ANCIENTANCESTORS.ORG

Discover
Human
Origins

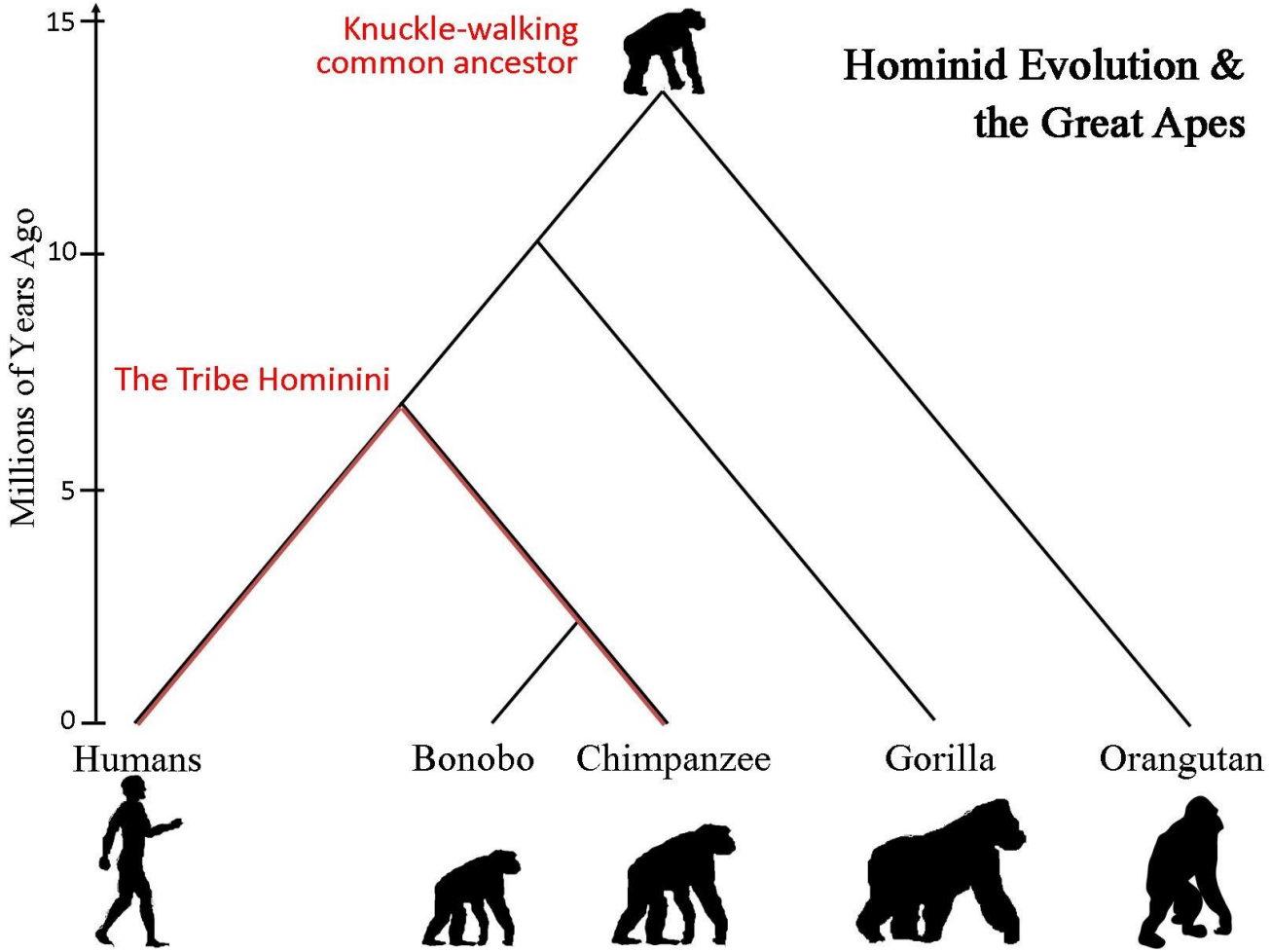
Be a Paleoanthropologist for a Day!

Paleoanthropology: The study of human origins includes two main branches:

- **Paleontology** → the study of ancient life
- **Physical Anthropology** → the study of human development in the context of primates

Hominid or Hominin?

