Phylogeny and the dispersal of \textit{Homo}

David S. Strait, U Albany
Biogeography

The study of how and why organisms are distributed across the landscape
Darwin’s voyage to the Galapagos Islands
Darwin's Finches

- Small ground finch: *Geospiza fuliginosa*
- Medium ground finch: *Geospiza fortis*
- Large ground finch: *Geospiza magnirostris*
- Cactus finch: *Geospiza scandens*
- Large cactus finch (Genovesa): *Geospiza conirostris*
- Large cactus finch (Española): *Geospiza conirostris*
- Sharp-beaked ground finch: *Geospiza difficilis*
- Small tree finch: *Camarhynchus parvulus*
- Large tree finch: *Camarhynchus psittacula*
- Woodpecker finch: *Cactospiza pallidus*
- Vegetarian finch: *PlatyptILA crassirostris*
- Warbler finch: *Certhidos olivacea*
Phylogeny implies biogeography
6 - 7 Myr

≥ 3 Myr

~ 1.8 Myr
6 - 7 Myr

≥ 3 Myr

~ 1.8 Myr

~ 1.8 Myr
Out of Africa 1: The old view

1.9 Myr
Out of Africa 1: The old view

1.9 Myr

1.6 - 1.3 Myr
Out of Africa 1: The old view

- 1.9 Myr
- 1.6 - 1.3 Myr
- 1.0 Myr
Out of Africa 1: The old view

- 1.9 Myr
- 1.6 - 1.3 Myr
- 1.0 Myr
- 500 Kyr
Out of Africa 1: The new(er) view

1.9 Myr
Out of Africa 1:
The new(er) view

1.9 Myr

1.8 Myr
Out of Africa 1: The new(er) view

1.9 Myr
1.8 Myr
At least 1.2 Myr
A new small-bodied hominin from the Late Pleistocene of Flores, Indonesia

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An Asian perspective on early human dispersal from Africa

Robin Dennell¹ & Wil Roebroeks²

The past decade has seen the Pliocene and Pleistocene fossil hominin record enriched by the addition of at least ten new taxa, including the Early Pleistocene, small-brained hominins from Dmanisi, Georgia, and the diminutive Late Pleistocene Homo floresiensis from Flores, Indonesia. At the same time, Asia’s earliest hominin presence has been extended up to 1.8 Myr ago, hundreds of thousands of years earlier than previously envisaged. Nevertheless, the preferred explanation for the first appearance of hominins outside Africa has remained virtually unchanged. We show here that it is time to develop alternatives to one of palaeoanthropology’s most basic paradigms: ‘Out of Africa 1’.

In Asia, the recent discoveries of H. georgicus and H. floresiensis should make us very wary of assuming that H. erectus s.l. was the only player on the Asian stage in the Early Pleistocene.
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The past decade has seen the Pliocene and Pleistocene fossil hominin record enriched by the addition of at least ten new taxa, including the Early Pleistocene, small-brained hominins from Dmanisi, Georgia, and the diminutive Late Pleistocene Homo floresiensis from Flores, Indonesia. At the same time, Asia's earliest hominin presence has been extended up to 1.8 Myr ago, hundreds of thousands of years earlier than previously envisaged. Nevertheless, the preferred explanation for the first appearance of hominins outside Africa has remained virtually unchanged. We show here that it is time to develop alternatives to one of palaeoanthropology’s most basic paradigms: ‘Out of Africa I’.

