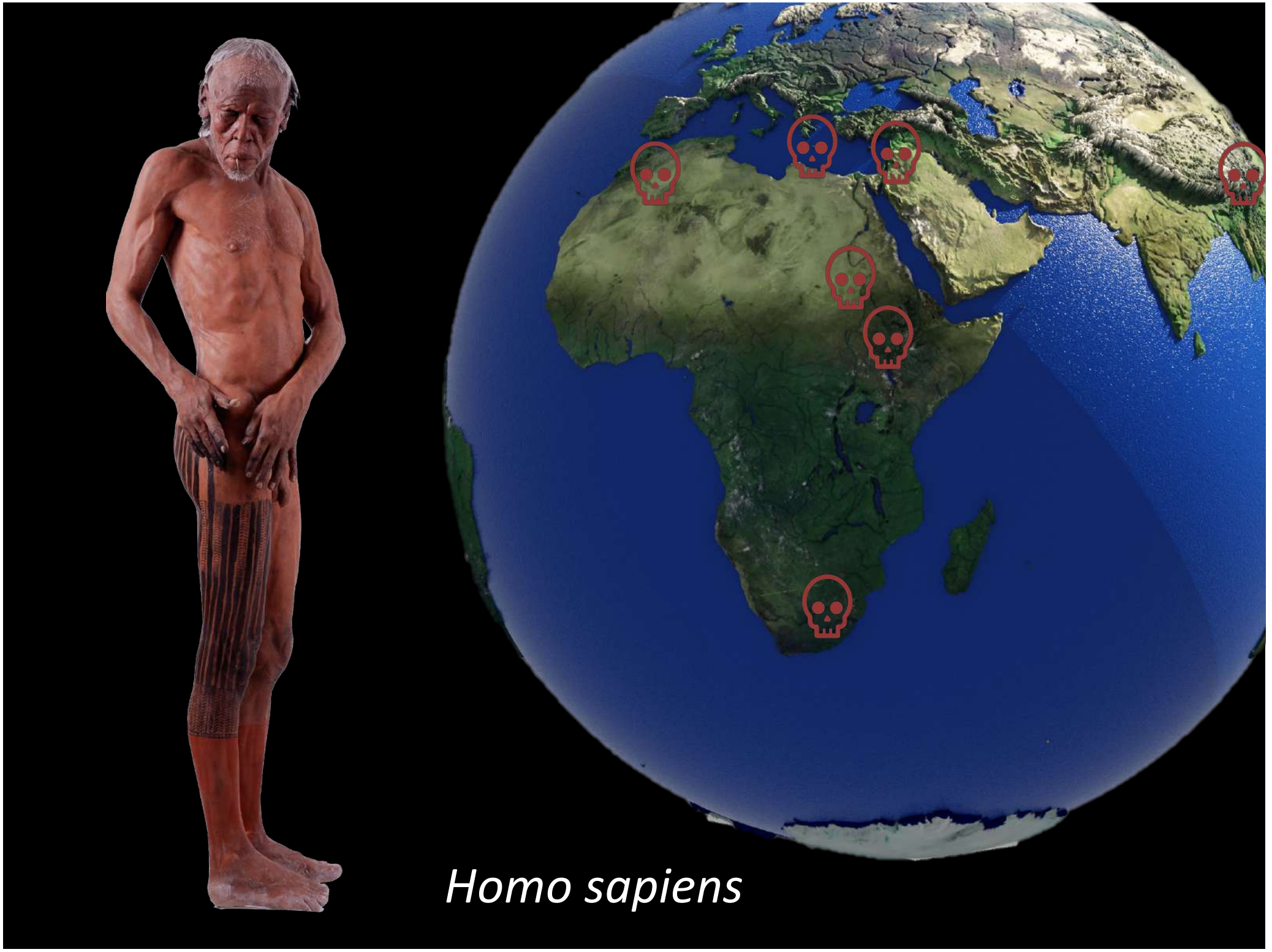
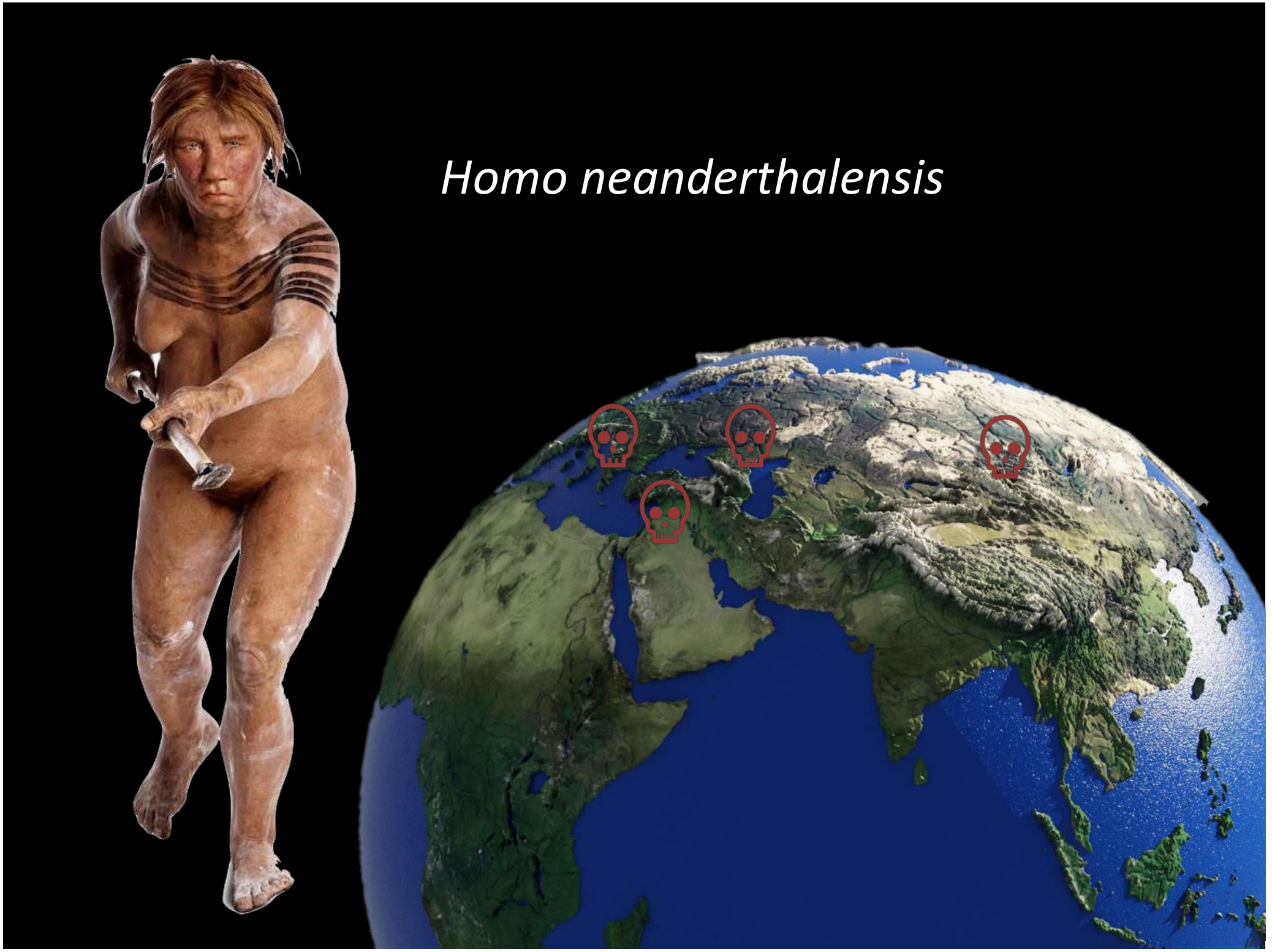
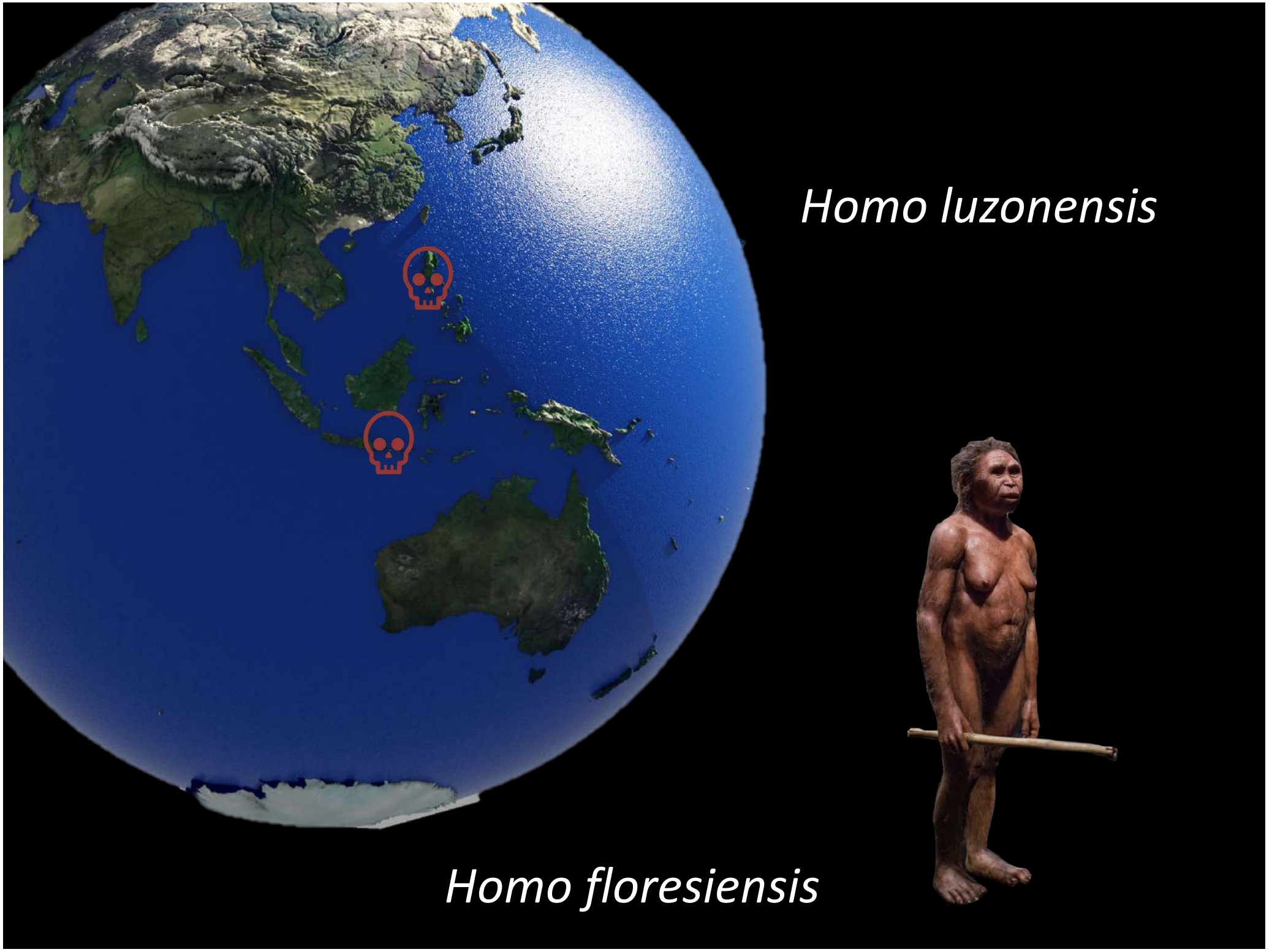
Who were the Denisovans?

