

A long continuous palaeoclimate-palaeoenvironmental record of the last glacial period from southern Italy and implications for the coexistence of Anatomically Modern Humans and Neanderthals

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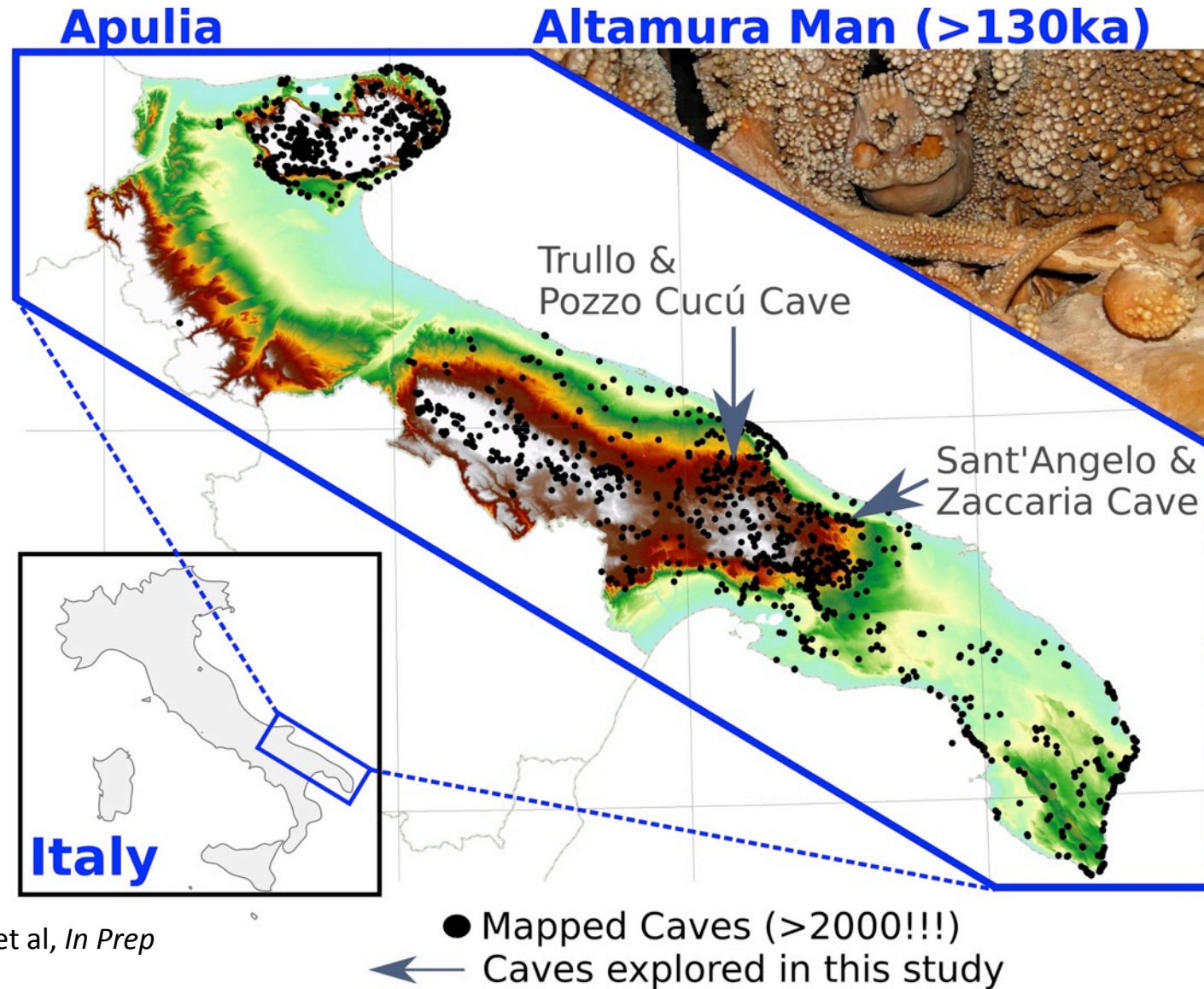
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Apulia: a land of caves and ancient humans



Columbu et al, *In Prep*

Early dispersal of modern humans in Europe and implications for Neanderthal behaviour

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The appearance of anatomically modern humans in Europe and the nature of the transition from the Middle to Upper Palaeolithic are matters of intense debate. Most researchers accept that before the arrival of anatomically modern humans, Neanderthals had adopted several 'transitional' technocomplexes. Two of these, the Uluzzian of southern Europe and the Châtelperronian of western Europe, are key to current interpretations regarding the timing of arrival of anatomically modern humans in the region and their potential interaction with Neanderthal populations. They are also central to current debates regarding the cognitive abilities of Neanderthals and the reasons behind their extinction¹⁻⁶. However, the actual fossil evidence associated with these assemblages is scant and fragmentary⁷⁻¹⁰, and recent work has questioned the attribution of the Châtelperronian to Neanderthals on the basis of taphonomic mixing and lithic analysis^{11,12}. Here we reanalyse the deciduous molars from the Grotta del Cavallo (southern Italy), associated with the Uluzzian and originally classified as Neanderthal^{13,14}. Using two independent morphometric methods based on micromorphographic data, we show that the Cavallo specimens can be attributed to anatomically modern humans. The secure context of the teeth provides crucial evidence that the makers of the Uluzzian technocomplex

were therefore not Neanderthals. In addition, new chronometric data for the Uluzzian layers of Grotta del Cavallo obtained from associated shell beads and included within a Bayesian age model show that the teeth must date to ~45,000–43,000 calendar years before present. The Cavallo human remains are therefore the oldest known European anatomically modern humans, confirming a rapid dispersal of modern humans across the continent before the Aurignacian and the disappearance of Neanderthals.

Two deciduous molars (Cavallo-B and Cavallo-C) were excavated in 1964 from the site of Grotta del Cavallo (Apulia, southern Italy; Supplementary Information). Cavallo is important as the type site of the Uluzzian technocomplex¹⁵, one of the three main transitional industries alongside the Châtelperronian and Szeletian, in Franco-Cantabria and Central Europe, respectively. These are strongly suspected of being produced by Neanderthals, although the actual fossil evidence in association is scant¹⁶.

Cavallo-B is a deciduous left upper first molar (dM¹), found in layer EIII (archaic Uluzzian). Cavallo-C is a deciduous left upper second molar (dM²) found 15–20 cm above Cavallo-B, in layer EII-I (evolved Uluzzian)¹³ (Supplementary Fig. 1 and Supplementary Table 1). The specimens (Fig. 1) were described in 1967 by Palma di Cesnola and

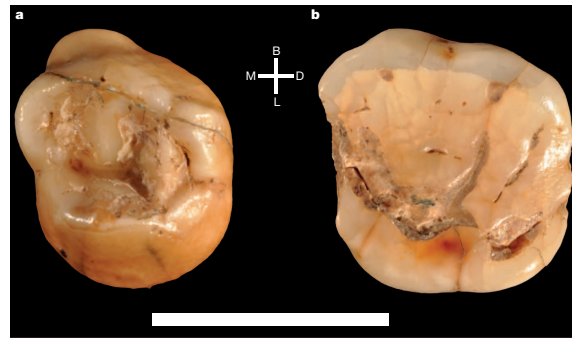


Figure 1 | Occlusal view of the deciduous molars from the Uluzzian layers of Grotta del Cavallo (Apulia, southern Italy). **a**, Cavallo-B (deciduous left upper first molar; dM¹). **b**, Cavallo-C (deciduous left upper second molar; dM²). B, buccal; D, distal; L, lingual; M, mesial. Scale bar, 1 cm.

