*April 2010, AAPA meeting*

*session 42: Computational methods for the automated analysis of virtual hominid endocasts*

# *Endocranial shape asymmetries in hominids, including fossil hominins and extant hominids, assessed via skull based landmark analysis of 3D reconstructions from CT images*

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## Material

110 skulls of extant great apes – adult and wild specimens -:

36 *Pan paniscus* (17 males and 19 females), 36 *Pan troglodytes* (17/19), 38 *Gorilla gorilla* (18/20)

45 extant anatomically modern humans (20 males and 20 females)

21 fossil anatomically modern humans:

Cro Magnon 1, 3, Mladeč 1; Pataud, Rochereil, Nazlet Khater 2, Skhul 5, Song Terus, Téviec 8, 9, 16, Afalou Bou Rhummel and Taforalt (N=10)

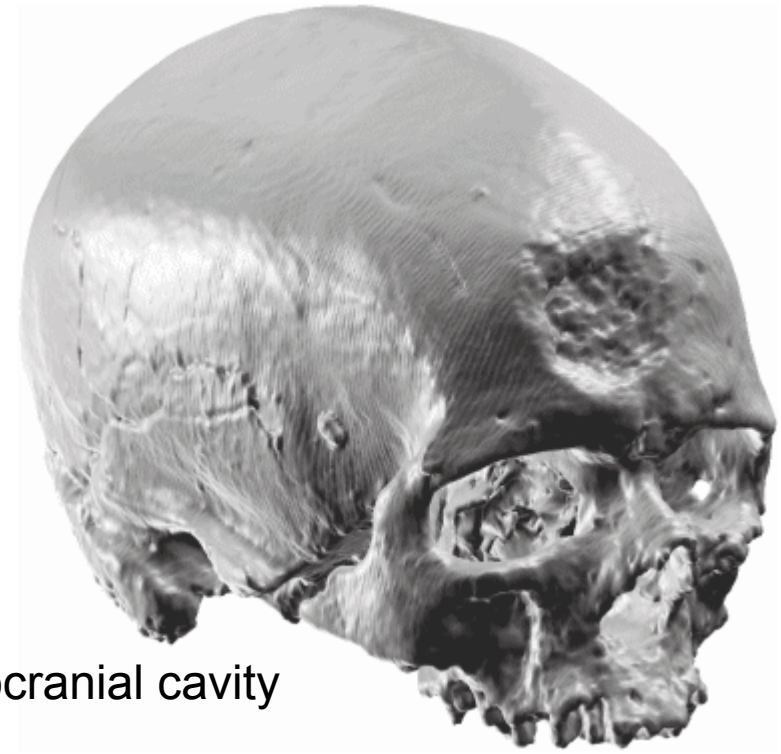
23 fossil hominins:

Sts 5, KNM-WT 17000, KNM-ER 1813, 3733, 3883, OH 9, Broken Hill, LH 18,

Ngandong 1, 7, 12, Sambungmacan 3, Ngawi, Liang Bua 1,

Petralona, Gibraltar 1, Guattari, La Chapelle-aux-Saints,

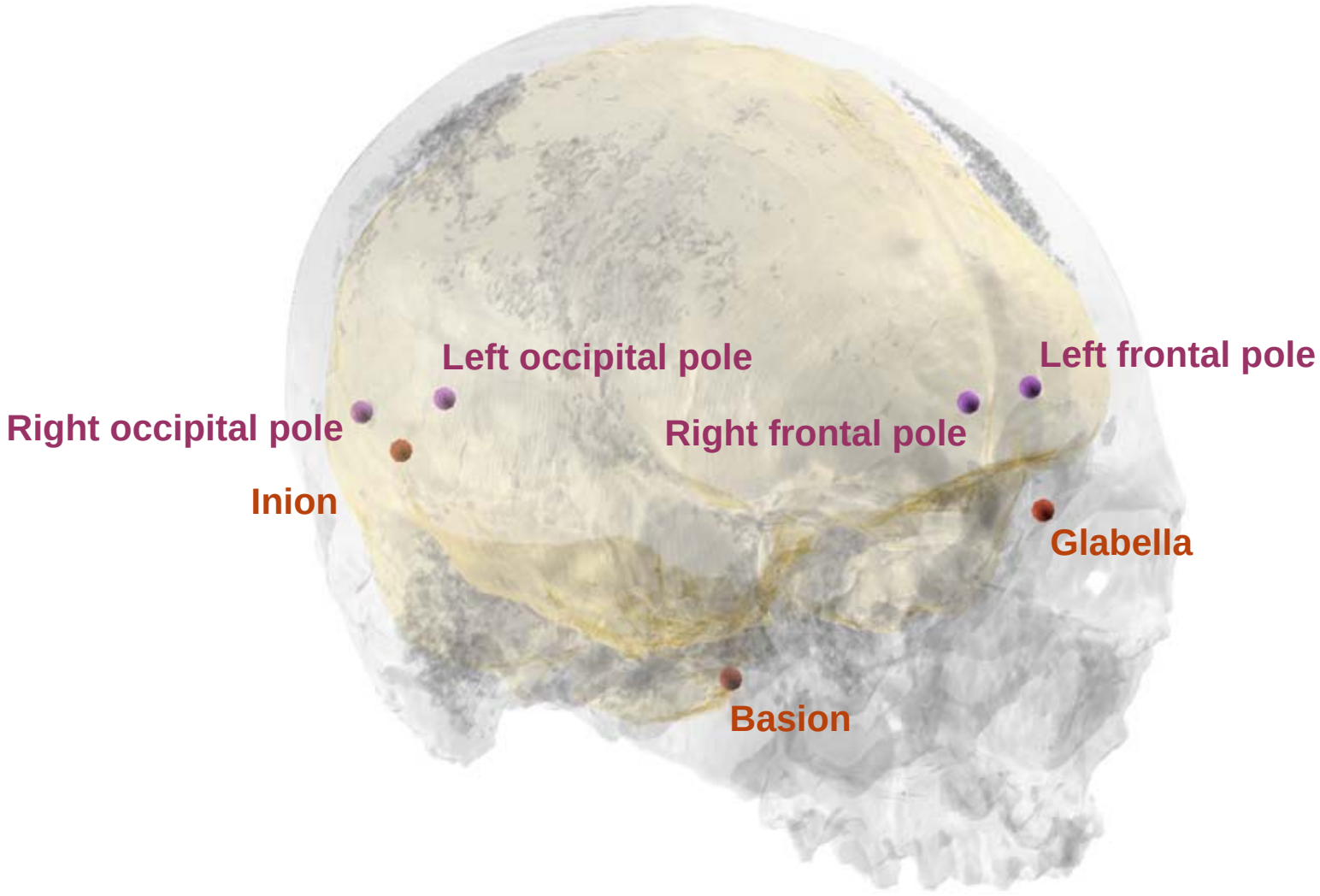
Saccopastore 1, La Ferrassie 1, La Quina H5, Spy 1 and 10