Tom Higham
(University of Oxford)

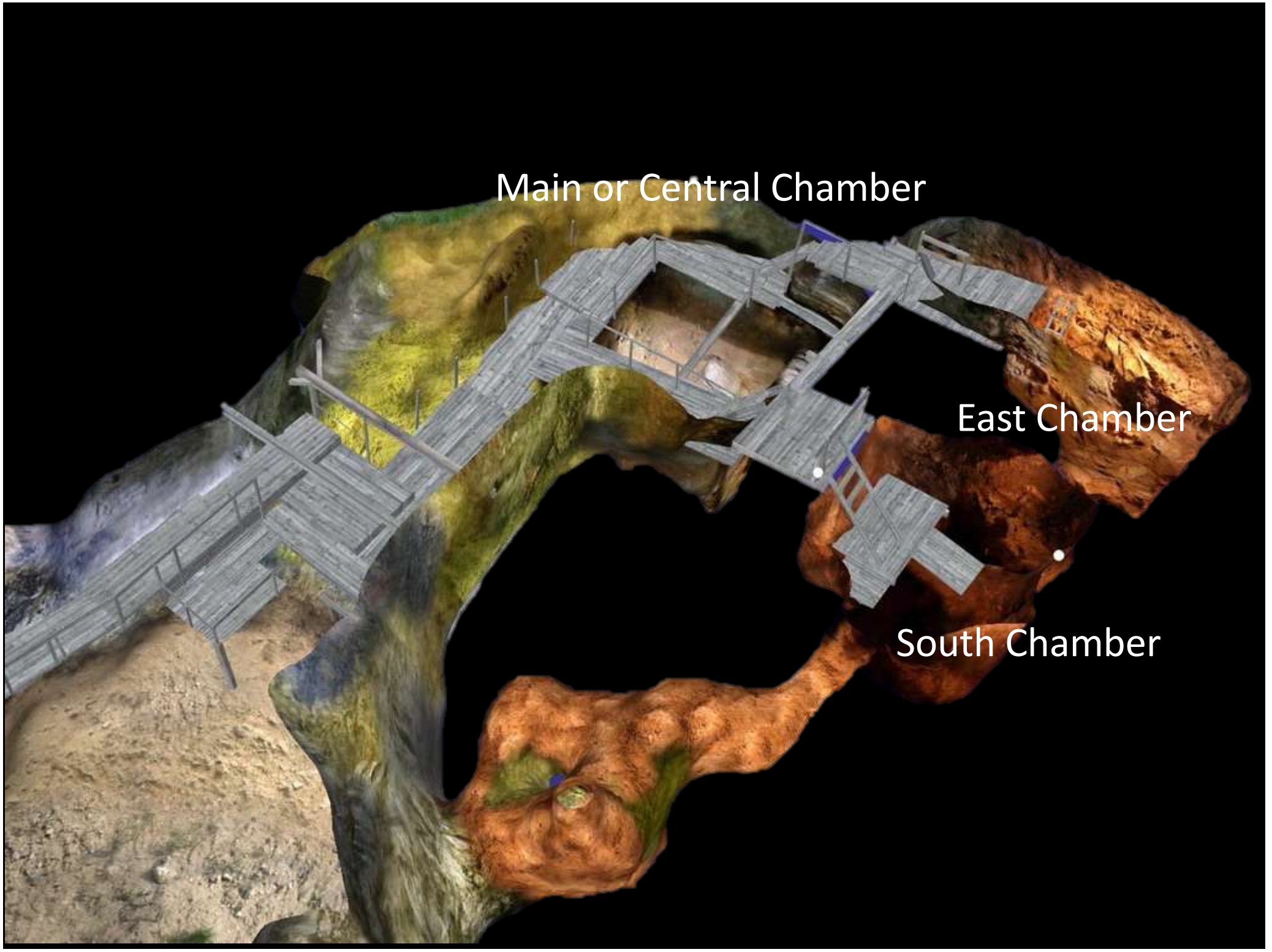
University Club, Otago 2020

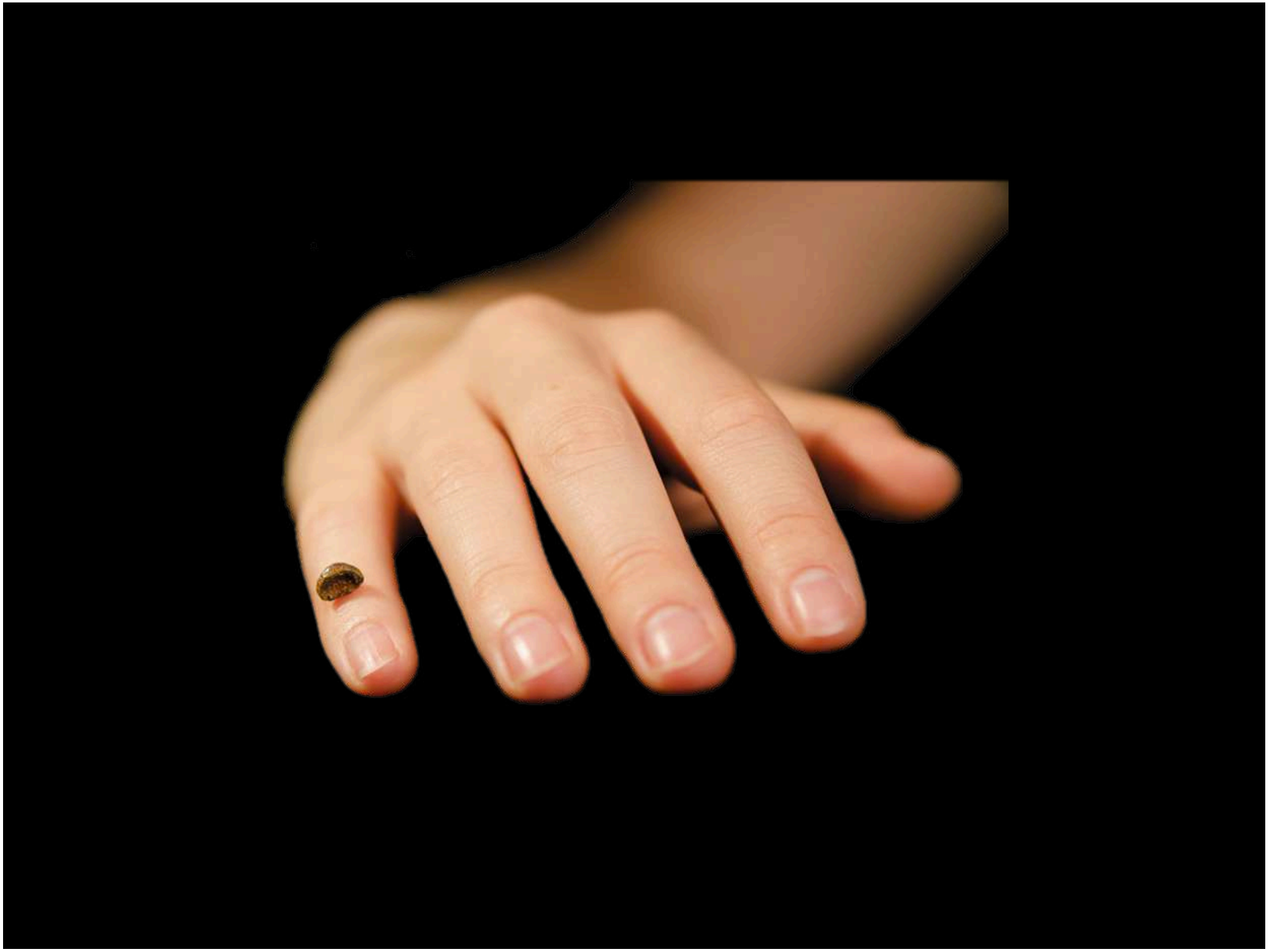

Homo sapiens


Homo neanderthalensis


Homo luzonensis
Homo floresiensis

Denisovans


Main or Central Chamber
East Chamber
South Chamber

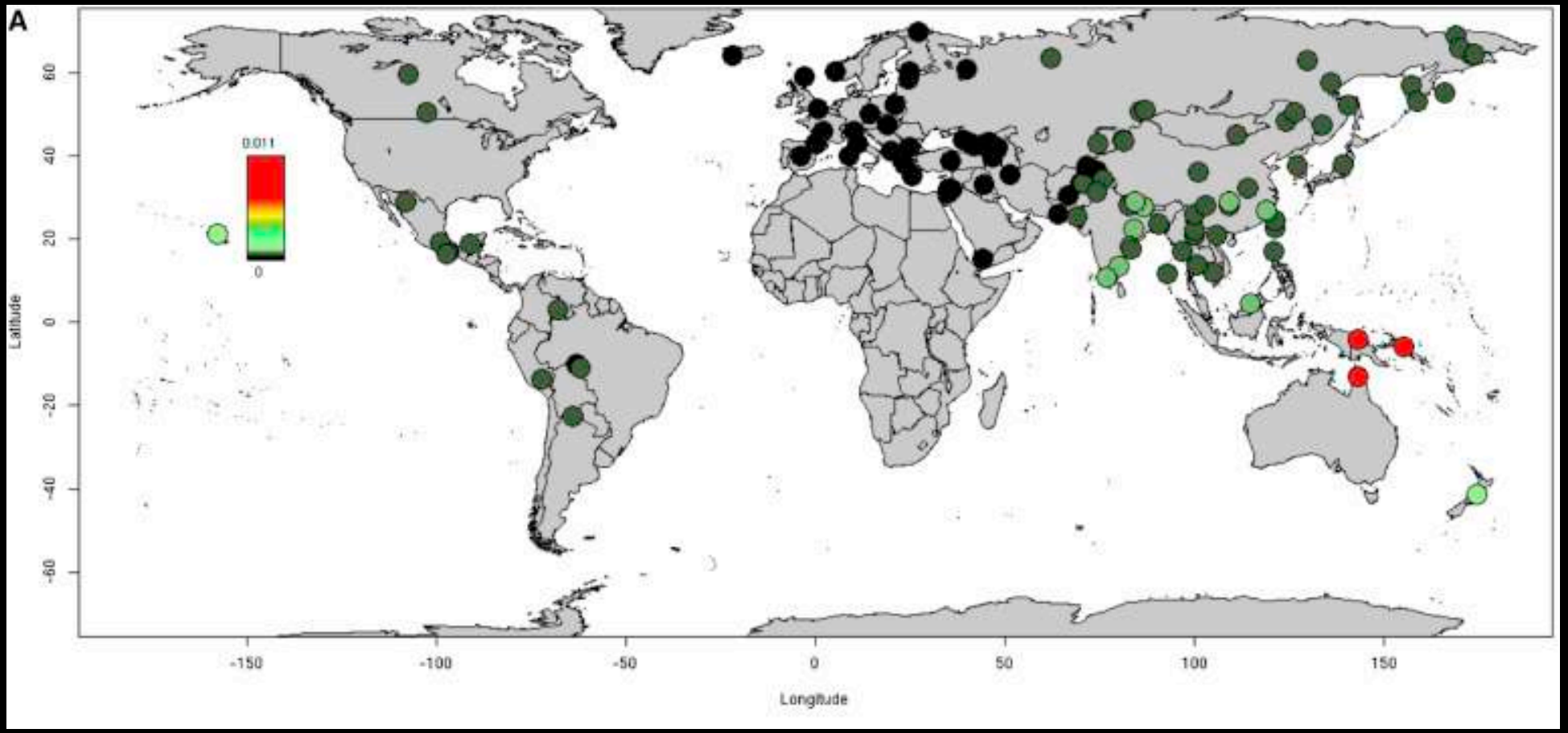


Denisovan remains

Denisova Cave, Russia

Our genetic legacy

- Some present-day humans derive up to ~5% ancestry from Denisovans, 2% from Neanderthals
- Neanderthal ancestry higher in present-day East Asians (2.3% - 2.6%) than in Europeans (1.8% - 2.4%)



Sankararaman et al. 2014; *Curr. Biol.*

Denisovan contribution to modern human biology

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Denisovan adaptive introgression in Tibetans at the *EPAS1* gene :
