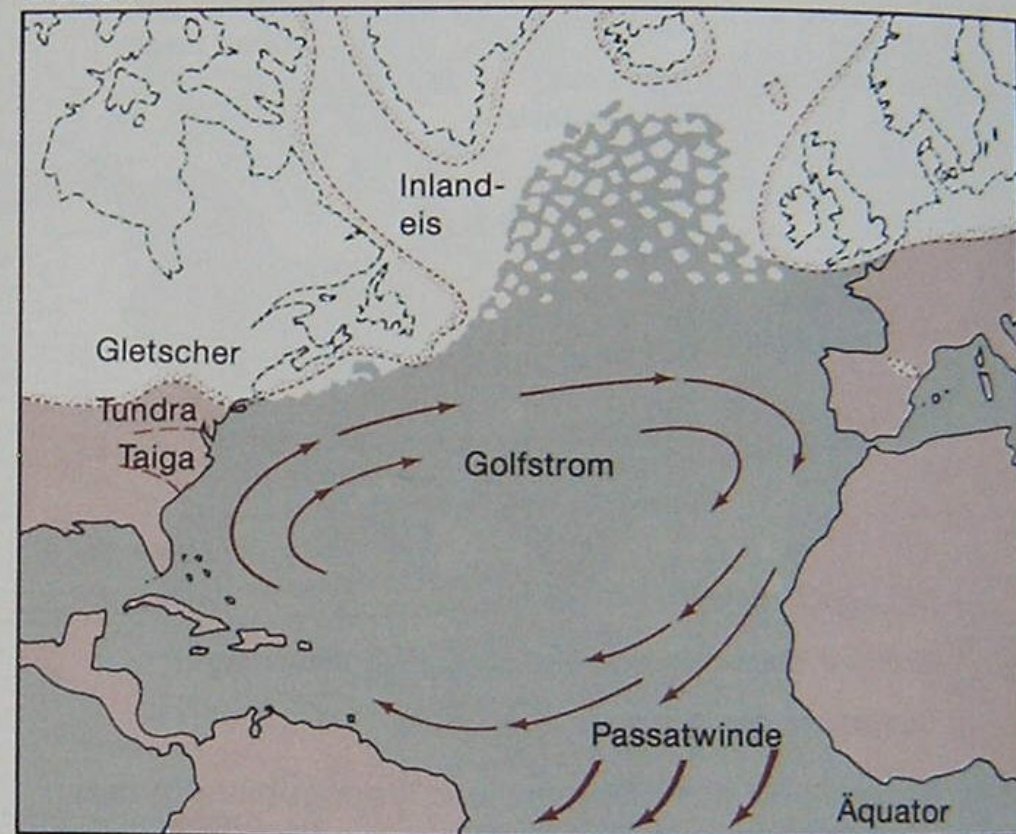


North Atlantic Circulation

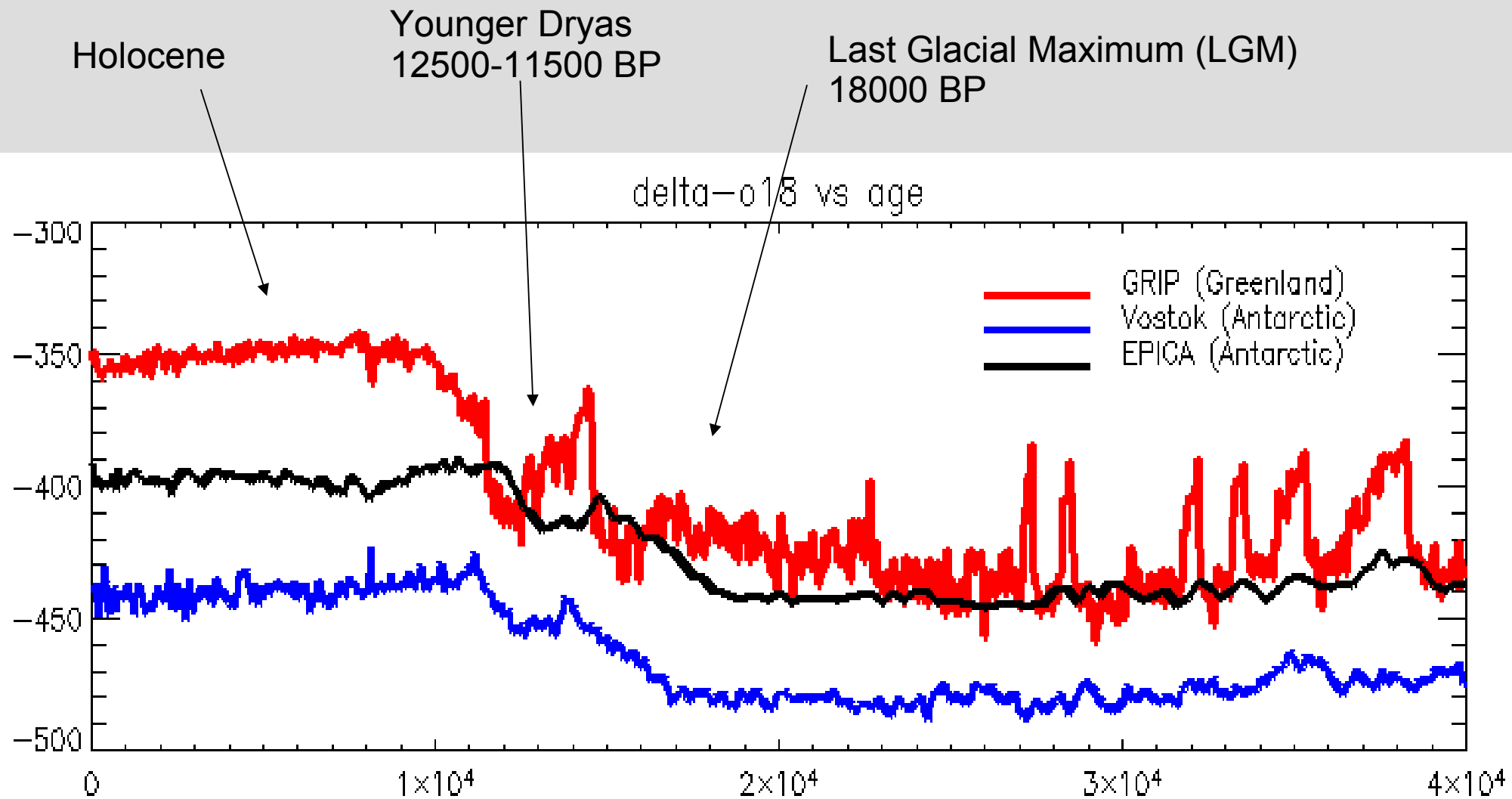
HEUTE

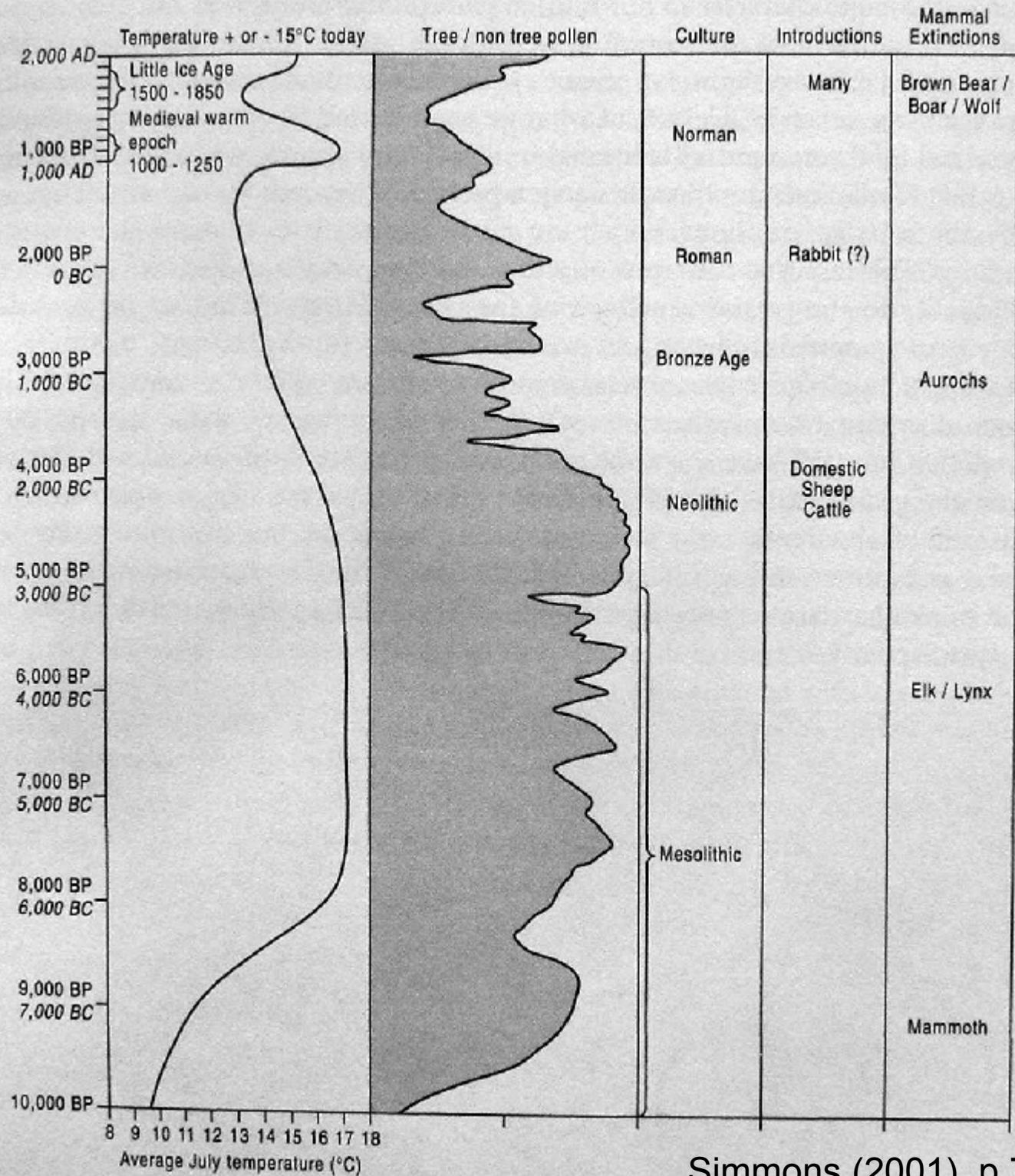


EISZEIT



Pleistocene-Holocene transition





The “Neolithic revolution” (“Neolithic bundle”)

- Sedentary lifestyle
- Domestication of Animals and Plants
- Pottery

But – is it so simple?

