La preservación del registro arqueomagnético en estructuras de combustión experimentales con 2 y 5 años de antigüedad

Ángela Herrejón Lagunilla[1]
Juan José Villalaín Santamaría[1]
Ángel Carrancho Alonso[2]
Carolina Mallol[3,4]
Cristo M. Hernández[3]

[1] Dpto. de Física, Universidad de Burgos
[2] Área de Prehistoria, Dpto. de Historia, Geografía y Comunicación, Universidad de Burgos
[3] Dpto. de Geografía e Historia, Área de Prehistoria , Universidad de La Laguna
[4] Archaeological Micromorphology and Biomarkers Laboratory, Instituto Universitario de Bio-Orgánica Antonio González

Magiber XI

Neanderthal Fire Technology Project

THE LEAKEY FOUNDATION

38° 41' 13" N 0° 30' 33" W

Around 40 experimental combustion structures performed in the surrounding area of El Salt archaeological site (Alcoy, Alicante)

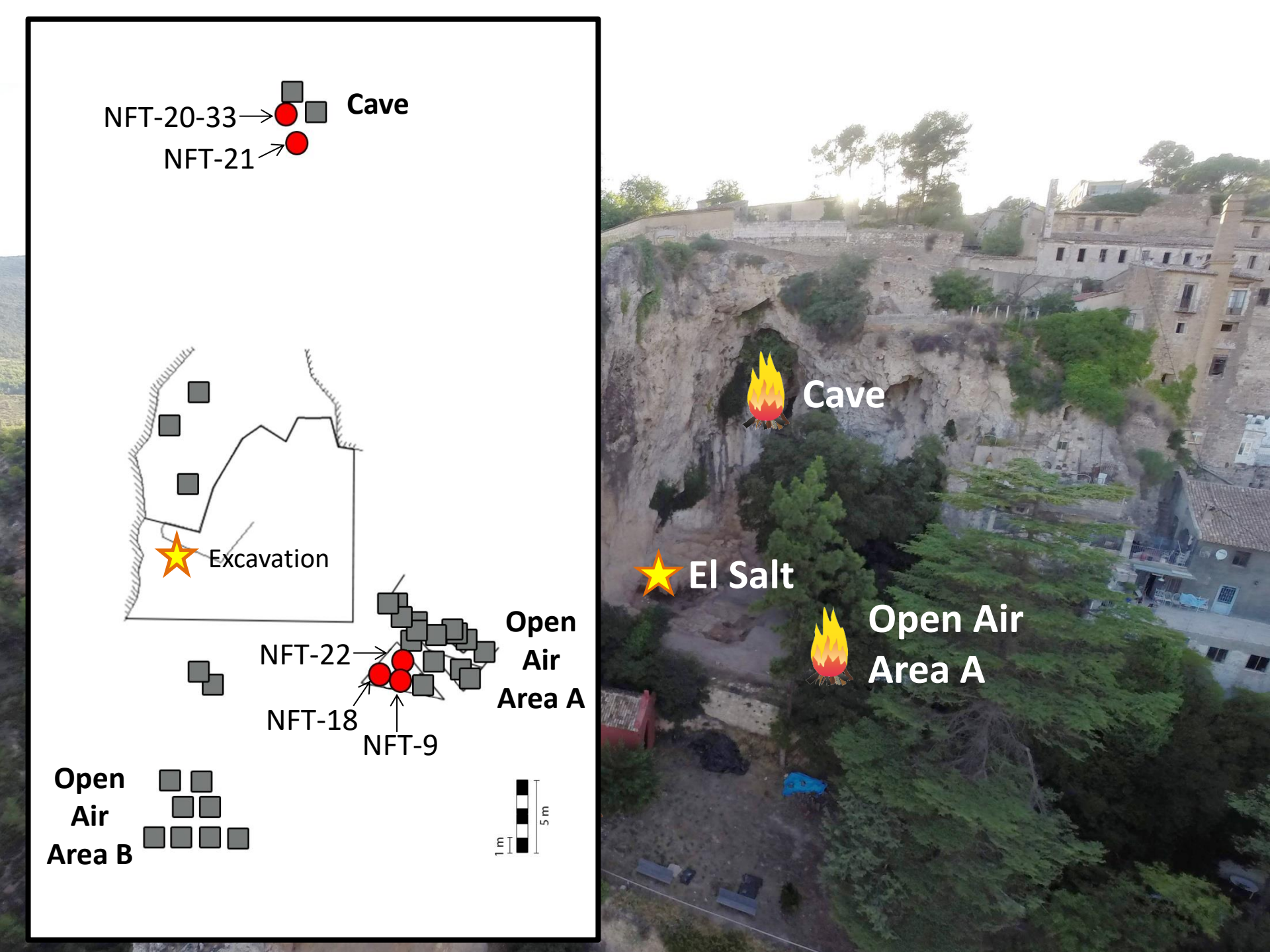
Project objectives

- ☑ Generation of an experimental dataset in order to understand the Middle Palaeolithic fires
- ☑ Evaluation of the taphonomic processes
- ☑ Multidisciplinar approach: spatial analysis, soil micromorphology, FTIR, archaeomagnetism, organic chemistry…

Controlled variables

- Context, type of substrate, type of structure, fuel, addition of materials (pre- and during combustion), temperatures, type of extinction, post-combustion actions, taphonomy


El Salt


NFT-20-33
NFT-21
Cave
Excavation
NFT-22
NFT-18
NFT-9
Open
Air
Area A
Open
Air
Area B
1 m
5 m
Cave
El Salt
Open Air
Area A

Open air

NFT-9
(2010)

NFT-18
(2010)

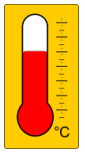
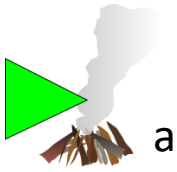
NFT-22
(2010)

Cave

NFT-20-33
(2010/2013)

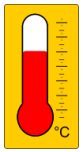
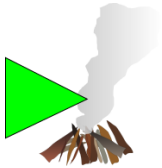
NFT-21
(2010)

OPEN AIR STRUCTURES

	NFT-9	NFT-18	NFT-22
	3-4 hours	2-3 hours	5-6 hours
	*Pinus nigra* (16.3 kg)	*Pinus nigra* (23.5 kg)	*Pinus nigra* (19.5 kg)
	3 *Bubo bubo* pellets (pre-comb.), chicken bones, 2 eggs and 2 roasted rabbits (comb.)	Bone fragments, limestones/travertine, flint Mariola-Benimartxó (pre-comb.), cow bone (comb.)	–
	–	622 °C / 663 °C	218 °C / 420 °C / 617 °C / 791 °C / 868 °C
	Natural extinction	Natural extinction	Natural extinction
	Addition of a charbonized epyphisis of horse bone and trampling during 15 days	–	–

(Performed in 2010 and sampled in 2015)

ESTRUCTURAS EN CUEVA

	NFT-20-33		NFT-21
	NFT-20 (2010)	NFT-33 (2013)	(2010)
	3-4 hours	–	2-3 hours
	*Pinus nigra* (12 kg)	*Pinus sylvestris*	*Pinus nigra* (7.2 kg)
	Serreta-Frare Biar flint (pre-comb.), horse excrement (comb.)	–	Limestons/conglomerates (pre-comb.), charred large branches, tibia and 9 horse ribs (comb.)
	733 °C / 770 °C	101.6 °C/ 592.4 °C / 864.4 °C	53 °C / 93 °C / 260 °C / 508 °C / 706 °C / 763 °C
	Natural extinction	Natural extinction	Extinction with sediment
	Relighting (NFT-33)	–	–

(Sampled in 2015)

Taphonomic processes

Spring 2013

- In the cave, the combustion structures looked intact. Only carnivore excrements and fingerprints were found in the ashes, as well as some spider webs.

- Open air combustion structures were covered by leaves from the surrounding trees during the first fall after the firing.

Fall 2010

Fall 2010

- Next spring, vegetation had grown above the open air comsbution structures

Summer 2011

Summer 2012

Summer 2014

Summer 2015

- When excavating, insects' activity and a layer formed by grey-brownish aggregates and decayed *Celtis sp.* leaves and seeds were found under the vegetation.

Summer 2015

Summer 2015

Reworked ashes!

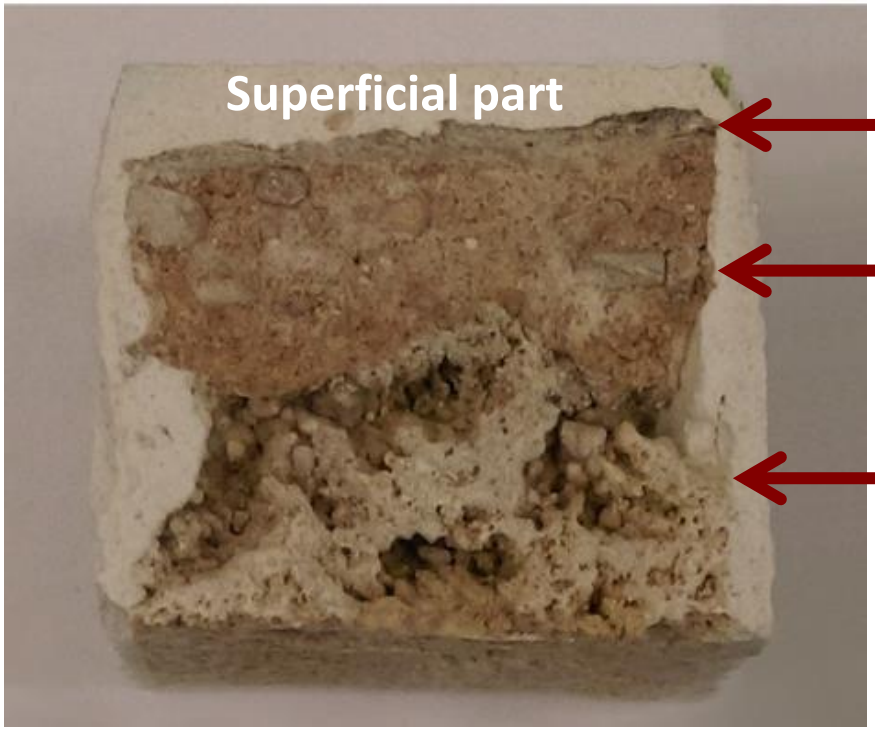
- Vegetation above the structures was carefully cut. However, sometimes roots were found in the sampled areas.