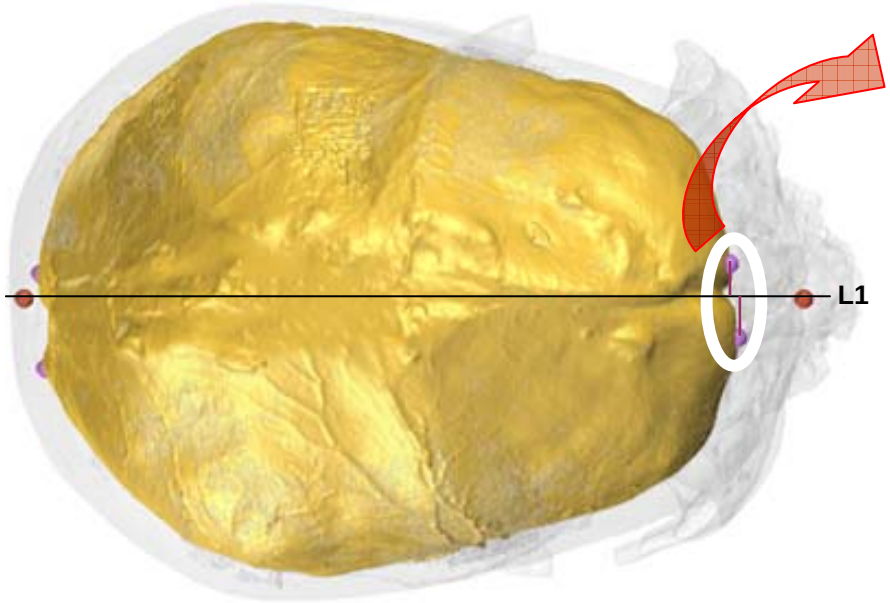


CT data of the original specimens

3D models, skull and endocranial cavity

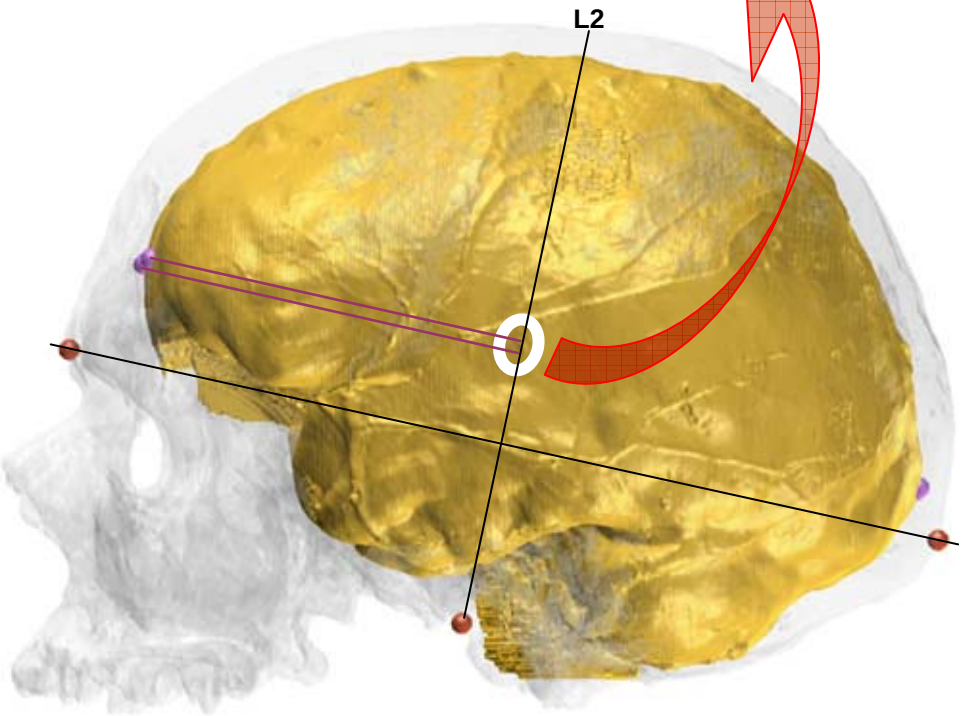
# Methods

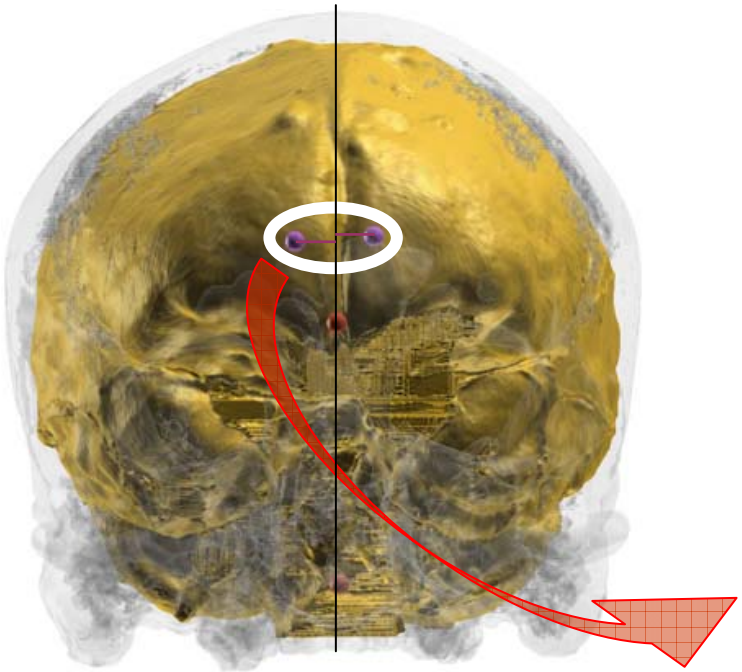

Left occipital pole
Left frontal pole
Right occipital pole
Right frontal pole
Inion
Glabella
Basion




(R-L) projections on L1:
AP component of the frontal petalia

(R-L) projections on L2:
Vertical component of the frontal petalia



(R-L) distance to the plane L1-L2:
Lateral component of the frontal petalia

# Results

## Preliminary questions

Validity of the analytical protocol demonstrated (Balzeau and Gilissen, J. Hum. Evol. *in press*)

Sexual dimorphism? Non significant for the different samples

Does the size matter?

significant correlation with EV only for LAT Fal in *Homo sapiens* ($p<0.05$)

But, all variables for the complete hominid sample ($p<0.001$)

## Comparisons of the complete multivariate dataset

Extant / fossil AMH are not different (Hotelling's T-squared, $p = 0.2365$)
AMH (extant and fossil) / fossil hominins ($p = 0.1546$)
Great apes / whole hominin sample significantly different ($p = 0.0015$)

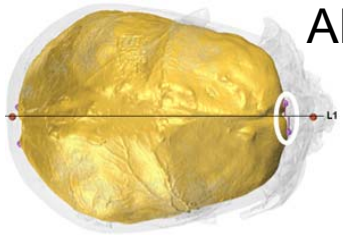
Asymmetry in an individual FA11: $(Ai) = \Sigma|R-L|$ for all traits, the index for a sample is $\Sigma Ai/N$

Anatomically modern humans = 17 ( = 19.2 mm)
Fossil hominins = 15.2 ( = 15 mm)
Great apes = 12.8 ( = 9 mm)