- **Hominids** descend from the common ancestor of all Great Apes
- **Hominins** are a part of the lineage leading to *Homo sapiens*

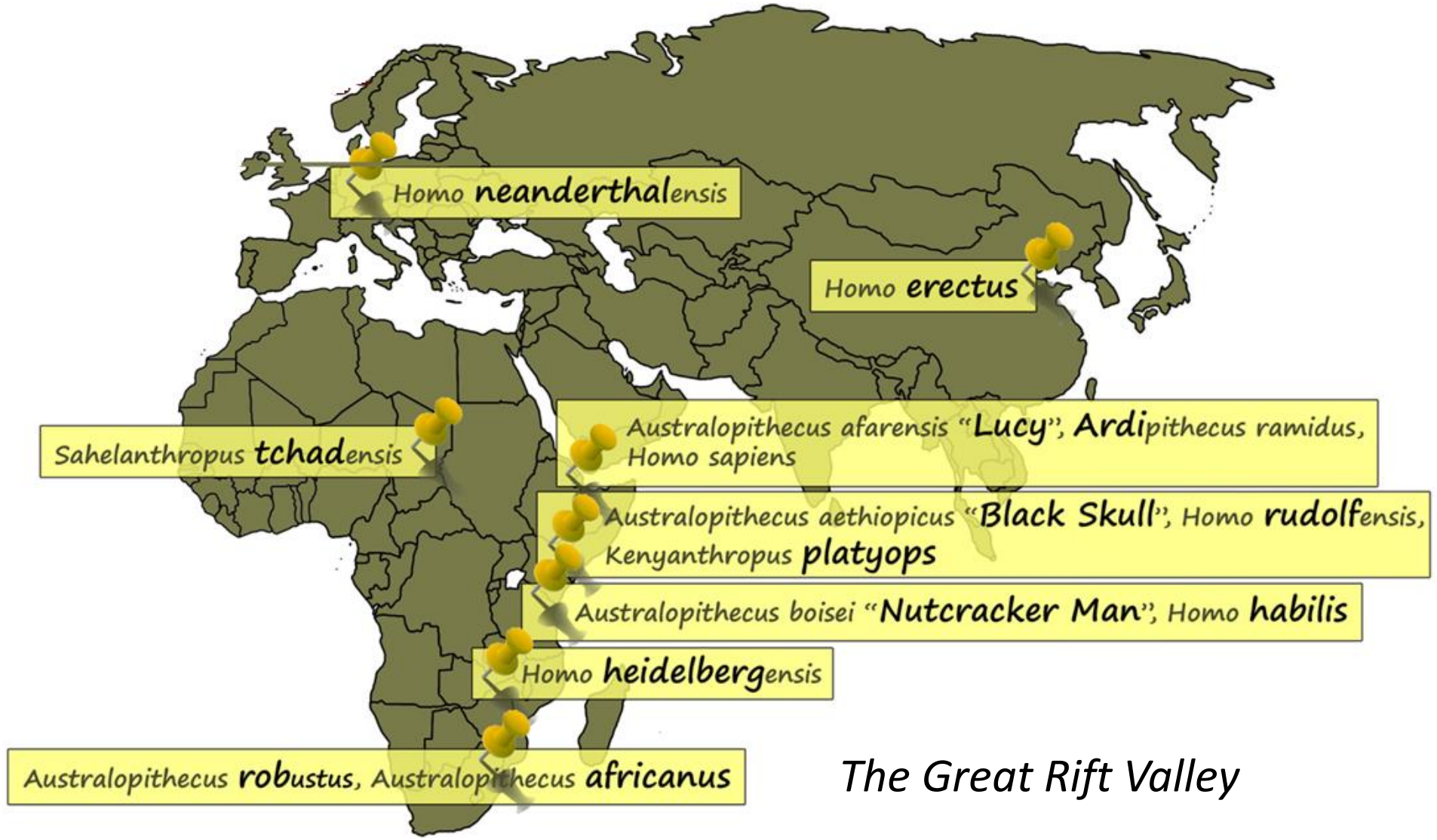


Fossilization and Excavation

- **Permineralization**- most common process where minerals in the sediment seep into broken down bone and soft tissue
- Excavation process:
  - Survey (Test Pits and Geomapping: *A. Sebida*)
  - Excavation (Planning and Gridding)
  - Lab Analysis

