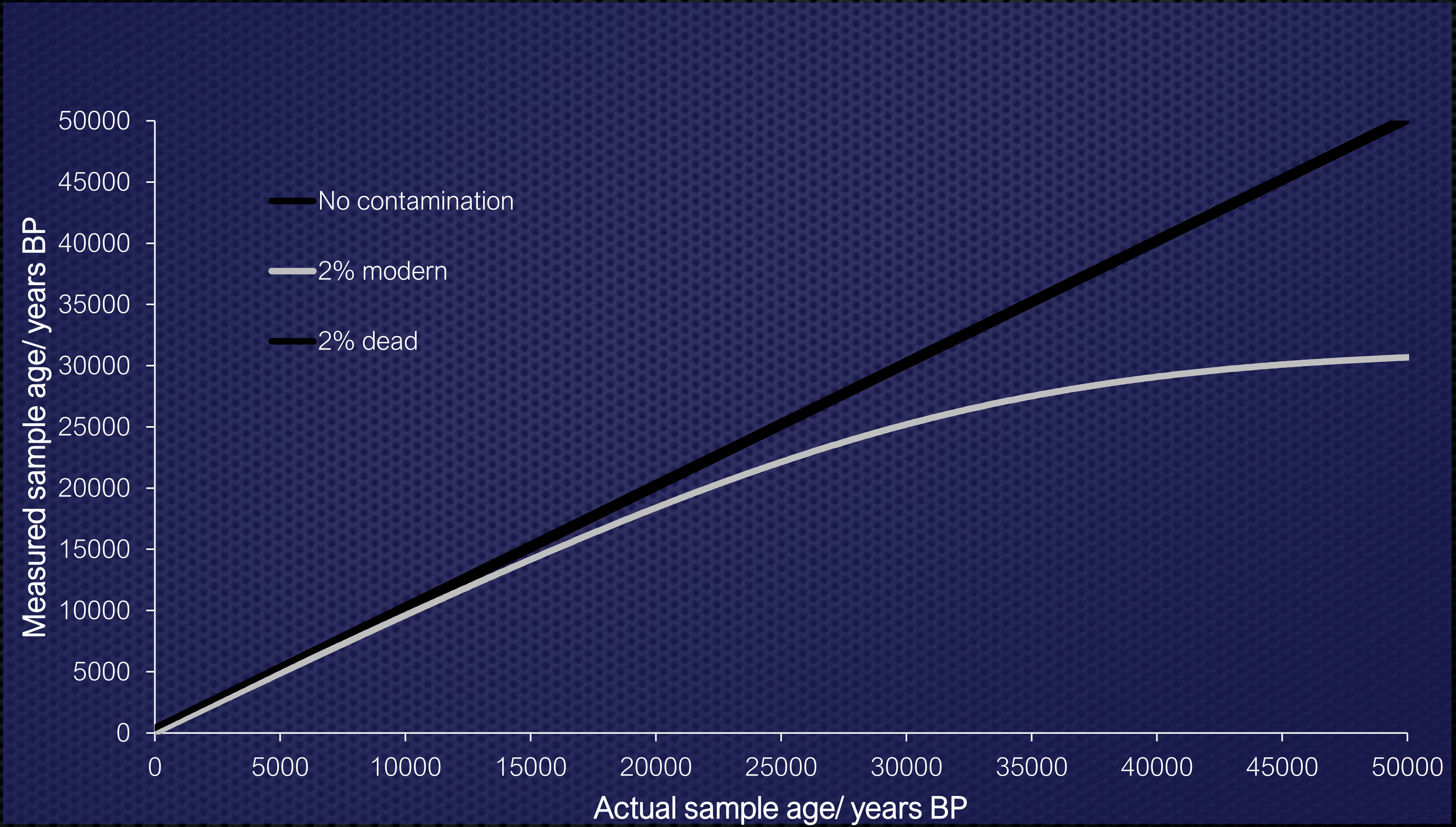
Marco Peresani

Cronologie e culture del Paleolitico – lezione 10 Paleo_lez.10 The chronology of the MP-UP transition

Contamination of radiocarbon samples



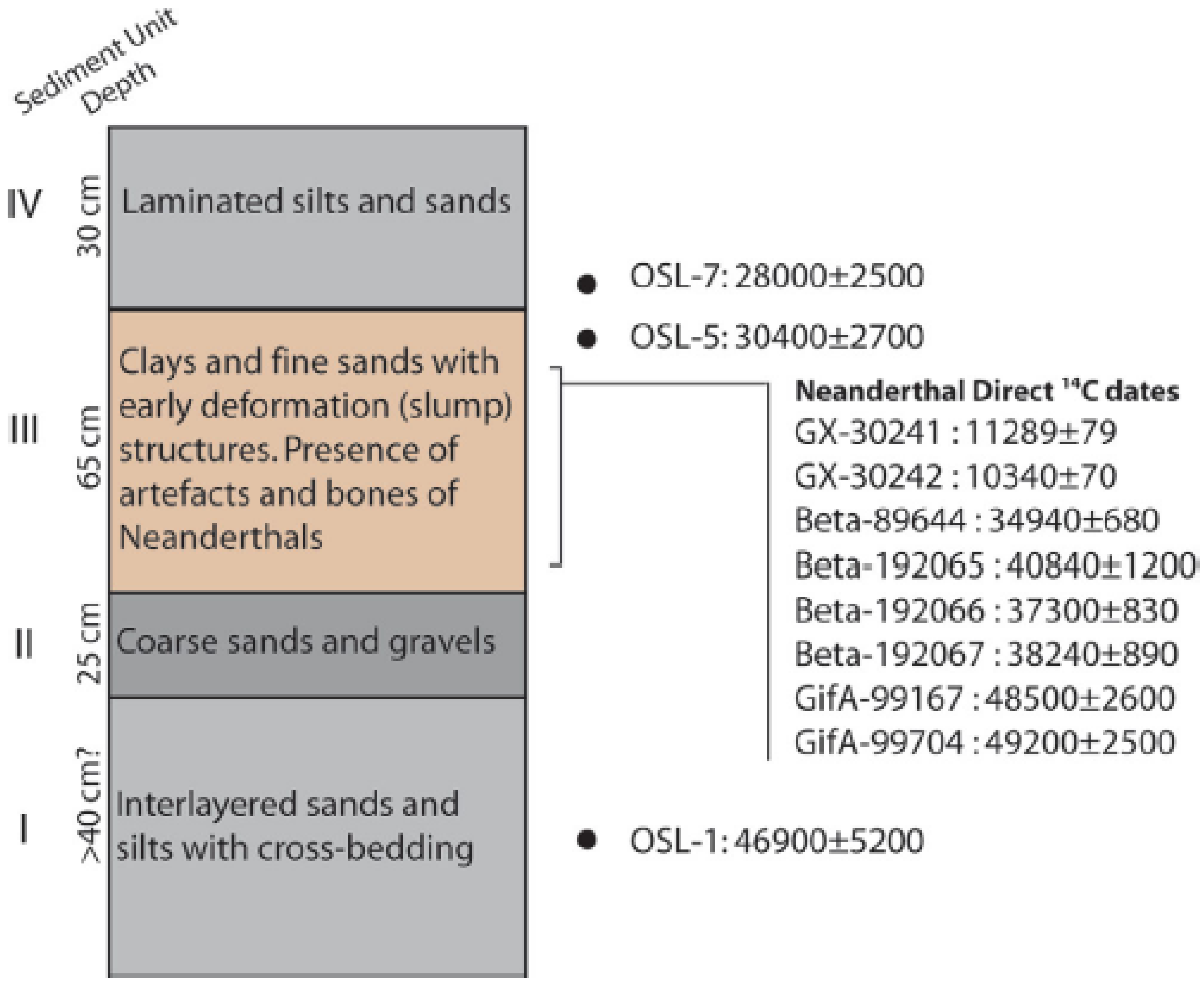
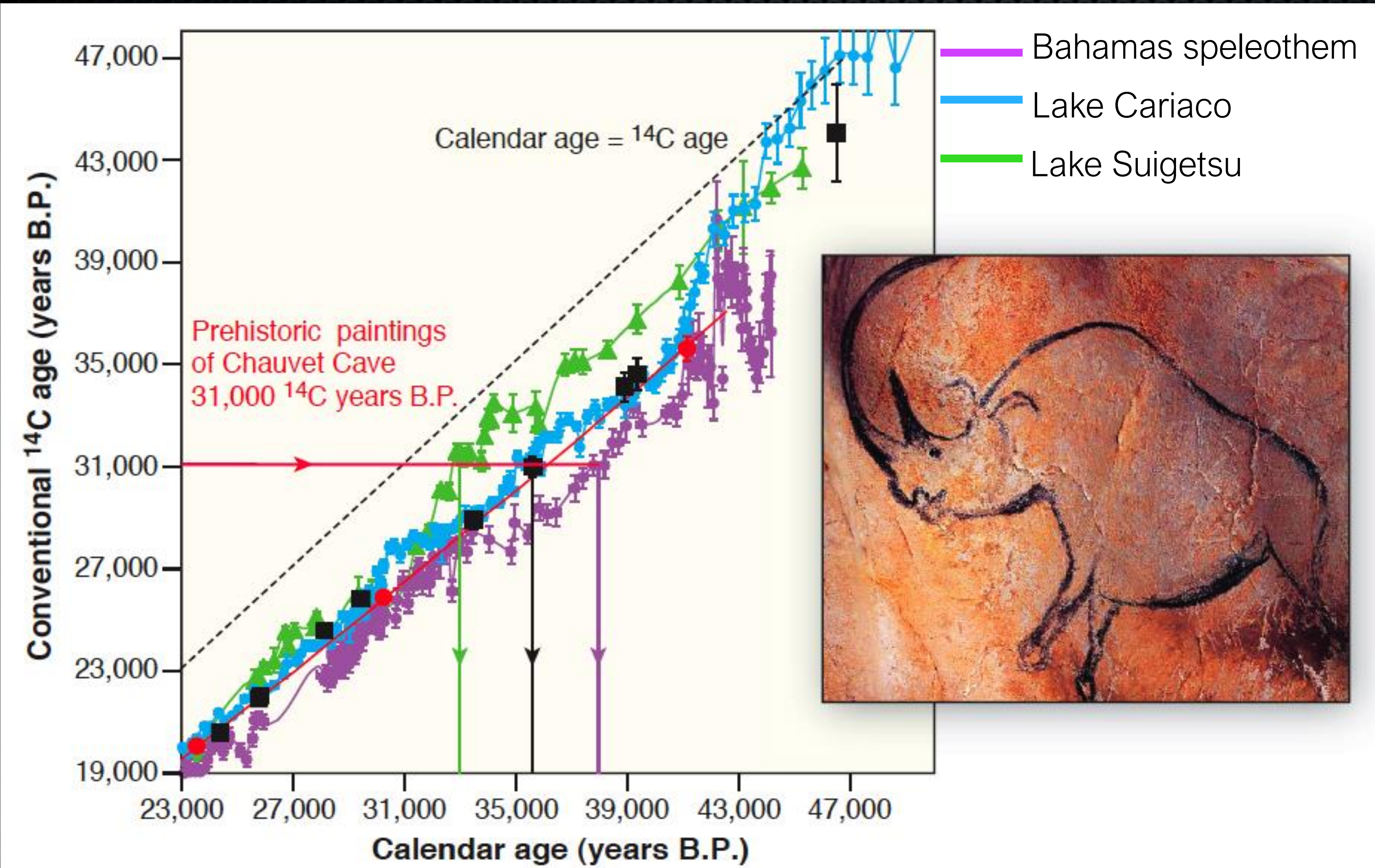


Figure 1. Sequence and chronometric data from the site of El Sidrón, Spain (after De Torres et al. *2010).*

Calibration



(after Bard, 2004).