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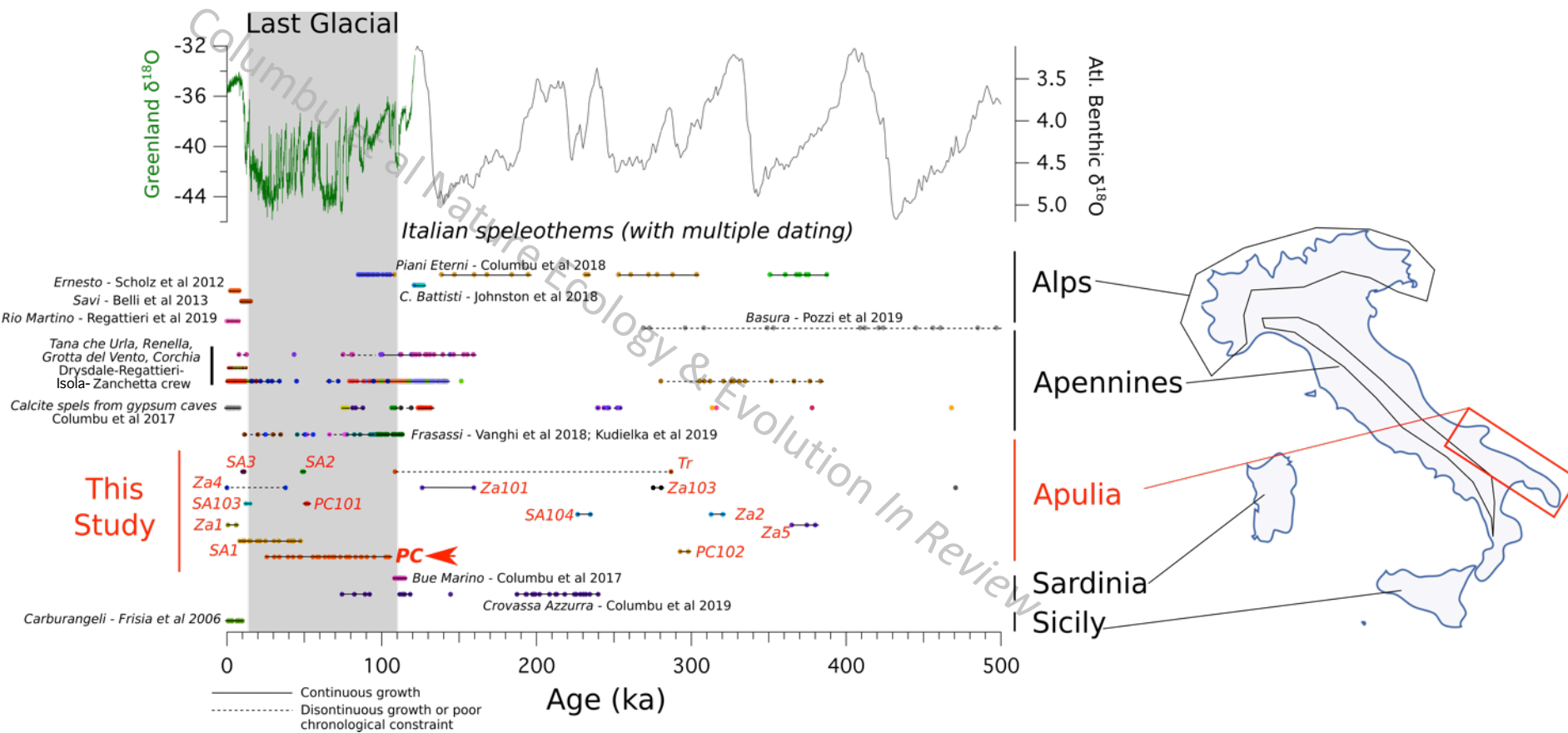
The oldest remain in Europe of Modern Human (MH), dated at ~45 ka, were found in Apulia.

Neanderthals inhabited this land since at least 130 ka, and disappeared around 42 ka.

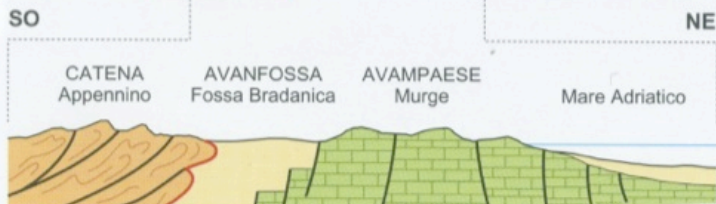
The two species cohabited for at least ~3000 years in the same territory

Continuous growth of last glacial speleothems in Italy, and all Europe, is scarce. But last glacial climate in Apulia was possibly milder than other areas, allowing speleothems deposition during the last glacial as well as older glacials.

PC + SA1 cover the whole last glacial period. This presentation focuses on PC from Pozzo Cucù Cave (red arrow)



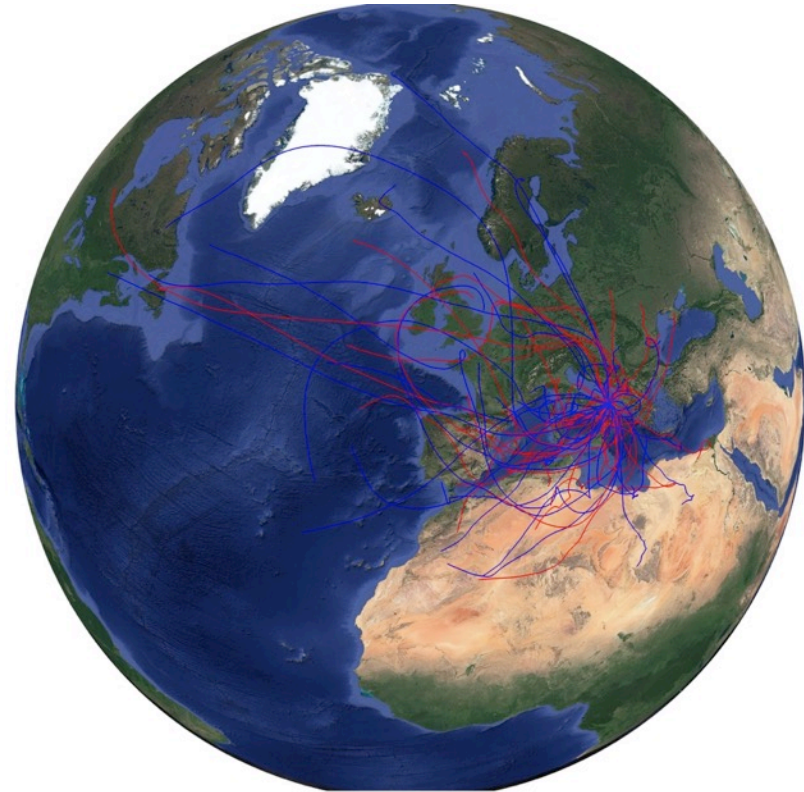
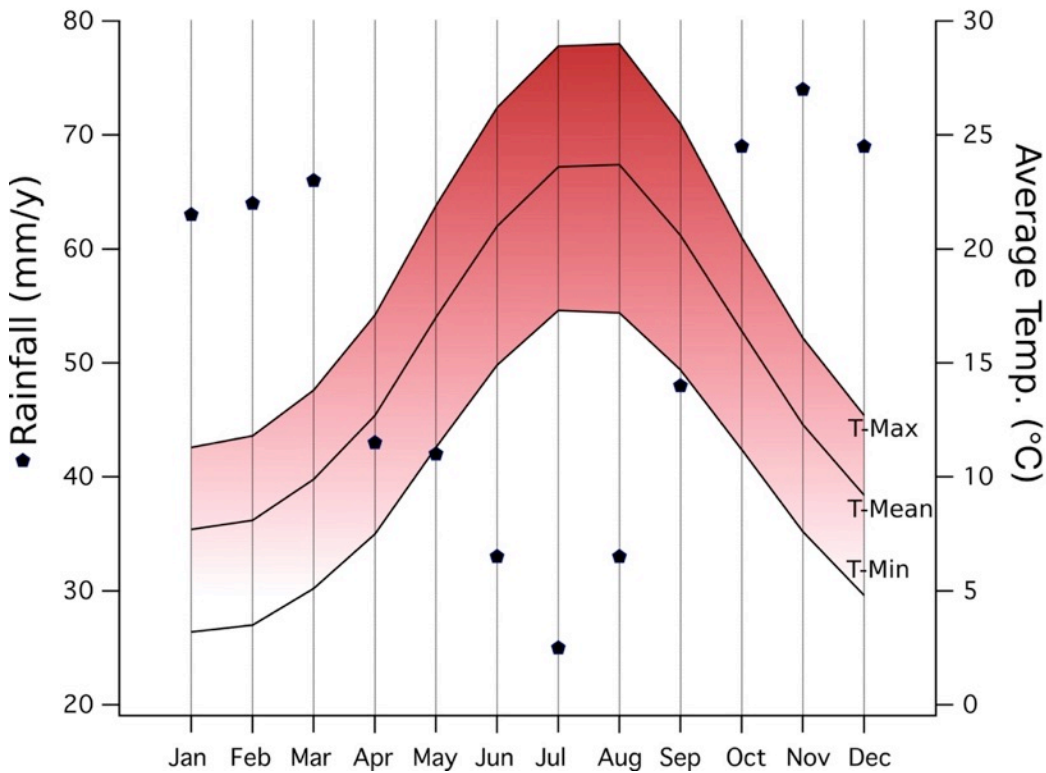
Pozzo Cucù Cave (PC sample)



The area of study denotes typical Mediterranean climate.