A trowel

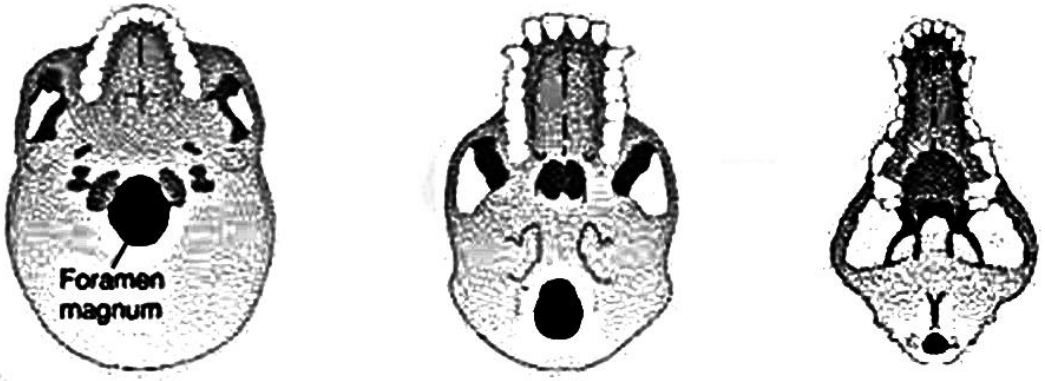
Hominin Species and Site Locations



Morphological Changes – **Upright Stature**

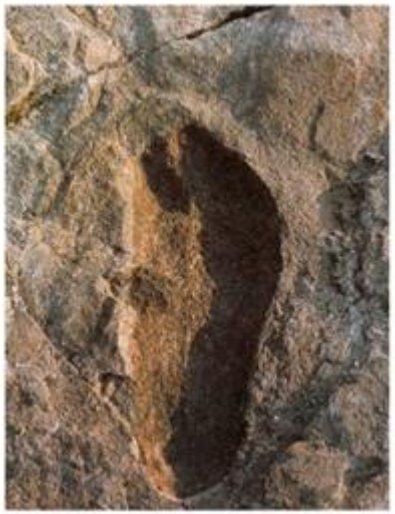
Spine and position of Foramen Magnum

Human Chimpanzee Dog



Morphological Changes – **Upright Stature**

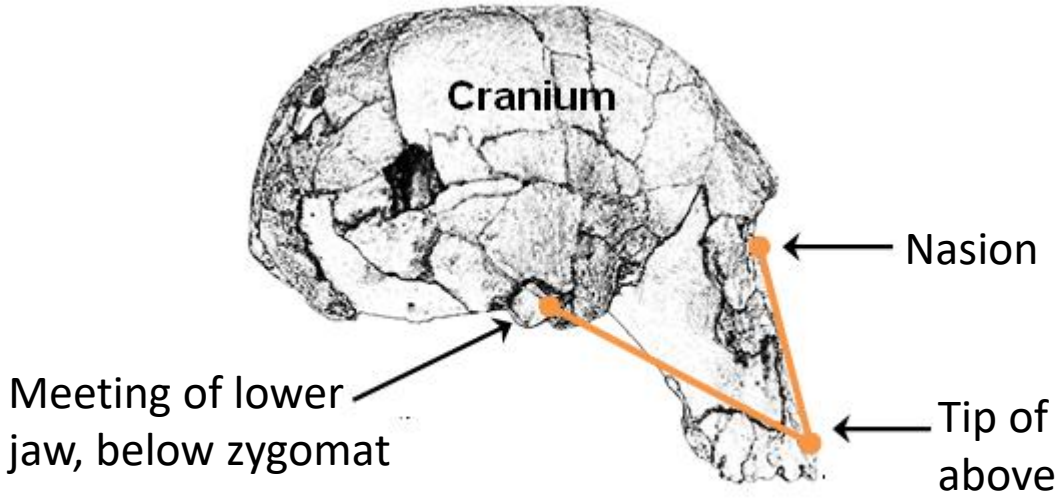
- **Quadrapedalism → Bipedalism**
  - Arborealism- Living in trees
  - Laetoli Footprints (3.6 MYA) →



- **Foramen Magnum-** The "Big Hole", meeting point of spine and cranium
- **Opisthion Index-** Ratio of the Foramen Magnum position to the total cranial length

Morphological Changes – **Facial Prognathism**

- **Prognathism-** The **protrusion** of the face and jaw, pronounced in the genus *Australopithecus*
- **Orthognathism-** tendency for a flat face, seen in humans
- **Maxilla**- A paired bone that forms the upper jaw
- **Zygomatic Process-** Facial bone connecting the cheek bones to the side of the cranium
- **Nasion-** Concavity at the bridge of the nose