→ associated with haemoglobin concentration and response to hypoxia at high-altitude

Huerta-Sánchez et al. 2014; *Nature*

Baishiya Cave, China

Chen et al., *Nature* 2019.

(Picture credit: Jean-Jacques Hublin, MPI-EVA, Leipzig)

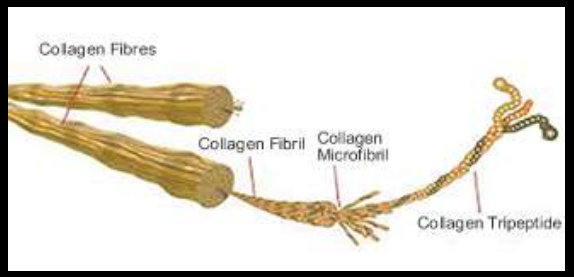
“The genome in search of a fossil”

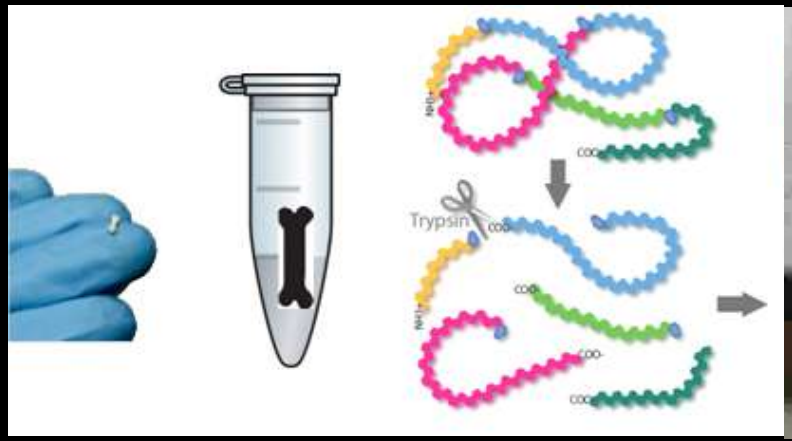
Denisova Cave

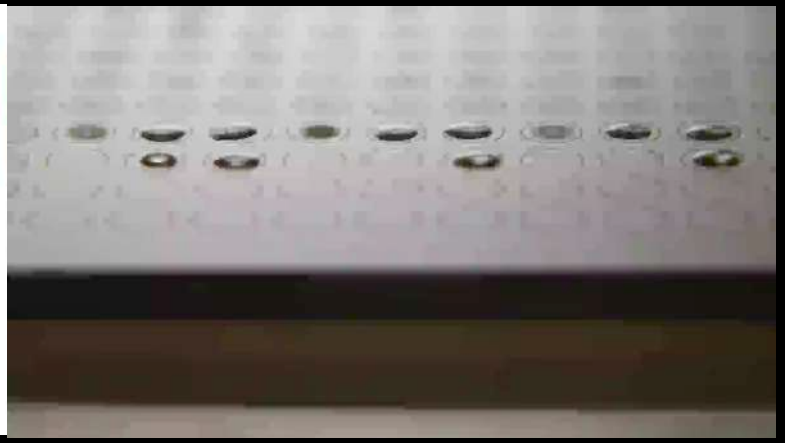

Денисова пещера
сектор 4 год
слой 11.4
квадрат
уровень 14
m18
сектор 4 год 2016
слой 11.2
квадрат
уровень 9
m17
субкв.
A Б
В Г

Collagen peptide mass fingerprinting

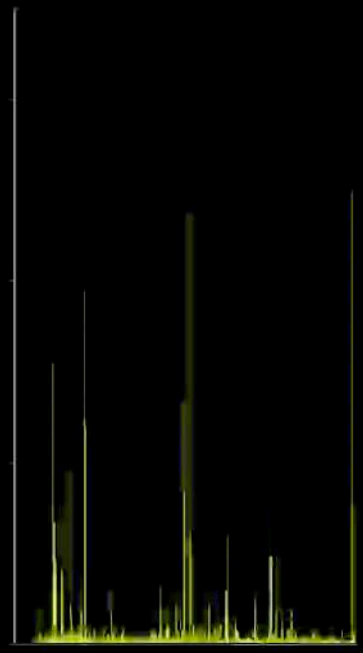
Species Identification using Soft-Ionization MALDI-ToF-ToF Mass Spectrometry