Airmasses, procuring rainfall precipitation, mostly transported by westerlies.

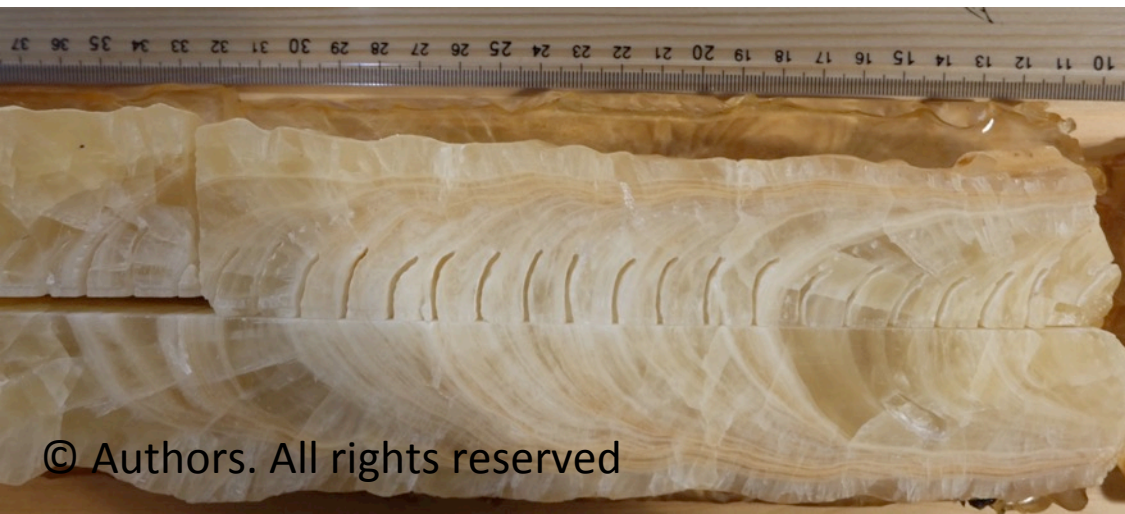
Main moisture source is the Atlantic.



PC stalagmite

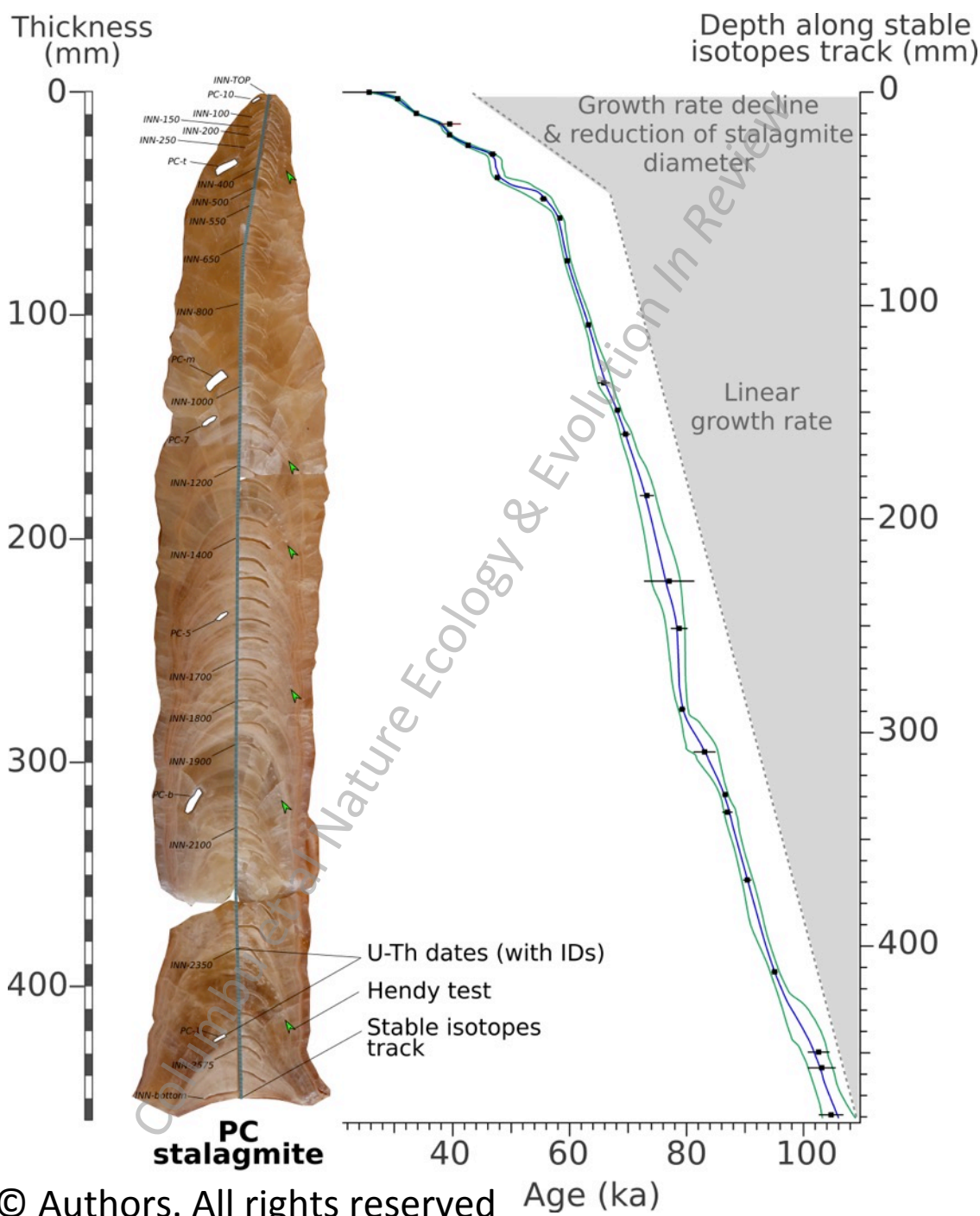
Stable isotope
(Innsbruck Uni)