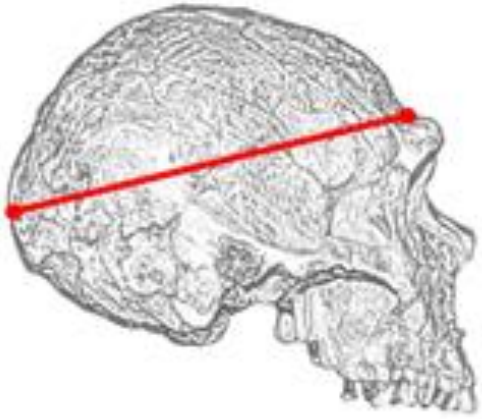
Maxillary Angle: Acute angle formed by 3 points of upper jaw

Morphological Changes – **Cranial Capacity**

- **Cranium-** Portion of the skull housing the brain
- **Frontal Lobe-** Brain region responsible for problem solving, memory, and language

Estimation Technique- A sphere within a cube:
-spherical volume = 0.524 x cubic volume

Length

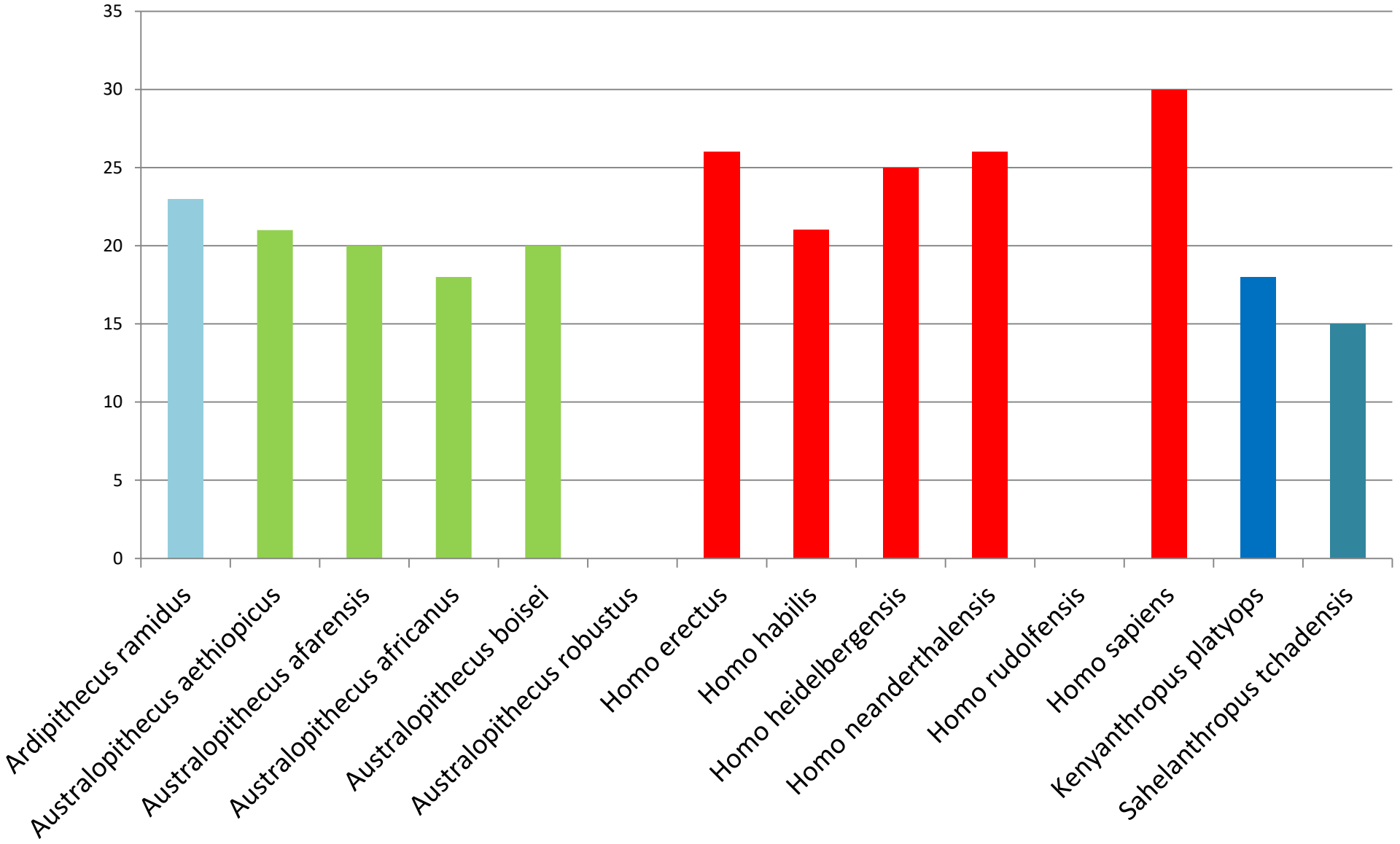


Width

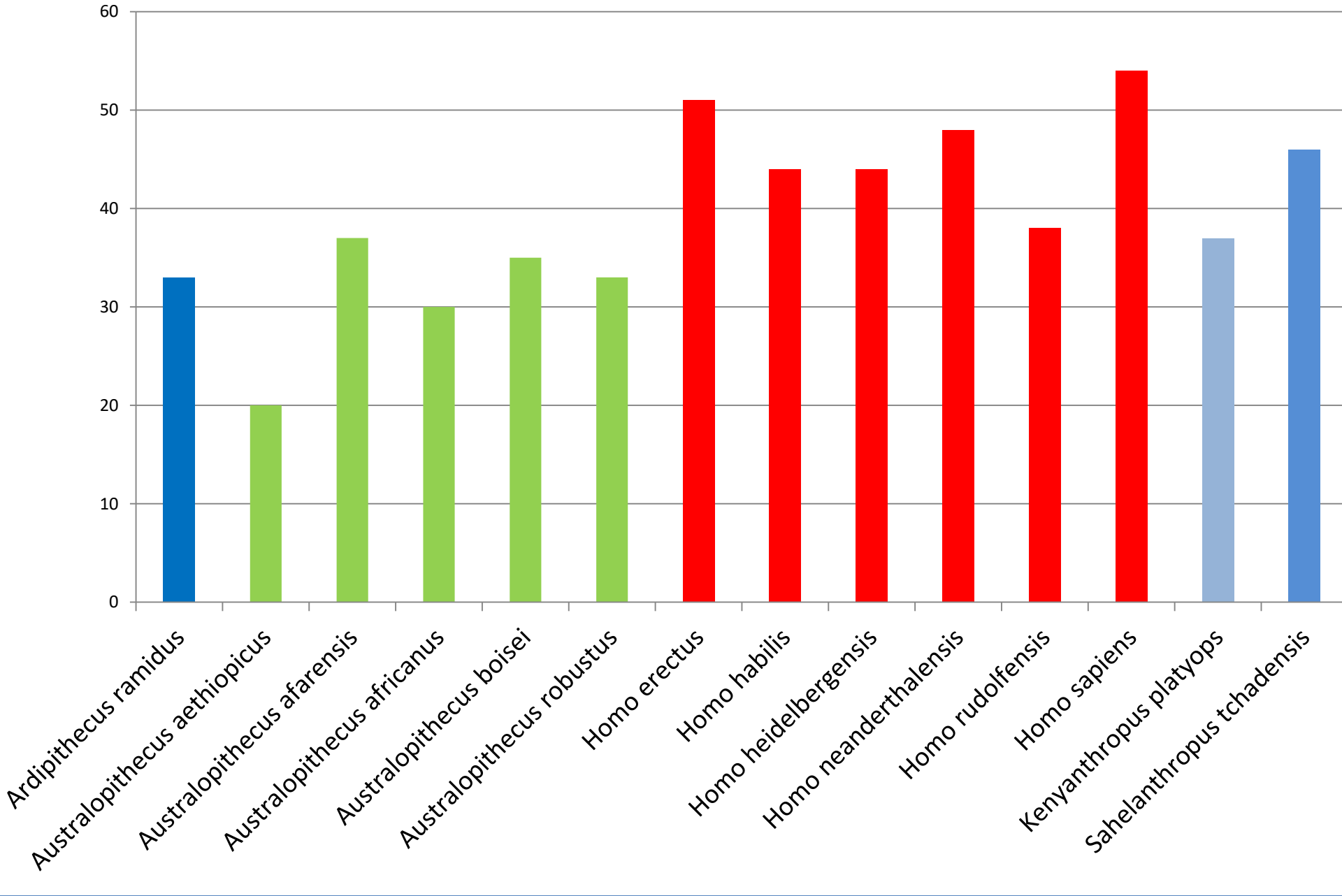
Height

	Bipedalism			Prognathism	CC			