There is no reason why hominin migrations were always from Africa into Asia, and movements in the opposite direction might also have occurred. We should even allow for the possibility that H. ergaster originated in Asia and perhaps explain its lack of an obvious east African ancestry as the result of immigration rather than a short (and undocumented) process of anagenetic (in situ) evolution.
Anatomical descriptions, comparative studies and evolutionary significance of the hominin skulls from Dmanisi, Republic of Georgia

G. Philip Rightmire a,*, David Lordkipanidze b, Abesalom Vekua c
Anatomical descriptions, comparative studies and evolutionary significance of the hominin skulls from Dmanisi, Republic of Georgia

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On morphological grounds, it can be argued that the group from which the skulls are drawn is close to a stem from which later more derived populations are evolved. As further comparative work is carried out, several hypotheses must be considered. One is that an early Homo population left Africa and settled in the Caucasus, where it was ancestral to the Dmanisi hominins. Dating does not presently rule out the possibility that H. erectus originated in Eurasia and that some groups then returned to Africa, where they evolved toward H. erectus ergaster. Also, both geographic considerations and the anatomy of the Dmanisi fossils are consistent with the hypothesis that hominins reaching the Caucasus early in the Pleistocene are closely linked to the first inhabitants of Java and/or China.
Postcranial evidence from early *Homo* from Dmanisi, Georgia

David Lordkipanidze¹, Tea Jashashvili¹,², Abesalom Vekua¹, Marcia S. Ponce de León², Christoph P. E. Zollikofer², G. Philip Rightmire³, Herman Pontzer⁴, Reid Ferring⁵, Oriol Oms⁶, Martha Tappen⁷, Maia Bukhsianidze¹, Jordi Agusti⁸, Ralf Kahlke⁹, Gocha Kiladze¹, Bienvenido Martinez-Navarro⁸, Alexander Mouskhelishvili¹, Medea Nioradze¹⁰ & Lorenzo Rook¹¹
The Primitive Wrist of *Homo floresiensis* and Its Implications for Hominin Evolution

Matthew W. Tocheri, ¹ Caley M. Orr, ², ³ Susan G. Larson, ⁴ Thomas Sutikna, ⁵ Jatmiko, ⁵ E. Wahyu Saptomo, ⁵ Rokus Awe Due, ⁵ Tony Djubiantono, ⁵ Michael J. Morwood, ⁶ William L. Jungers ⁴
Descriptions of the upper limb skeleton of *Homo floresiensis*
S.G. Larson\(^a,\,*\), W.L. Jungers\(^a\), M.W. Tocheri\(^b\), C.M. Orr\(^c\), M.J. Morwood\(^d,f\), T. Sutikna\(^e\), Rokhus Due Awe\(^e\), T. Djubiantono\(^g\)

Descriptions of the lower limb skeleton of *Homo floresiensis*
W.L. Jungers\(^a,\,*\), S.G. Larson\(^a\), W. Harcourt-Smith\(^b\), M.J. Morwood\(^c,f\), T. Sutikna\(^d\), Rokhus Due Awe\(^d\), T. Djubiantono\(^e\)

Liang Bua *Homo floresiensis* mandibles and mandibular teeth: a contribution to the comparative morphology of a new hominin species
Peter Brown\(^*\), Tomoko Maeda
Homo floresiensis: a cladistic analysis

D. Argue\textsuperscript{a,*}, M.J. Morwood\textsuperscript{b}, T. Sutikna\textsuperscript{c,d}, Jatmiko\textsuperscript{c}, E.W. Saptomo\textsuperscript{c}

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Objectives

• Use cladistic analysis to test the predictions of “Out-of-Africa 1”:
  • The first hominin to leave Africa was a descendant of early African *Homo erectus* (i.e., *H. ergaster*).
  • All European and Asian *H. erectus* populations are descended from that original dispersing population (i.e., there were not multiple dispersals out of Africa).
  • African *H. erectus* is descended from African ancestors (i.e., there were not dispersals of Asian hominins back into Africa).