0.1-0.2 mm spacing

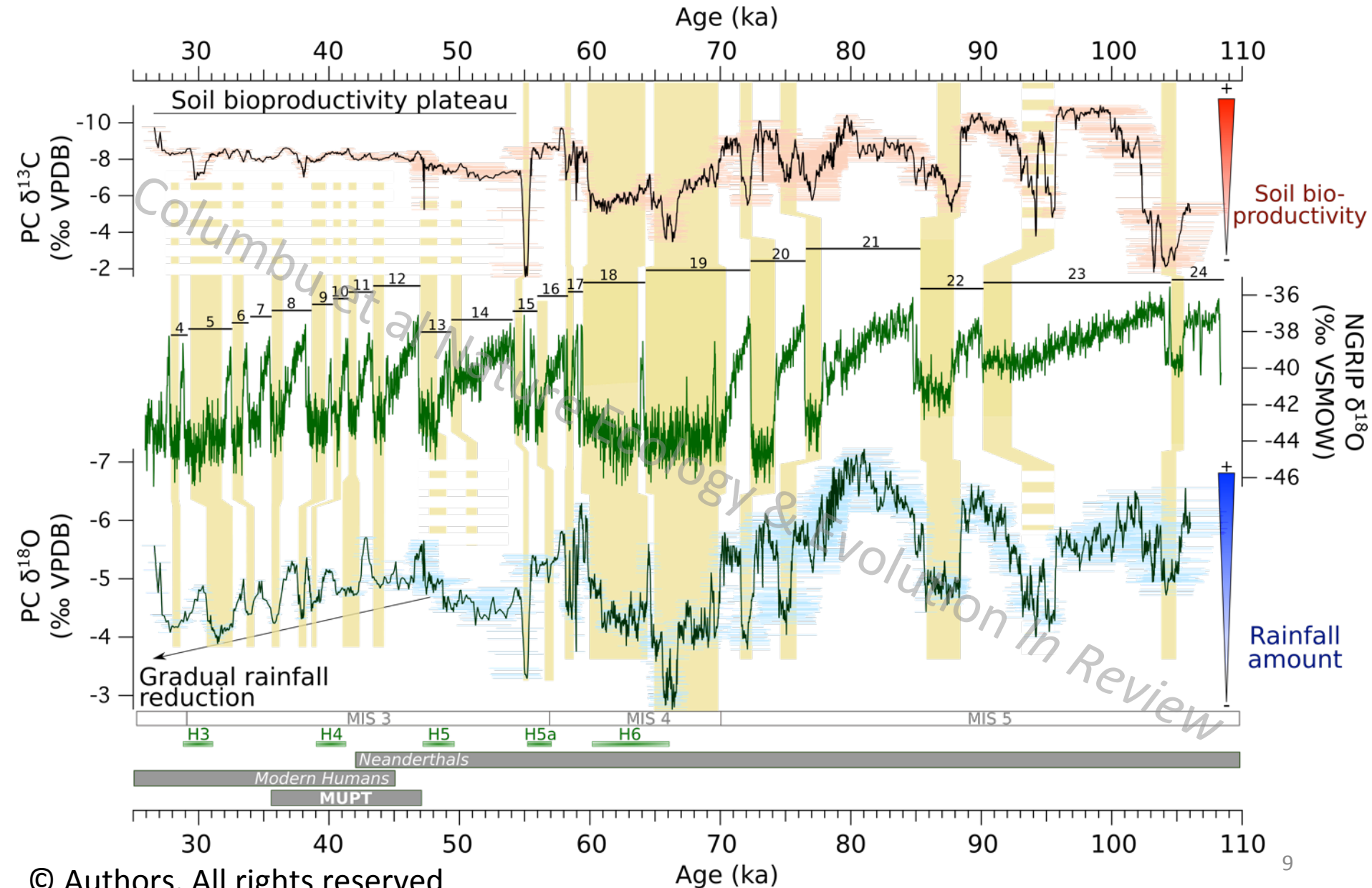


Dating
(Melbourne & Xi'an Uni)