Name	**Opisthocranion-opisthion distance (cm)**	**Opisthocranion-orale distance (cm)**	**Opisthion index**	**Maxillary angle (°)**	**Height**	**Width**	**Length**	**Cranial capacity (cm^3)**
Ardipithecus ramidus	3.4	14.5	23	33	**7.5**	8.7	10.3	268
Australopithecus aethiopicus	4.5	21.6	21	20	6.9	10.4	13.7	393
Australopithecus afarensis	3.2	16	20	37	8.5	9.4	12.6	402
Australopithecus africanus	3	16.8	18	30	9.4	8.8	12.5	413
Australopithecus boisei	4	19.8	20	35	9	11.3	15	610
Australopithecus robustus	unmeasurable			33	unmeasurable			
Homo erectus	5.2	20	26	51	10.5	13.2	17.4	964
Homo habilis	3.3	15.4	21	44	10	10.2	12.8	522
Homo heidelbergensis	4.8	19.5	25	44	11	12.7	16	894
Homo neanderthalensis	5.8	22.2	26	48	14	14.5	17.8	1445
Homo rudolfensis	unmeasurable			38	9	11.5	16	662
Homo sapiens	5.5	18.6	30	54	14.5	14	17.5	1421
Kenyanthropus platyops	3.2	17.7	18	37	9.5	11	11.8	493
Sahelanthropus tchadensis	2.5	17.2	15	46	8.2	9.5	13.3	414

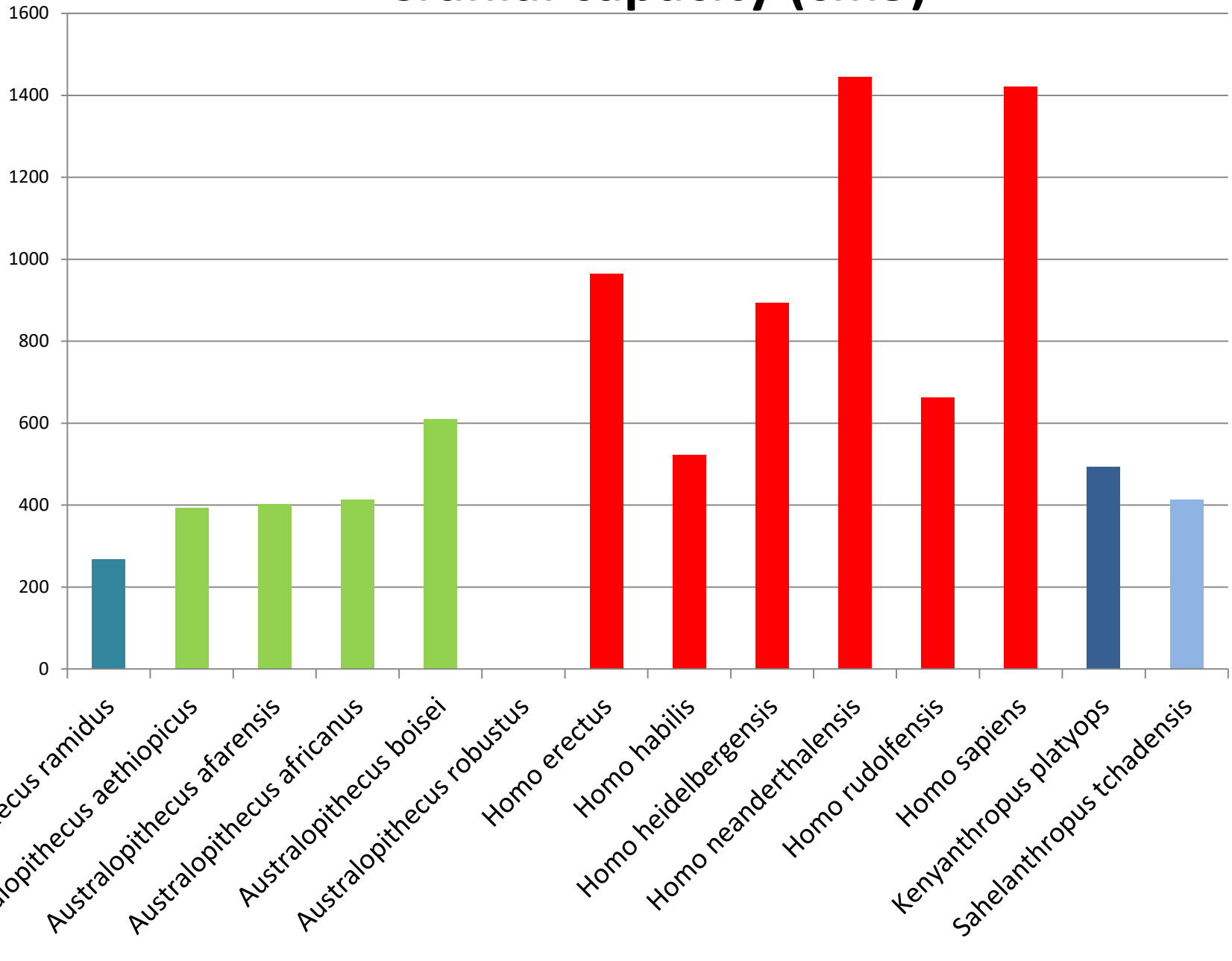
Opisthion index



Maxillary angle (°)