Origin of food production

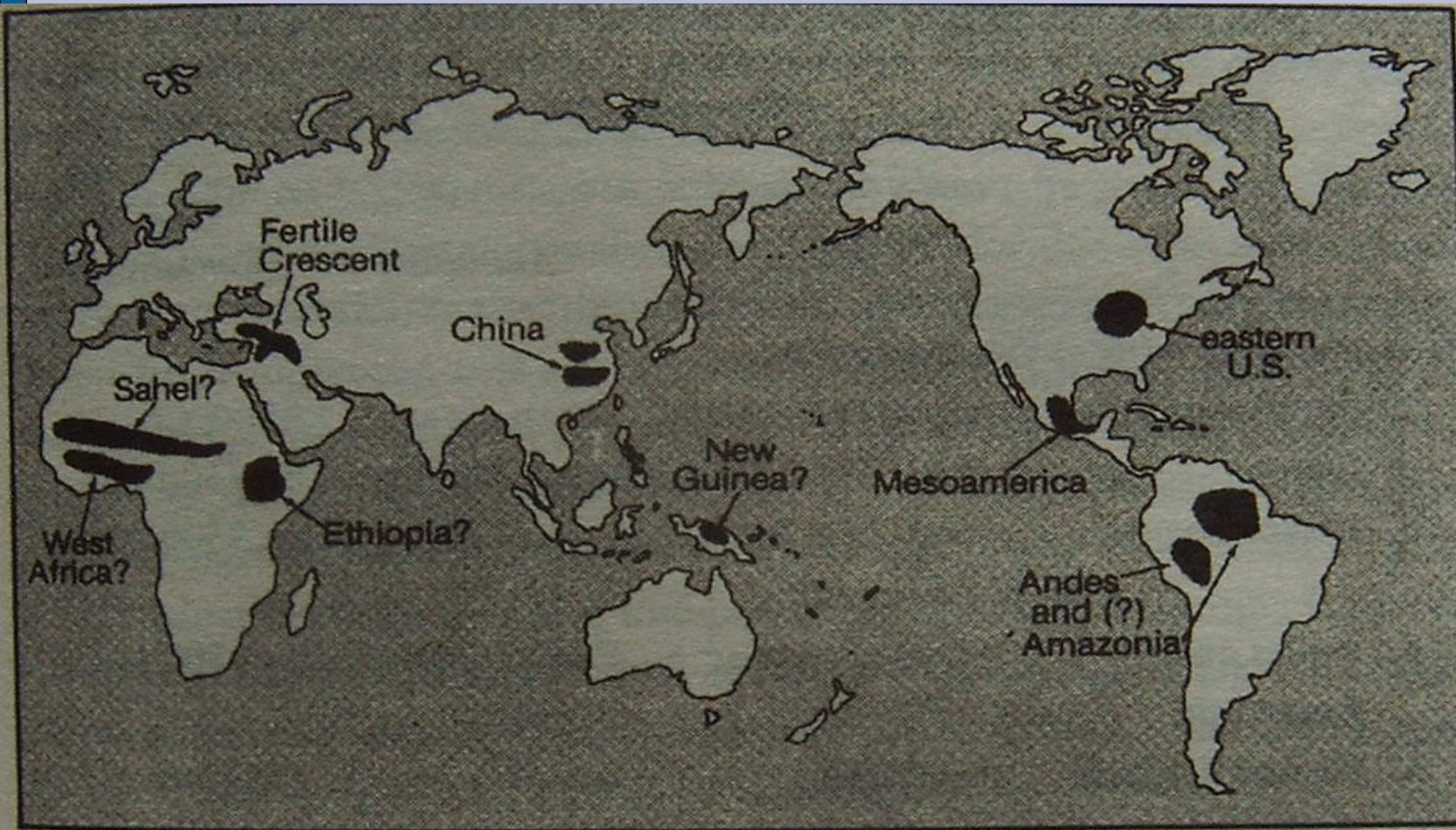
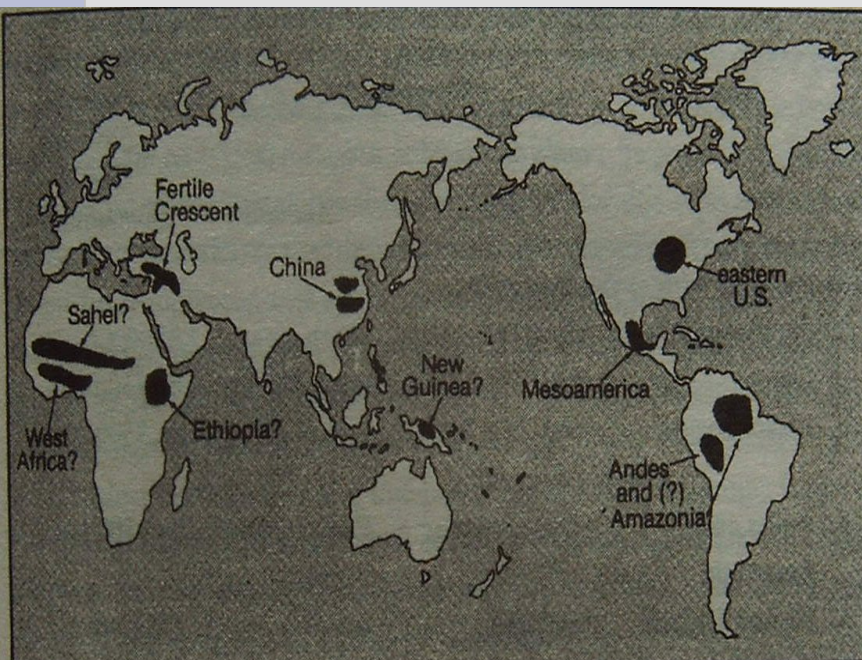


TABLE 5.1 Examples of Species Domesticated in Each Area

Area	Domesticated		Earliest Attested Date of Domestication
	Plants	Animals	
Independent Origins of Domestication			
1. Southwest Asia	wheat, pea, olive	sheep, goat	8500 B.C.
2. China	rice, millet	pig, silkworm	by 7500 B.C.
3. Mesoamerica	corn, beans, squash	turkey	by 3500 B.C.
4. Andes and Amazonia	potato, manioc	llama, guinea pig	by 3500 B.C.
5. Eastern United States	sunflower, goosefoot	none	2500 B.C.
? 6. Sahel	sorghum, Afri- can rice	guinea fowl	by 5000 B.C.
? 7. Tropical West Africa	African yams, oil palm	none	by 3000 B.C.
? 8. Ethiopia	coffee, teff	none	?
? 9. New Guinea	sugar cane, banana	none	7000 B.C.?
Local Domestication Following Arrival of Founder Crops from Elsewhere			
10. Western Europe	poppy, oat	none	6000–3500 B.C.
11. Indus Valley	sesame, eggplant	humped cattle	7000 B.C.
12. Egypt	sycamore fig, chufa	donkey, cat	6000 B.C.