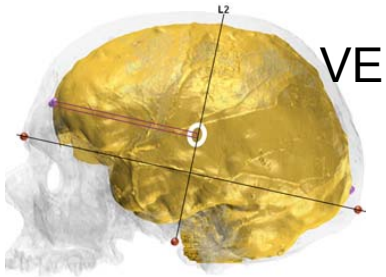
FRONTAL ASYMMETRIES

OCCIPITAL ASYMMETRIES

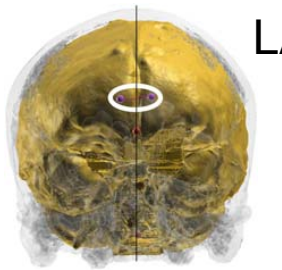
AP

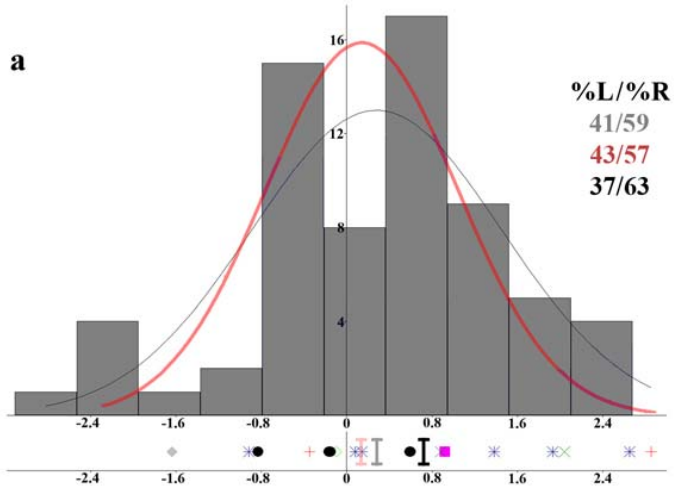


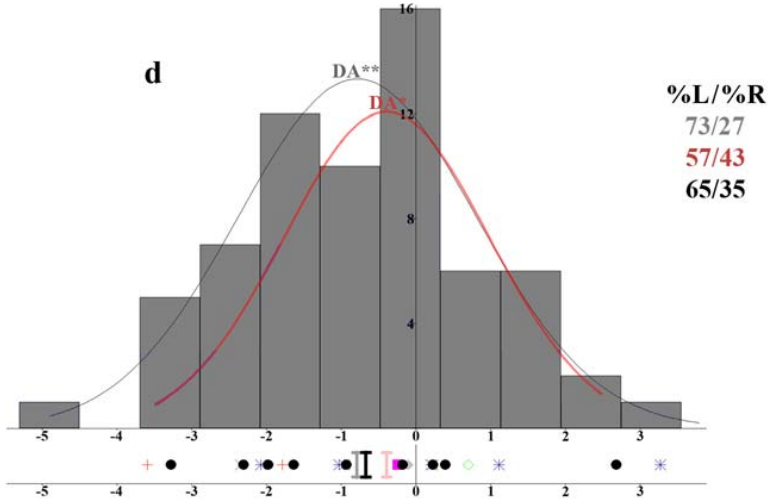

VERT

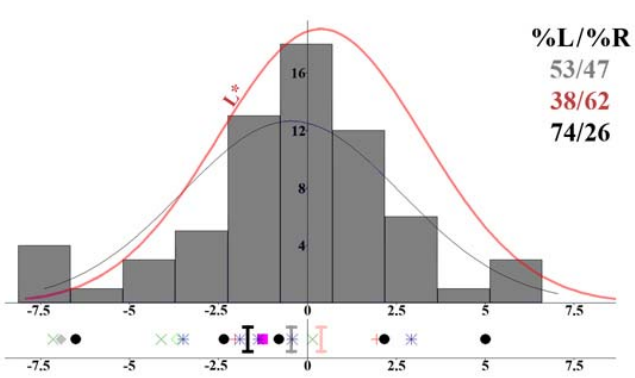


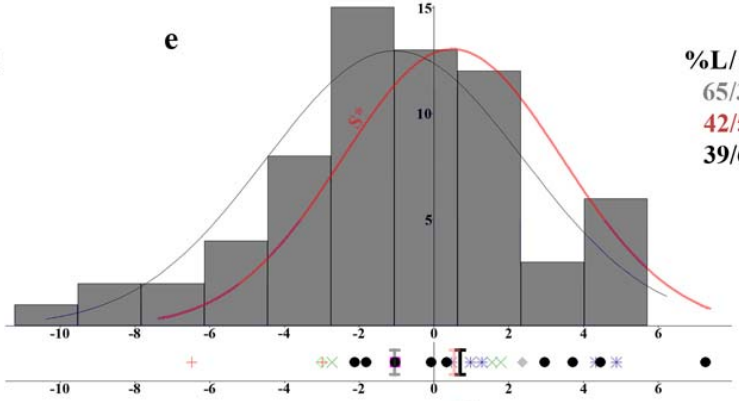

LAT

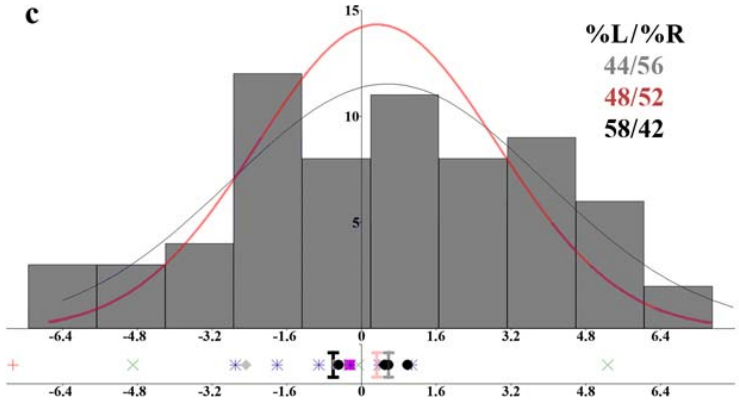


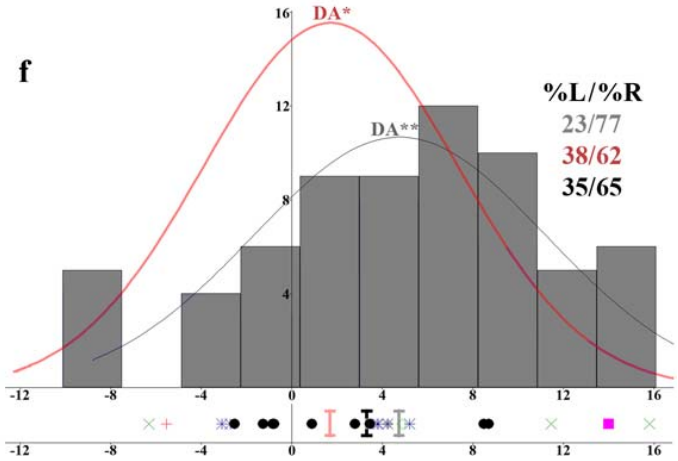