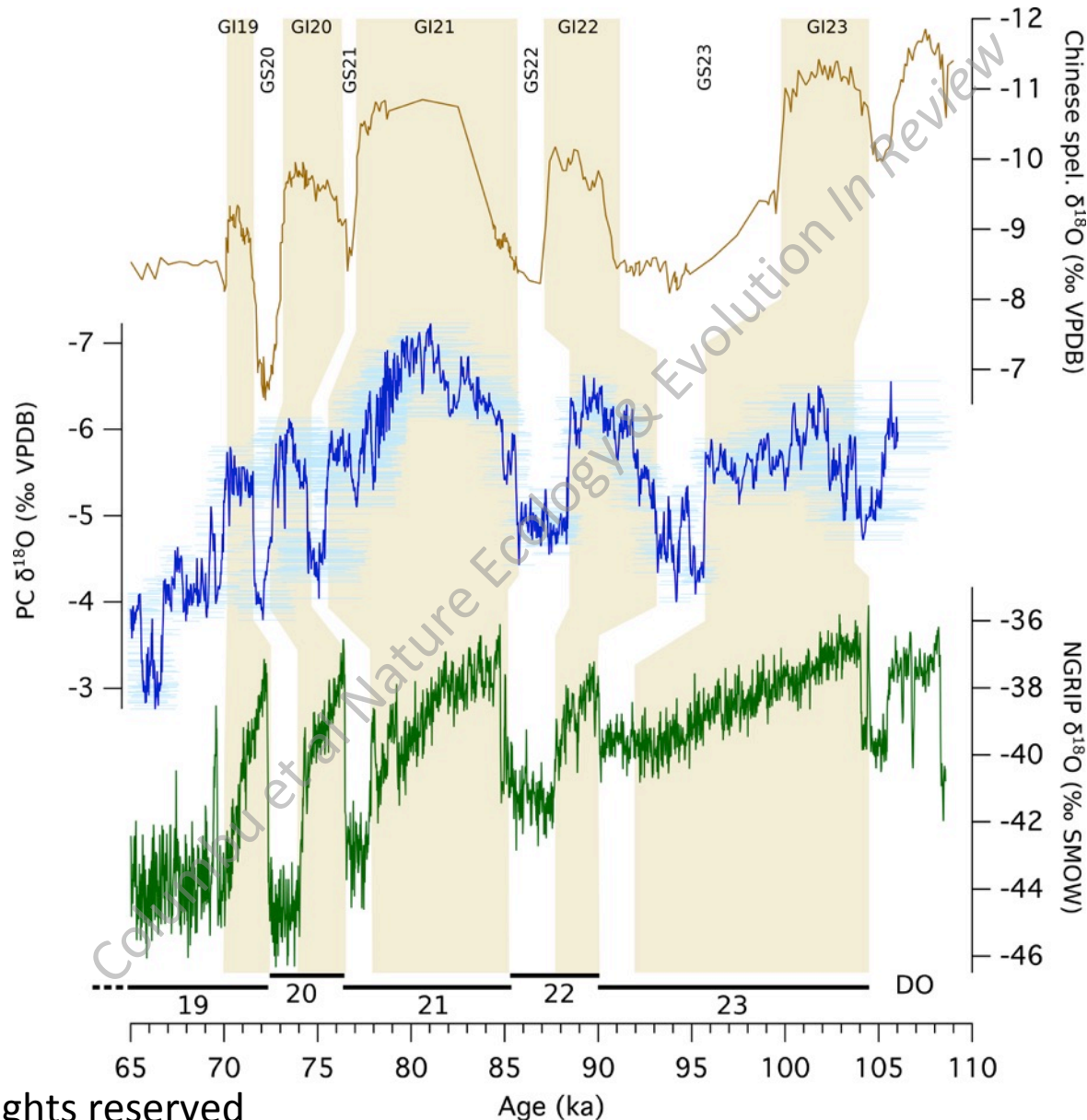
27 U-Th ages produced

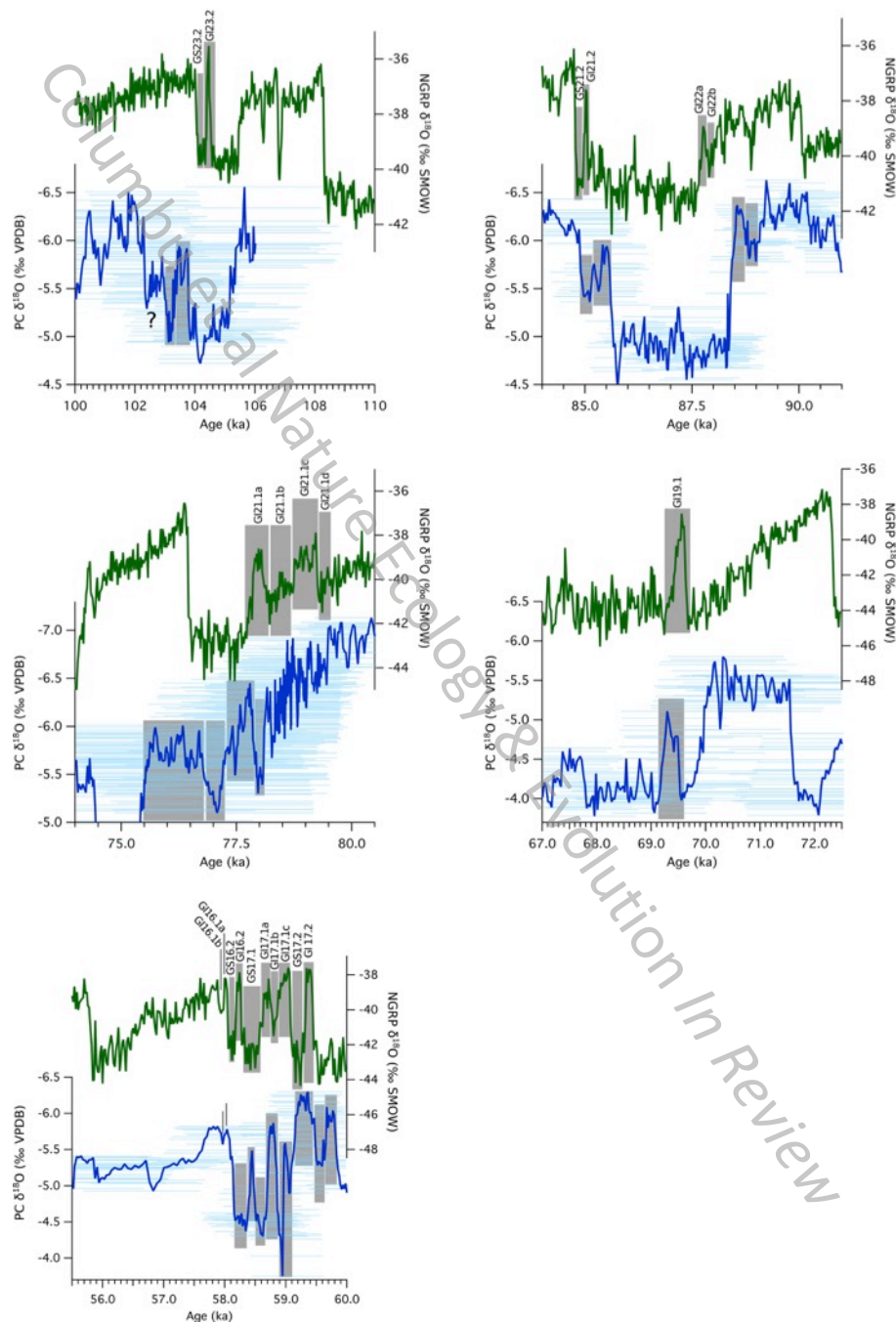


$\delta^{18}\text{O}$ reproduces almost all DO cycles, at times with interesting features

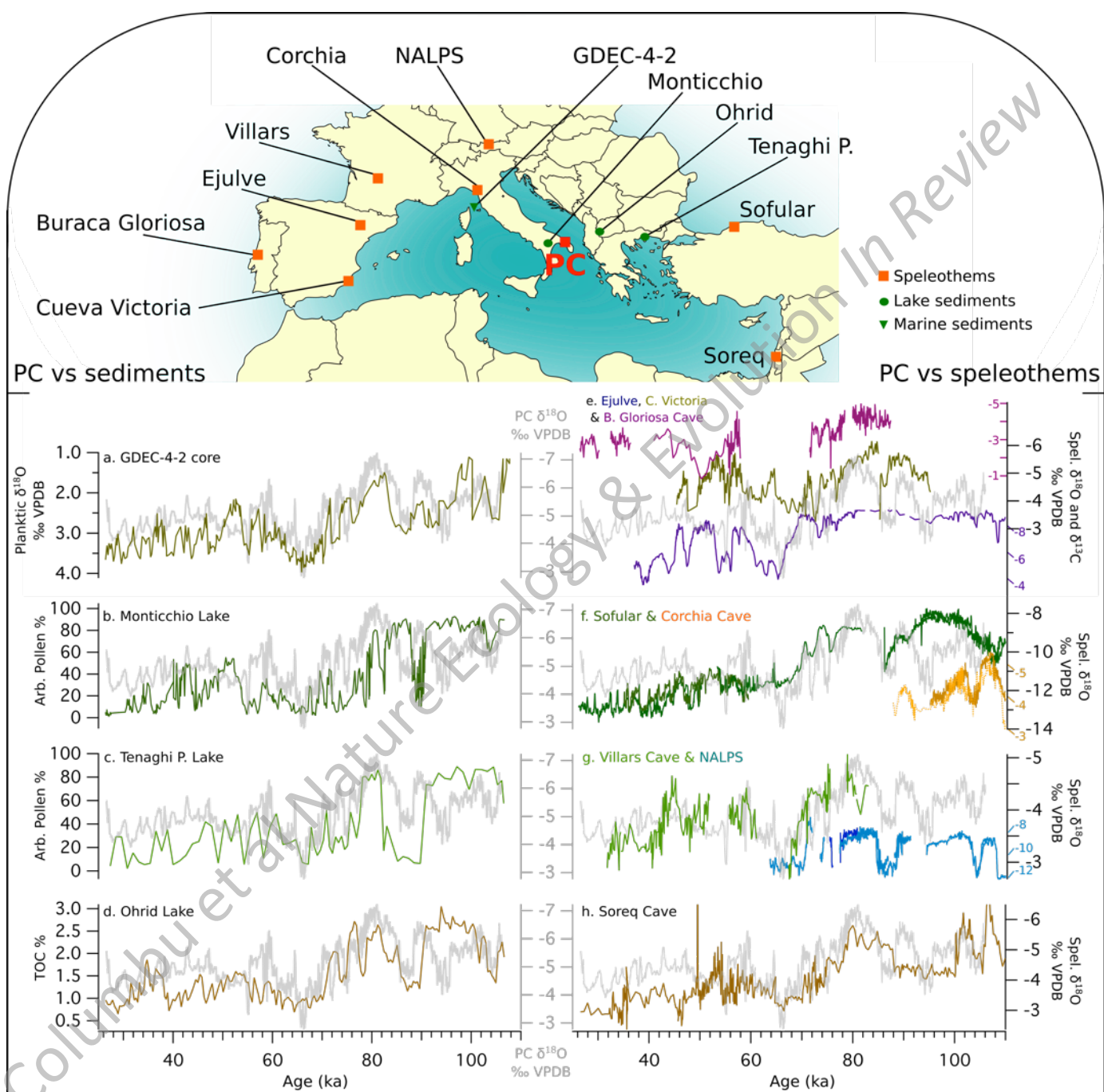


During DO 23-19, stadials/interstadials in PC resembles Asian stadials/interstadials too