2006-2009 NERC-funded project:

Radiocarbon dating of the European Middle to Upper Palaeolithic transition

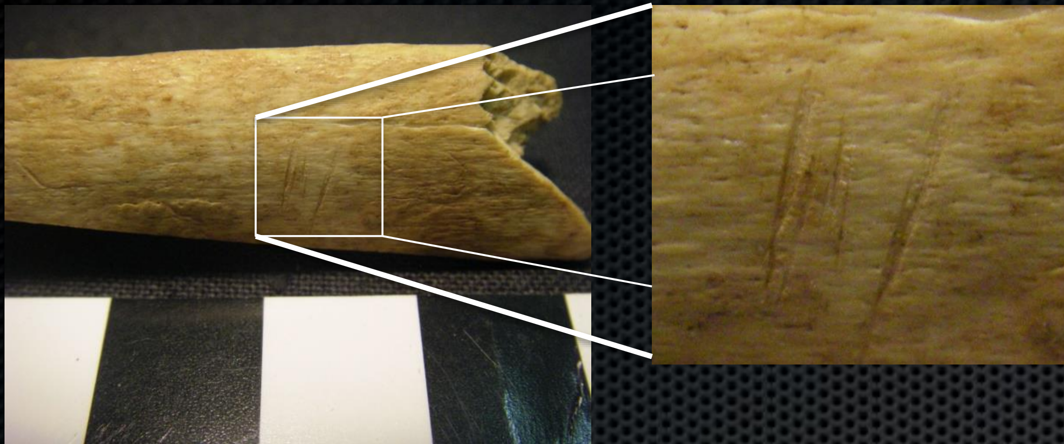
400 new AMS dates from more than 60 sites

Pretreatment Methods

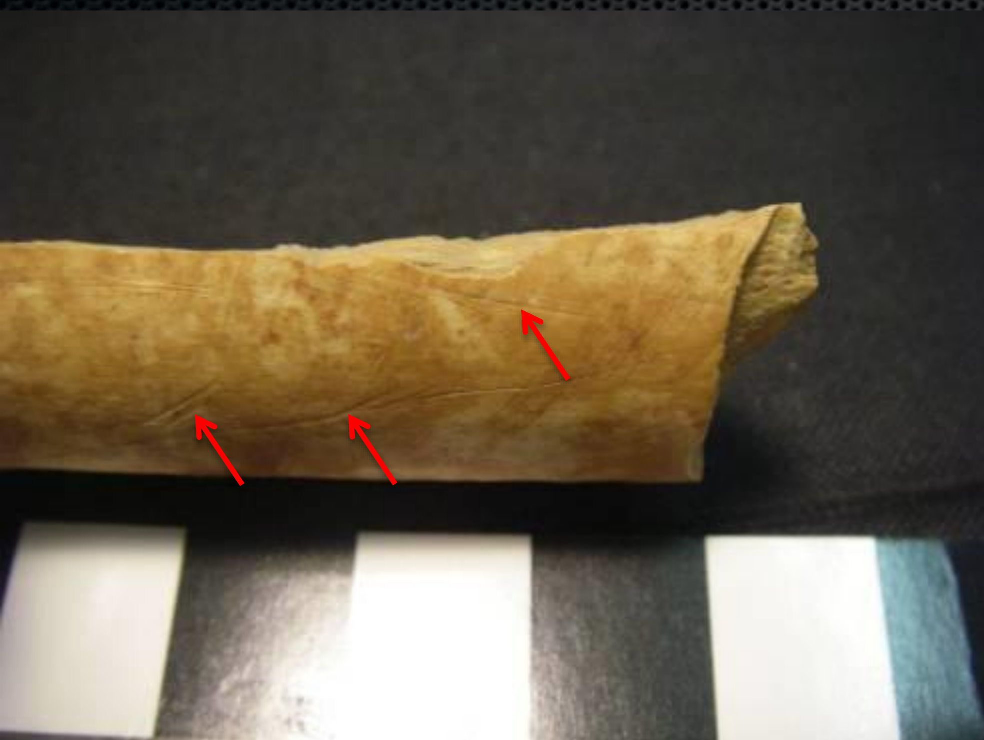
Ultrafiltration AMS dating of bone artefacts, cut-marked bone, ornaments and human remains.

ABOx-SC dating of identified charcoal samples.

Direct AMS shell carbonate dating using novel screening and CarDS decontamination methods.



A6 Ibex bone



A6 Cervus elaphus bone

Ultrafiltration

- ✓ Quality of collagen extracted is improved.
- ✓ Much improved contamination removal.
- ✓ Big improvements for Palaeolithic dating.

OxA	Method	Radiocarbon age BP	±
8408	AG (unpurified gelatin)	28080	360
13716	AF (ultrafiltrated gelatin)	31730	250

Section in tunnel A

Sagittal section in the cave mouth (removed in 1986)

The stratigraphic interval of the Neandertal – sapiens substitution

A9: Mousterian
47,6Cal BP (min. age)

Previous chronology

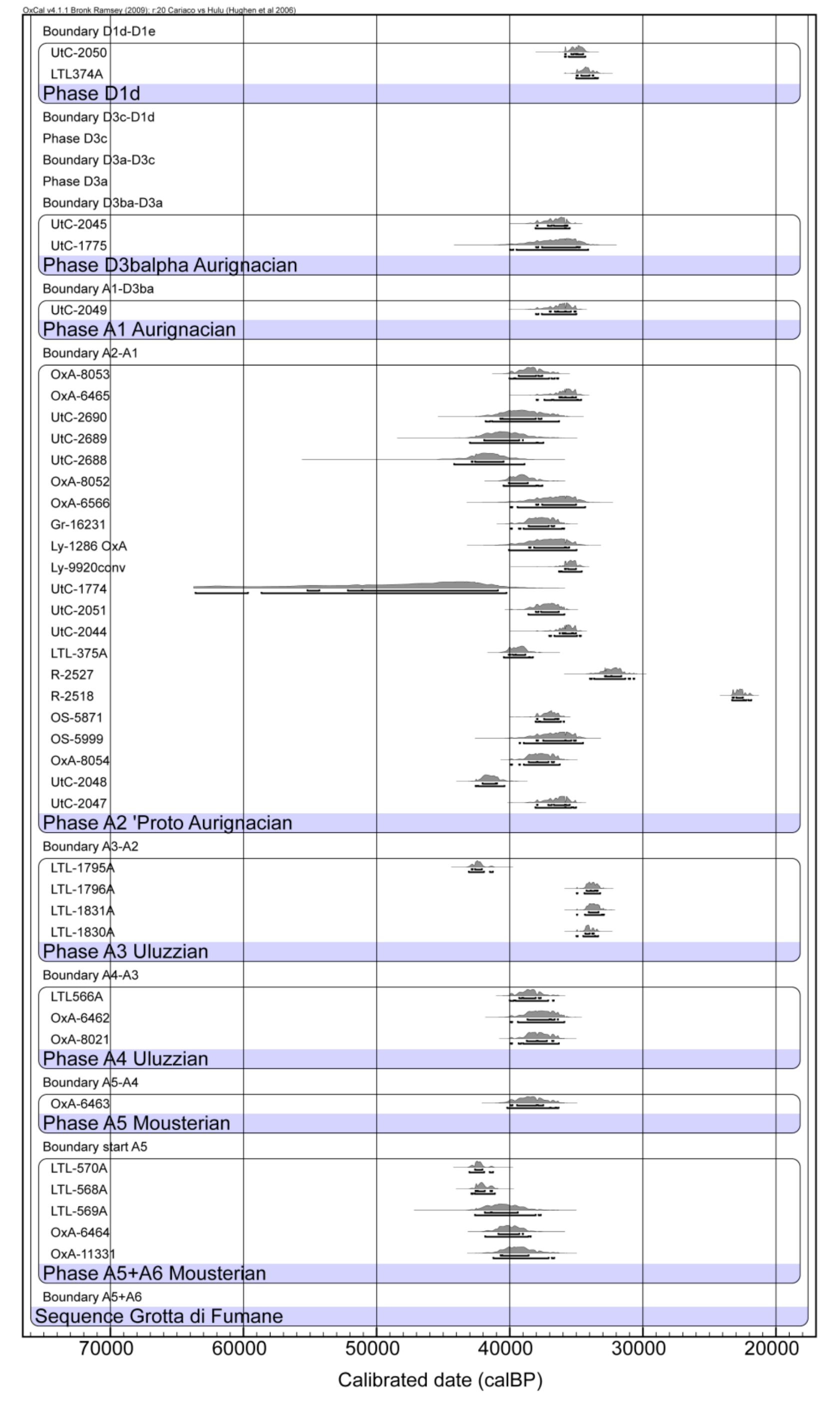
Gravettian
D1d (sporadic presence)

Aurignacian
A1, D6 to D3

Proto-Aurignacian
A2

Uluzzian
A4 to A3

Mousterian
A5-A6



New results

FUMANE

ABOx-SC vs ABA

OxA no.	Context	Treatment	Radiocarbon age BP
11348	Lyr D1d	ABA	31490 ± 250
17571		ABOX	31590 ± 160
8051	Lyr D3ba, h. 15, sq. 57	ABA	32020 ± 340
18200		ABA	32600 ± 190
17981		ABOX	33890 ± 220
11347	Lyr A2, sq. 97d	ABA	30650 ± 260
17569		ABOX	35640 ± 220
11360	Lyr A2, sq. 107i	ABA	31830 ± 260
17570		ABOX	35180 ± 220
19525	Lyr A2/struc.18	ABA	33380 ± 210
19584		ABOX	35850 ± 310
19413	Lyr A2/struc. 16	ABA	32120 ± 240
19414		ABOX	34180 ± 270
19411	Lyr A2/struc.17	ABA	32530 ± 240
19412		ABOX	34940 ± 280