Food for thought:

- Why become a farmer?
- What do you need?
- Advantages, disadvantages?
- How does society change?

The Fertile Crescent



- 13.500-9500 BC: Protoneolithic (Natufian)
- 9500-8500 BC: Pre-pottery Neolithic A (PPNA)
- 8200-6800 BC: PPNB
- 6500-5500 BC: Pottery Neolithic

Pre-pottery Neolithic (Natufian, 13500-9500 BC)

Early Natufian:

- Environment: woodland (oak, pistacia)
- Sedentary lifestyle
- Subsistence: Mostly hunting (gazelle) and gathering (wild grasses)

Late Natufian:

- During Younger Dryas; Drought in the Levant
- Landscape management (clearing scrubs to encourage cereals)?
- Domestication of drought-resistant crops?

Pre-Pottery Neolithic A (PPNA, 9500-8500 BC)

- Large Settlements
- Hunting (gazelle)

Pre-Pottery Neolithic A (PPNB, 8200-6800 BC)

- Large Settlements
- Gazelles disappearing
- Domestication of sheep and goat (some evidence for domestication much earlier)



The first European Farmers

Bandkeramic culture

(from ca 5500 BC)



	Climate Events Vegetation Zones	Human Events	Climate Triggers
9,000 B.C.-	Pre-Boreal (<i>renewed warming</i>)	Farming spreads rapidly in southwestern Asia Abu Hureyra II and Jericho	Moister conditions (<i>circulation resumes</i>)
10,000 B.C.-		Farming begins in southeastern Asia	Drought in southeastern Asia Cold in Europe
11,000 B.C.-	Younger Dryas (<i>cold</i>) Lake Agassiz spills	Abu Hureyra I Clovis in North America	Atlantic circulation shuts down
12,000 B.C.-		Monte Verde / Meadowcroft First settlement of the Americas Cave paintings at Niaux, France	Spread of forests in Europe
13,000 B.C.-	Bolling / Allerod (<i>rapid warming</i>)		Rapid warming
14,000 B.C.-	HEINRICH I EVENT ends	First settlement of northeastern Siberia	
15,000 B.C.-	Some warming variable temperatures	Final Ice Age cultures in Europe	Rapid sea level rise
16,000 B.C.-	Late Ice Age (<i>cold</i>)	Climatic amelioration in Eurasia Cro-Magnons in Europe	Rapid retreat of ice sheets

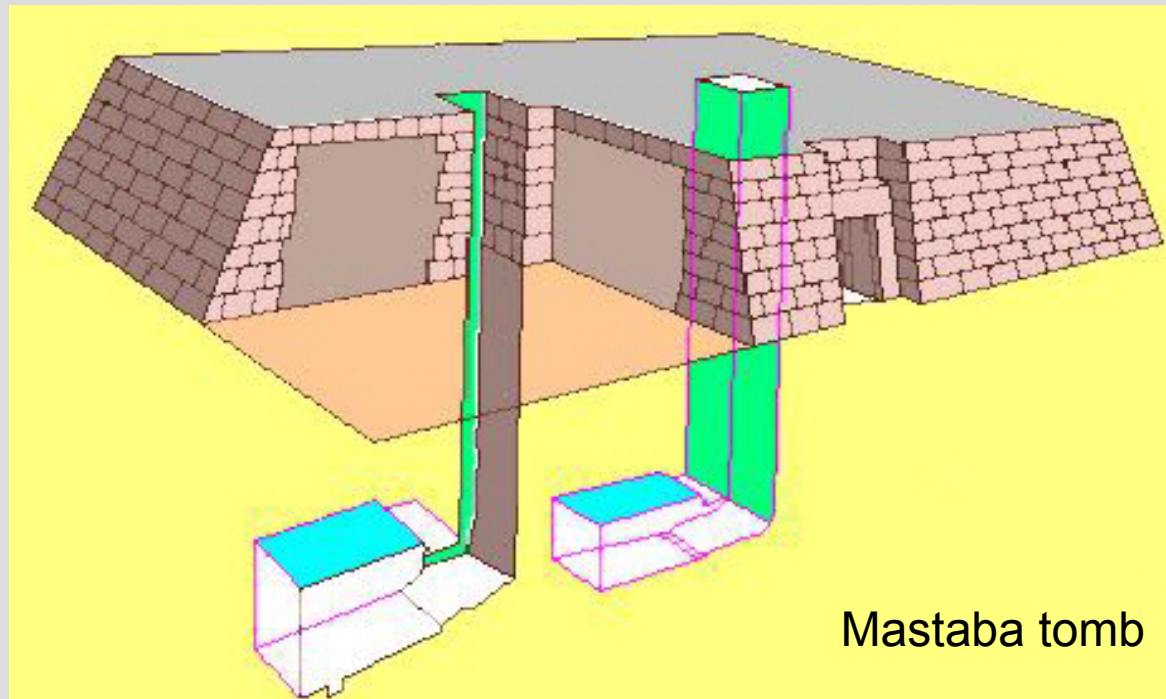
	Climate Events Vegetation Zones	Human Events	Climate Triggers
3000 B.C.	Sub-Boreal	Unification of Egypt	
4000 B.C.		Towns appear in Egypt Cities develop in Mesopotamia	Major aridification in the Sahara, Egypt, and Mesopotamia
		Ertebolle culture in Scandinavia	Warm, moist conditions in Europe
5000 B.C.		Cattle herded in the Sahara	Drought in American West
	Atlantic		
6000 B.C.	Mini Ice Age (colder, drier)	Linearbandkeramik farmers move into Central Europe First settlement of southern Mesopotamia Farmers in the Balkans	Euxine lake flooded Sea level rise Laurentide ice sheet collapses—Atlantic circulation slows
7000 B.C.			
8000 B.C.	Boreal	Farming spreads rapidly in Southwestern Asia	
9000 B.C.	Pre-Boreal	"Broad-spectrum hunter-gatherers" in Northern Europe	Atlantic circulation resumes