Summer 2015

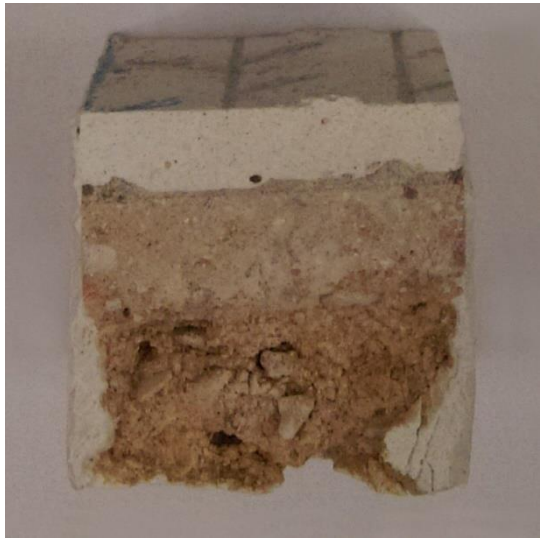
Original substrate

- Open air area

- Cave

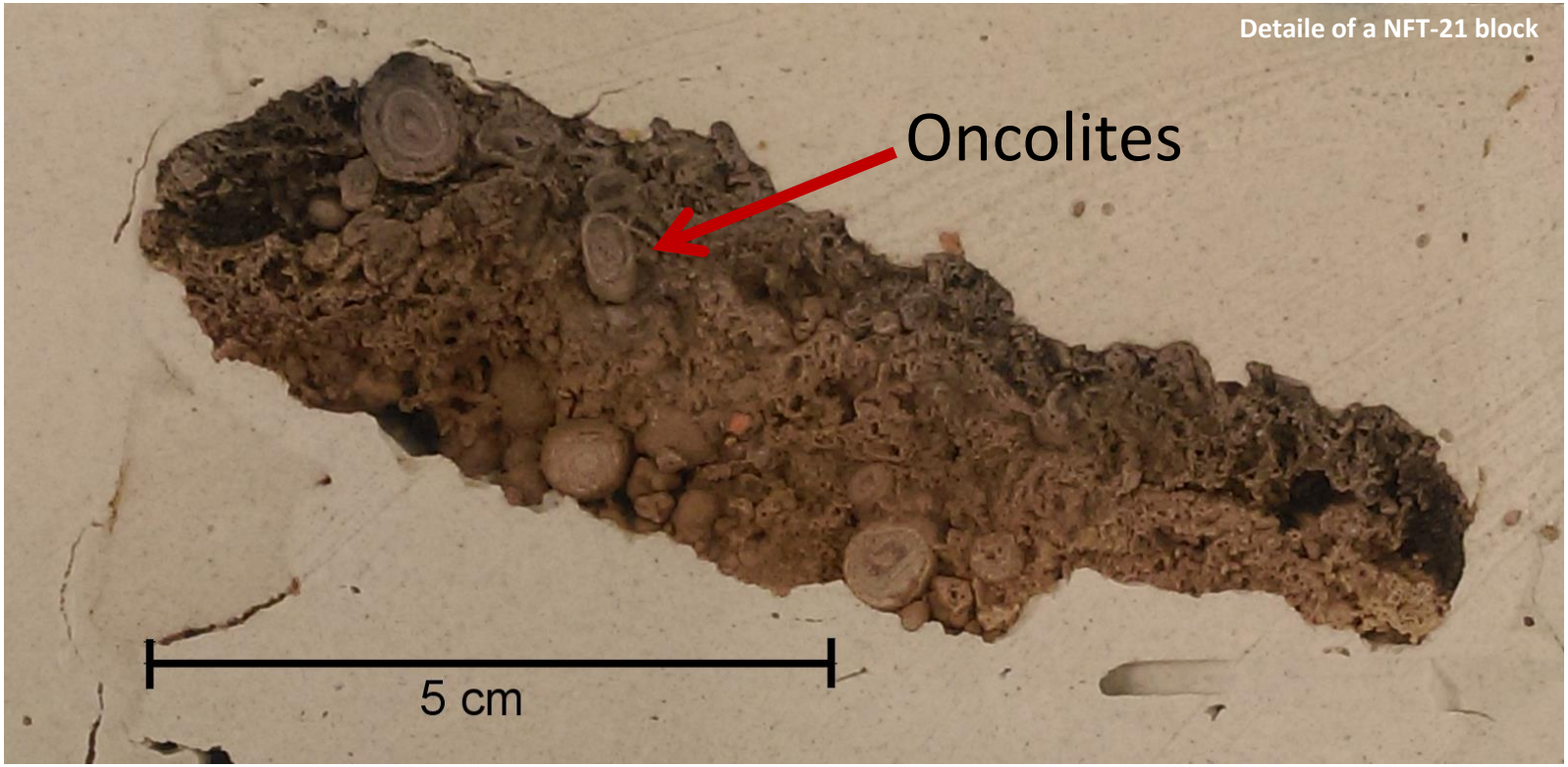


NFT-20-33 area



- Cave

NFT-21 area

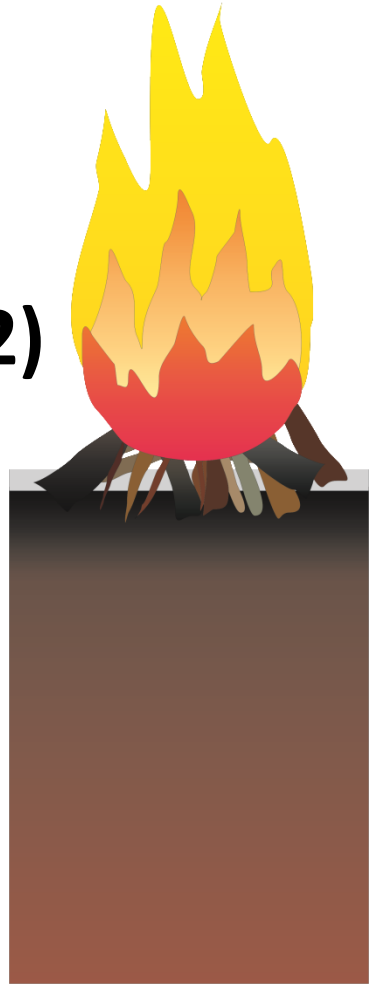


(Modified from Herrejón Lagunilla *et al.* 2019)

After the fire…

1)

2)



3)

As a results, two main layers are found : an ash layer on the top (calcined fuel) , and the thermoaltered substrate underlying

Fuel is located above the substrate. With the fire, the fuel is progressively comsumpted by the flames and the substrate is affected by the heat.

Results

PLOS ONE

RESEARCH ARTICLE

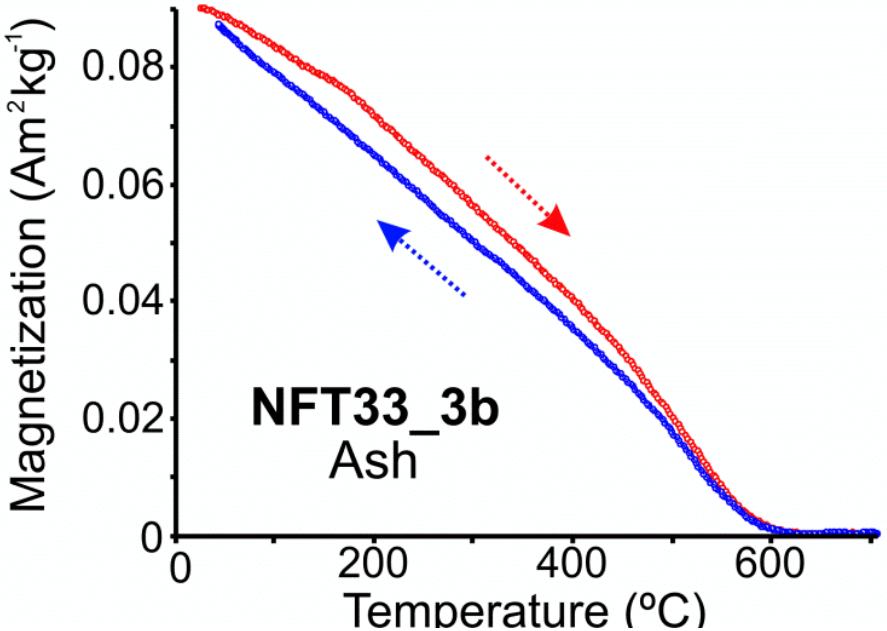
An experimental approach to the preservation potential of magnetic signatures in anthropogenic fires