Problems with radiocarbon dating the Middle to Upper Palaeolithic transition in Italy

Thomas Higham [a,*], Fiona Brock [a], Marco Peresani [b], Alberto Broglio [b], Rachel Wood [a], Katerina Douka [a]

[a] Oxford Radiocarbon Accelerator Unit, Research Laboratory for Archaeology and the History of Art, South Parks Road, University of Oxford, Oxford OX1 3QY, England, UK
[b] Università di Ferrara, Dipartimento di Biologia ed Evoluzione, Sezione di Paleobiologia, Preistoria e Antropologia, Corso Ercole I d'Este, 32-44100 Ferrara, Italy

FUMANE
ABOx-SC vs ABA

OxA no.	Context	Treatment	Radiocarbon age BP
6463	Lyr A5, sqs. 85,86,95,96	ABA	33700 ± 600
18199		ABA	36860 ± 700
17980		ABOX	40150 ± 350
8022	Lyr A5+A6, sq.90	ABA	38800 ± 750
8023		ABA	38250 ± 700
17567		ABA	39500 ± 330
17568		ABA	39490 ± 350
17566		ABOX	40460 ± 360
19410	Lyr A5 sq 88i, struc. III	ABA	34500 ± 270
2275-45		ABOX	41650 ± 650

Problems with radiocarbon dating the Middle to Upper Palaeolithic transition in Italy

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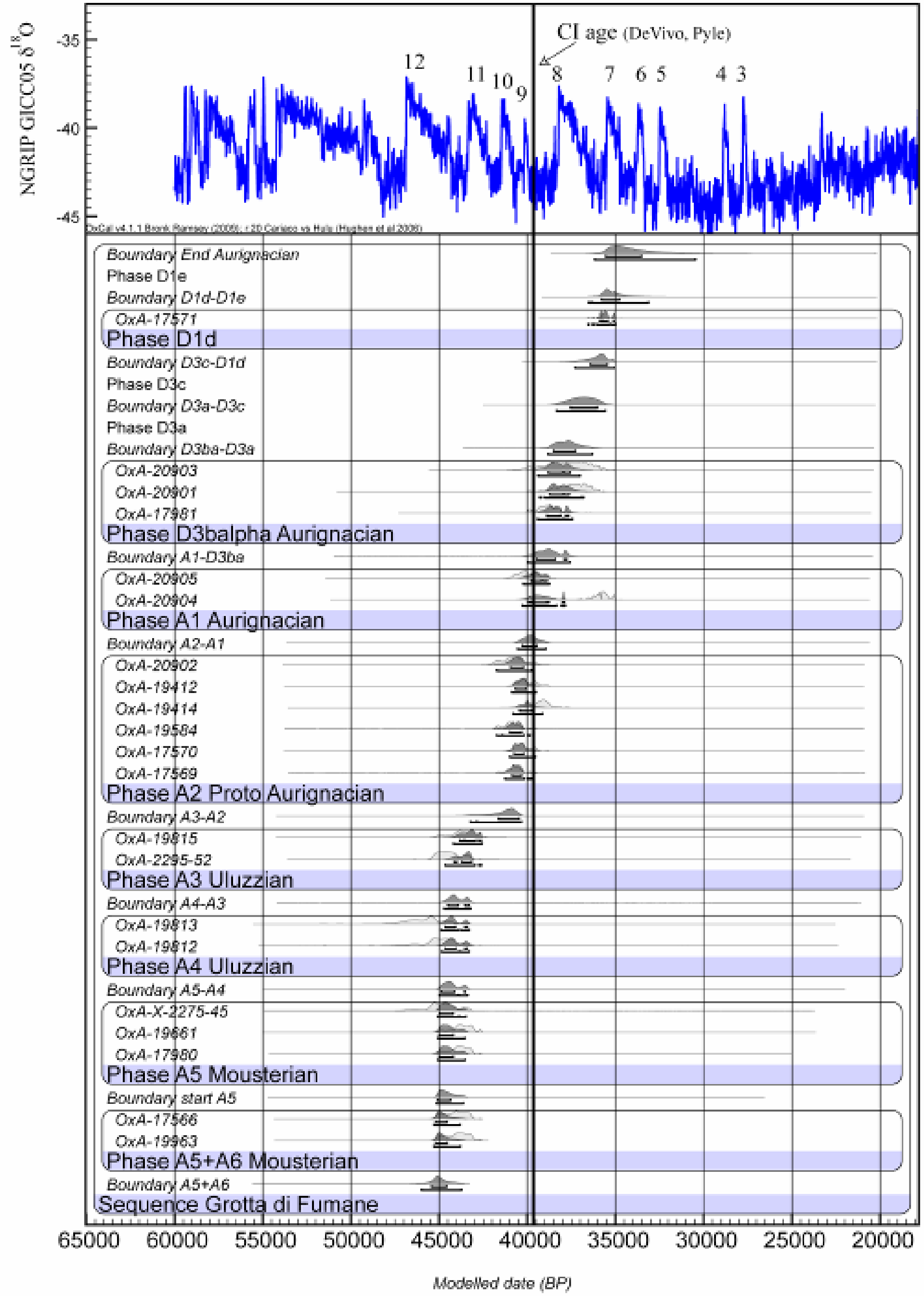
Fumane New chronology



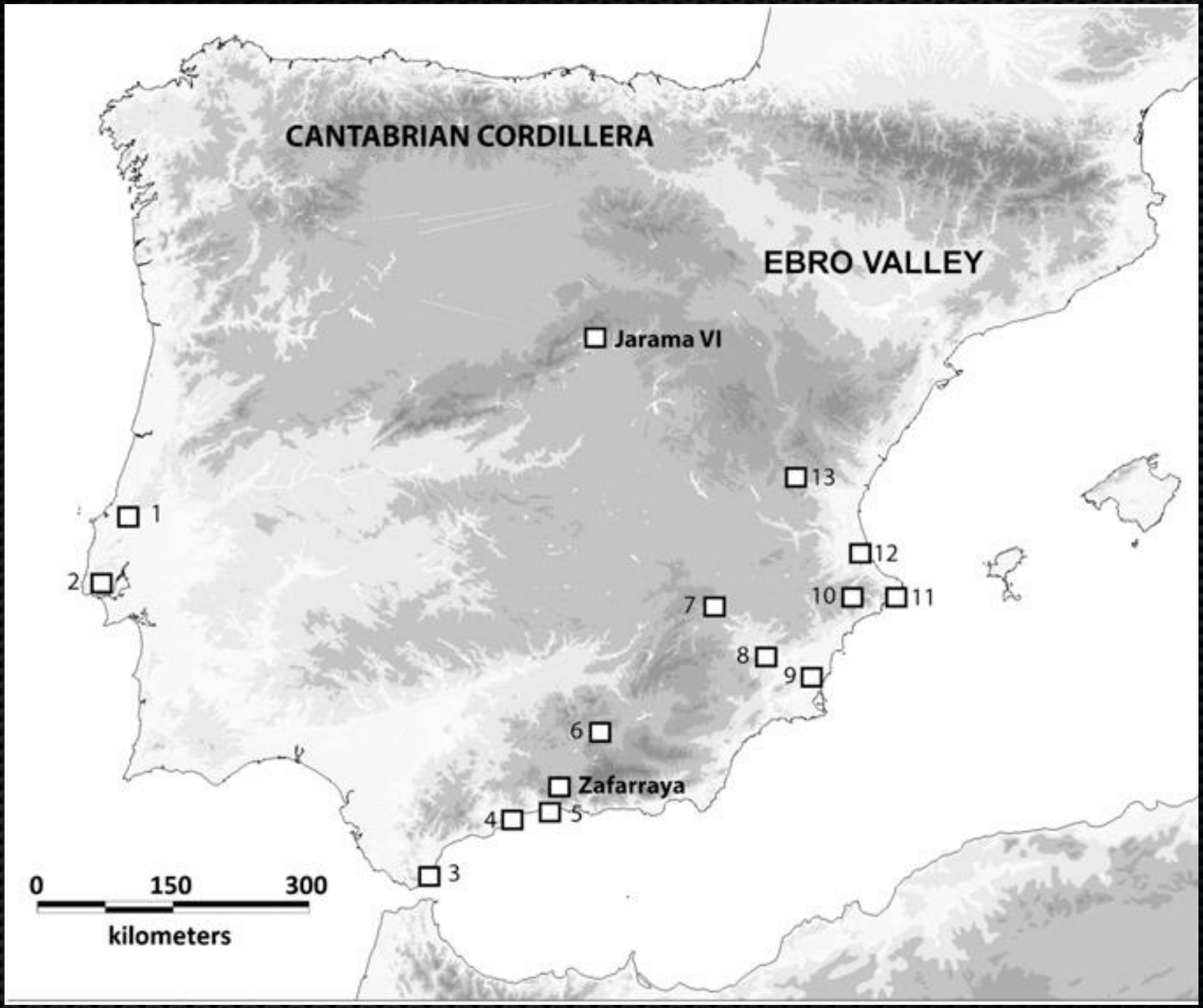
- Radiocarbon dating beyond ~30,000 BP is difficult due to contamination with small amounts of modern contamination.
- Improving pretreatment chemistry is the most important issue in dating reliability.
- ABOx-SC and ultrafiltration are just two methods, others are being developed.
- Many problems likely within previous ^{14}C dates for this period.
- New dates support a rapid dispersal of modern humans throughout Italy at the time of the M-Upper Palaeolithic transition.