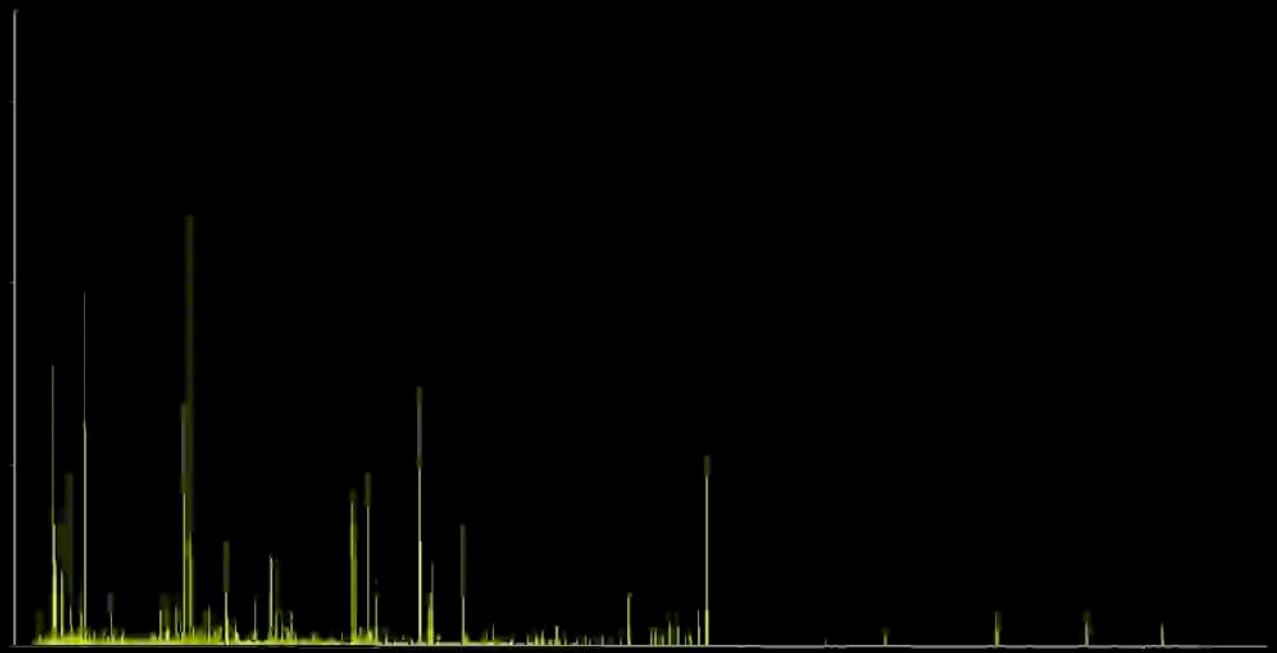


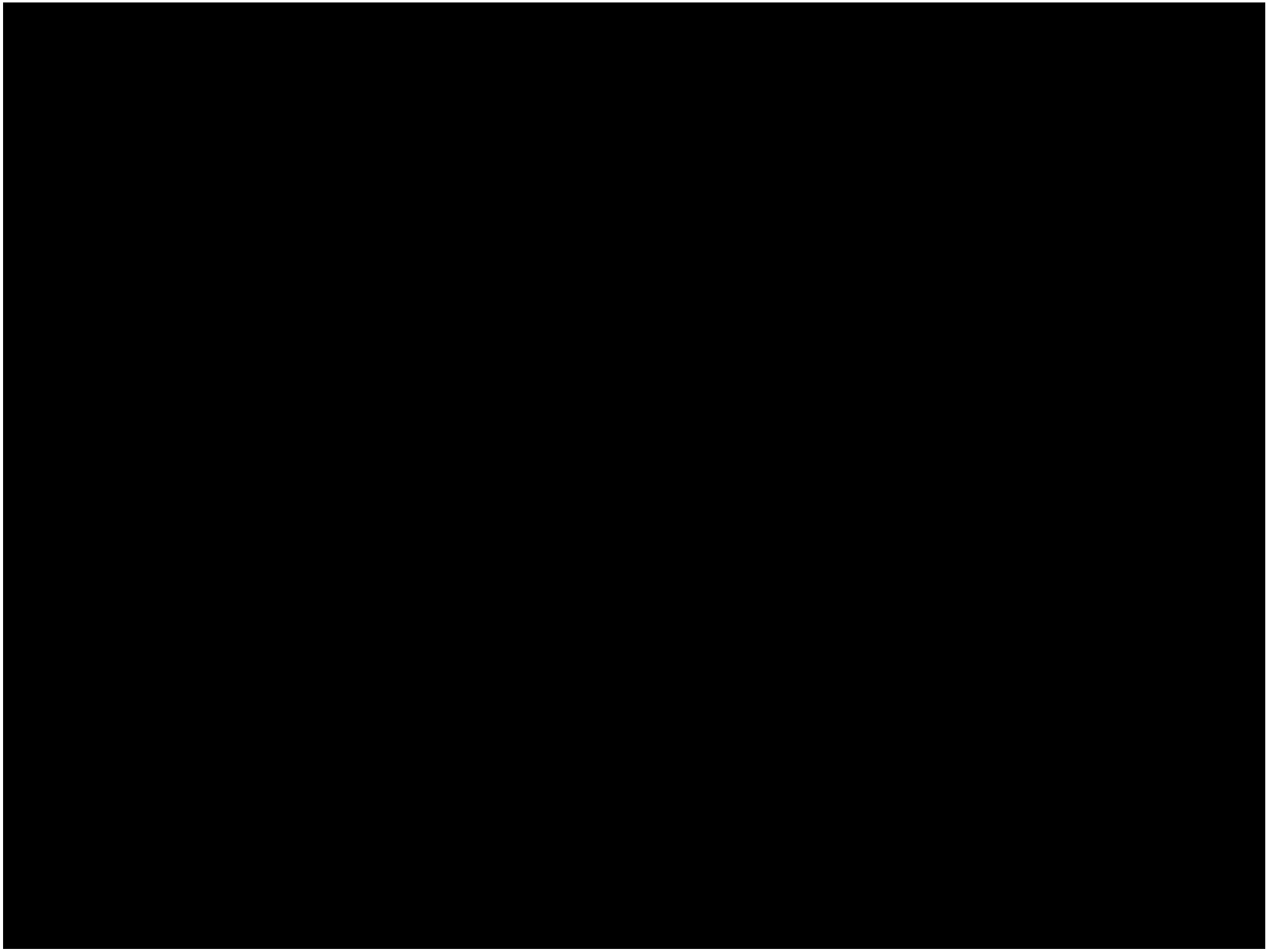


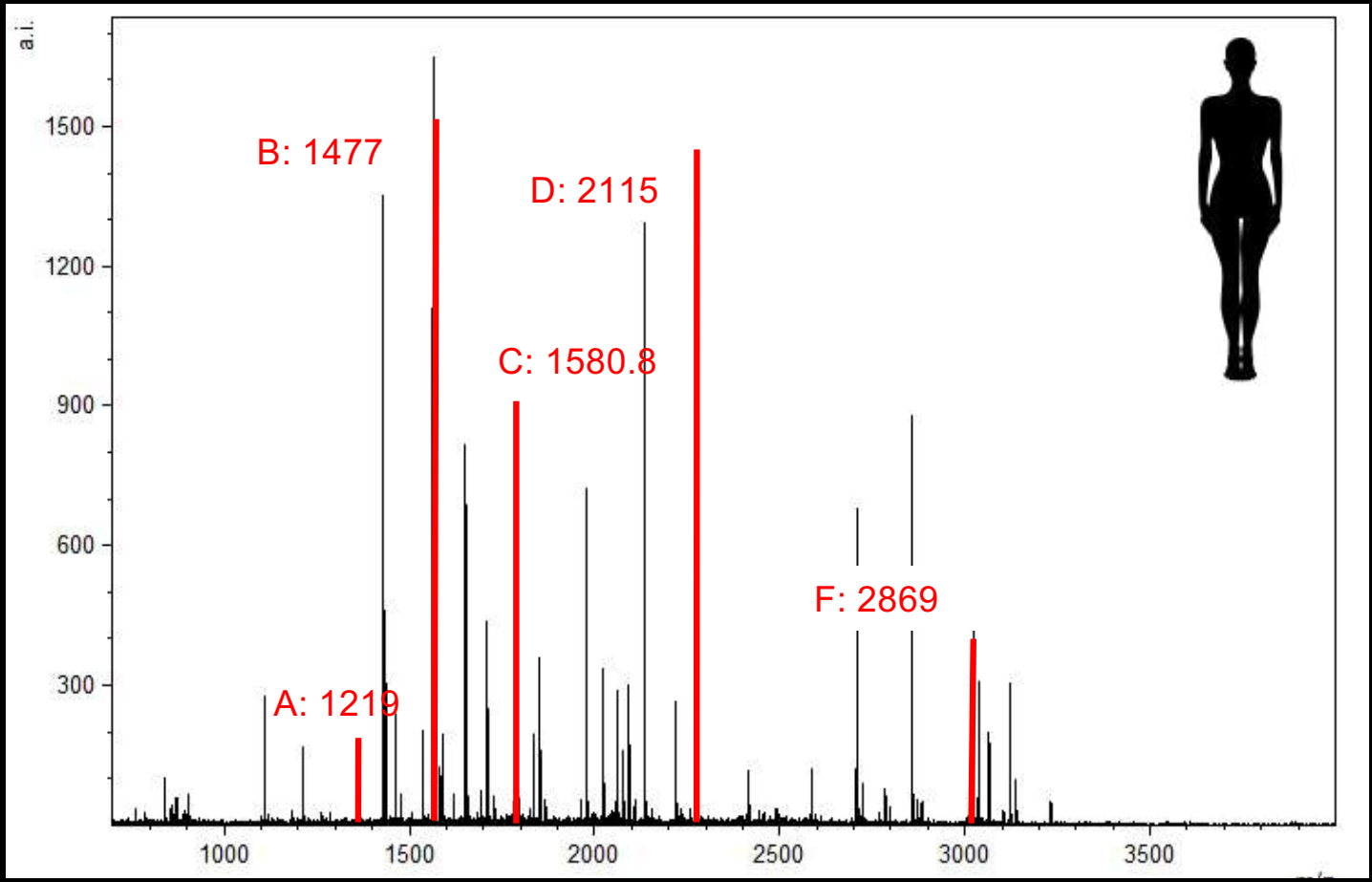


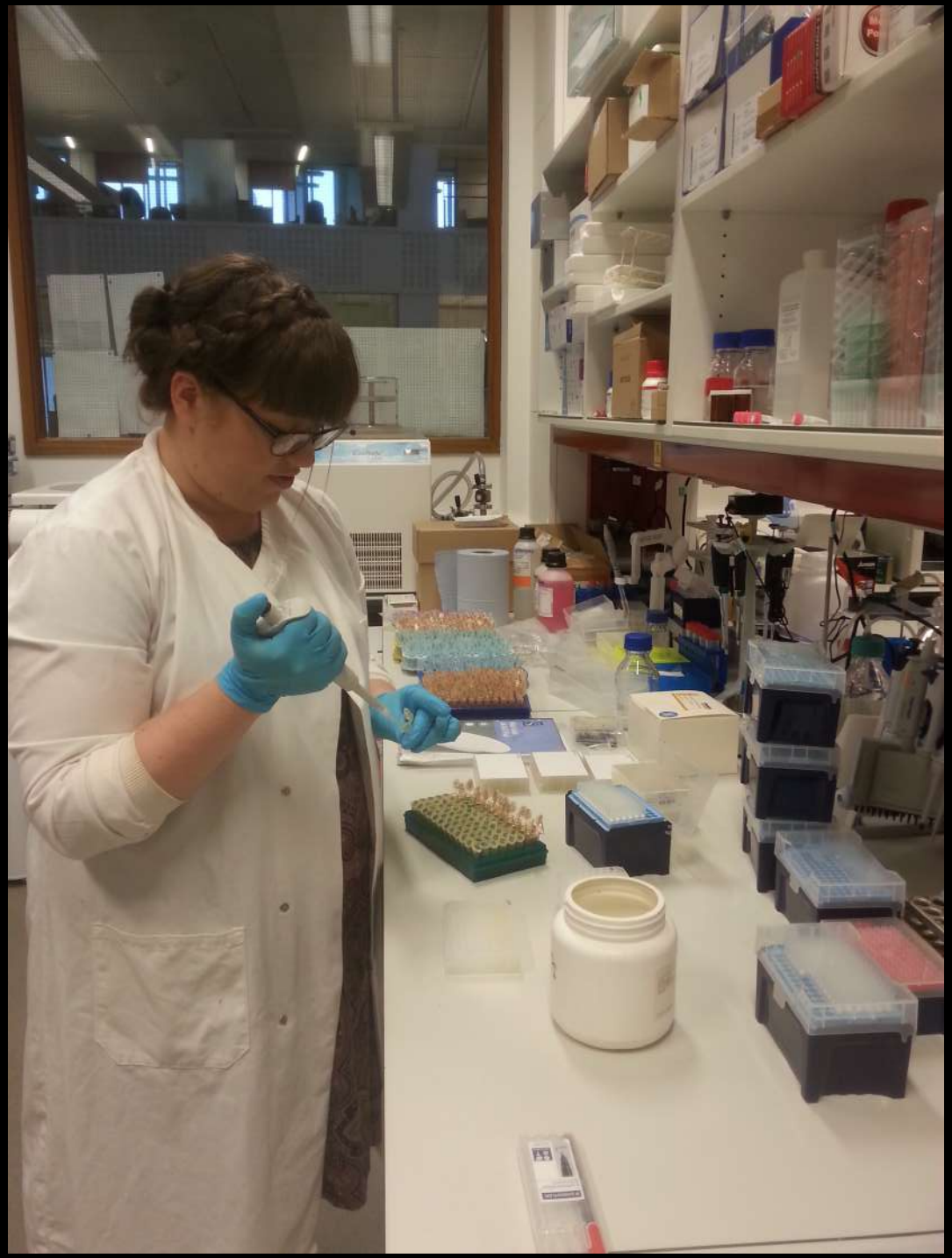
Buckley et al. 2009; *RCIMS*.