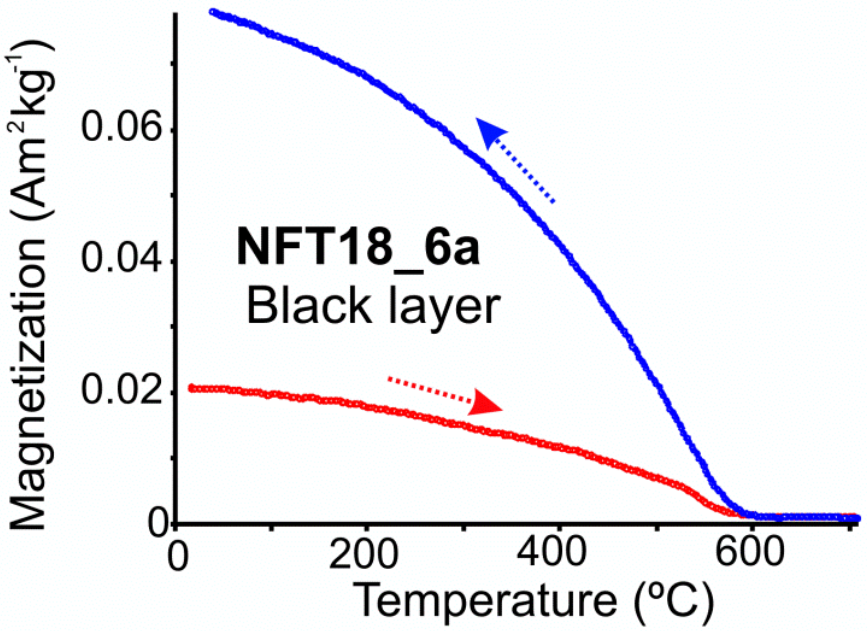
Ángela Herrejón Lagunilla[1]*, Ángel Carrancho[2], Juan José Villalaín[1], Carolina Mallol[3,4¤], Cristo Manuel Hernández[3]

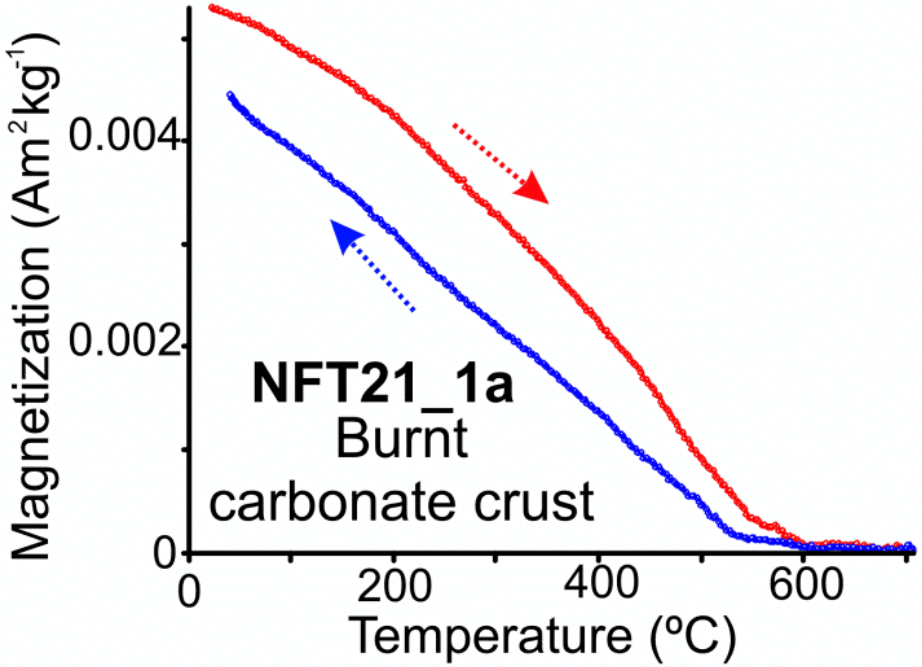
1 Departamento de Física, Universidad de Burgos, Burgos, Spain, 2 Área de Prehistoria, Departamento de Historia, Geografía y Comunicación, Universidad de Burgos, Burgos, Spain, 3 Departamento de Geografía e Historia, Área de Prehistoria (Facultad de Humanidades), Universidad de La Laguna, Campus de Guajara, La Laguna, Tenerife, Spain, 4 Archaeological Micromorphology and Biomarkers (AMBI Lab), Instituto Universitario de Bio-Orgánica Antonio González, La Laguna, Tenerife, Spain

¤ Current address: Archaeological Micromorphology and Biomarkers (AMBI Lab), Instituto Universitario de Bio-Orgánica Antonio González, Avda. Astrofísico Francisco Sánchez, La Laguna, Tenerife, Spain
* aherrejon@ubu.es, angelaherrejonlagunilla@gmail.com

Herrejón Lagunilla Á, Carrancho Á, Villalaiín JJ, Mallol C, Hernández CM (2019) An experimental approach to the preservation potential of magnetic signatures in anthropogenic fires. PLoSONE 14(8): e0221592. https://doi.org/10.1371/journal.pone.0221592





