Supplementary Discussion 3. Cladistic Relationships

We began examination of the phylogenetic hypotheses described in the text by first investigating the cladistic relationships among the OTUs under consideration: Ardipithecus ramidus, Australopithecus anamensis (previously described Kenyan hypodigm), Au. afarensis, and the Assa Issie/Aramis/Hana Hari series described in this paper.

We started our analysis by enlisting those morphological features that have been considered the most significant in the phylogenetic placement of Ar. ramidus, and therefore used in the diagnosis of that taxon (White et al., 1994, 1995). The validity of these features in the recognition of Ar. ramidus has recently been corroborated by the Gona hominids (Semaw et al., 2005).

For the "outgroup OTU", we used the combined modern and fossil ape taxonomic composition that formed the comparative basis of the White et al. (1994) diagnosis. The recently announced late Miocene hominid taxa, Orrorin tugenensis, Ardipithecus kadabba, and Sahelanthropus tchadensis, were tentatively included in the analysis as an additional outgroup OTU. However, we treated these as a single combined OTU, because information available for these proposed late Miocene taxa is limited and is insufficient for conclusive taxonomic evaluation (Haile Selassie et al., 2004).

The results are presented in the character matrix and cladogram below: 1) Au. anamensis and Au. afarensis are sister taxa to the exclusion of Ar. ramidus (as concluded by Ward et al., 2001), 2) the Assa Issie/Aramis/Han Hari series of the present study are broadly comparable to Au. anamensis in diagnostically important features, and 3) Ar. ramidus and Australopithecus species are sister taxa.

CHARACTERS USED IN THE ANALYSIS:

Shared derived features of Australopithecus and Ar. ramidus (from White et al., 1994)

A) canine more incisiform with short crown and higher shoulders
B) lower canine with cupped distal wear
C) lower P3 relatively smaller
D) lower P3 with weak mesiobuccal basal projection, lacks functional honing
E) lower molars relatively broader
F) foramen magnum relatively anteriorly placed

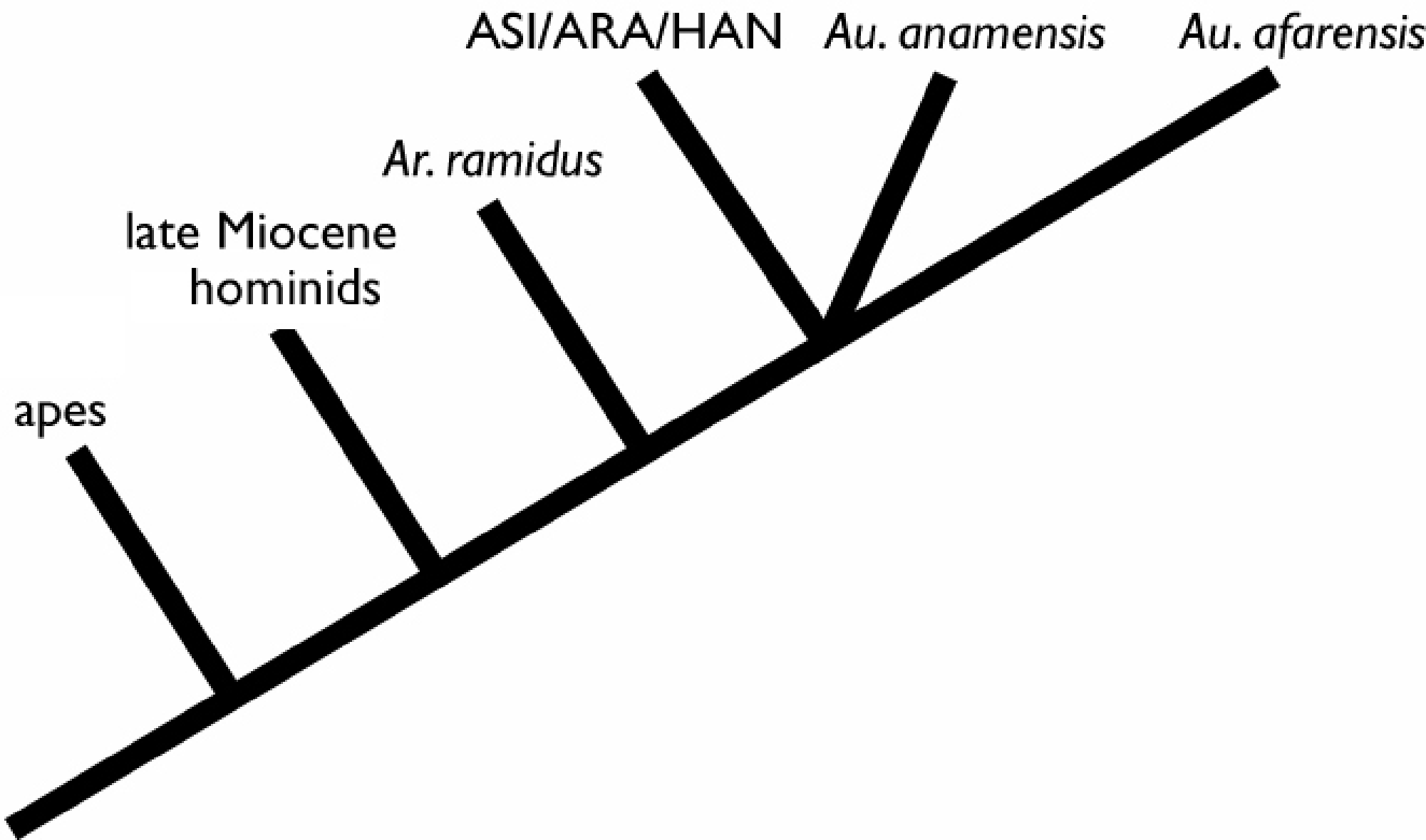
Derived features of Australopithecus species (from White et al., 1994, 1995)