Ancient Egypt

- 5500-3100 Pre-, protodynastic
- 3100-2630 Early Dynasties
- 2630-2181 Old Kingdom
- 2181-2040 First Intermediate
- 2040-1782 Middle Kingdom
- 1782-1570 Second Intermediate
- 1570-1070 New Kingdom
- 1070-664 Third Intermediate
- 664-... Persian
 - Graeco-Roman
 - Arab

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Mastaba tomb

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Hatshepsut
(ca 1479-1458)



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Akhenaten (1353?-1336?)

Nefertiti



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Ramesses II
(1279-1213)



Tutankhamun, 1333-1323



Ankhtifi

Early First Intermediate Period

The Prince, Count, Royal Seal-bearer, Sole Companion, Lector-priest, General, Chief of scouts, Chief of foreign regions, Great Chief of the nomes of Edfu and Hierakonpolis, Ankhtifi, says:

Horus brought me to the nome of Edfu for life, prosperity, health, to re-establish it, and I did (it)...

Ankhtifi

Nomarch of Hierakonpolis

..... the sky was clouded and the earth [...] of hunger on this sandbank of Apophis. The south came with its people and the north with its children; they brought the finest oil in exchange for the barley which was given them. My barley went upstream until it reached lower Nubia and downstream until it reached the Abydene nome. All of Upper Egypt was dying of hunger and people were eating their children, but I did not allow anyone to die of hunger in this nome.

Ankhtifi

Nomarch of Hierakonpolis

I was the beginning and the end of mankind,
since nobody like myself existed before nor
will he exist; nobody like me was ever born
nor will he be born. I surpassed the feats of
the ancestors, and coming generations will
not be able to equal me in any of my feats
within this million of years.

Ankhtifi

Nomarch of Hierakonpolis

The whole country has become like locusts
going upstream and downstream (...); but
never did I allow anybody in need to go from
this nome to another.

I am the hero without equal.

Collapse of Akkad

Sumerian King List
about the time after Sharkalishari (ca
2100BC):

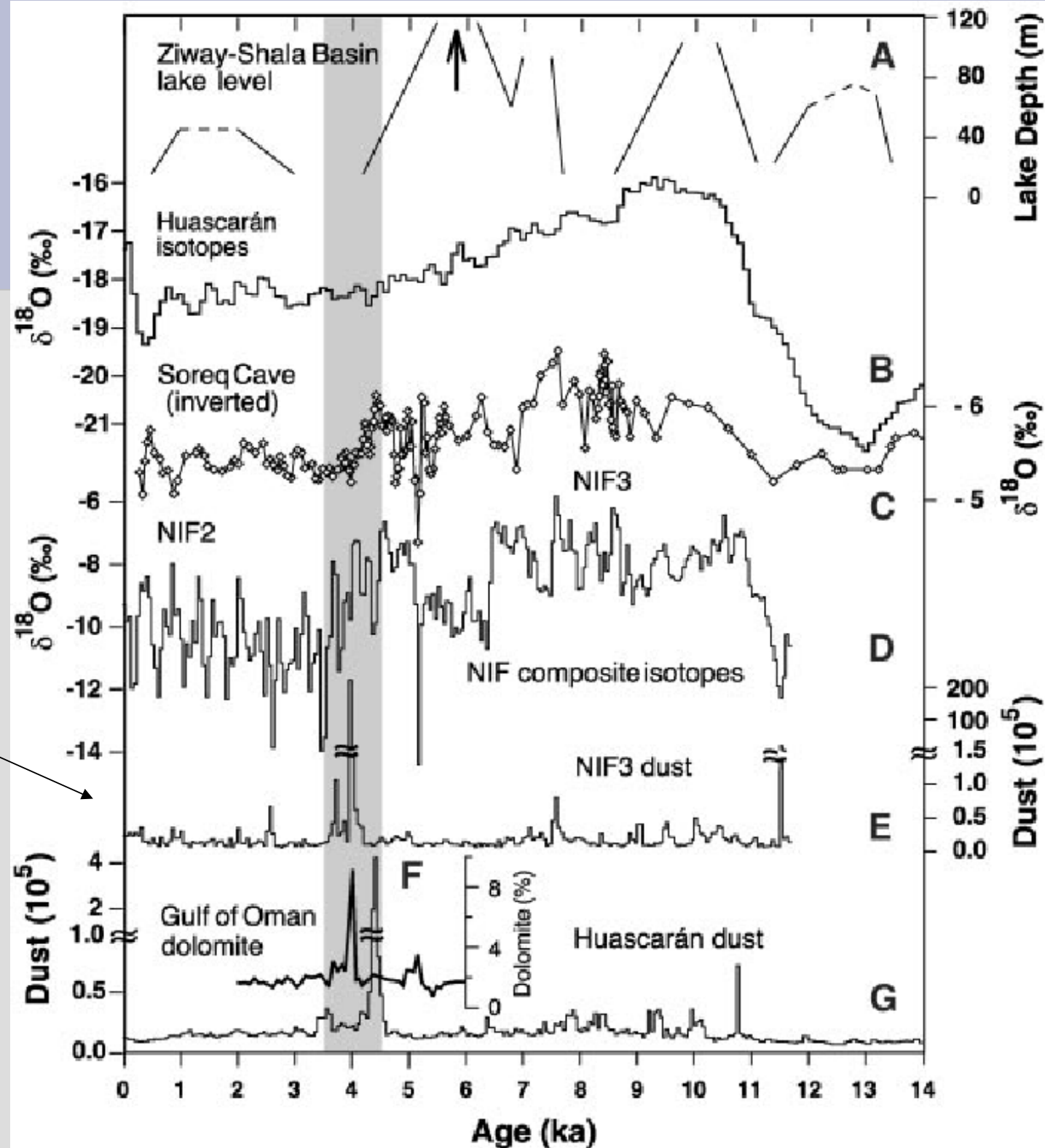
Who was king? Who was not king? Igigi the king; Nanum, the king; Imi the king; Elulu, the king—the four of them were kings but reigned only three years. Dudu reigned 21 years; Shudurul, the son of Dudu, reigned 15 years. (A total of) 11 kings reigned 197 years. Agade was defeated and its kingship carried off to Uruk. In Uruk, Urnigin reigned 7 years, Irgigir, son of Urnigin, reigned 6 years; Kudma reigned 6 years; Puzur-ili reigned 5 years, Utu-utu reigned 6 years. Uruk was smitten with weapons and its kingship carried off by the Gutian hordes