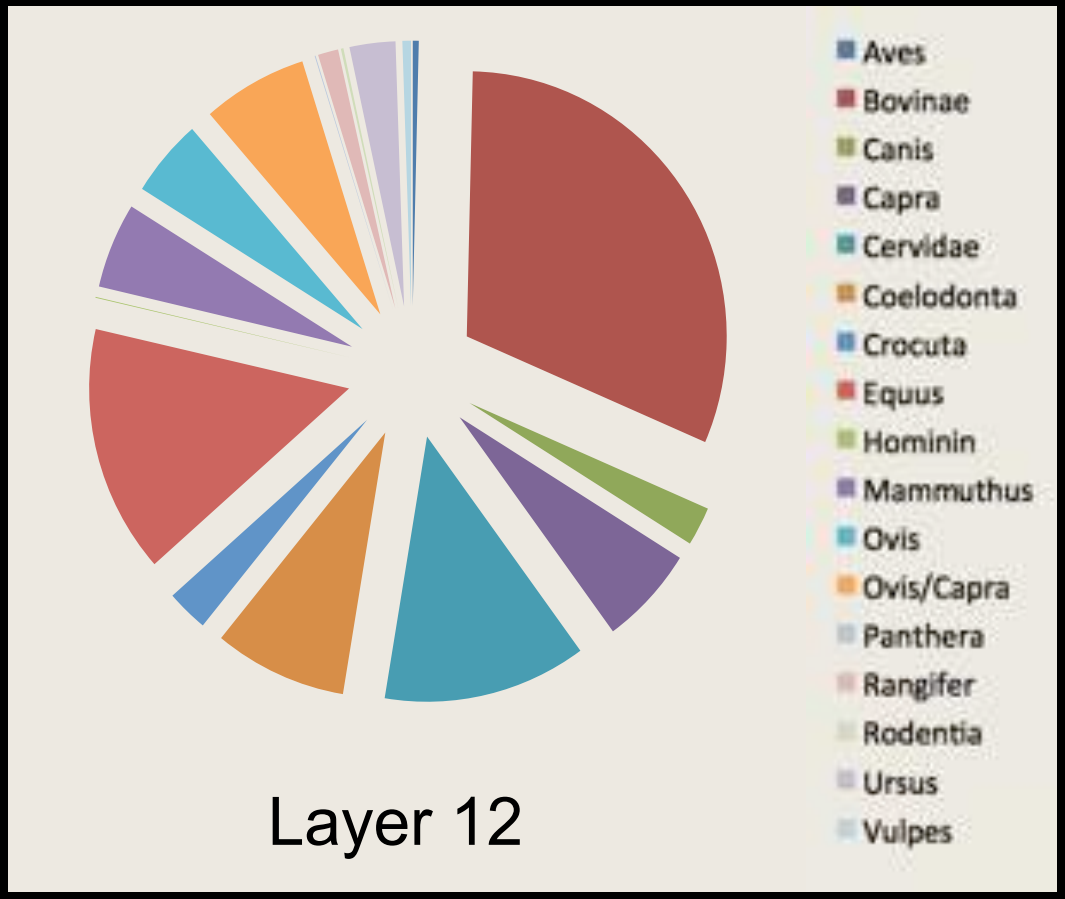




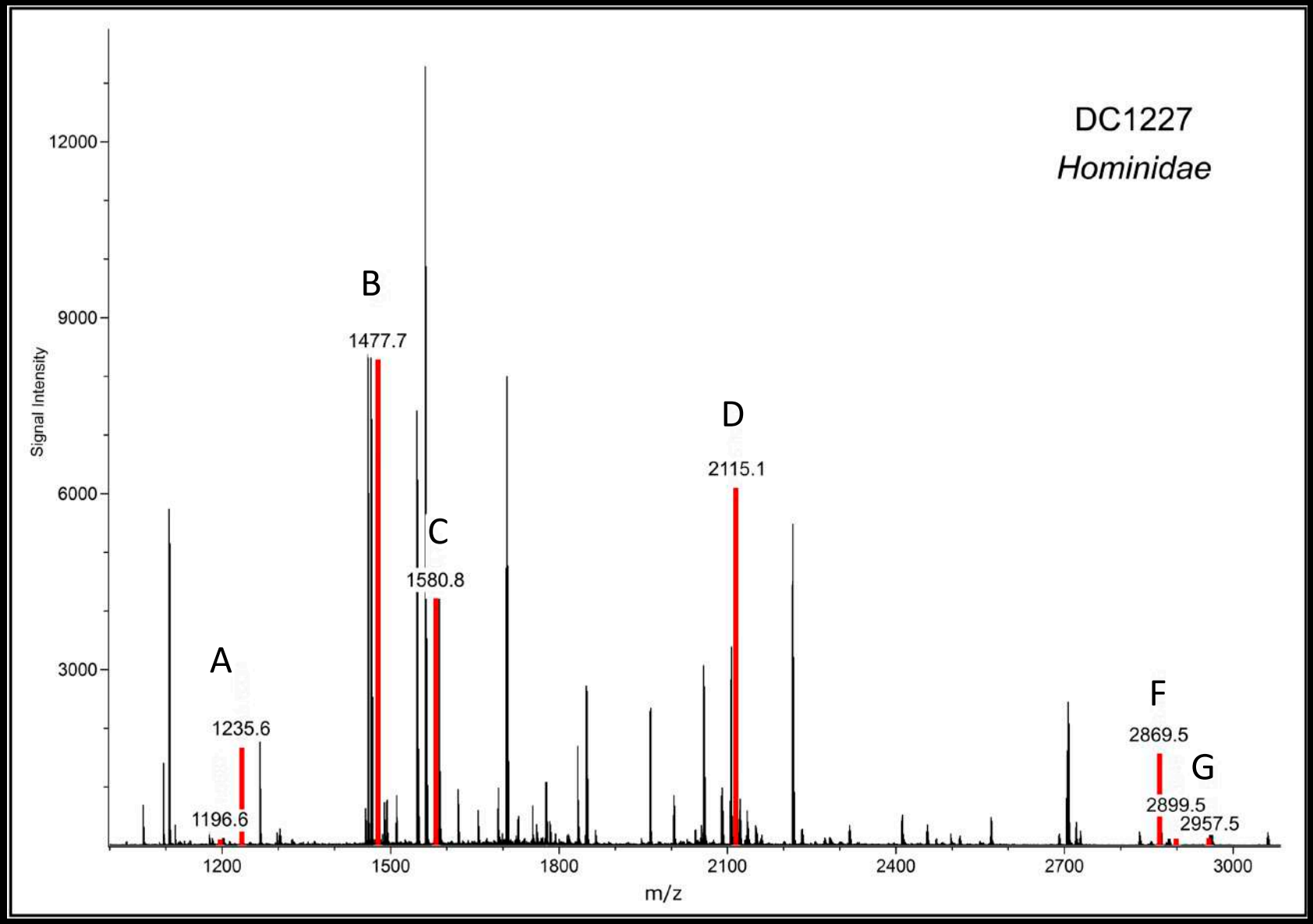


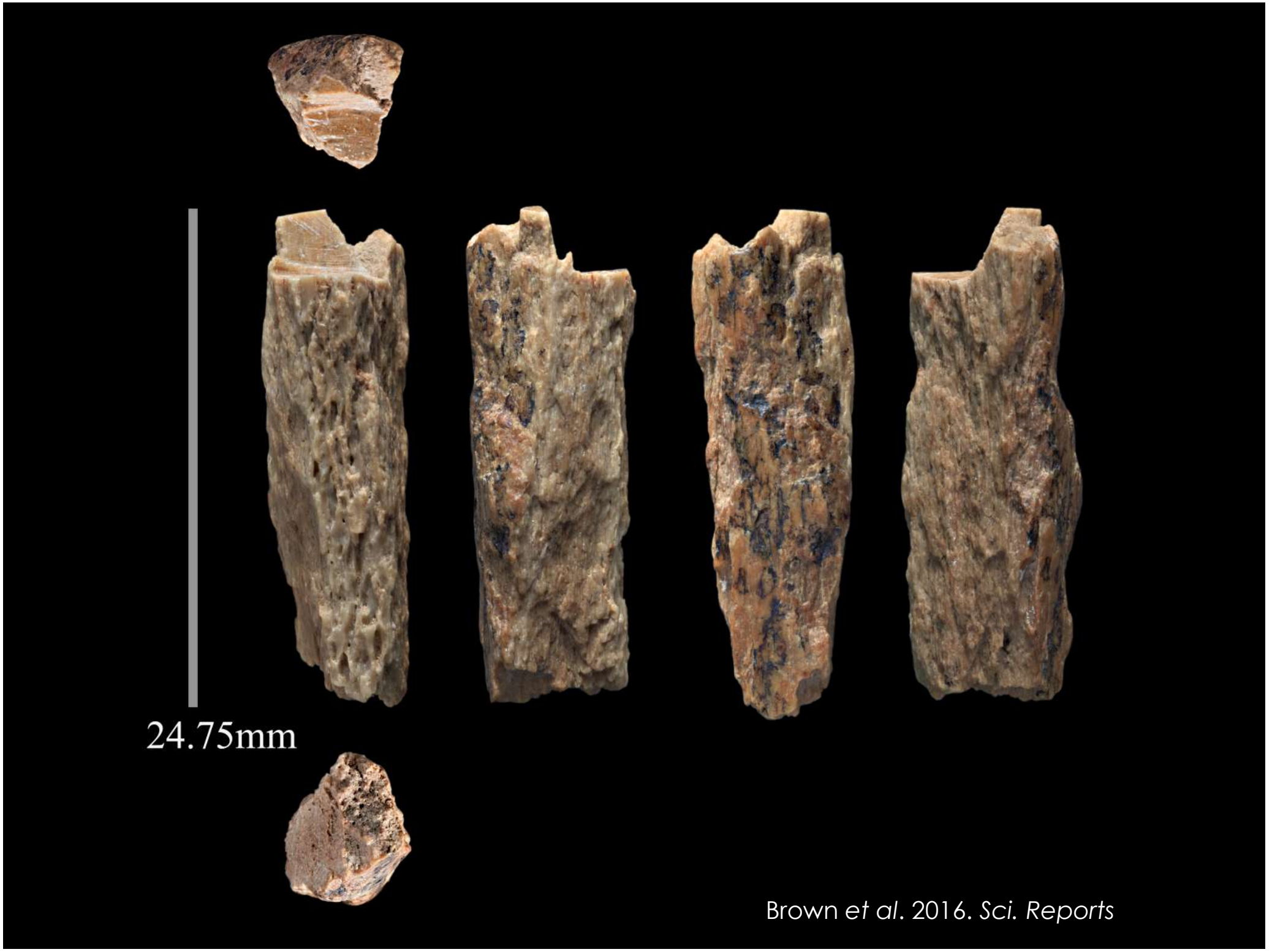

a.i.
1500
1200
900
600
300
B: 1477
D: 2115
C: 1580.8
F: 2869
A: 1219
1000
1500
2000
2500
3000
3500