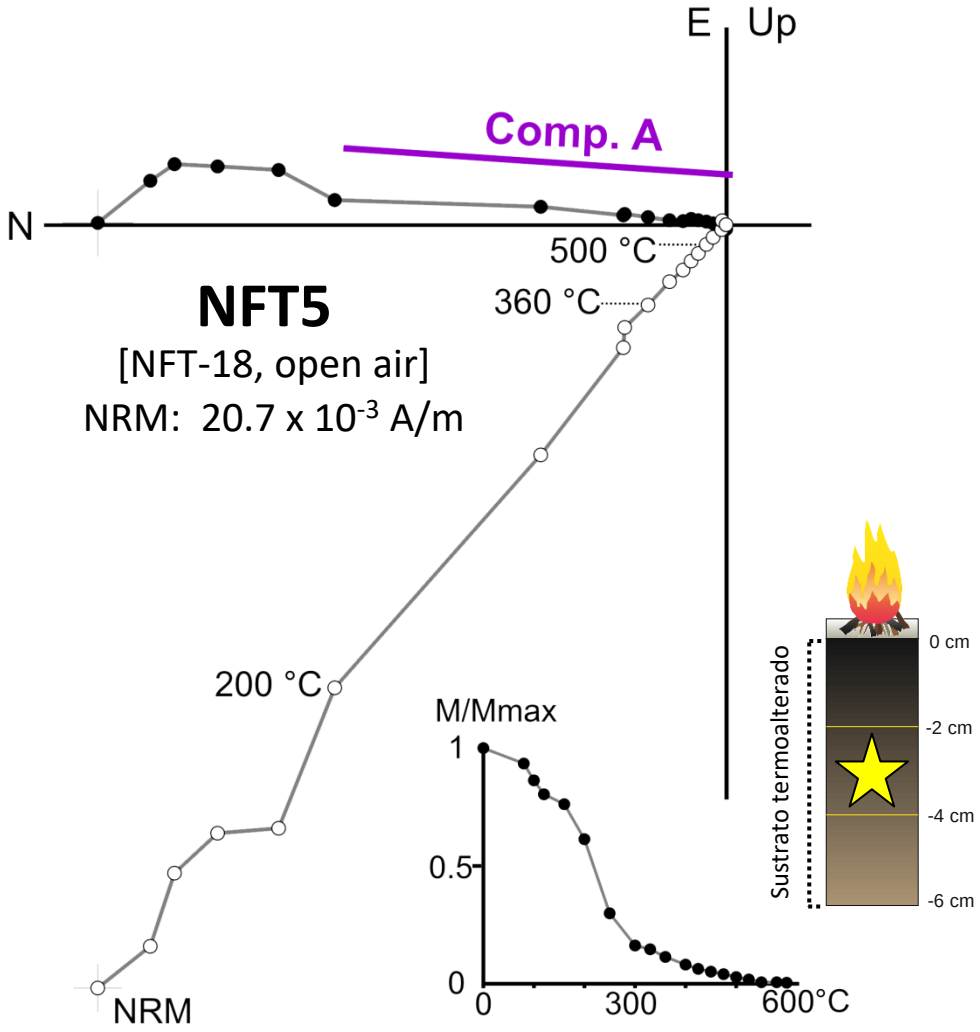


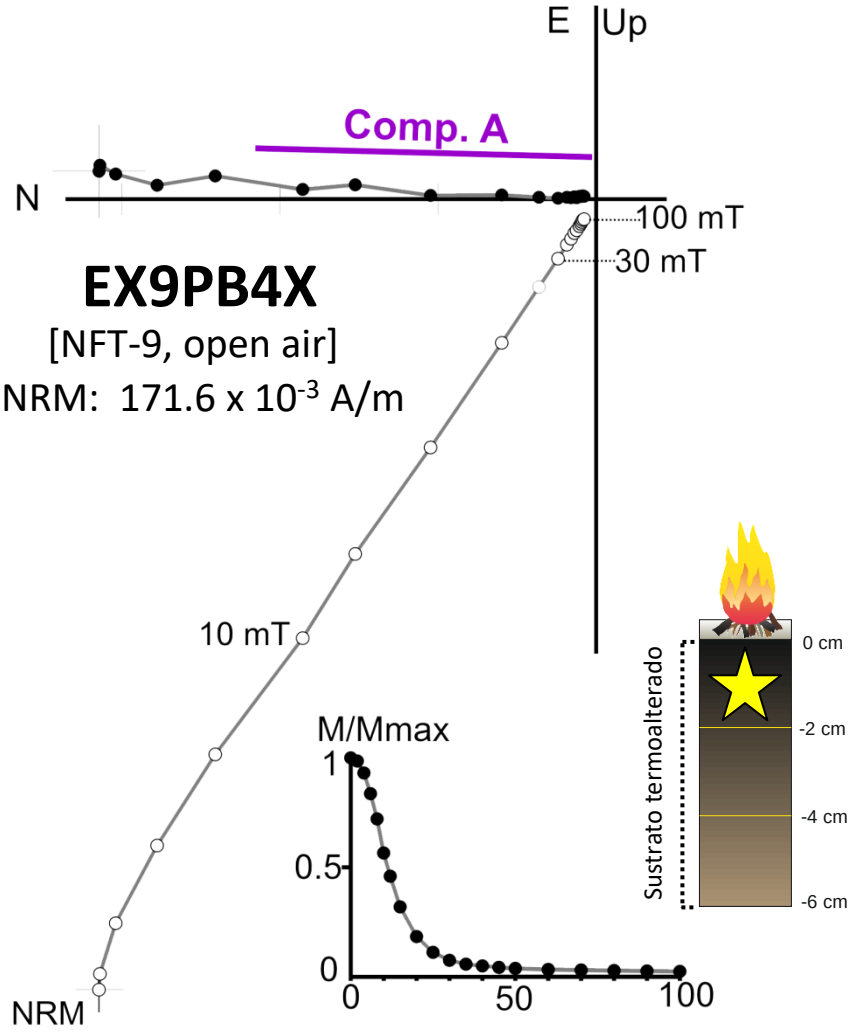
- Main carrier of the remanente → magnetite

- Three directional behaviors:

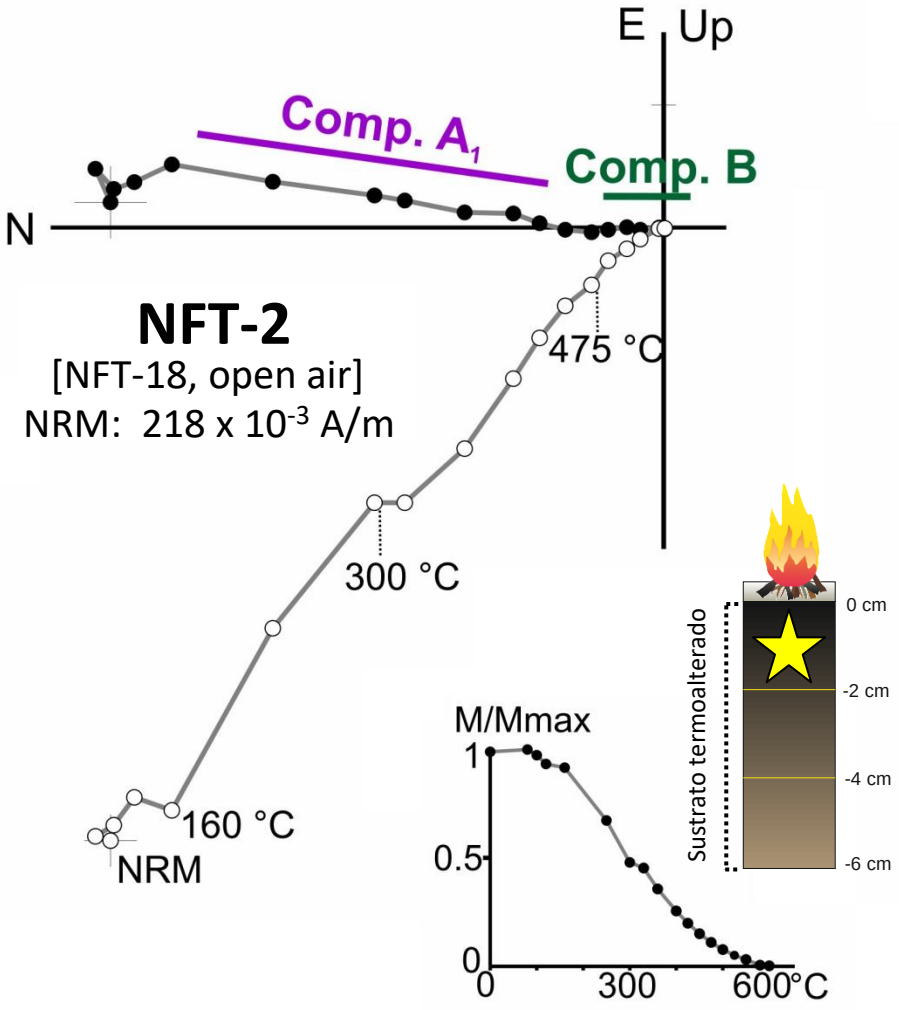
1) A single component

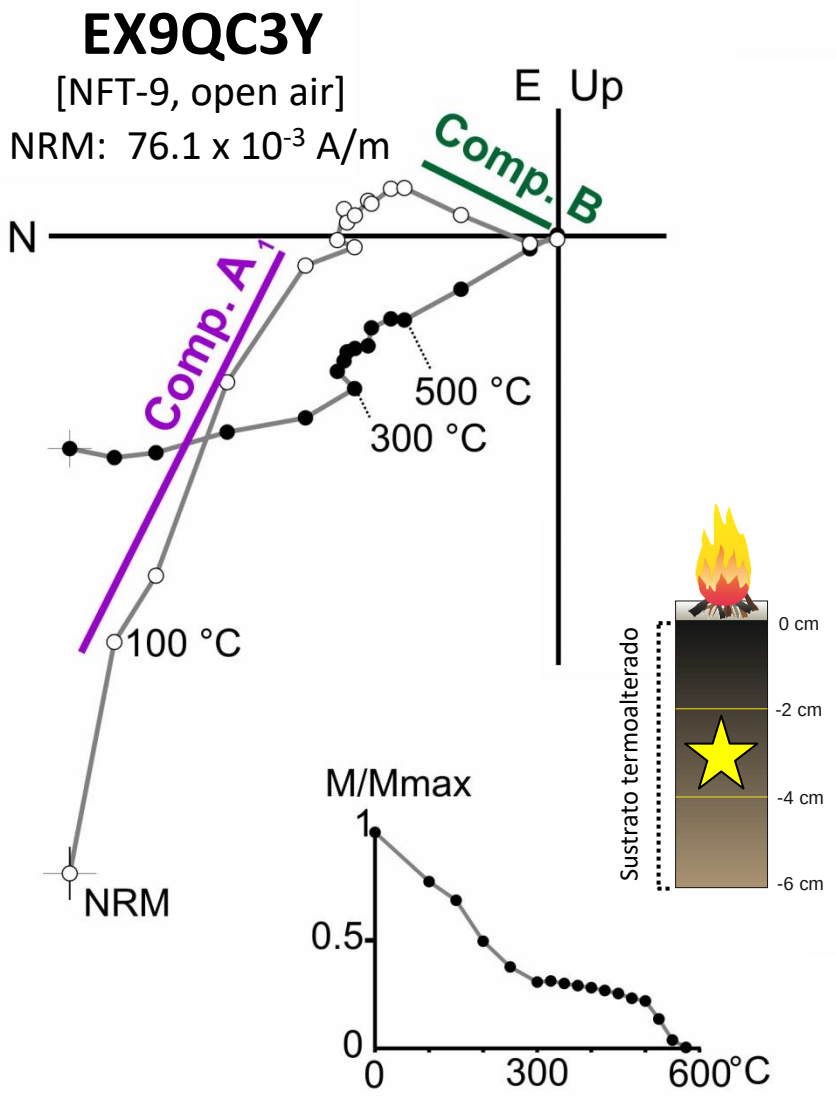
(TRM/TCRM)