Radiocarbon dating casts doubt on the late chronology of the Q:1 Middle to Upper Palaeolithic transition in southern Iberia

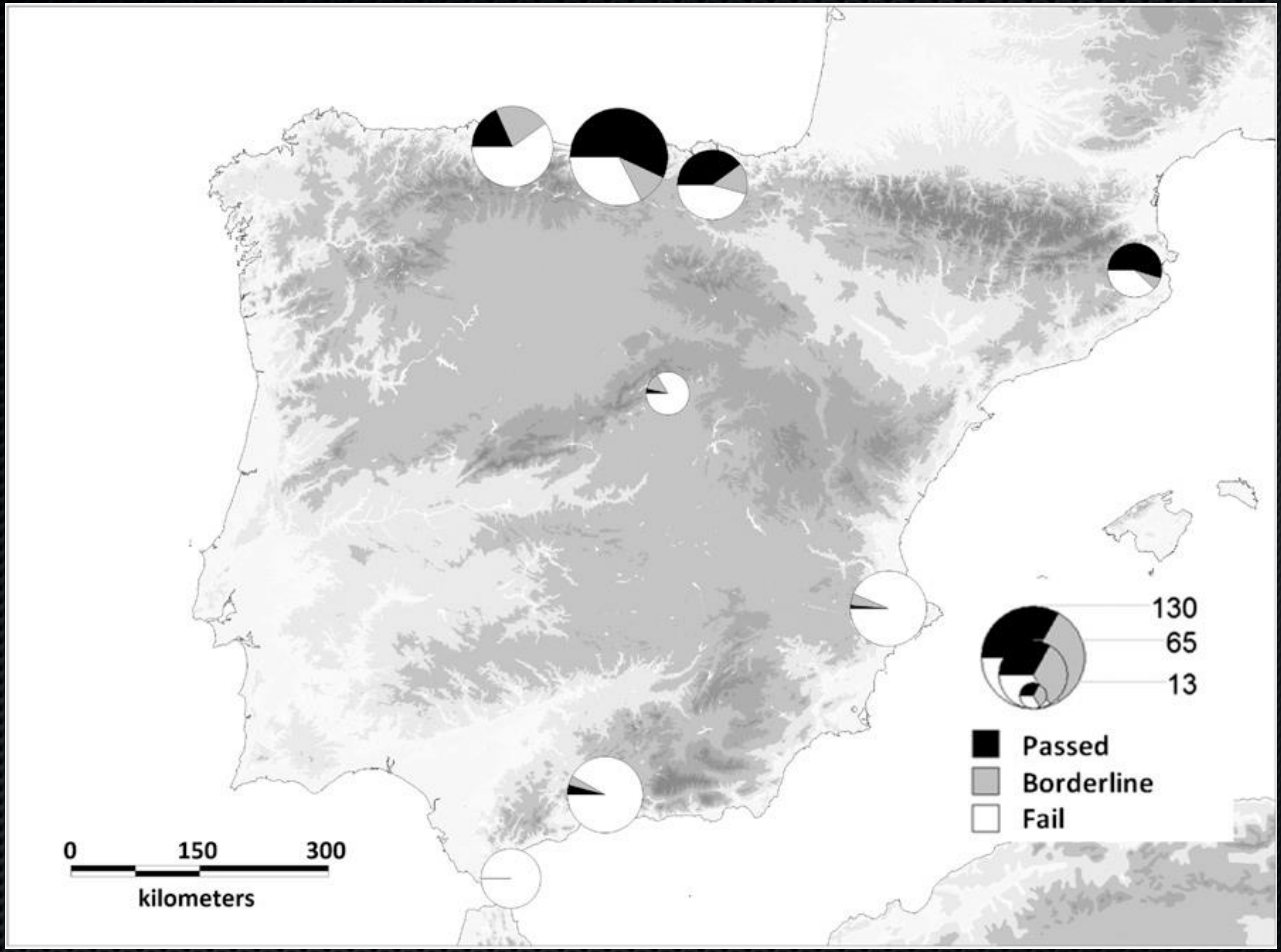
Rachel E. Wood, Cecilio Barroso-Ruíz, Miguel Caparrós, Jesús F. Jordá Pardo, Bertila Galván Santos, and Thomas F. G. Higham

It is commonly accepted that some of the latest dates for Neanderthal fossils and Mousterian industries are found south of the Ebro valley in Iberia at ca. 36 ka calBP (calibrated radiocarbon date ranges). In contrast, to the north of the valley the Mousterian disappears shortly before the Proto-Aurignacian appears at ca. 42 ka calBP. The latter is most likely produced by anatomically modern humans. However, two-thirds of dates from the south are radiocarbon dates, a technique that is particularly sensitive to carbon contaminants of a younger age that can be difficult to remove using routine pretreatment protocols. We have attempted to test the reliability of chronologies of 11 southern Iberian Middle and early Upper Paleolithic sites. Only two, Jarama VI and Zafarraya, were found to contain material that could be reliably dated. In both sites, Middle Paleolithic contexts were previously dated by radiocarbon to less than 42 ka calBP. Using ultrafiltration to purify faunal bone collagen before radiocarbon dating, we obtain ages at least 10 ka 14C years older, close to or beyond the limit of the radiocarbon method for the Mousterian at Jarama VI and Neanderthal fossils at Zafarraya. Unless rigorous pretreatment protocols have been used, radiocarbon dates should be assumed to be inaccurate until proven otherwise in this region. Evidence for the late survival of Neanderthals in southern Iberia is limited to one possible site, Cueva Antón, and alternative models of human occupation of the region should be considered.

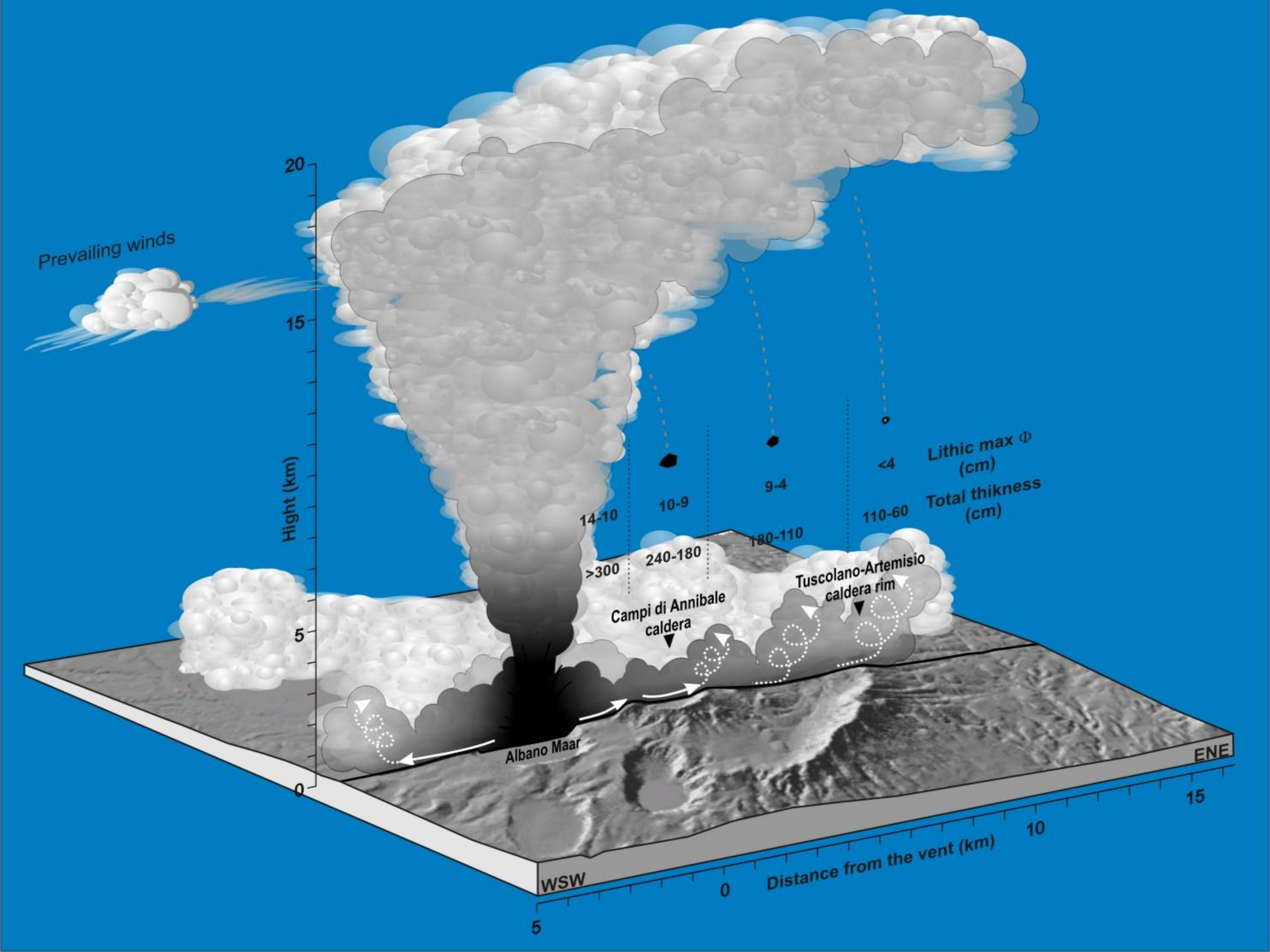
www.pnas.org/cgi/doi/10.1073/pnas.1207656110



The location of sites discussed in the main text and sampled in this study, alongside major topological features relating to the Ebro frontier hypothesis. 1, Gato Preto; 2, Pego do Diabo; 3, Gorham's Cave; 4, Bajondillo; 5, Nerja; 6, Carihuela; 7, El Niño; 8, Cueva Antón; 9, Sima de las Palomas; 10, El Salt; 11, Cendres; 12, Mallaetes; 13, Quebrada.



The %N content of bone across Iberia. Nitrogen contents are higher in north of the Ebro, indicating markedly better preservation of collagen than in the south.


Prevailing winds
20
15
5
0
Hight (km)
Lithic max Φ (cm)
Total thikness (cm)
14-10
10-9
9-4
<4
>300
240-180
180-110
110-60
Campi di Annibale caldera
Tuscolano-Artemisio caldera rim
Albano Maar
WSW
ENE
Distance from the vent (km)
5
0
10
15