Sargon of Akkad
(2333-2279)



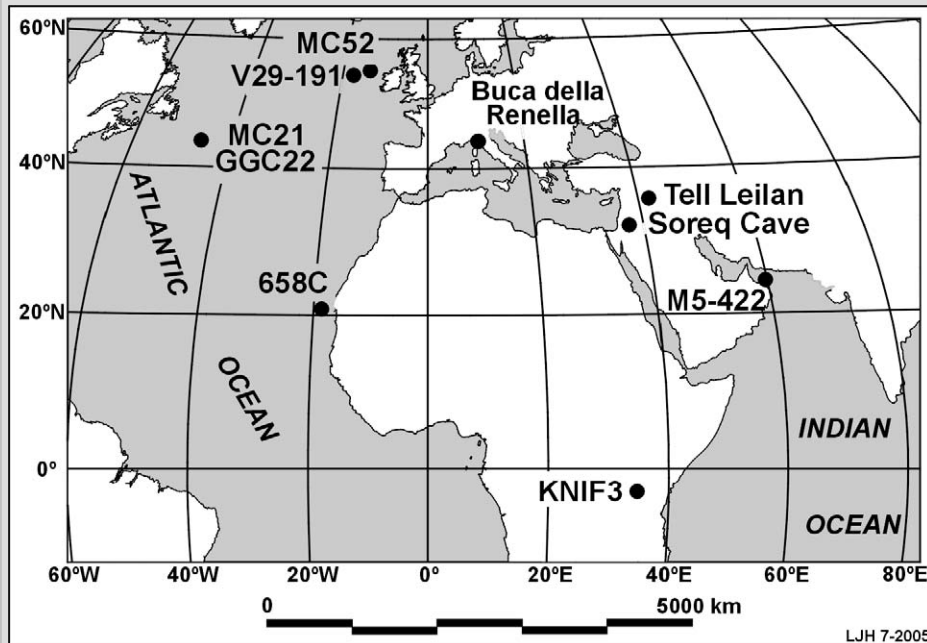
Climate

Kilimanjaro
Ice Core records

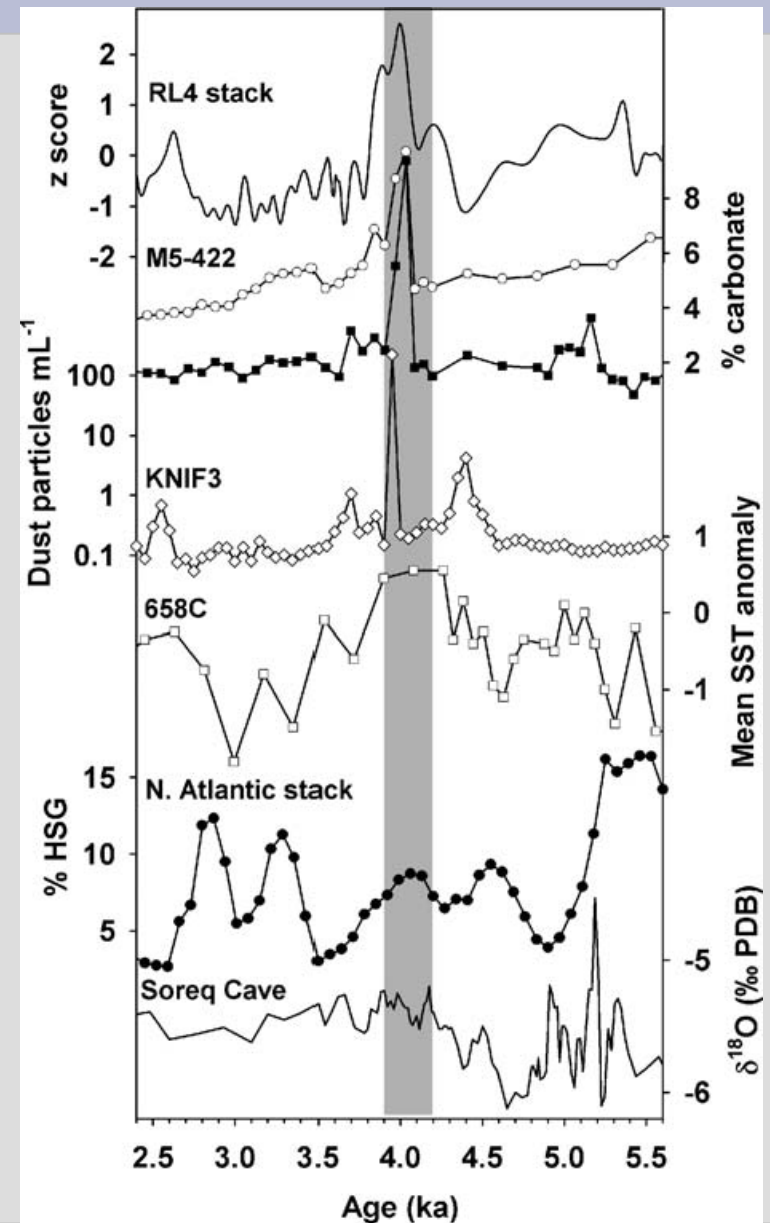


Climate Reconstructions

Drysdale et al. on the civilisation gap of 2100:
 “(In Syria ...) This hiatus is capped by a thin
 tephra layer, overlain by as much as 1 m of
 eolian-rich sediments (Weiss et al. 1993).”
 (tephra=ash deposits)



Drysdale et al. (2006)



A volcano? Back to 1993...

The genesis and collapse of third millennium north Mesopotamian civilization.

Weiss, H., Courty, Wetterstrom, W., Guichard, F., Senior, L., Meadow, R., Curnow, A. (1993), Science 261 (5124), 995-1004.

Abstract:

Archaeological and soil-stratigraphic data define the origin, growth, and collapse of Subir, the third millennium rain-fed agriculture civilization of northern Mesopotamia on the Habur Plains of Syria. At 2200 B. C., a **marked increase in aridity and wind