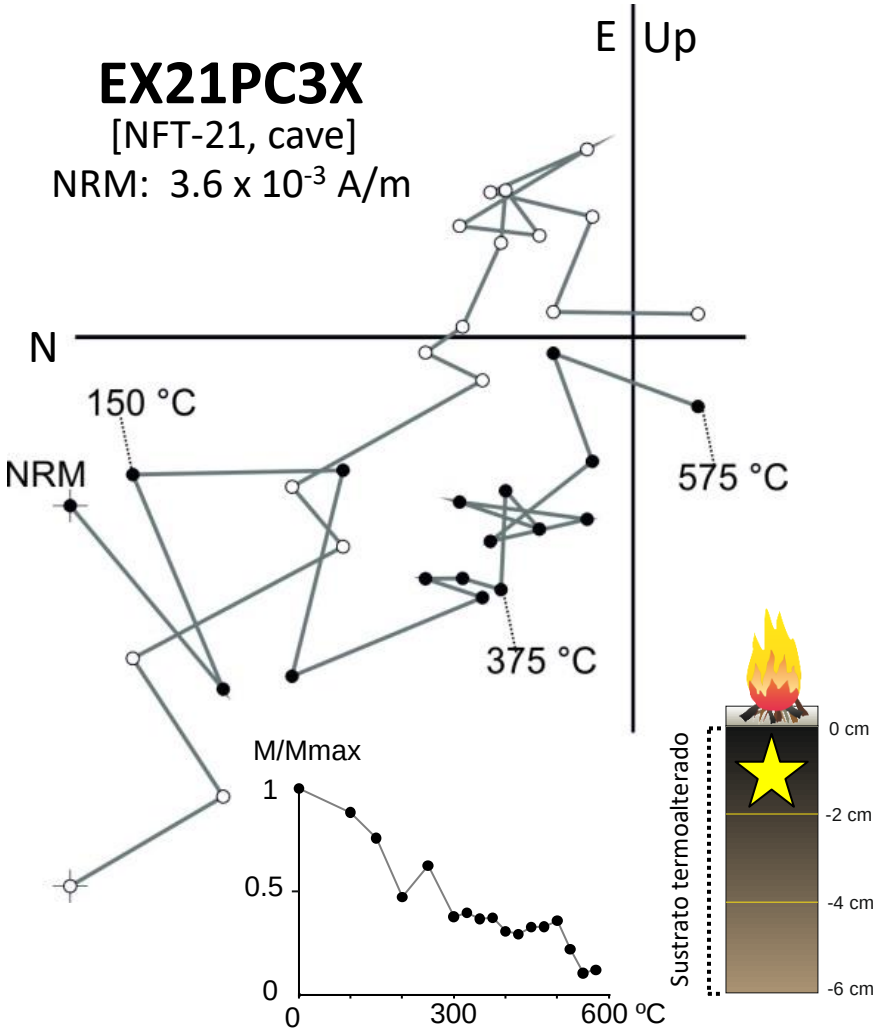
2) Two components
(pTRM)

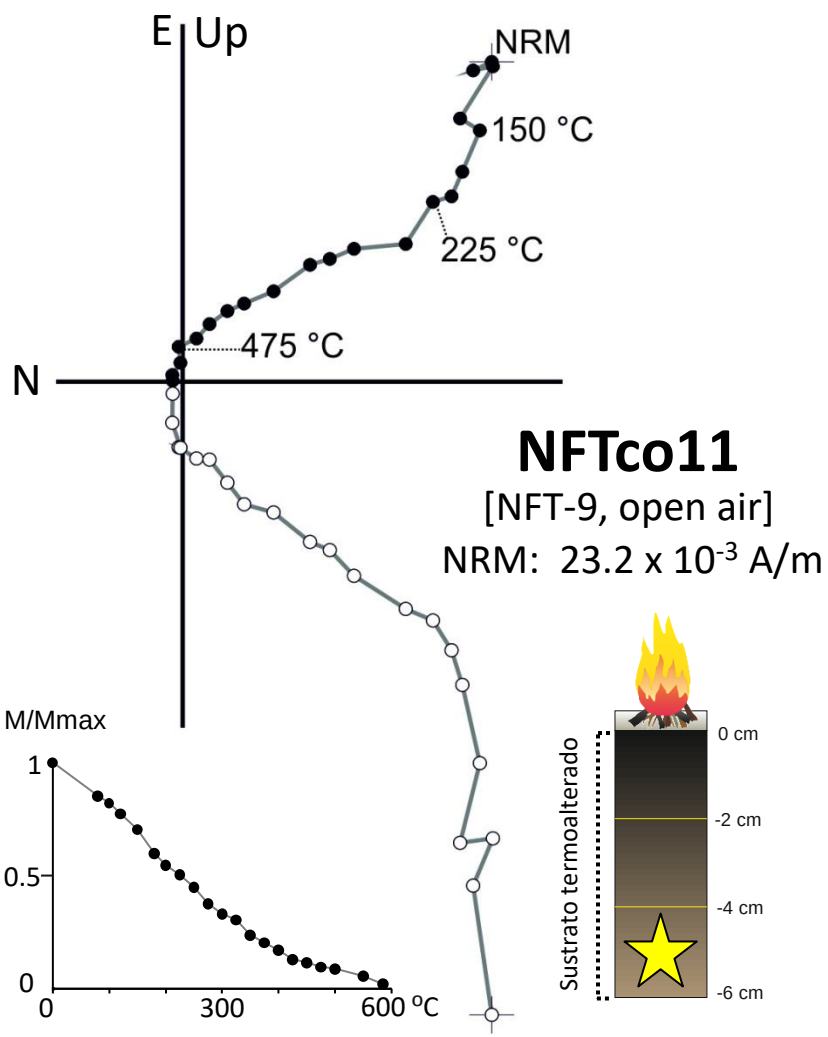


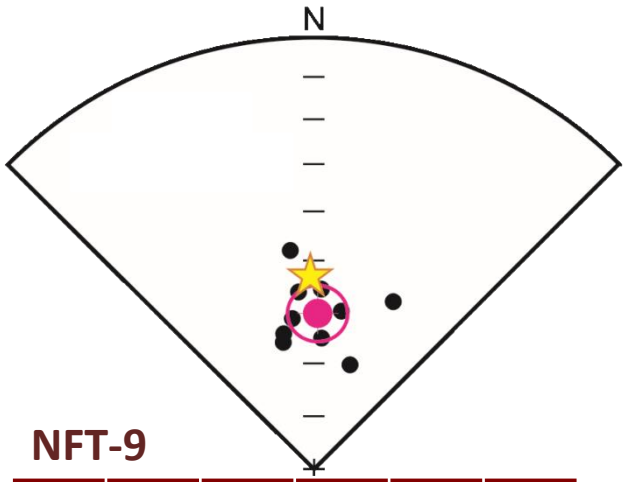


3) Erratic diagrams, with anomalous directions and/or low NRM intensity

(mechanic post-combustion processe/low thermal impact)

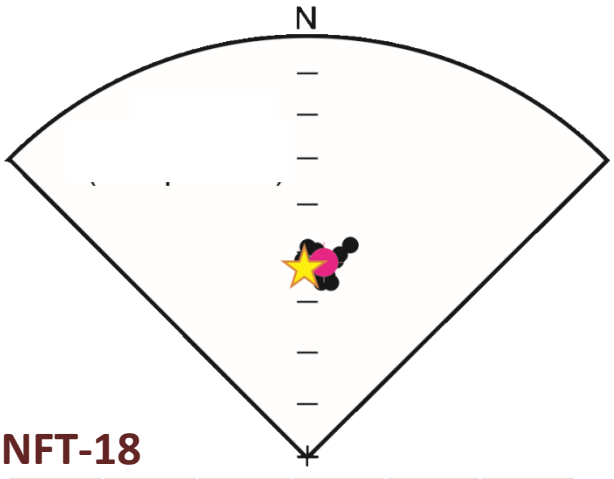






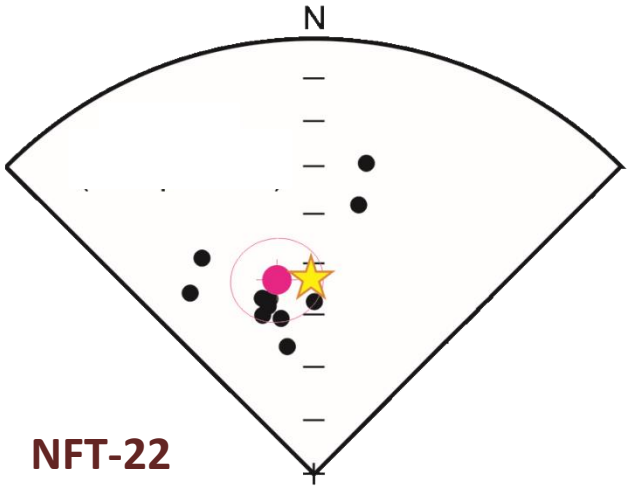
NFT-9

N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
10/14	1.4	60.4	79.5	5.5	7.3



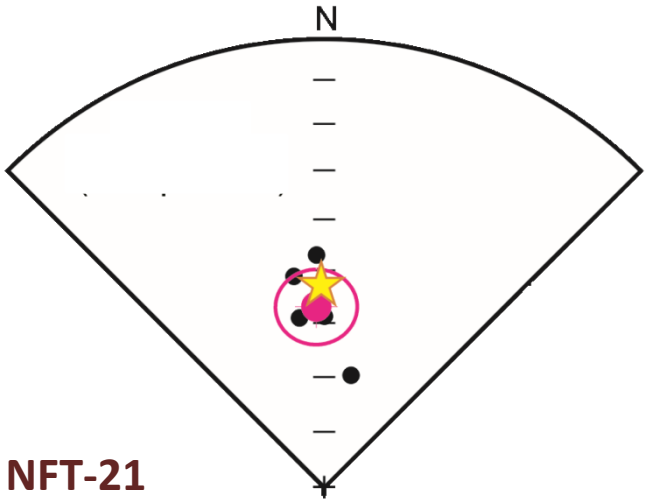
NFT-18

N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
14/15	4.8	51.9	565.3	1.7	3.6



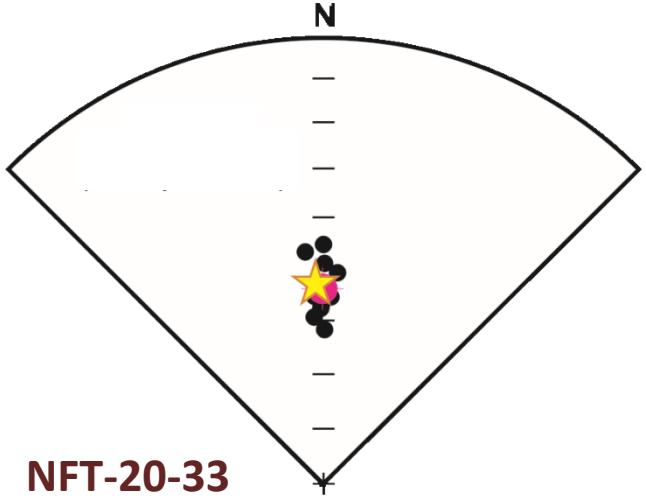
NFT-22

N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
11/15	349.2	52.6	31.8	8.2	6.1