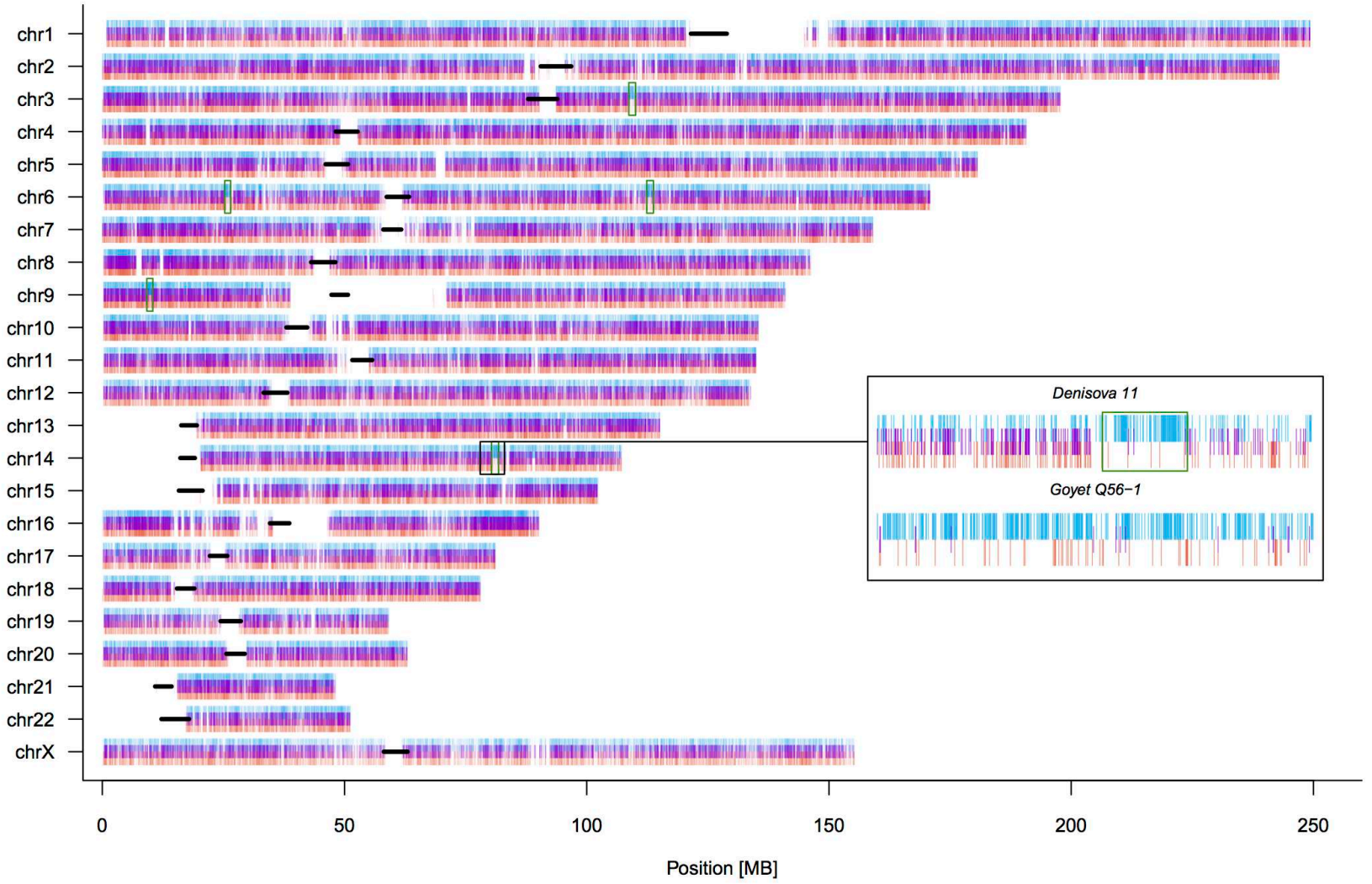
2315 bone fragments


DC1227
Hominidae
Signal Intensity
12000
9000
6000
3000
A
1196.6
1235.6
B
1477.7
C
1580.8
D
2115.1
F
2869.5
G
2899.5
2957.5
1200
1500
1800
2100
2400
2700
3000
m/z