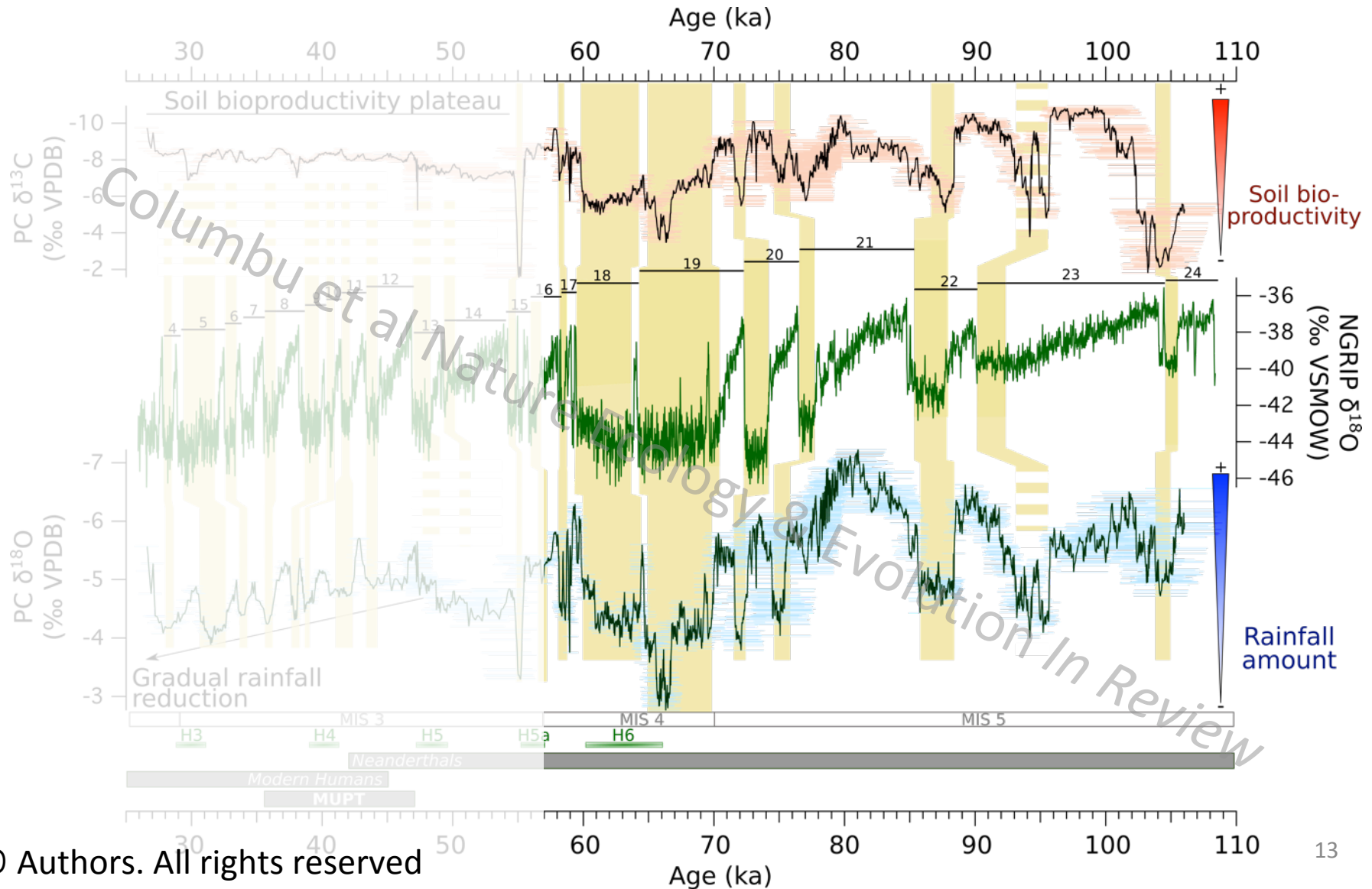


Sub-Duval cycles also detected

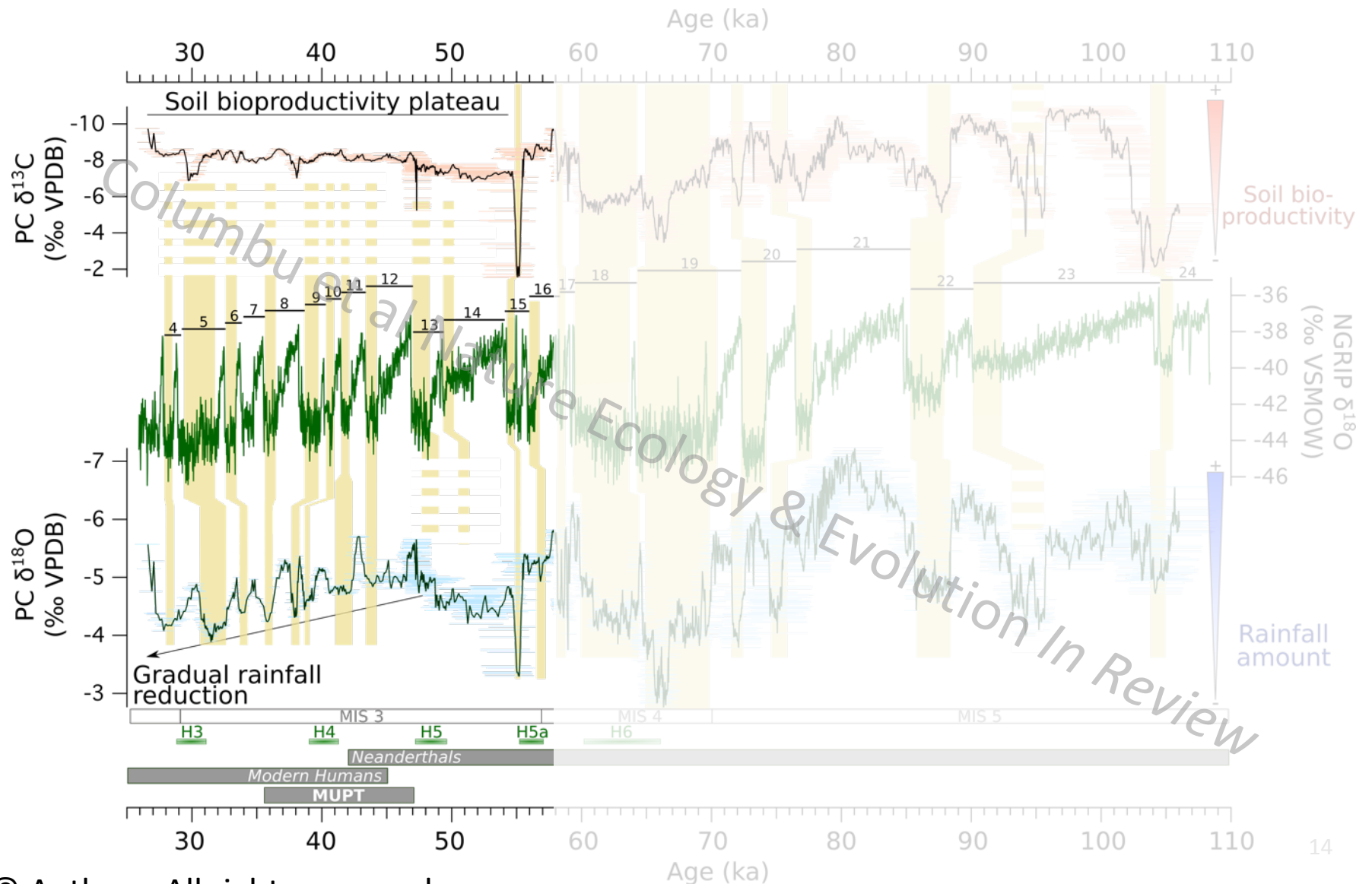


PC $\delta^{18}\text{O}$ (gray in the background)
 vs
 Mediterranean
 archives

PC $\delta^{18}\text{O}$ is reflecting hemispheric climate changes. From MIS 5 to MIS 4, it is interpreted as rainfall amount variation.
 Soil bioproductivity, expressed by PC $\delta^{13}\text{C}$, changed accordingly.



During MIS 3 PC $\delta^{18}\text{O}$ shows a gradual rainfall reduction. DO-like variations had not consequences on $\delta^{13}\text{C}$.



Remarks #1

During MIS 3 there is a shift from Atlantic-dominated rainfall to Mediterranean dominated rainfall. Hence, in the area of study, rainfall amount variability at stadial/interstadial scale is less pronounced.

With the exception of a net cold/dry event at ~ 55 ka, coinciding with Heinrich 5a, MIS 3 rainfall variability is not capable in producing important changes in soil bioproductivity.

Events like Heinrich 5 and 4 are not recorded by PC, as other records around the Mediterranean.