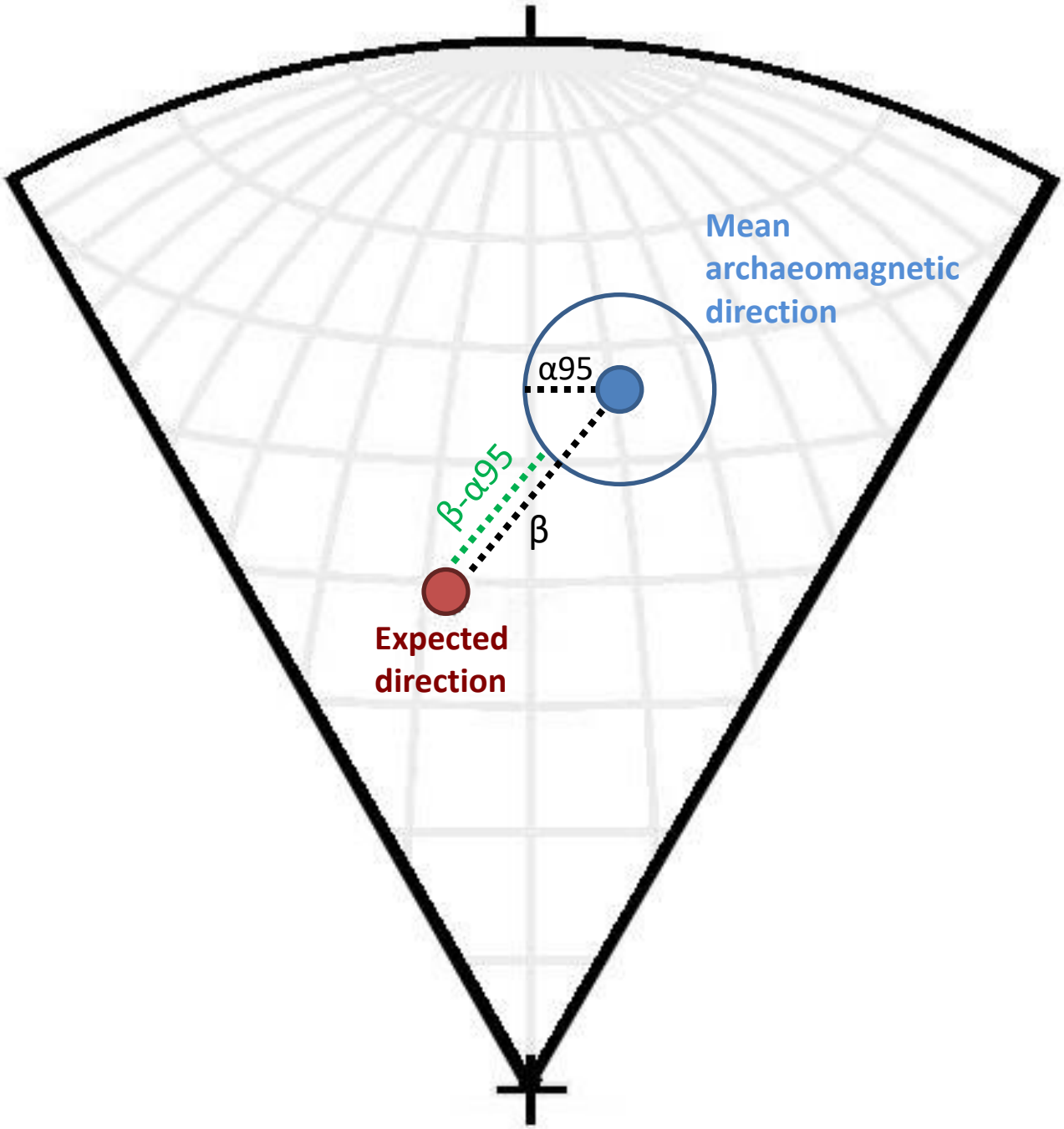
NFT-21

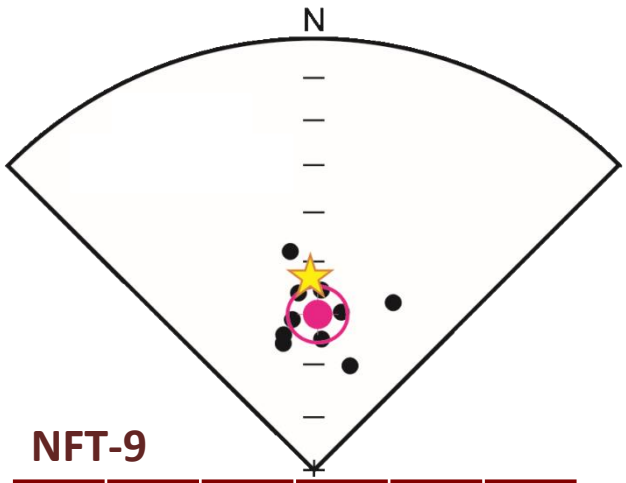
N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
6/11	357.5	56.9	89.4	7.1	3.8



NFT-20-33

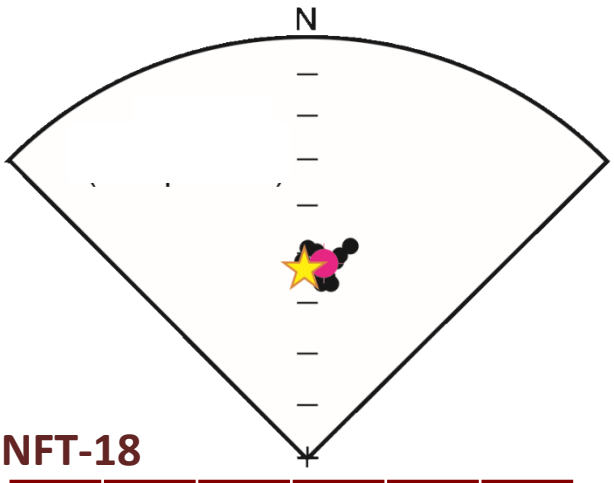
N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
14/17	359.7	53.9	288.1	2.3	0.6


Mean
archaeomagnetic
direction
α95
β-α95
β
Expected
direction



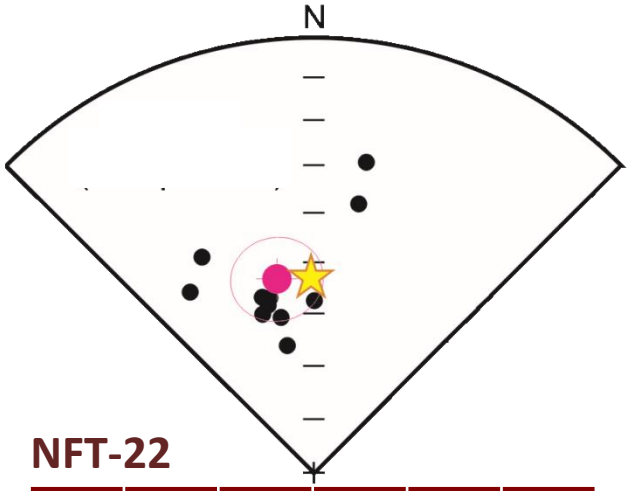
NFT-9

N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
10/14	1.4	60.4	79.5	5.5	7.3



NFT-18

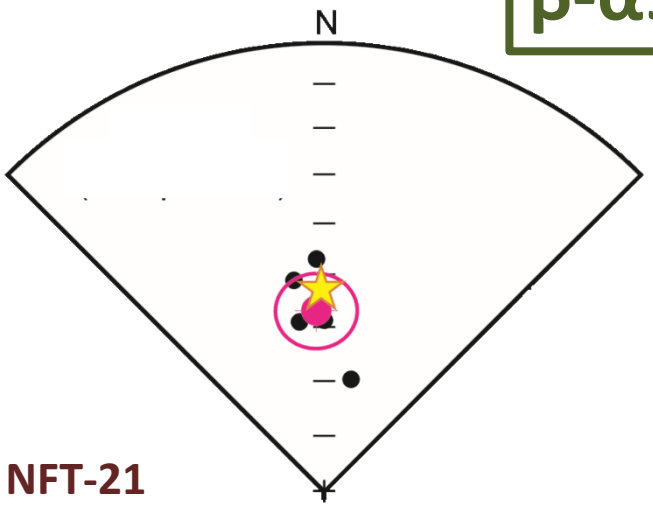
N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
14/15	4.8	51.9	565.3	1.7	3.6