• Evaluate the phylogenetic and biogeographic hypotheses emerging from recent analyses of the Dmanisi and Liang Bua hominins.
Methods: Taxa

- **Outgroup:**
  - *Australopithecus africanus*

- **Ingroup:**
  - *Homo habilis*
  - *Homo rudolfensis*
  - *Homo ergaster*
  - *Homo georgicus*
  - *Homo erectus*
  - *Homo floresiensis*
  - *Homo heidelbergensis*
  - *Homo neanderthalensis*
  - *Homo sapiens*

*H. ergaster* includes only the early fossils from the Turkana Basin (e.g., ER 992, ER 3733, ER 3883, WT 15000)
Methods: Taxa

- Outgroup:
  - *Australopithecus africanus*

- Ingroup:
  - *Homo habilis*
  - *Homo rudolfensis*
  - *Homo ergaster*
  - *Homo georgicus*
  - *Homo erectus*
  - *Homo floresiensis*
  - *Homo heidelbergensis*
  - *Homo neanderthalensis*
  - *Homo sapiens*

*H. erectus* includes early and late Asian fossils, similar African fossils, and fossils now attributed to *H. antecessor* (e.g., Sangiran, Zhoukoutian, Ngangdong, Sambungmachan, Trinil, OH 9, Ternifine, ER 42700, Gran Dolina, Sima del Elephante, Ceprano)
Methods: Taxa

- Outgroup:
  - *Australopithecus africanus*

- Ingroup:
  - *Homo habilis*
  - *Homo rudolfensis*
  - *Homo ergaster*
  - *Homo georgicus*
  - *Homo erectus*
  - *Homo floresiensis*
  - *Homo heidelbergensis*
  - *Homo neanderthalensis*
  - *Homo sapiens*

*H. heidelbergensis* includes Asian, African and European archaic humans, including specimens preserving an incomplete set of Neanderthal features (e.g., Dali, Zuttiyeh, Kabwe, Bodo, Florisbad, Petralona, Arago, Steinheim, Mauer, Sima de los Huesos, Swanscombe).
Methods: Taxa

- Outgroup:
  - *Australopithecus africanus*

- Ingroup:
  - *Homo habilis*
  - *Homo rudolfensis*
  - *Homo ergaster*
  - *Homo georgicus*
  - *Homo erectus*
  - *Homo floresiensis*
  - *Homo heidelbergensis*
  - *Homo neanderthalensis*
  - *Homo sapiens*  

_H. sapiens_ includes only early African specimens (e.g., Omo Kibish, Herto, Jebel Irhoud, Border Cave, Klasies River Mouth, Ngaloba, Dar Es Soltane)
Methods: characters

- Examined 81 (mostly cranial) characters, but not all of them were cladistically useful.
- Many characters were either too variable, or autapomorphic.
- Examined 51 “traditional” characters.
- Of those, 28 were cladistically useful.
- Examined 30 “craniometric” characters derived from the Howells data set.
- Of those, 7 were cladistically useful.
Two equally parsimonious trees

Tree length = 70
Consistency index = 0.69
Retention index = 0.68
2.3 Myr
2.3 - 1.9 Myr
????
1.9 Myr
1.9 Myr
1.8 Myr
1.5 Myr
Conclusion

- Cladistic analysis supported cladograms in which *H. floresiensis* and *H. georgicus* diverge prior to the appearance of *H. ergaster*.
- Biogeographic patterns implied by this phylogeny are inconsistent with Out-of-Africa 1.
- The first hominins to leave Africa may be broadly classified as belonging to *H. habilis sensu lato*.
- Several species of *Homo* evolve first in Asia and subsequently disperse into Africa and Europe.
- Neanderthals may have evolved in Europe, and modern humans may have evolved in Africa, but the archaic ancestors of these lineages are likely to have evolved first in Asia.
- Fieldwork efforts directed towards expanding the fossil record of *Homo* in Eurasia are needed.
Dedicated to the memory of Charlie Lockwood
Adaptive landscapes

Figure 2—Diagrammatic representation of the field of gene combinations in two dimensions instead of many thousands. Dotted lines represent contours with respect to adaptiveness.
Figure 4.—Field of gene combinations occupied by a population within the general field of possible combinations. Type of history under specified conditions indicated by relation to initial field (heavy broken contour) and arrow.