Sedimentary archives

Continental

Marine

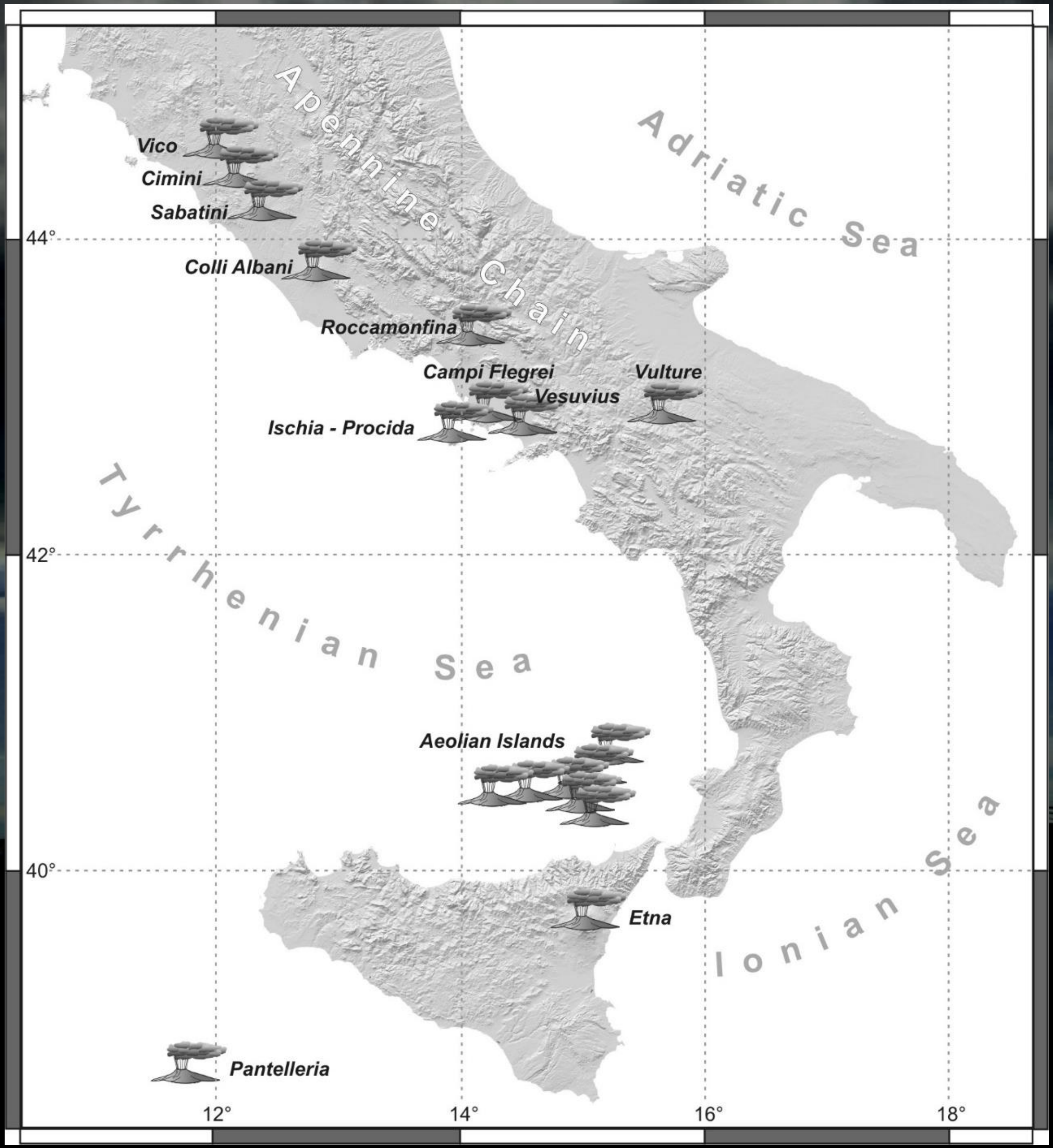
Subaerial — Lacustrine — Archaeological

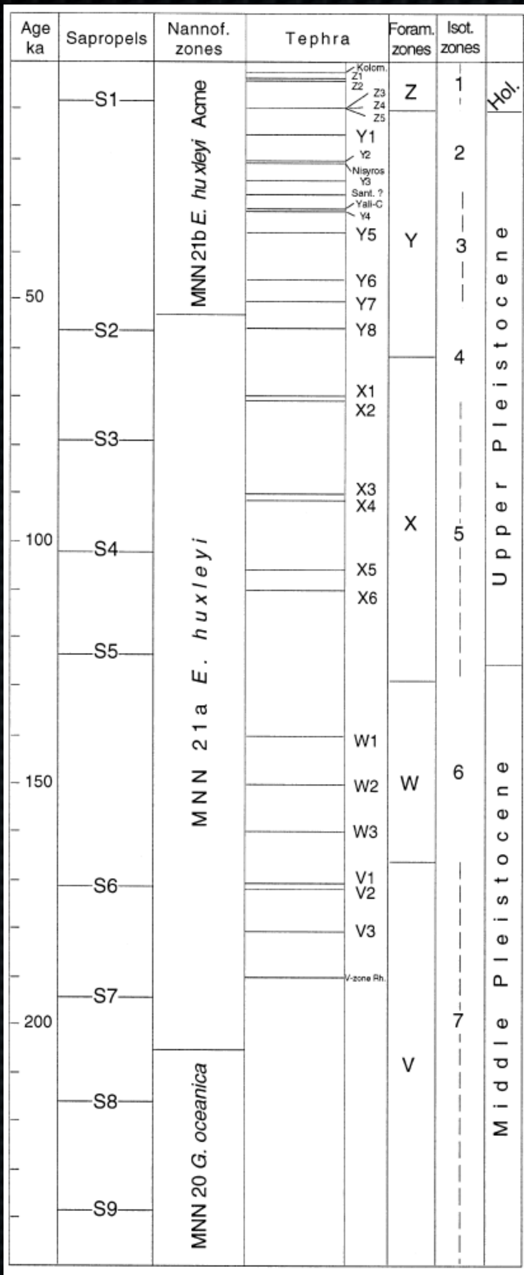
Tephra — Events/Processes

morpho-pedo-sedimentary	Climatic-environmental	cultural	Climatic-environmental

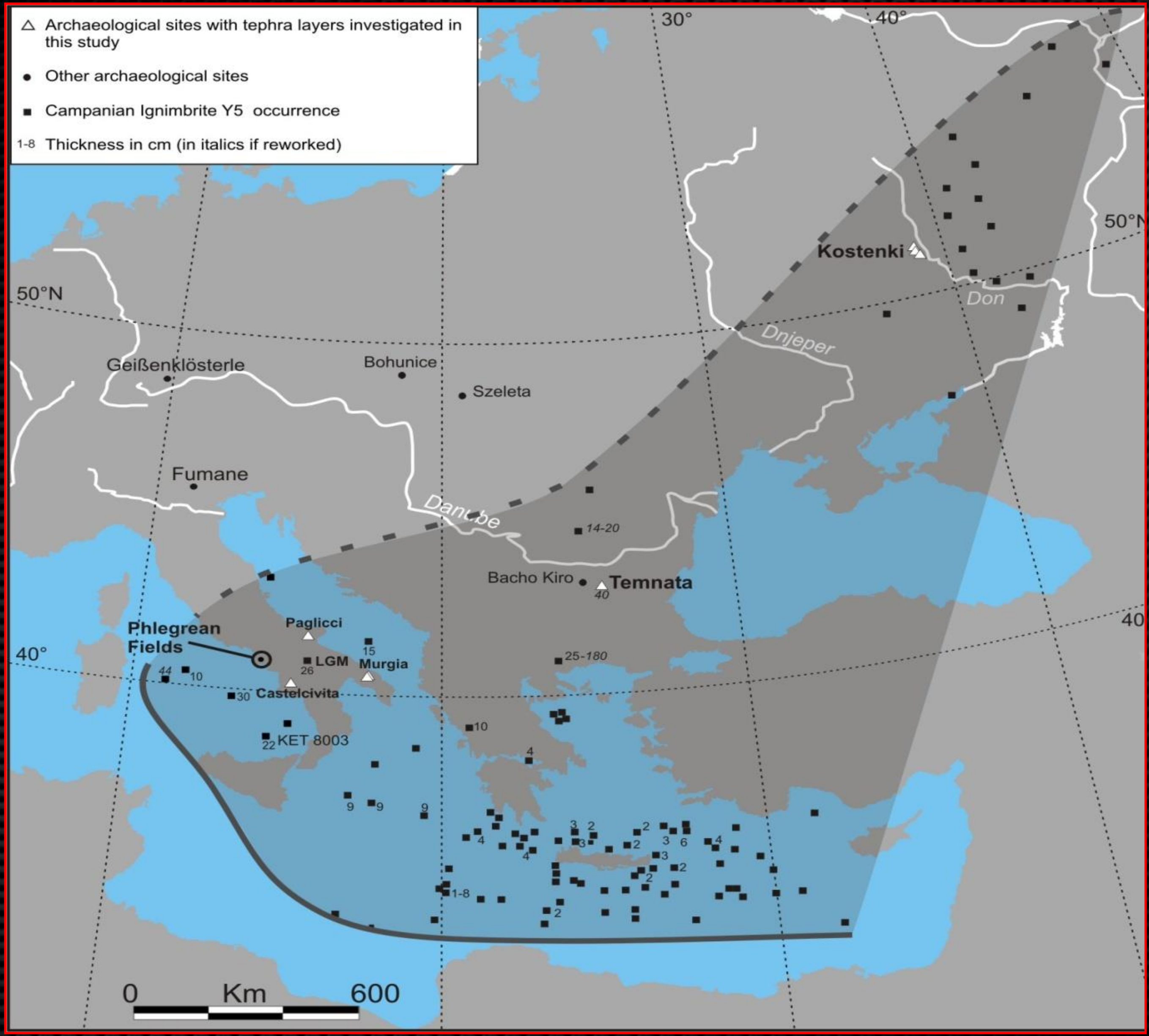
The simultaneous deposition of the tephra layers in different sedimentary settings, allows to precisely synchronise a number of events and processes recorded in the natural and archaeological archive, with significant implication in terms of evaluation of their potential interdependence