Cranial capacity (cm3)



DISCUSSION

- Based on the Opisthion Index, which species are bipedal?
- What are the benefits of bipedalism?
- What characteristics define orthognathic (less prognathic) skulls?
- How could jaw and teeth size reflect in a hominid's diet?
- How does the cranial capacity vary?
- How does the cranial vault shape vary?
- Do any skulls have a larger cranial capacity than Homo sapiens?

Dating Methods:

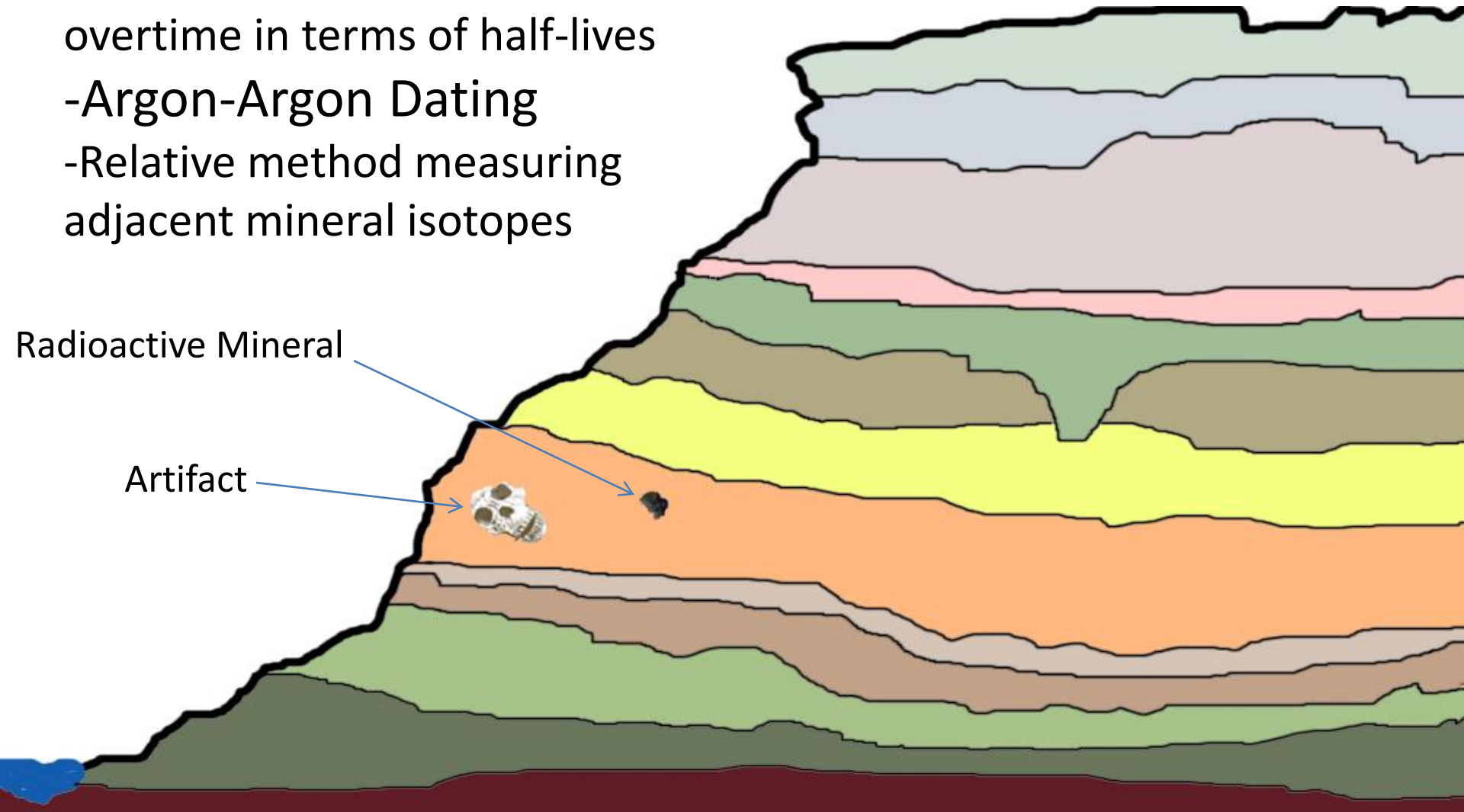