circulation, subsequent to a volcanic eruption**, induced a considerable degradation of land-use conditions. After four centuries of urban life, this abrupt climatic change evidently caused abandonment of Tell Leilan, regional desertion, and collapse of the Akkadian empire based in southern Mesopotamia. Synchronous collapse in adjacent regions suggests that the impact of the abrupt climatic change was extensive.

But when you think you have a simple story, then ...

... somebody else writes a paper (September 2009):

The Holocene 19,6 (2009) pp. 823–833

Possible complexity of the climatic event around 4300–3800 cal. BP in the central and western Mediterranean

Michel Magny,^{1*} Boris Vannière,¹ Gianni Zanchetta,² Eric Fouache,³ Gilles Touchais,⁴ Lera Petrika,⁵ Céline Coussot,³ Anne-Véronique Walter-Simonnet¹ and Fabien Arnaud⁶

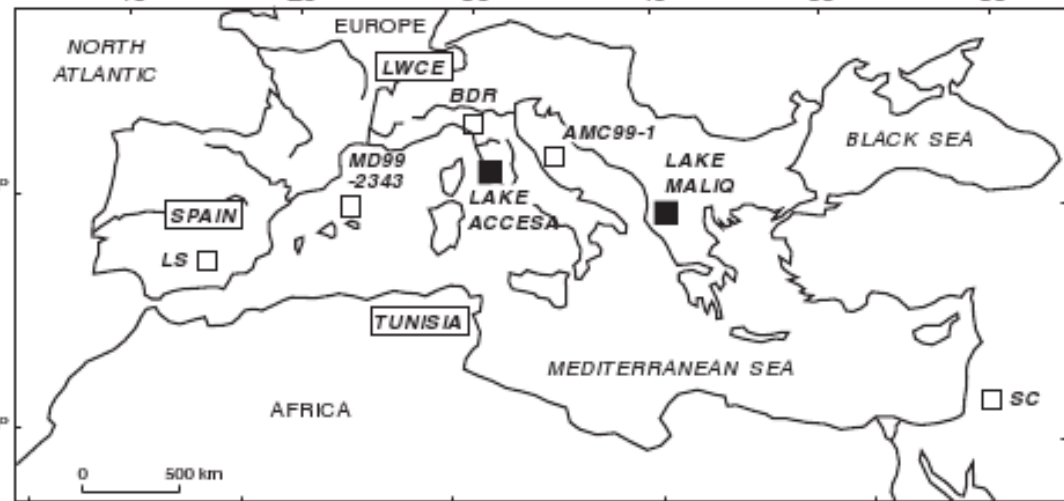
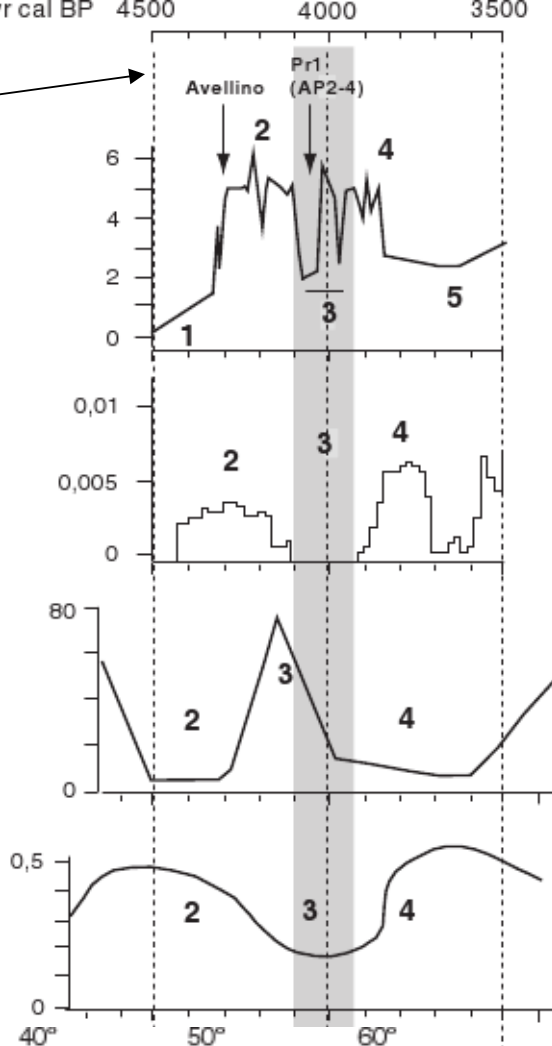
Tephra layers