Quaternary active volcanoes in central Mediterranean area



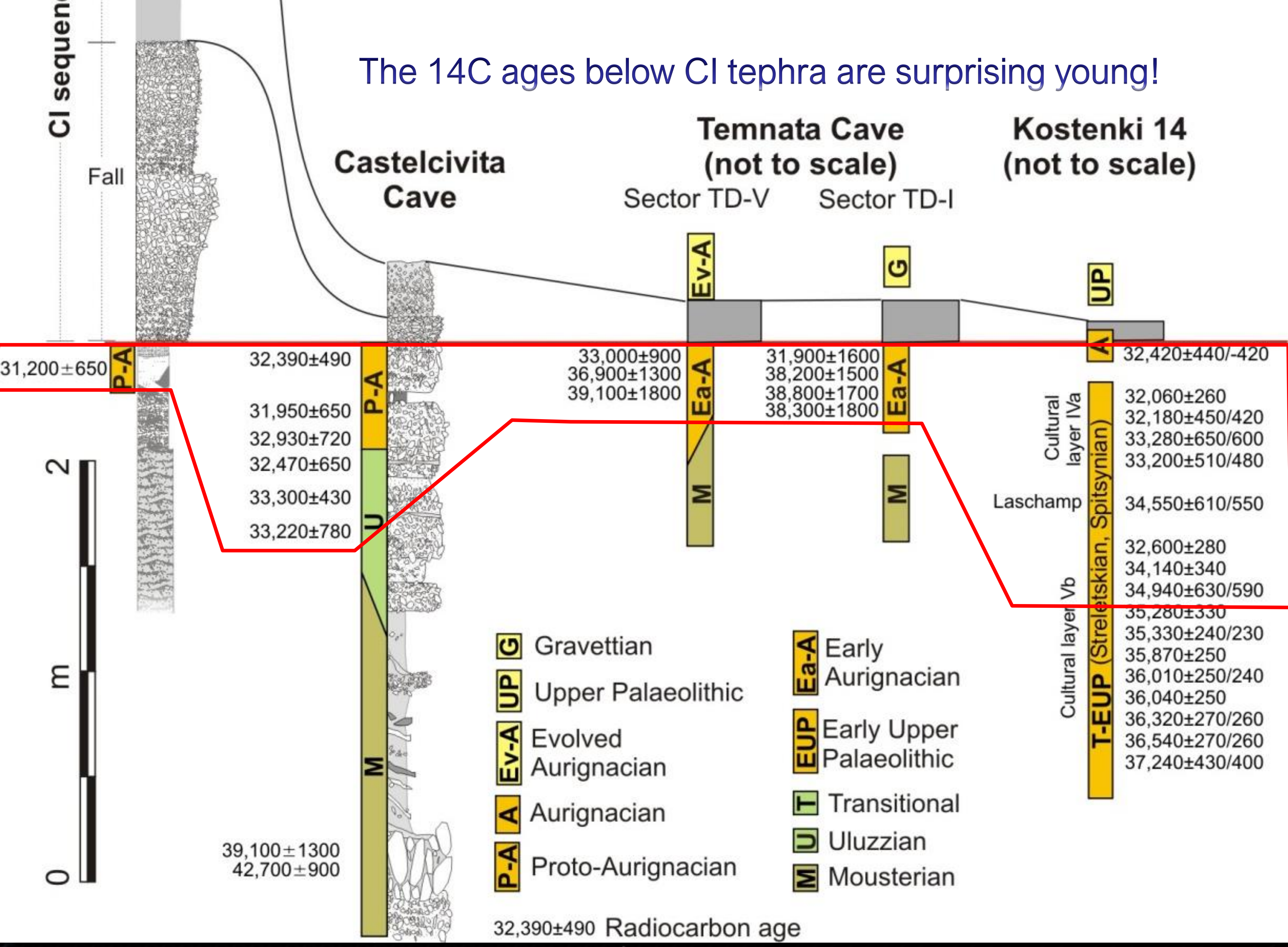

Age ka
Sapropels
Nannof. zones
Tephra
Foram. zones
Isot. zones
S1
S2
S3
S4
S5
S6
S7
S8
S9
50
100
150
200
MNN 21b E. huxleyi Acme
MNN 21a E. huxleyi
MNN 20 G. oceanica
Kolcm.
Z1
Z2
Z3
Z4
Z5
Y1
Y2
Nisyros
Y3
Sant. ?
Yali-C
Y4
Y5
Y6
Y7
Y8
X1
X2
X3
X4
X5
X6
W1
W2
W3
V1
V2
V3
V-zone Rh.
Z
Y
X
W
V
1
2
3
4
5
6
7
Hol.
Upper Pleistocene
Middle Pleistocene


0
0.5
1
2
3
10



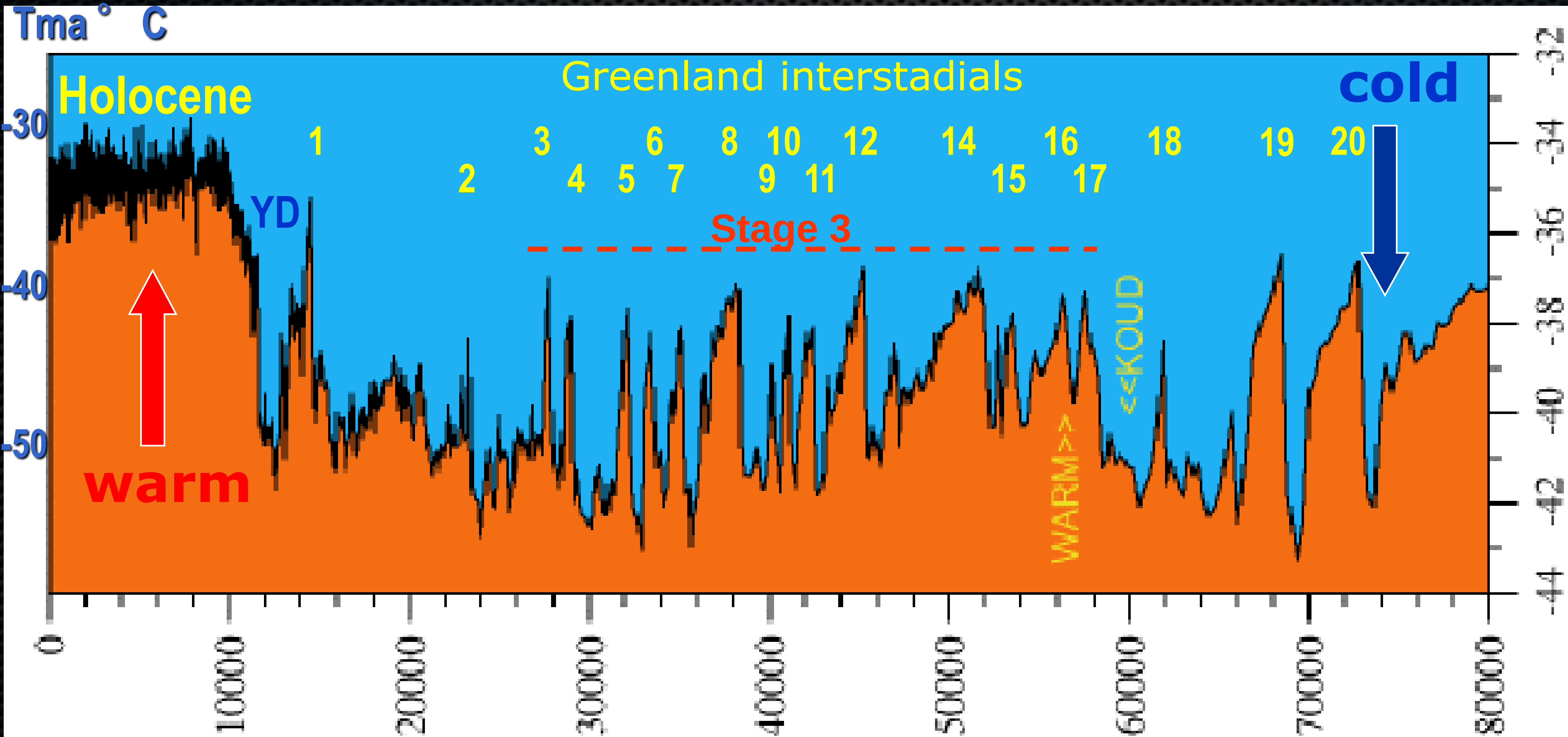
Archaeological sites with tephra layers investigated in this study
Other archaeological sites
Campanian Ignimbrite Y5 occurrence
1-8 Thickness in cm (in italics if reworked)
30°
40°
50°N
40°
Kostenki
Don
Dnjeper
Geißenklösterle
Bohunice
Szeleta
Fumane
Danube
14-20
Bacho Kiro
Temnata
Phlegrean Fields
Paglicci
LGM
Murgia
Castelcivita
25-180
KET 8003
0
Km
600

The 14C ages below CI tephra are surprising young!