-Radio Carbon Dating

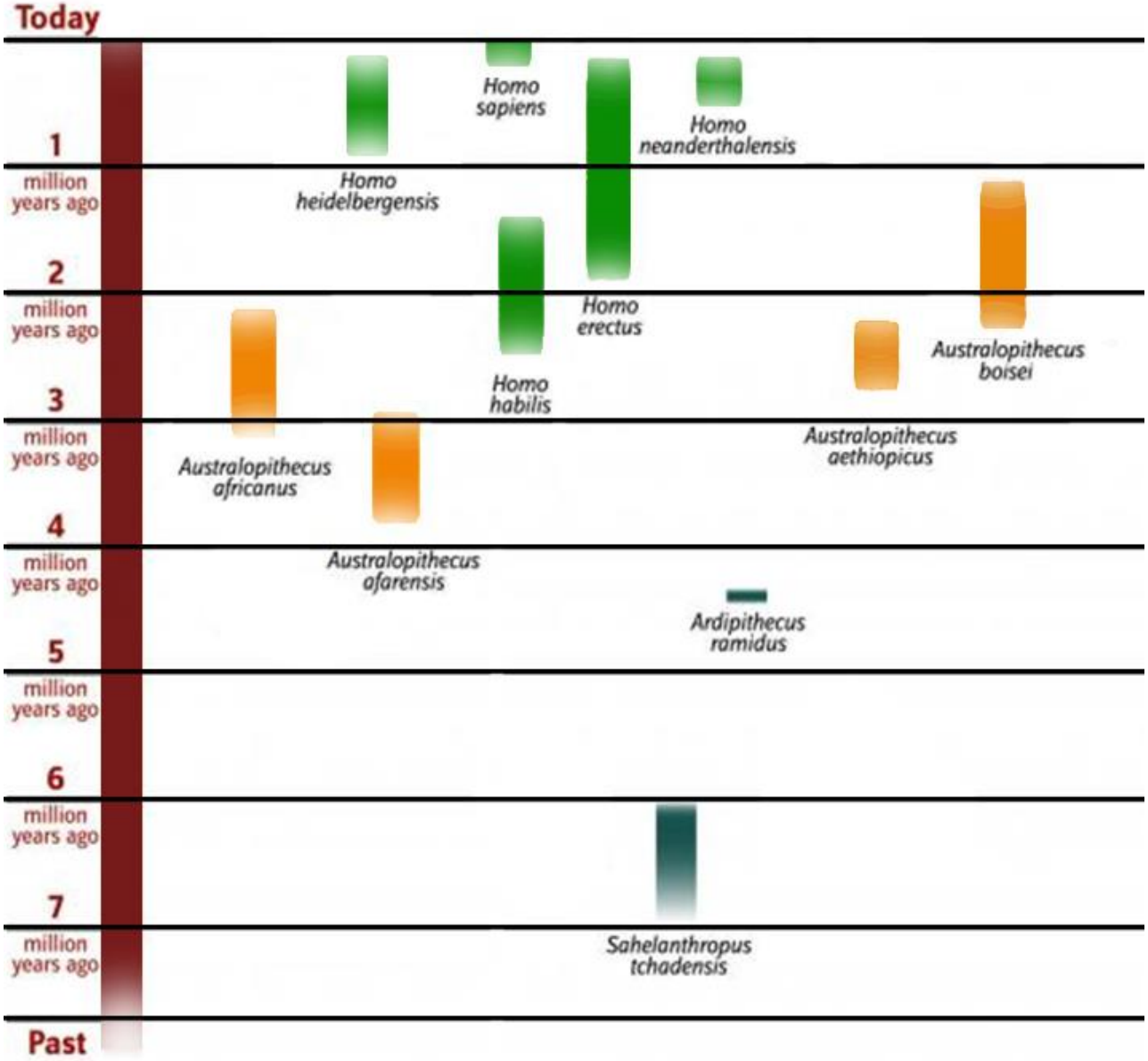
-Carbon14-carbon12 ratio decays overtime in terms of half-lives

-Argon-Argon Dating

-Relative method measuring adjacent mineral isotopes

Stratigraphy:





Conclusion

- What are the three milestones of human evolution?
- What order did these milestones occur?
- Which species have robust features? gracile features?
- Does a bigger brain make you smarter?
- Who won the evolutionary game?