G) canines smaller relative to postcanine teeth
H) lower dm1 broader with relatively smaller protoconid, larger more mesially placed metaconid and developed anterior fovea, larger higher talonid
I) temporomandibular joint with defined articular eminence
J) thicker canine enamel
K) thicker molar enamel
L) lower P3 less asymmetric, protoconid not as dominant and tall, transverse crest more transverse
M) upper P3 less asymmetric with less dominant buccal cusp
N) postcanine teeth more megadont

Character	ape	late Miocene hominids	Ar. ramidus	ASI/ARA/HAN	Au. anamensis	Au. afarensis	
A	0	0/1	1	2	2	3	note 1
B	0	?	1	-	2	2	note 2
C	0	-	1	-	1	1	
D and L	0	0/1	1	-	2	3	
E	0	1	1	-	1	1	
F	0	1	1	-	-	1	
G	0	0	0	1	1	2	
H	0	-	0	-	1	2	
I	0	0	0	-	0/1	1	note 3
J	0	0	0	1	1	1	
K	0-2	0	0	1	1	2	note 4
M	0	0	0	1	1	1/2	note 5
N	0-2	0	0	1	1	1	note 6

"Ape" refers to the combined modern/fossil ape condition as outlined above.
0, primitive condition; 1, 2, and 3 represent increasingly derived conditions; 0/1 and 1/2 notations indicate intermediate conditions. For the purposes of this study, among-taxa variations of the OTUs coded as "0" were not considered.
note 1: canine morphology is discussed in the text.
note 2: canine wear is variable, but Au. afarensis and Au. anamensis canines tend to wear more flat.
note 3: gorillas have weak but distinct temporomandibular eminence.
note 4: molar enamel thickness is variable among apes.
note 5: Ouranopithecus has a derived upper P3 morphology.
note 6: coding is absolute postcanine size.

The analysis of this matrix was run on PAUP 4.0β10 (Swofford, D. L. 1998. PAUP*. Phylogenetic Analysis Using Parsimony (*and other methods). Sunderland, MA). The characters were ordered, and we performed a branch-and-bound search. Three most parsimonious trees of 29 steps were obtained, with consistency and retention indices of 1.00. The consensus of these most parsimonious trees is given below.


ASI/ARA/HAN
Au. anamensis
Au. afarensis
Ar. ramidus
late Miocene
hominids
apes