Remarks #2

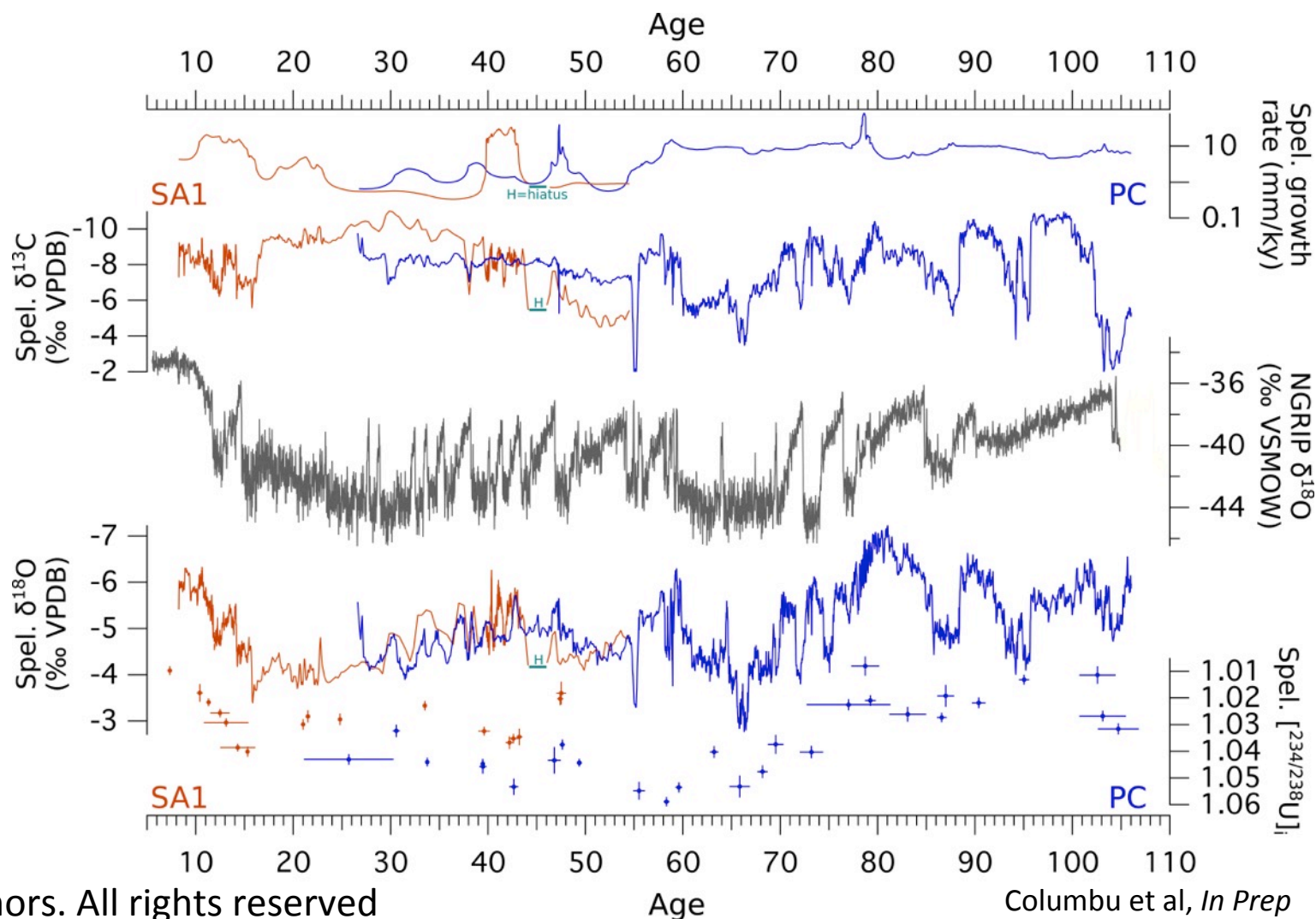
The long-lasting availability of freshwater and the lack of drastic climate shifts suggest that Apulia acted as an environmental niche during MH-Neanderthals turnover (Middle to Upper Paleolithic transition (MUPT)).

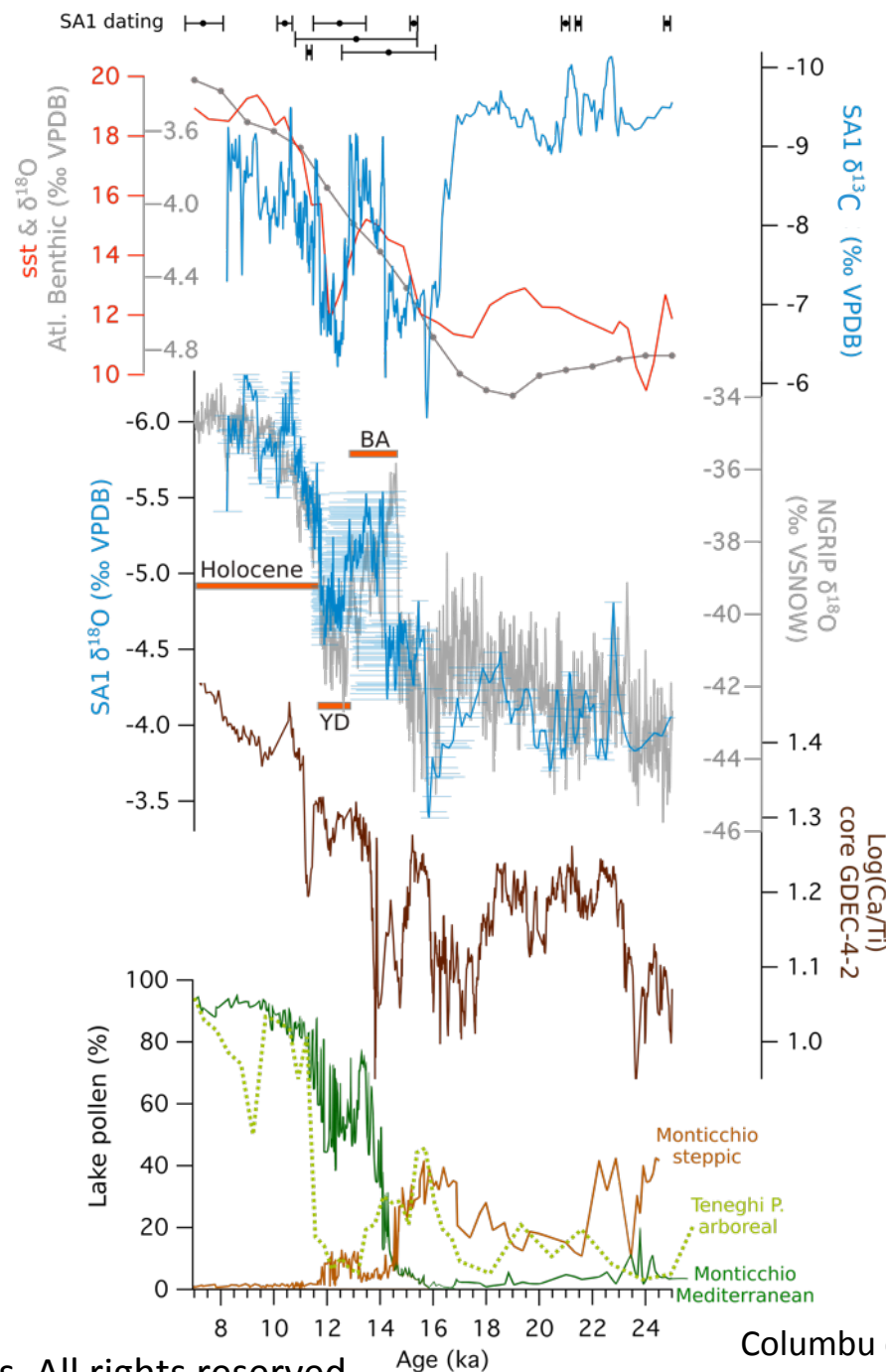
Accordingly, climate did not play a key role in the disappearance of the Neanderthals in this area, thus the Neanderthal-MH turnover must be approached from a perspective that takes into account climate and environmental conditions favorable for both species.

In this view, the advanced hunting technology of MH groups over Neanderthals since their migration to Europe appears now a solid reason to explain the territorial supremacy of the former that induced the extinction of the latter after ~3000 years of coexistence.

A glimpse to future studies: extending PC record with SA1-stalagmite (collected from a cave ~40 km from PC).

PC+SA1 is supposed to be the longest continuous last glacial record in Europe.





SA1 during termination I. Bolling-Allerod and Younger Dryas well recorded by $\delta^{18}\text{O}$.