NFT-22

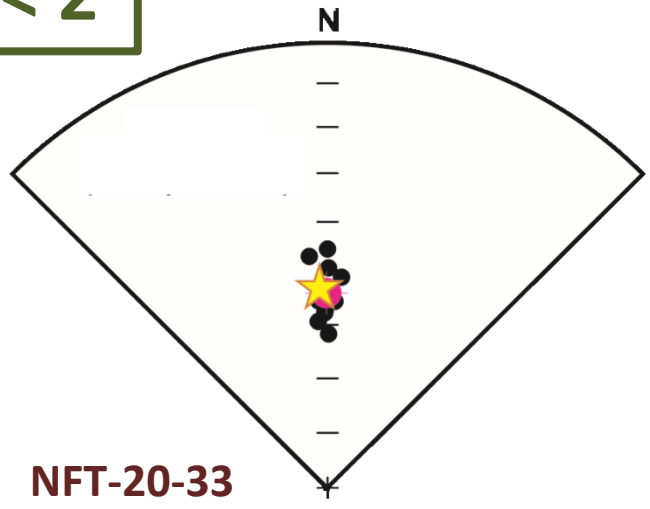
N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
11/15	349.2	52.6	31.8	8.2	6.1

β-α95 < 2



NFT-21

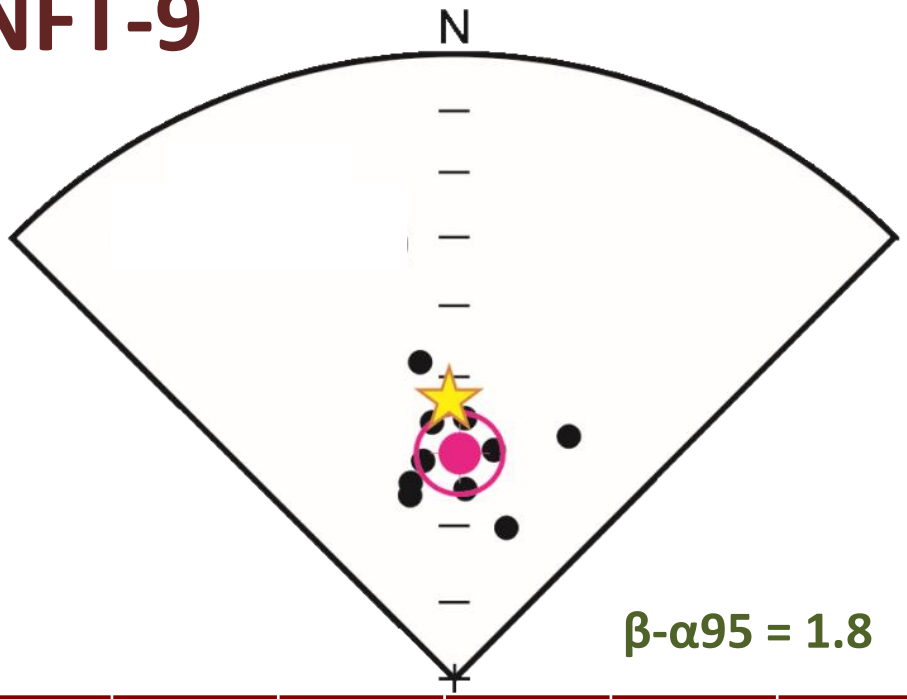
N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
6/11	357.5	56.9	89.4	7.1	3.8



NFT-20-33

N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
14/17	359.7	53.9	288.1	2.3	0.6

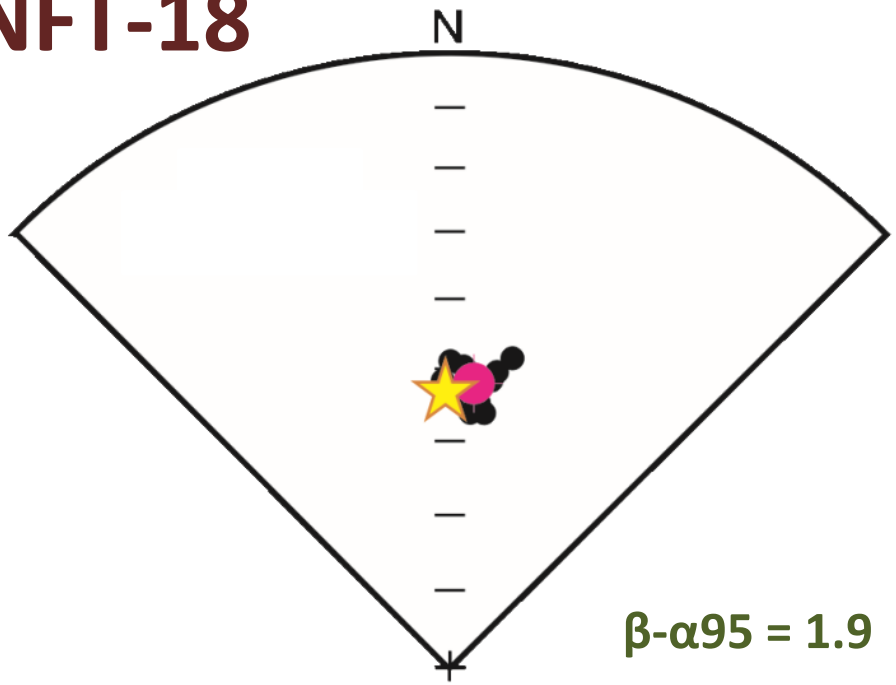
NFT-9



β-α95 = 1.8

N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
10/14	1.4	60.4	79.5	5.5	7.3

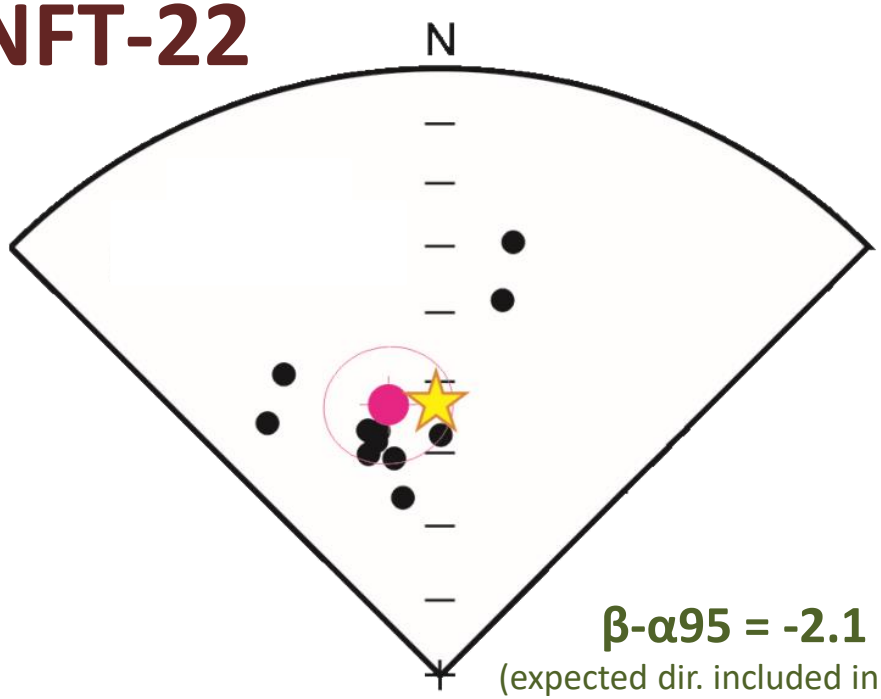
NFT-18



β-α95 = 1.9

N/N’	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
14/15	4.8	51.9	565.3	1.7	3.6

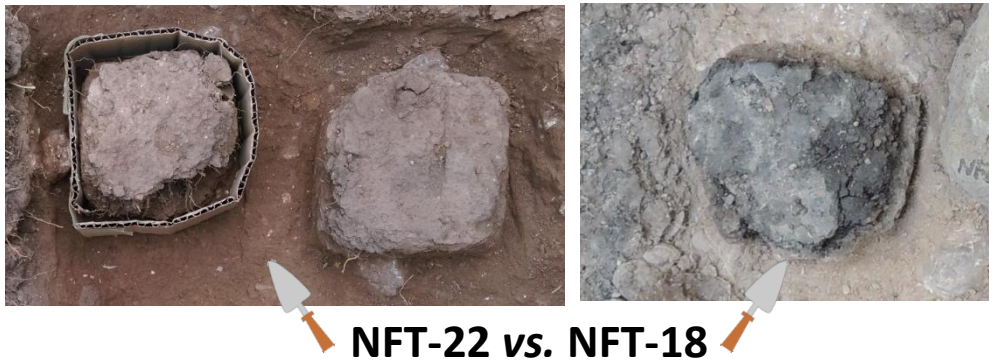
NFT-22



β-α95 = -2.1

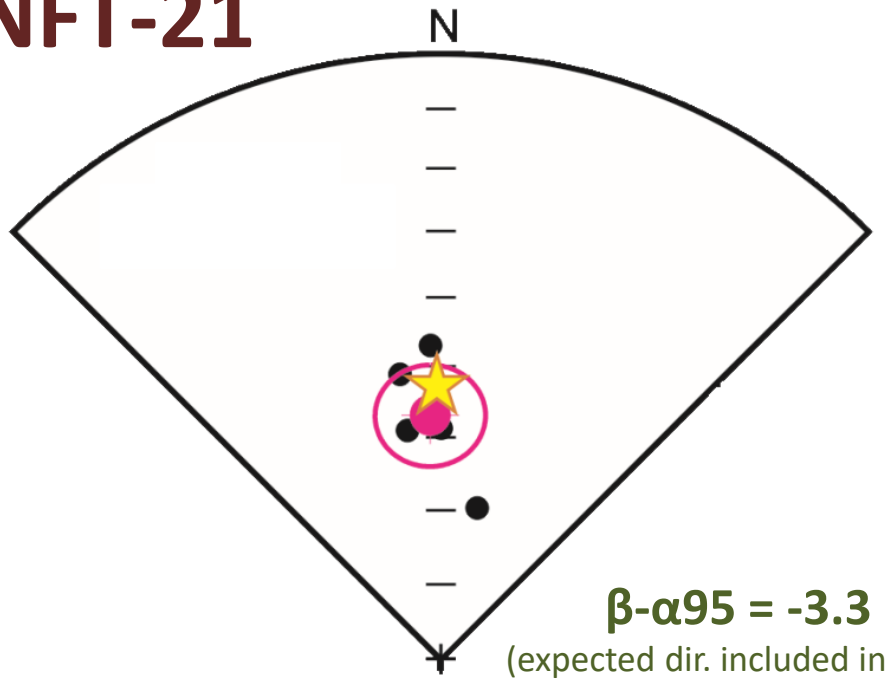
(expected dir. included in α95)