Lake Accesa,
north-central Italy
(lake level, m)

Spain
(flood periods,
probability per year)

Siles, southern Spain
(charcoals $\times 10^3 \times g^{-1}$)

Tunisia
(soil formation,
probability per year)



Lake-level (m)
at Accesa,
central Italy

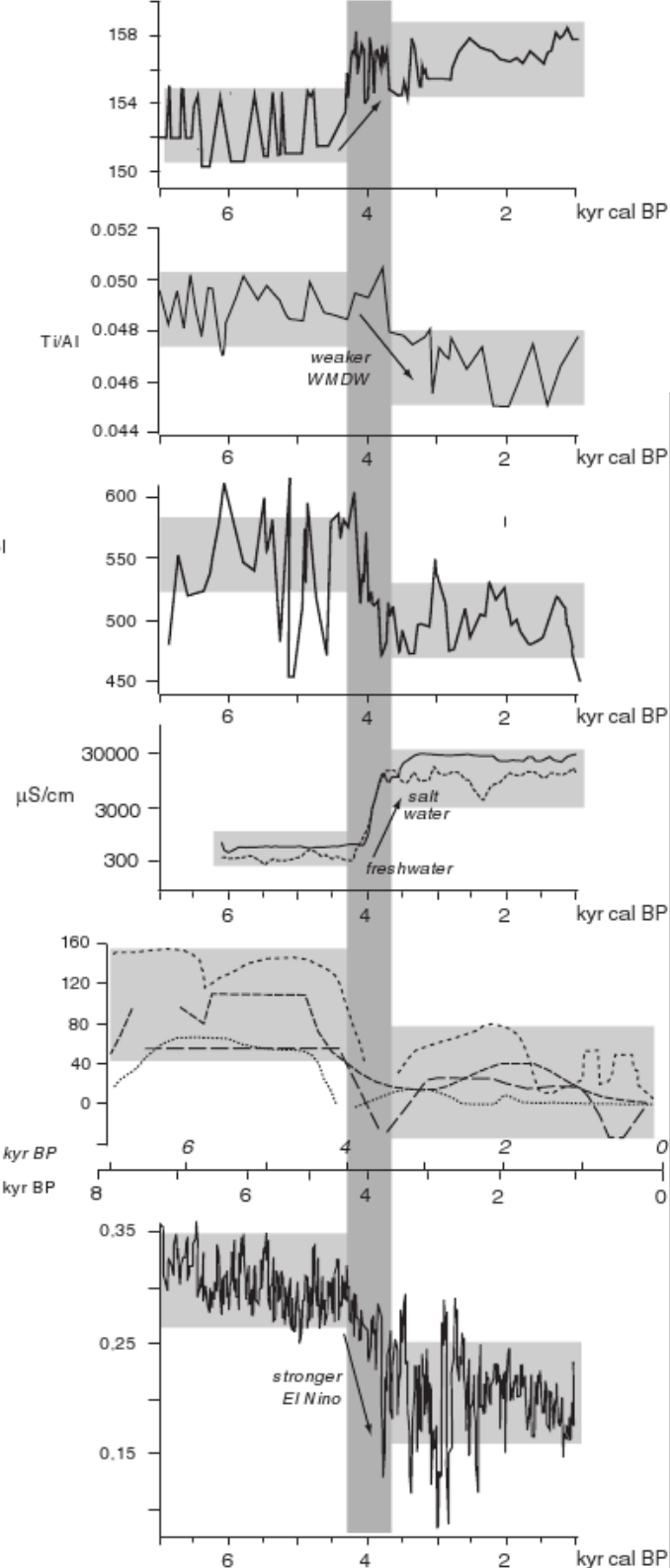
Western
Mediterranean
(Balearic Basin)

Soreq Cave, Israël
(Precipitation,
mm/year)

Lake Yoa,
northern Chad
(water
conductivity)

Lake levels (m)
in African tropics

Cariaco basin
(Titanium, %)



“Possible complexity ...”

- Tripartite climate oscillation
 - wet: 4300-4100
 - dry: 4100-3950
 - wet: 3950-3500
- Tephra (volcanic deposits)
 - ca. 4300
 - ca. 4050
- “oscillation appears to have developed at a key moment during a crucial transition from mid to late Holocene”
- “better understanding requires further investigation”

Literature

- Diamond (1998): Guns, Germs and Steel.
- Fagan (2004): The Long Summer
- Drysdale et al. (2006): Late Holocene drought responsible for the collapse of Old World civilizations is recorded in Italian cave flowstone. *Geology* 34(2), p.101-104.
- Thompson et al. (2002): Kilimanjaro Ice Core Record: Evidence of Holocene Climate Change in Tropical Africa. *Science* 298, p. 589-593.
- Magny et al (2009): Possible complexity of the climatic event around 4300 – 3800 cal BP in the central and western Mediterranean. *The Holocene*, 19, p. 823-833
- Preston, G. W. et al. (2011). From nomadic herder-hunters to sedentary farmers. *Journal of Arid Environments*, in press.