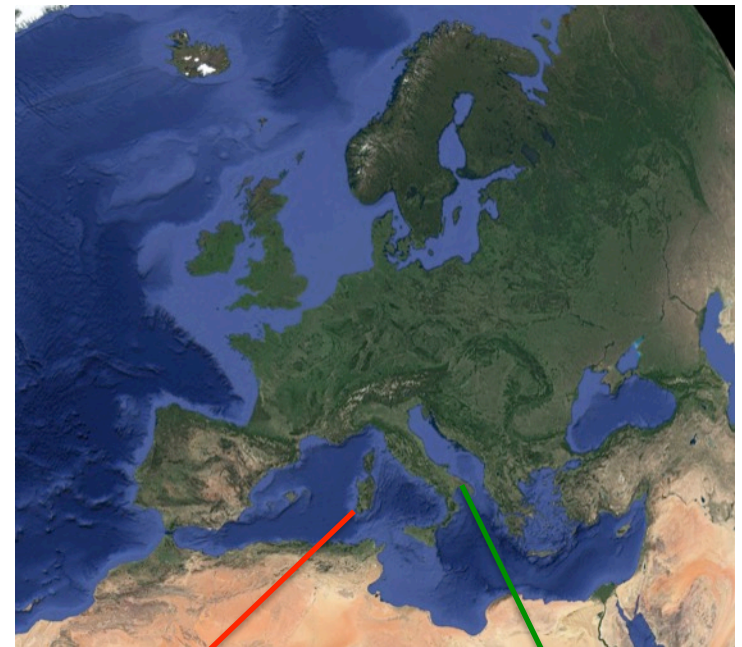
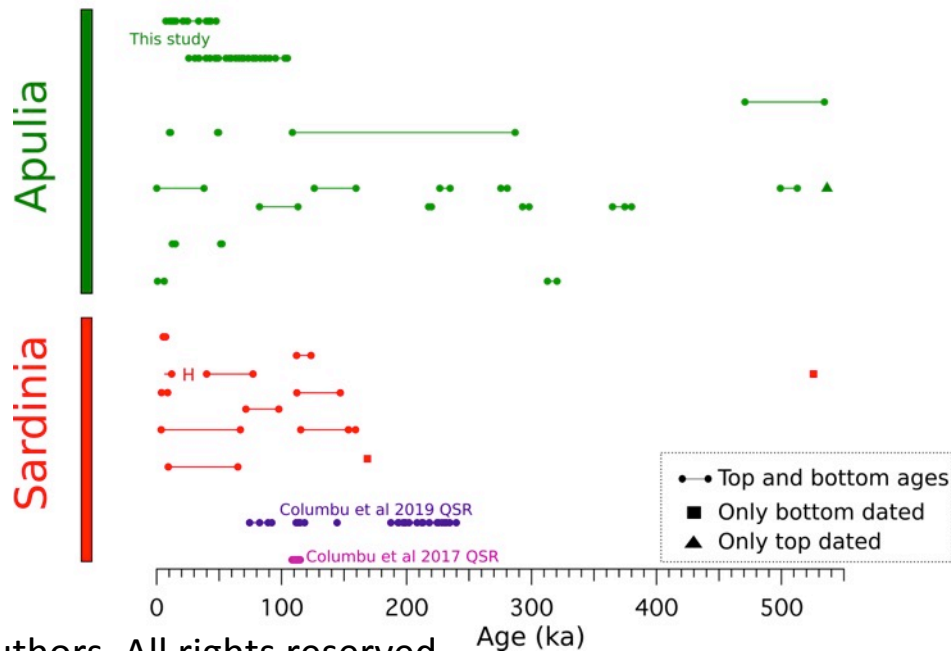
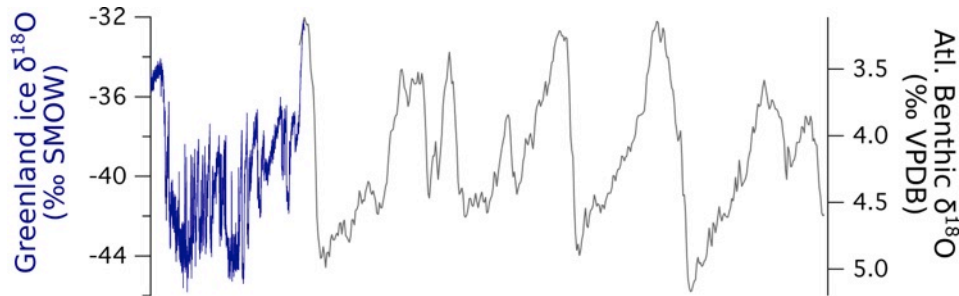
Soils report an abrupt decrease in bioproductivity only at ~17 ka (top curve).

Interesting step-like shape of SA1 $\delta^{18}\text{O}$ progressing toward BA (middle curve). NGRIP in the background (gray)

Communication:

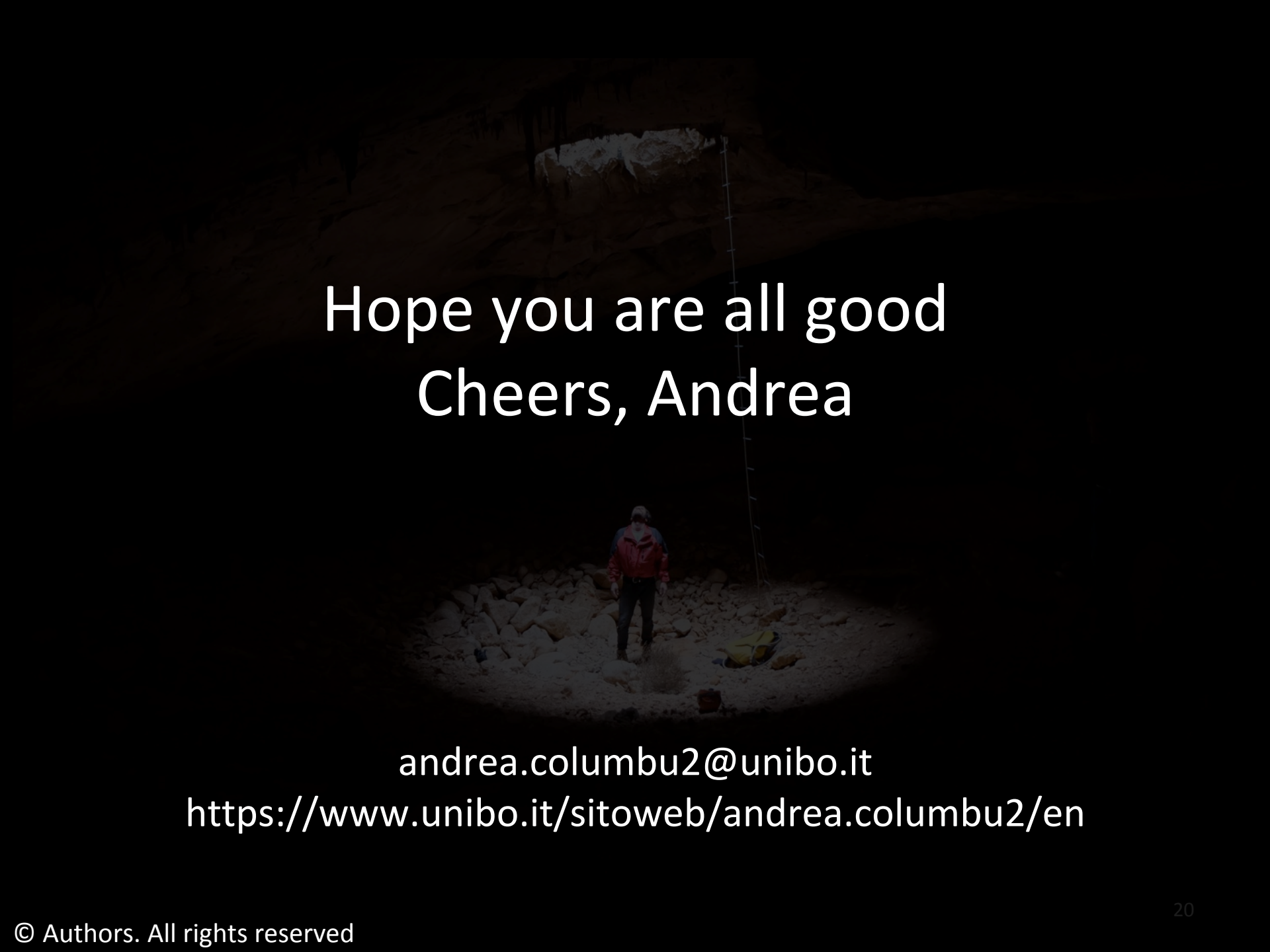
During the last years I have collected several samples from Apulia and Sardinia, most of them preliminarily dated (image below). This dataset allows to explore the Mediterranean climate from different interesting perspectives.

I have good ideas in mind, but scarce resources and no stable position. I am looking for new collaborations and a possible new position for continuing this research. If you are interested in collaborating with me, please drop me an email!



Sardinia

Apulia

A person wearing a red jacket and dark pants stands in the center of a dark cave. A long, thin ladder is leaning against the cave wall to the right of the person. The cave floor is covered in rocks and debris. The background is dark and textured, suggesting a rocky cave interior.

Hope you are all good
Cheers, Andrea

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