N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
11/15	349.2	52.6	31.8	8.2	6.1



NFT-22 *vs.* NFT-18

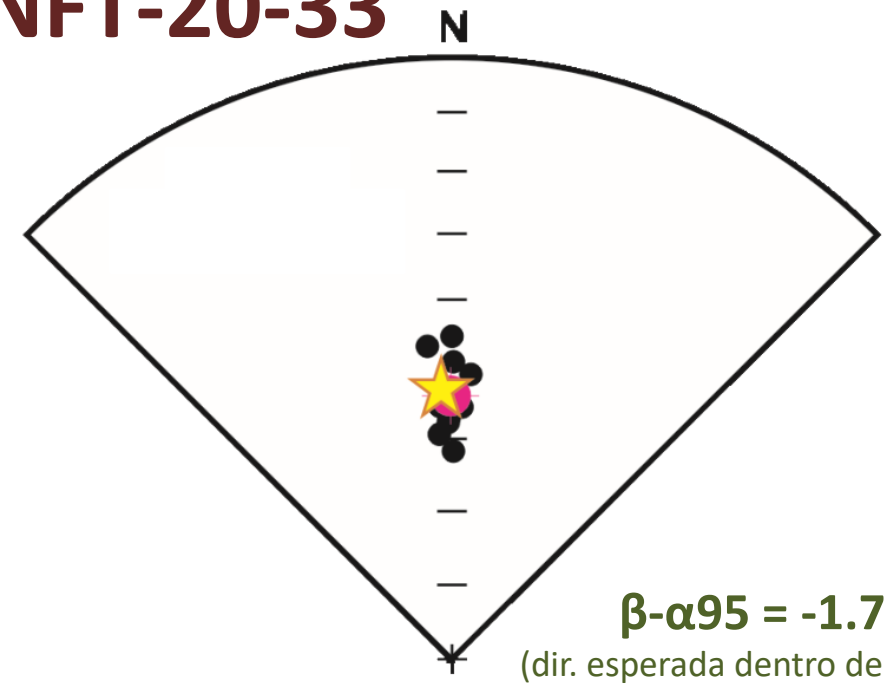
NFT-21



β-α95 = -3.3
(expected dir. included in α95)

N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
6/11	357.5	56.9	89.4	7.1	3.8

NFT-20-33

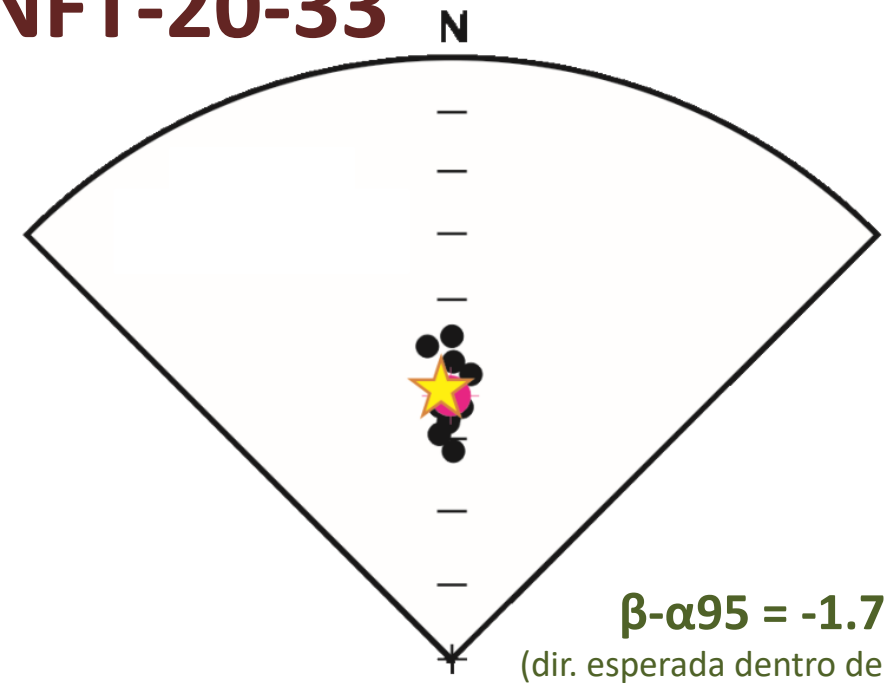


β-α95 = -1.7
(dir. esperada dentro de α95)

N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
14/17	359.7	53.9	288.1	2.3	0.6

NFT-20
(2010)

NFT-20-33

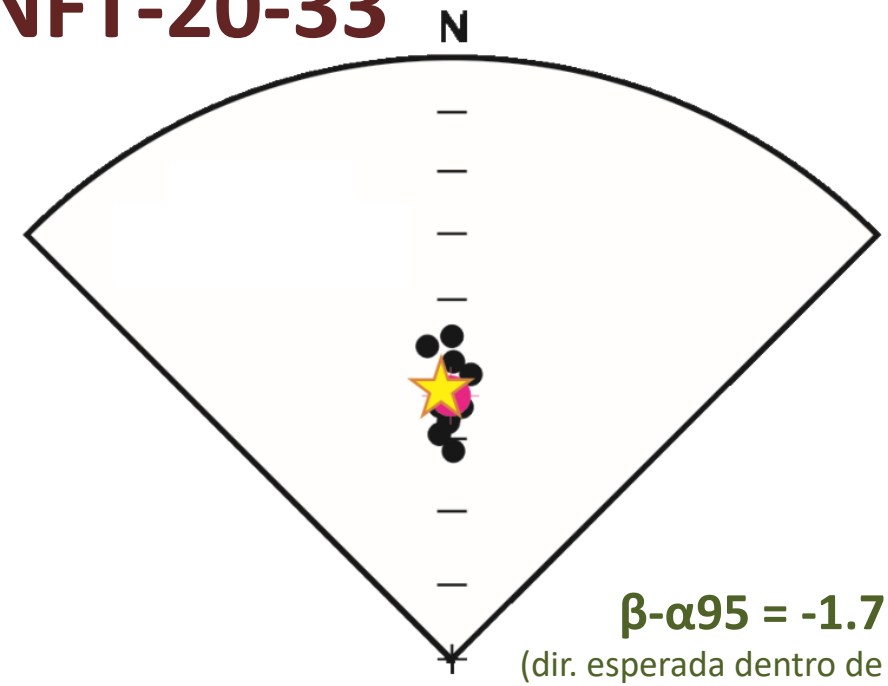


β-α95 = -1.7
(dir. esperada dentro de α95)

N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
14/17	359.7	53.9	288.1	2.3	0.6

Abandoned during 3 years

NFT-20-33



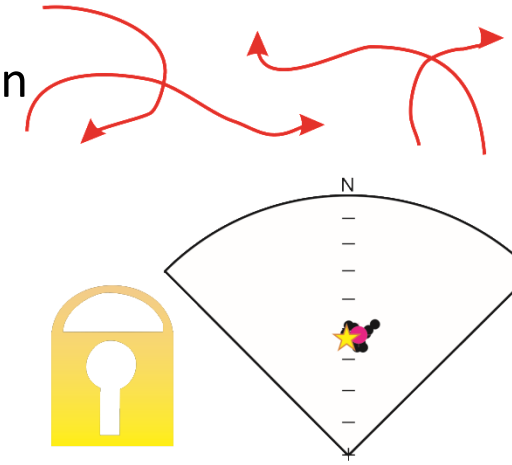
β-α95 = -1.7
(dir. esperada dentro de α95)

N/N'	Dec. (°)	Inc. (°)	*k*	α95 (°)	β
14/17	359.7	53.9	288.1	2.3	0.6

NFT-33
(2013)

Conclusiones

- In this context, ashes are problematic in order to obtein directional data.



- However, thermoaltered substrate exhibits a good directional record.

- It is very important to take into account the studied facies and the type of substrate above which the fire was carried out.

- There is a correlation between the preservation of the combustion structures and the quality of the directional data.

Thanks for your attention!

Acknowledgements:

Special thanks are given to all the people who collaborated in the performance and excavation of the experimental fires.

This work has been possible due to the support of The Leakey Foundation ("Neandertal Fire Technology Project"), the JCYL-ESF predoctoral grant of the first author, the JCYL-EFRD project BU235P18 and the MINECO-EFRD projects HAR2015-68321-P and CGL2016-77560, as well as the ERC Consolidator Grant project PALEOCHAR (648871)

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