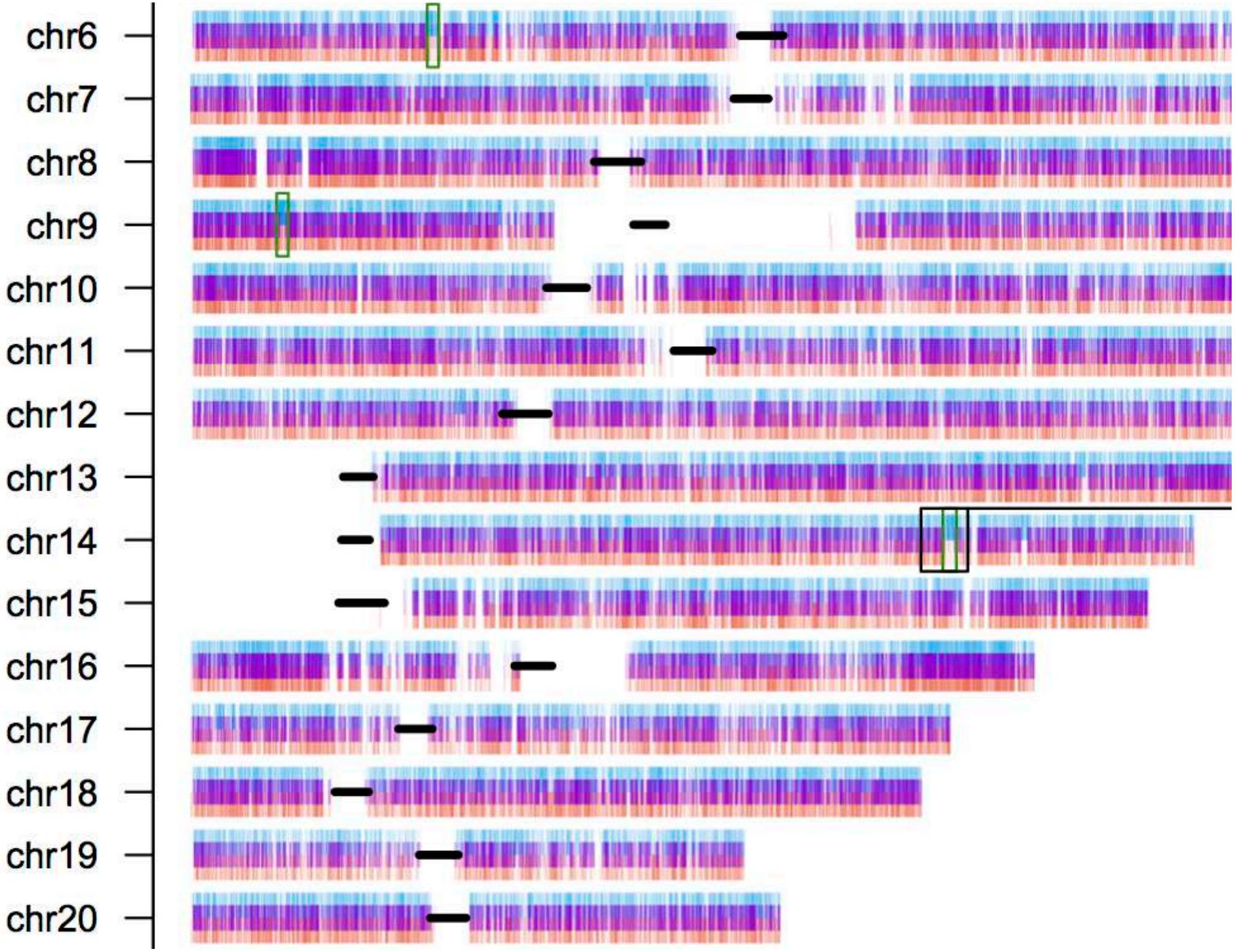


Brown *et al*. 2016. *Sci. Reports*

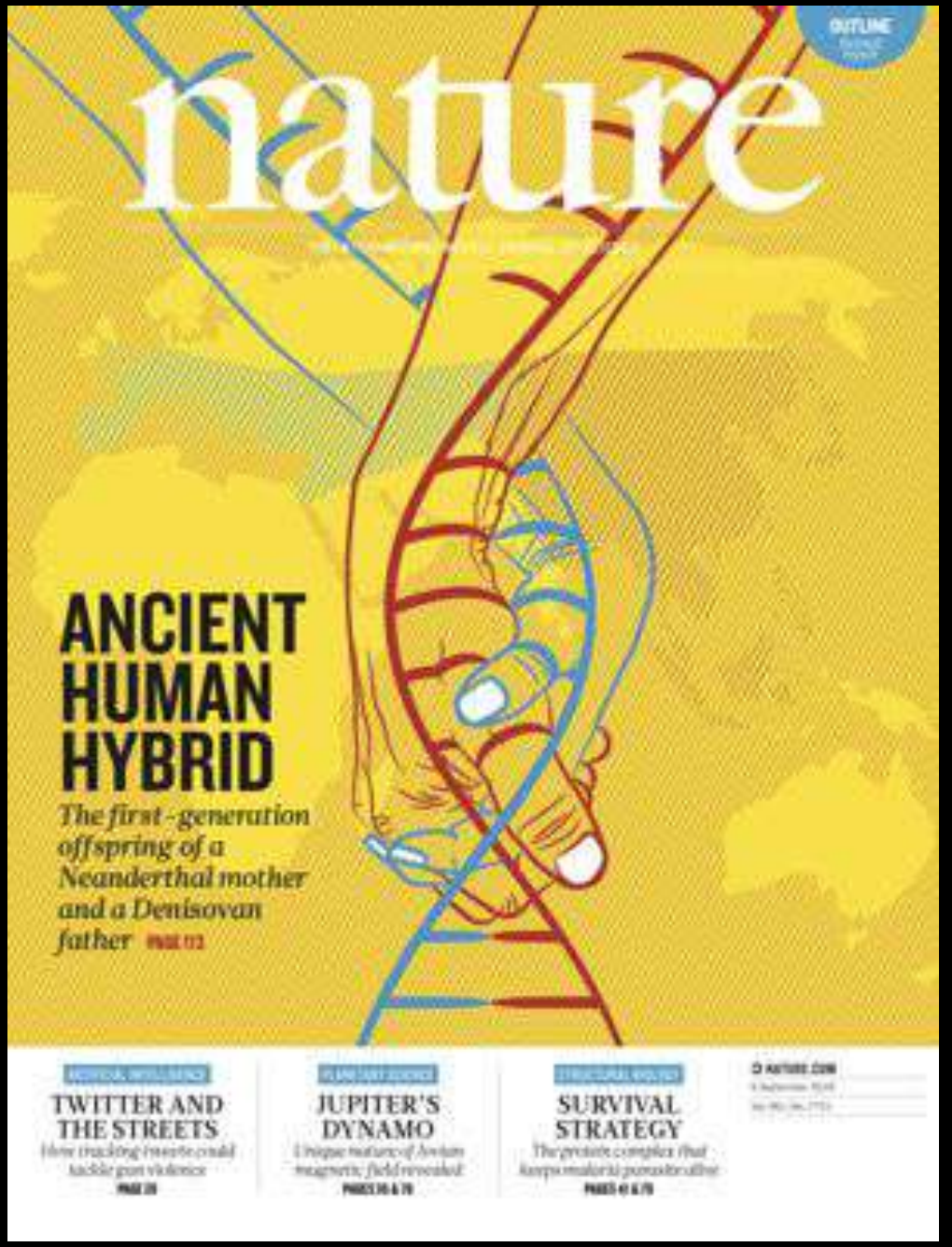
Denisova 11 genome data



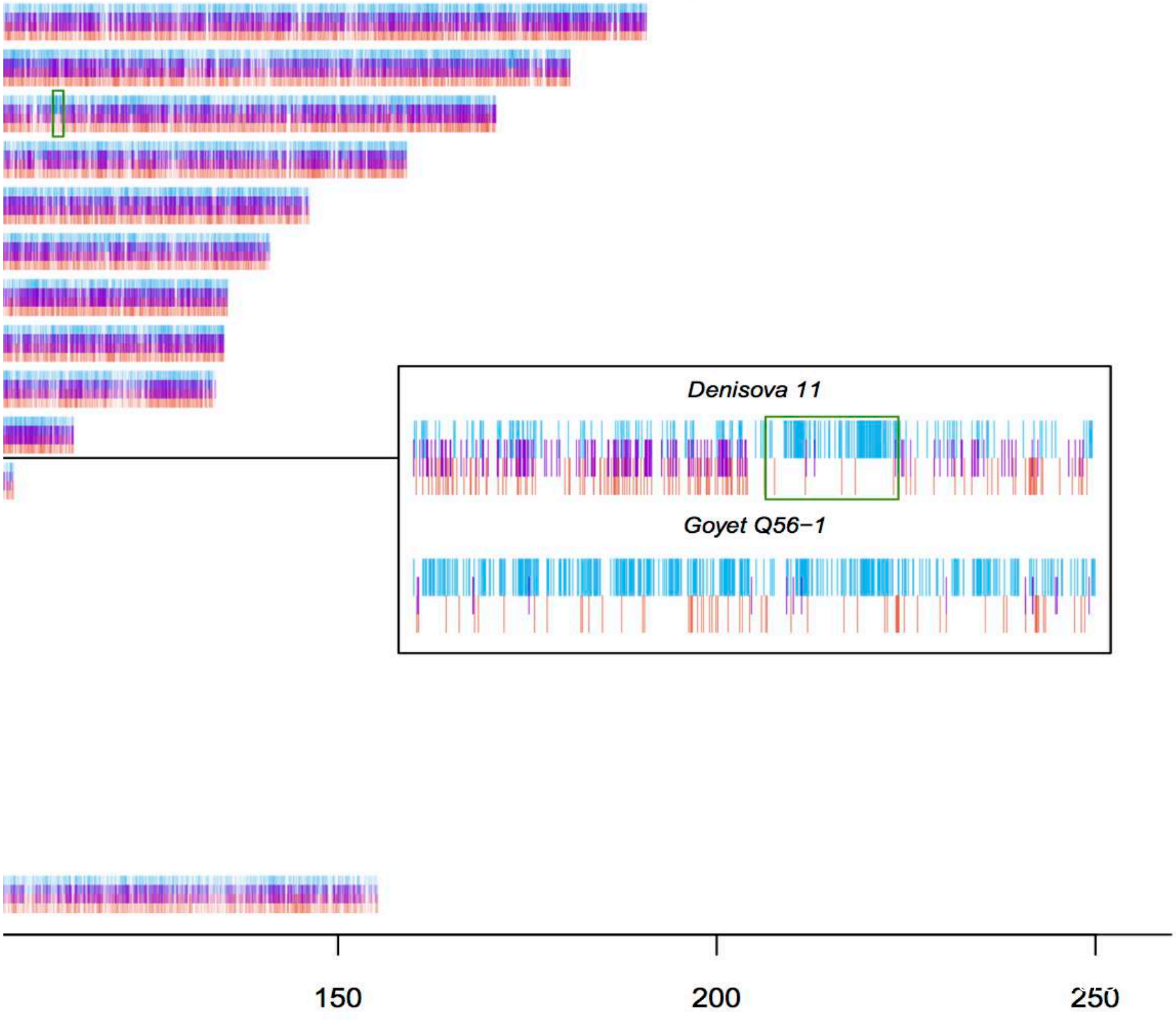
Slon *et al*. 2018; *Nature*


chr6
chr7
chr8
chr9
chr10
chr11
chr12
chr13
chr14
chr15
chr16
chr17
chr18
chr19
chr20

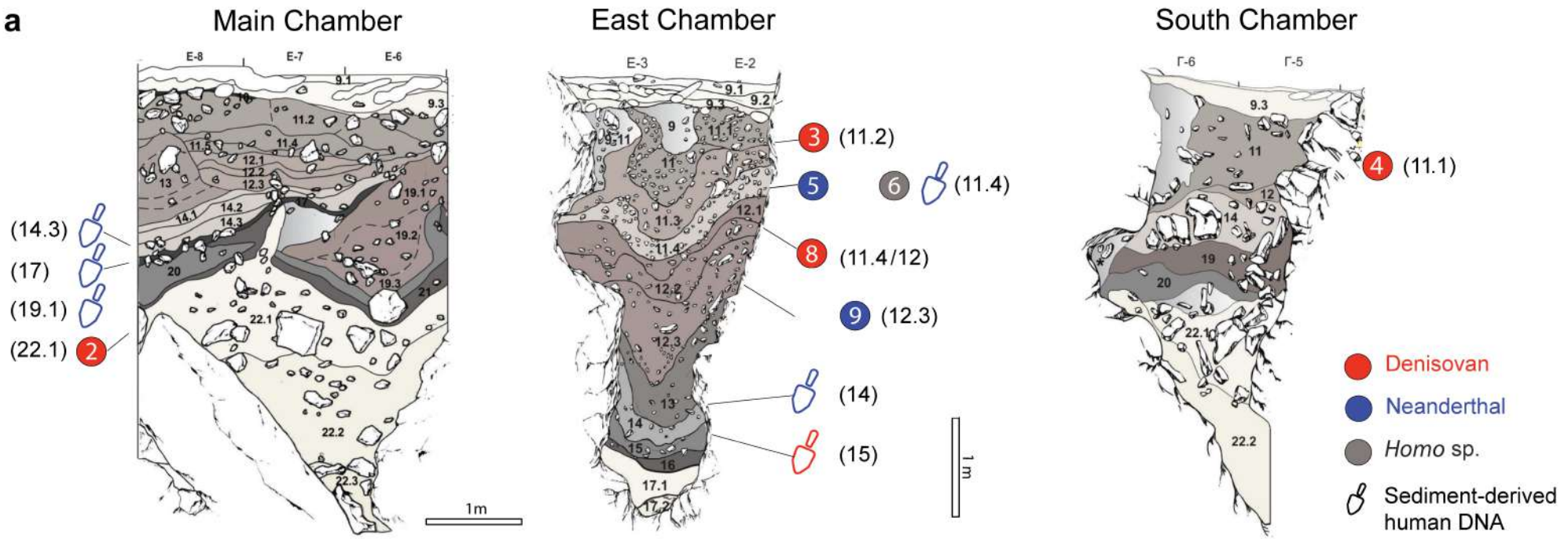
Denisova 11 is the daughter of a Neanderthal mother and a Denisovan father



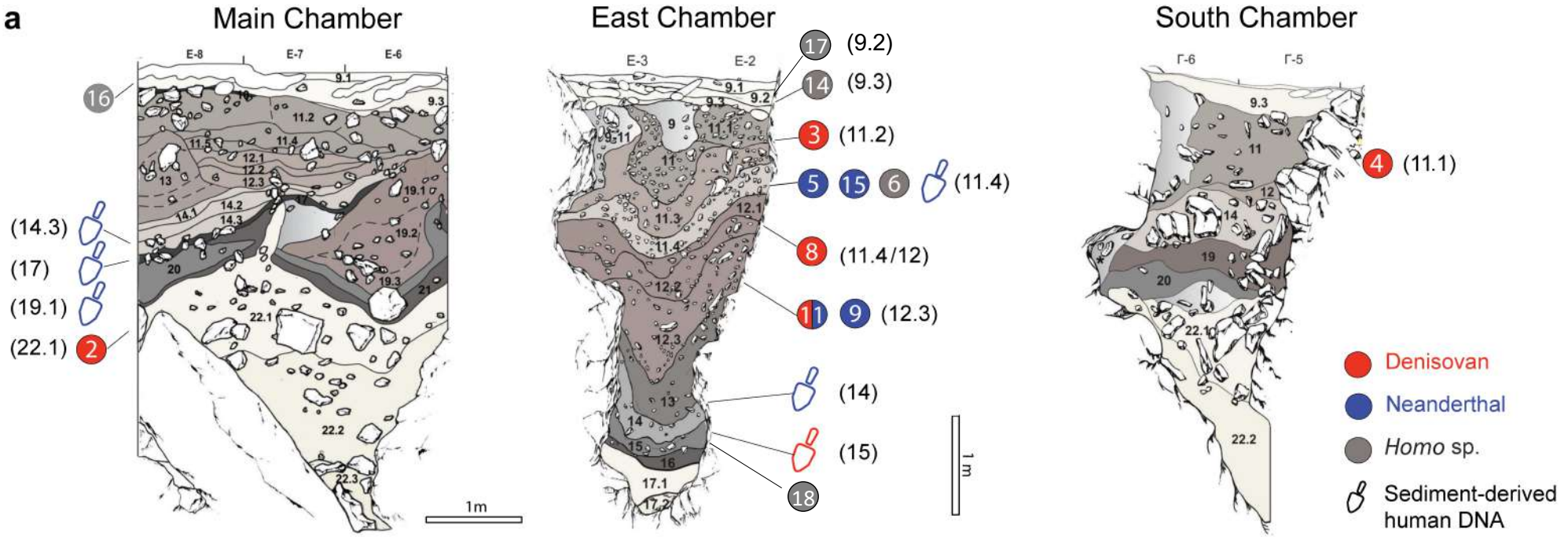
Slon *et al*. 2018; *Nature*

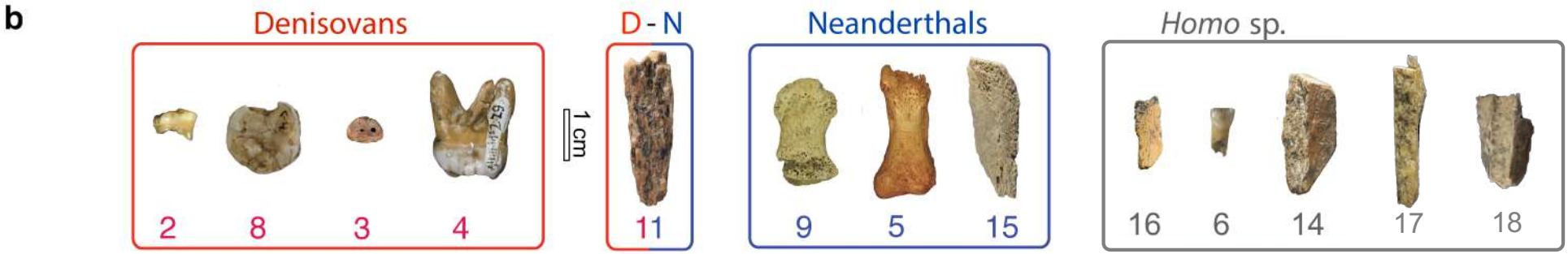

Denisova 11
Goyet Q56−1
150
200
250

Previous human remains at Denisova



Current human remains at Denisova





There are now 14 human remains from Denisova, 9 of which were found using ZooMS

Conclusions

- A new group of humans called ‘Denisovans’ has been discovered in Siberia;
- Modern humans interbred with them and Neanderthals between 50-30,000 years ago.
- Some of the genes we inherited are advantageous, some deleterious;
- Using collagen peptide mass fingerprinting we can identify new human bones from tiny fragments in the archaeological record;
- One of these bones from Denisova Cave turned out to be a the first offspring of two different human groups, indicating that interbreeding might have been common when these groups met.

Acknowledgements

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