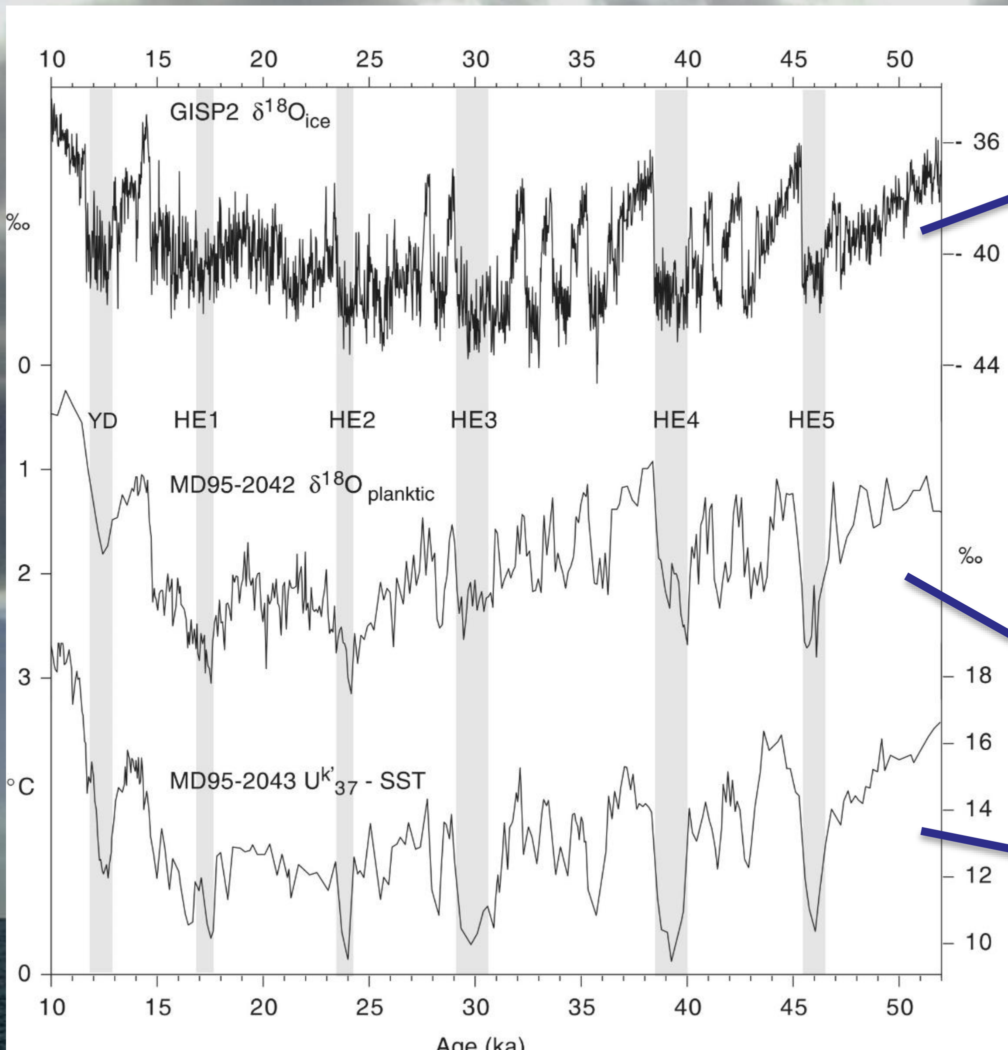


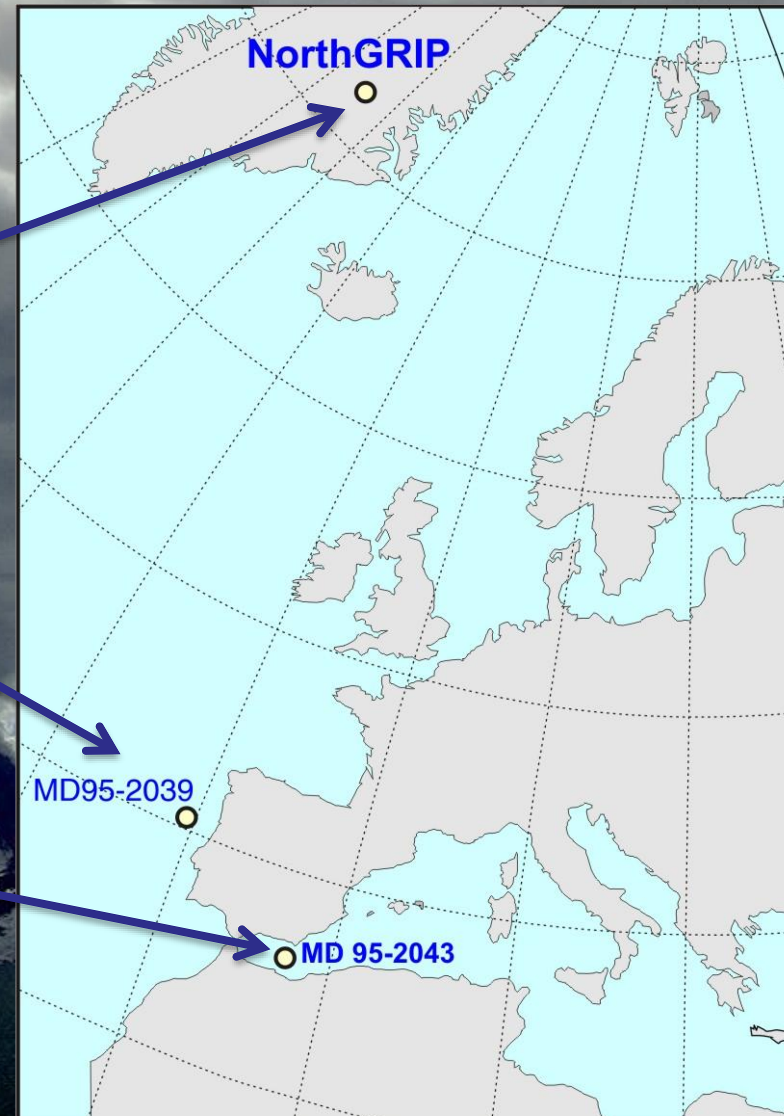
GRIP ice core: $\delta^{18}O$

Climate instability at the millennium scale during the Last Glaciation: frequent, large, short climate variations from 80 to 10 ka over Greenland (ΔTma 8-16 ° C). Abrupt climatic warming, transitions lasting few decades.
15 D-O events (Greenland Interstadials) during Stage 3

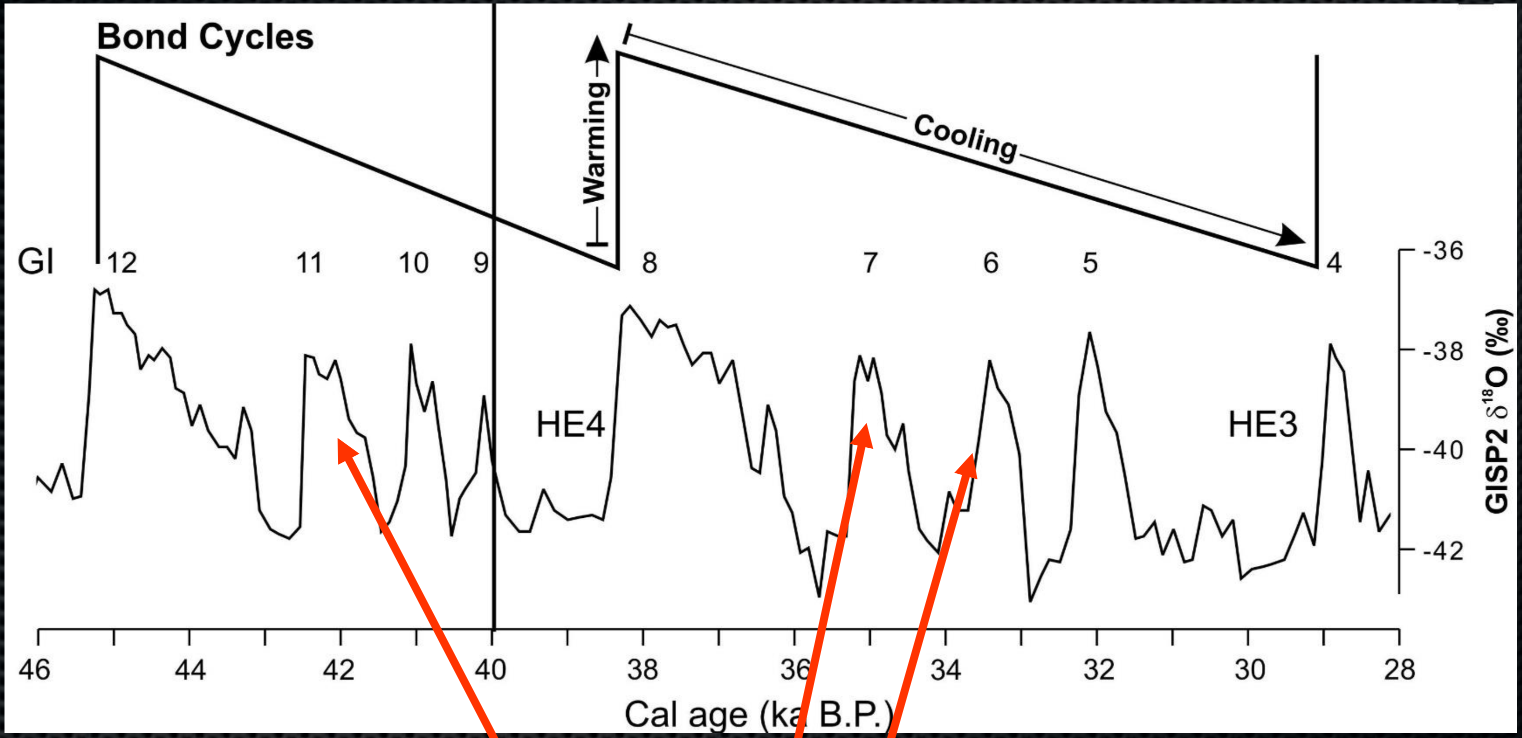


NorthGRIP – MD95-2043/39 correlation





Bond cycles



Dansgaard-Oescher events

D-O events attributed to melt water discharge into the North Atlantic, leading to partial or complete shutdown of deep water formation: "thermal-freshwater seesaw"

(Knutti et al. 2004)

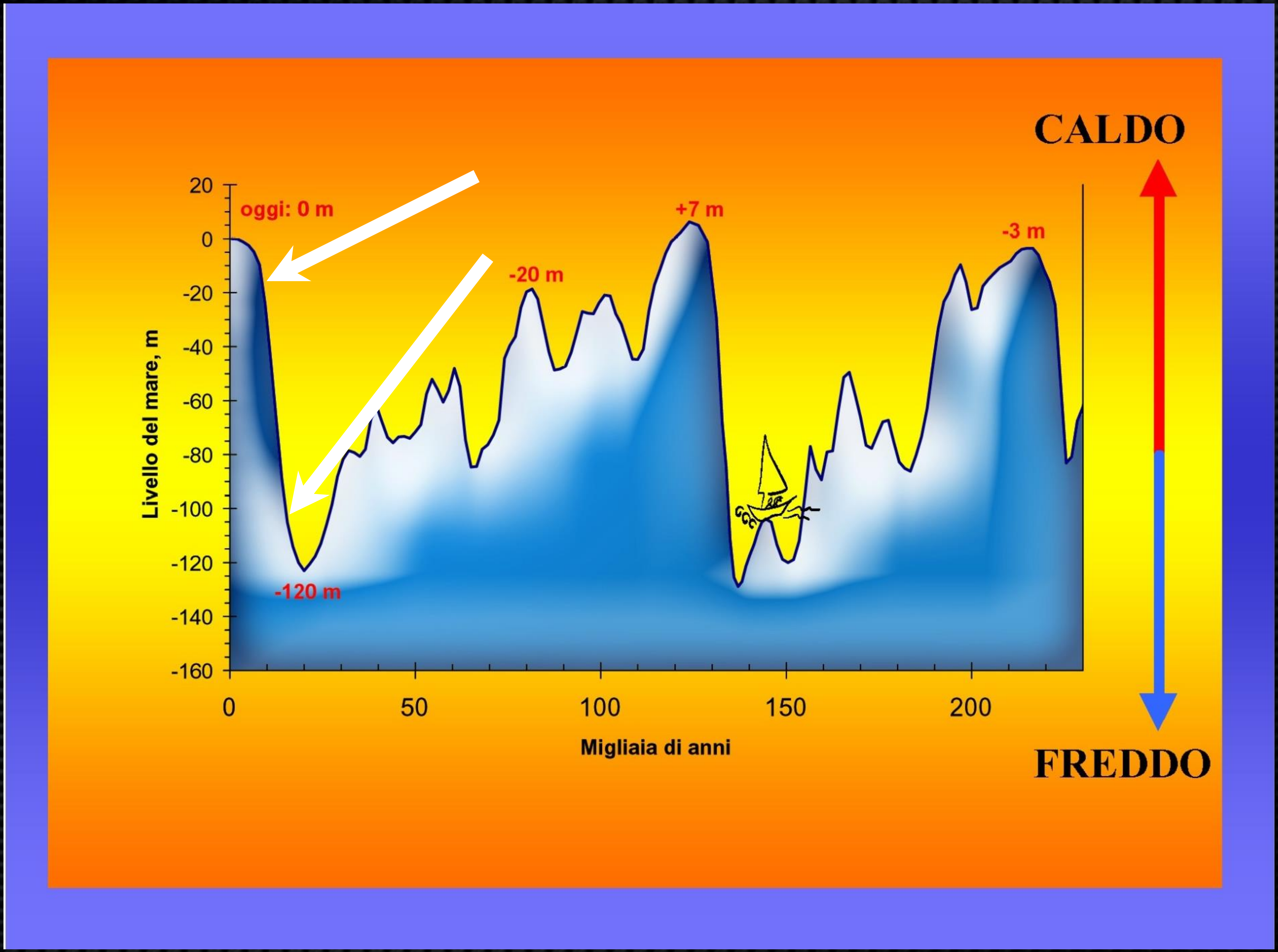
Heinrich events precede major, long-lasting D-O events. They coincide with cold conditions in the North Atlantic, with warm episodes in Antarctica (AIM) and with substantial increases in sea level.