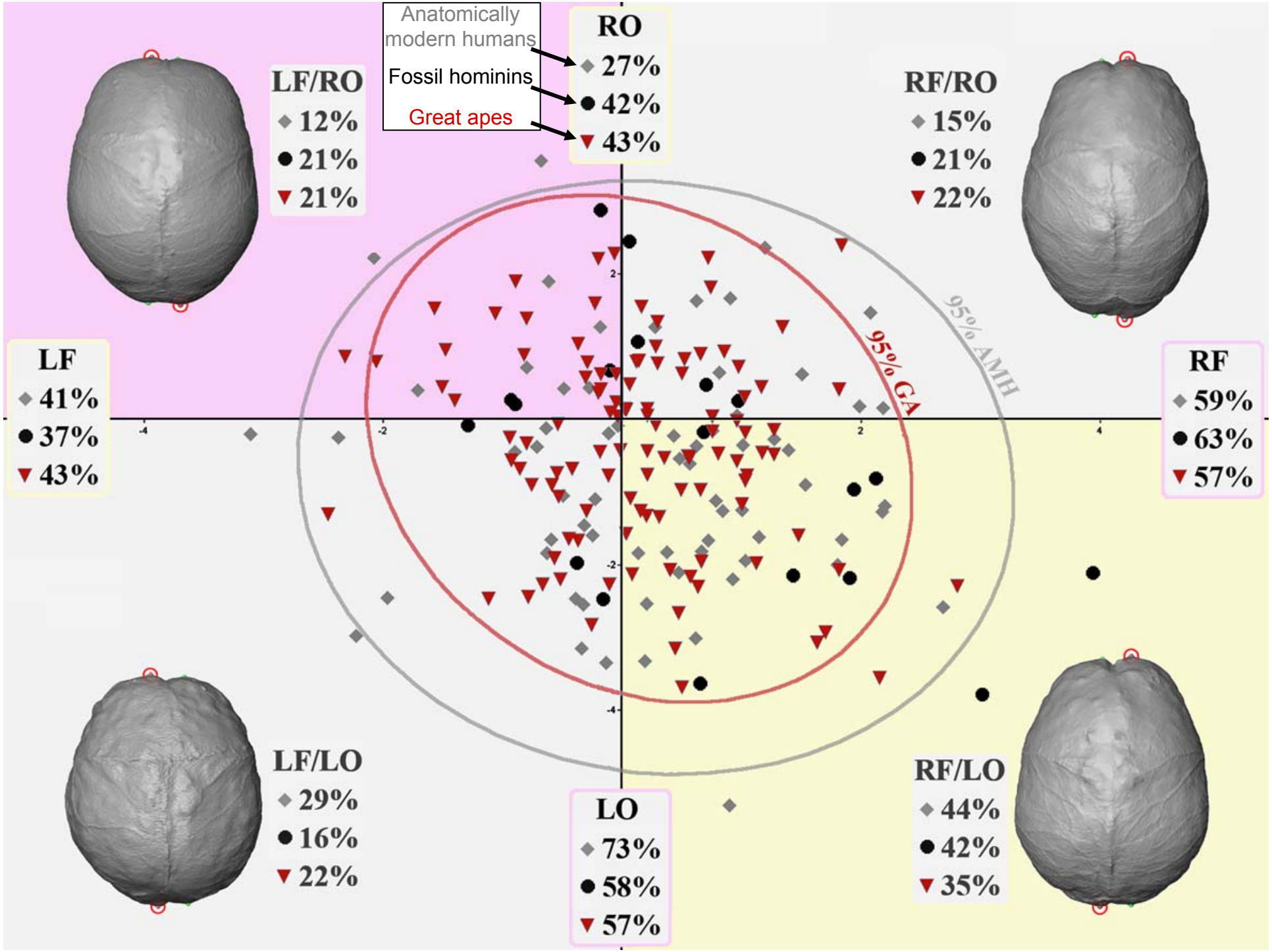




Anatomically modern humans
Fossil hominins
Great apes
RO
27%
42%
43%
LF/RO
12%
21%
21%
RF/RO
15%
21%
22%
LF
41%
37%
43%
RF
59%
63%
57%
LF/LO
29%
16%
22%
LO
73%
58%
57%
RF/LO
44%
42%
35%
95% GA
95% AMH

## Synthesis and conclusions

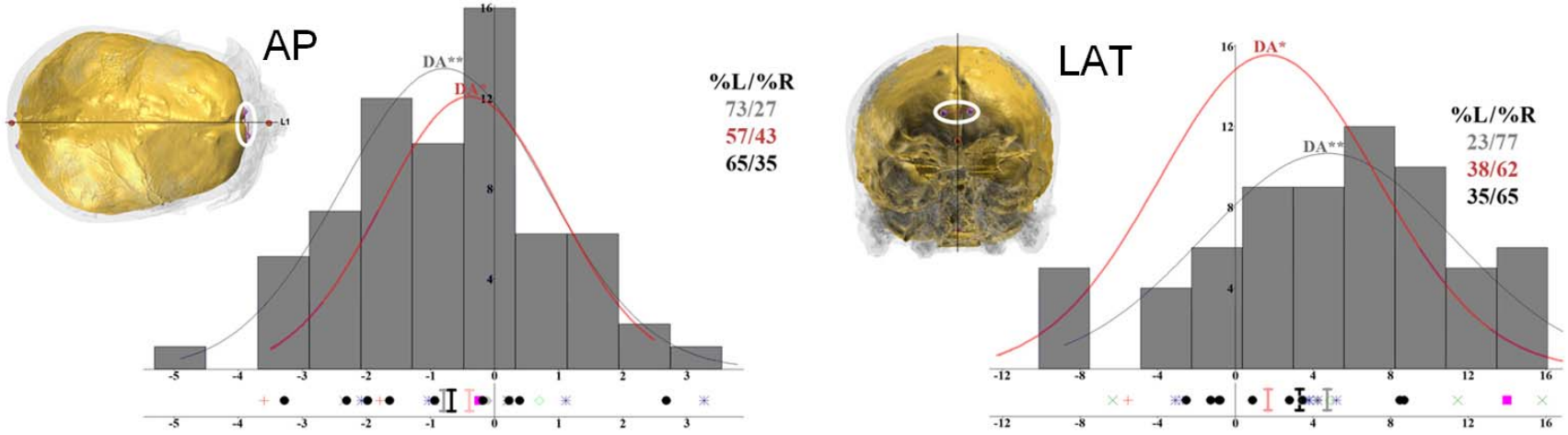
1- Fossil Hominins

Larger samples are necessary, but are closer to AMH than to GA

2- Common pattern of endocranial shape asymmetries in hominids

Similarities and differences

Presence of DA for the AP and lateral components of the occipital petalia !




Implications for the discussion of the possible relationships between AP petalias in hominins and functional or behavioural capacities

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