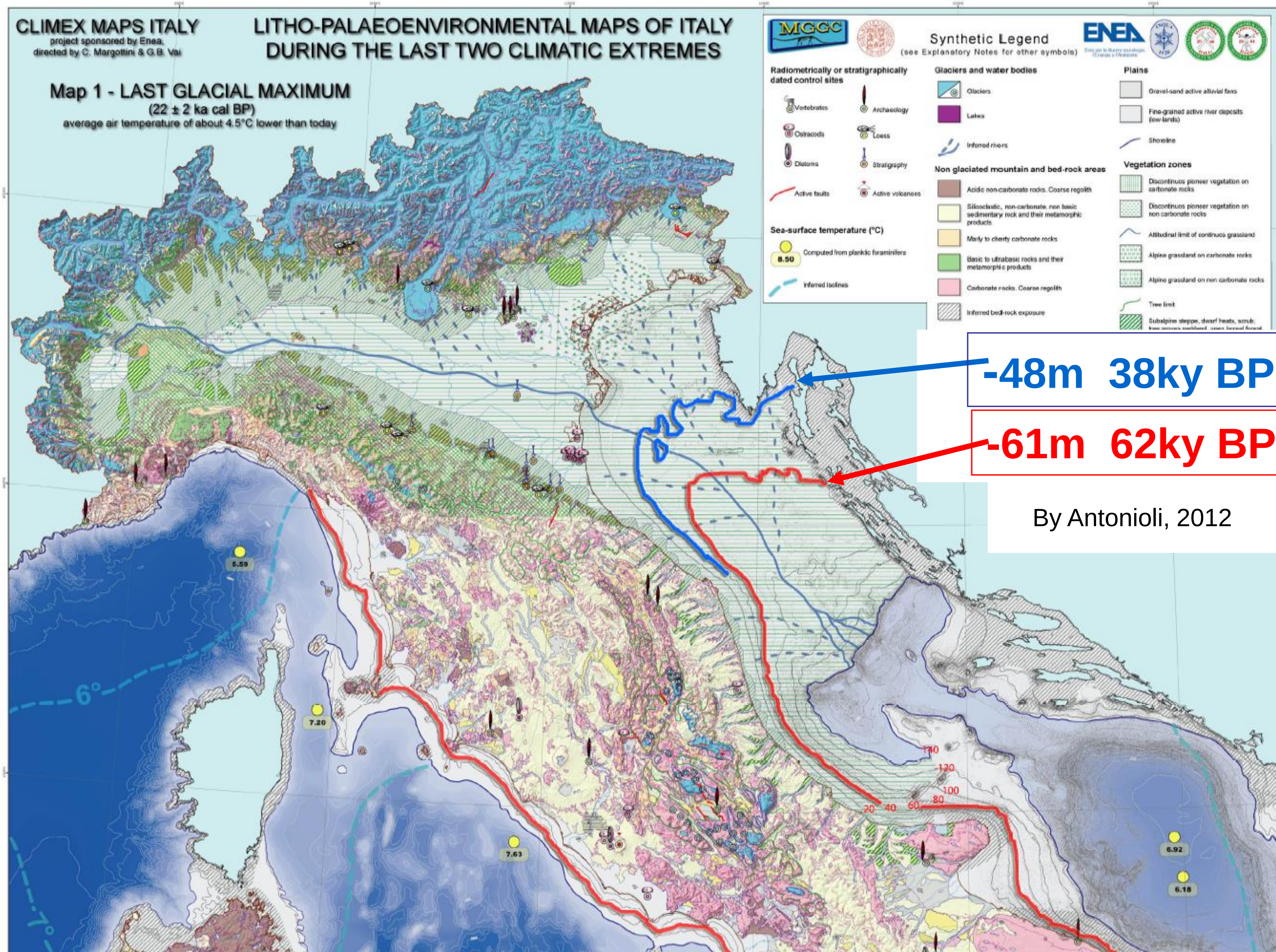
Mechanisms proposed for the origin of Heinrich layers:

- **binge-purge cycle of the Laurentide ice sheet (surge)**
- **jökulhlaup (giant outburst) from a Hudson Bay lake (subglacial?)**
- **ice shelf buildup/collapse**

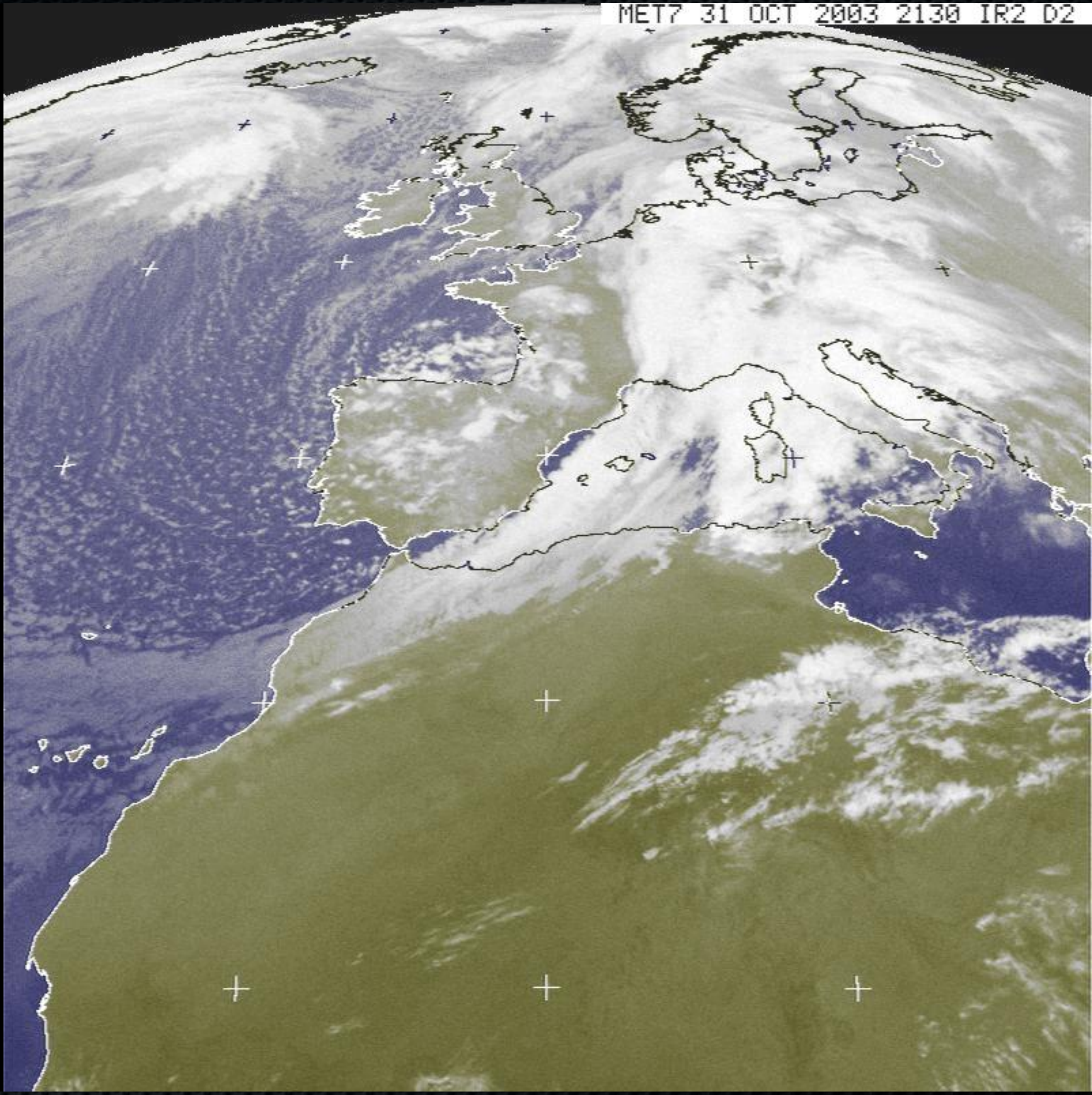
(Hemming, 2004)

Eustatic sea-level oscillation during the middle-Upper Pleistocene




CLIMEX MAPS ITALY
project sponsored by Enea,
directed by C. Margottini & G.B. Vai
LITHO-PALAEOENVIRONMENTAL MAPS OF ITALY
DURING THE LAST TWO CLIMATIC EXTREMES
Map 1 - LAST GLACIAL MAXIMUM
(22 ± 2 ka cal BP)
average air temperature of about 4.5°C lower than today
MGGC
Synthetic Legend
(see Explanatory Notes for other symbols)
ENEA
Radiometrically or stratigraphically dated control sites
Vertebrates
Archaeology
Ostracods
Loess
Diatoms
Stratigraphy
Active faults
Active volcanoes
Sea-surface temperature (°C)
Computed from planktic foraminifera
Inferred isolines
Glaciers and water bodies
Glaciers
Lakes
Inferred rivers
Non glaciated mountain and bed-rock areas
Acidic non-carbonate rocks. Coarse regolith
Marly to cherty carbonate rocks
Basic to ultrabasic rocks and their metamorphic products
Carbonate rocks. Coarse regolith
Inferred bed-rock exposure
Plains
Gravel-sand active alluvial fans
Fine-grained active river deposits (low-lands)
Shoreline
Vegetation zones
Altitudinal limit of continuous grassland
Alpine grassland on carbonate rocks
Alpine grassland on non carbonate rocks
Tree limit
6°
7°
5.59
7.20
7.63
6.92
6.18
8.50
20
40
60
80
100
120
140
-48m 38ky BP
-61m 62ky BP
By Antonioli, 2012

Regional climate features of Western Europe are influenced by atlantic air masses



Meteosat image 31.10.2003


icecap
shrub tundra
coniferous parkland
open
deciduous
woodland
semi-desert
desert

General traits of forest cover in Southern Europe during the middle part of the last glaciation

- thermophilous broad-leaved absent from the northern side of the Alps, scattered populations in the middle latitude Europe and the Mediterranean, mostly mixed to conifers

- the "pleniglacial interstadials" did not support warm and wet temperate forest in most of Europe, instead mixed forest are documented in moist regions of Iberia, N-Italy, Slovenia, mountains in the Balkanic peninsula, etc.

- forest cover never dense and pluristratified (corridors for large mammals from boreal regions, like moose in Italy)

- evidence of millennial scale forest dynamics related to fire frequency. In Iberia: low fire activity, low biomass during Heinrich events, and no apparent relationship between the arrival of the Anatomical Modern Humans.