

Activity: Can You Identify the Age?

Skeletons are good age markers because teeth and bones mature at fairly predictable rates.

How Teeth Reveal Age

For toddler to age 21, teeth are the most accurate age indicators. Like many other mammals, humans have two sets of teeth - "baby" teeth and permanent teeth.

Baby teeth, also called milk or **deciduous teeth**, start erupting at about six months, beginning with the central incisors in the lower jaw (**mandible**). Each tooth type - incisors, canines, premolars, molars - erupts on a predictable schedule.

- The incisor teeth are any of the four anterior teeth in each jaw, used for cutting and gnawing.
- The canine teeth are the four sharp-pointed teeth next to the incisors.
- The premolar teeth are one of eight bicuspid teeth located in pairs on each side of the upper and lower jaws behind the canines and in front of the molars.
- The molar teeth are the teeth with a broad crown used to grind food, located behind the premolars.

Permanent teeth begin to replace deciduous teeth at about six years of age and finish erupting by about 21 years of age.

X-rays provide views of the unerupted permanent teeth and tooth roots still within the bone. The crown of a tooth forms first, followed by the root. Scientists estimate age by comparing the stage of tooth formation in the X-rays and bone with known dental growth standards.

Below are three X-rays showing dental development:

- Figure 2 is the jaw of a four- to five-year old child.
- Figure 3 is the jaw of an 11- to 13-year old adolescent.
- Figure 4 is the jaw an adult over 21 years old.

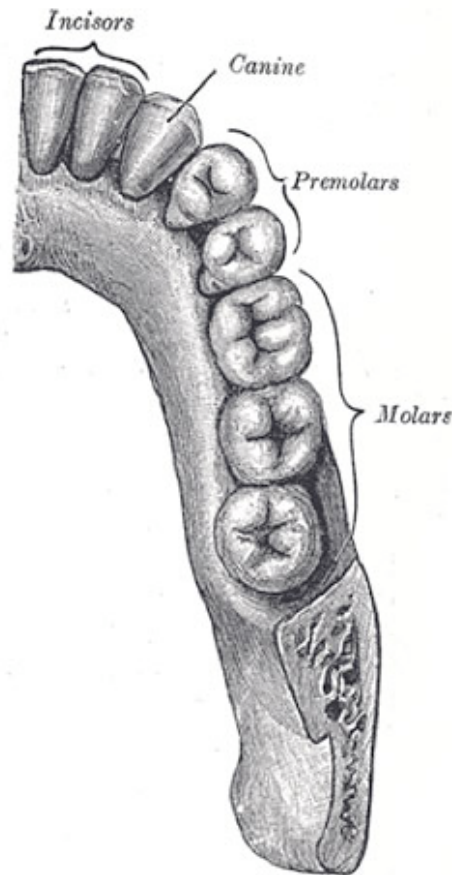


Figure 1. Human teeth.
(Source: Gray's Anatomy)

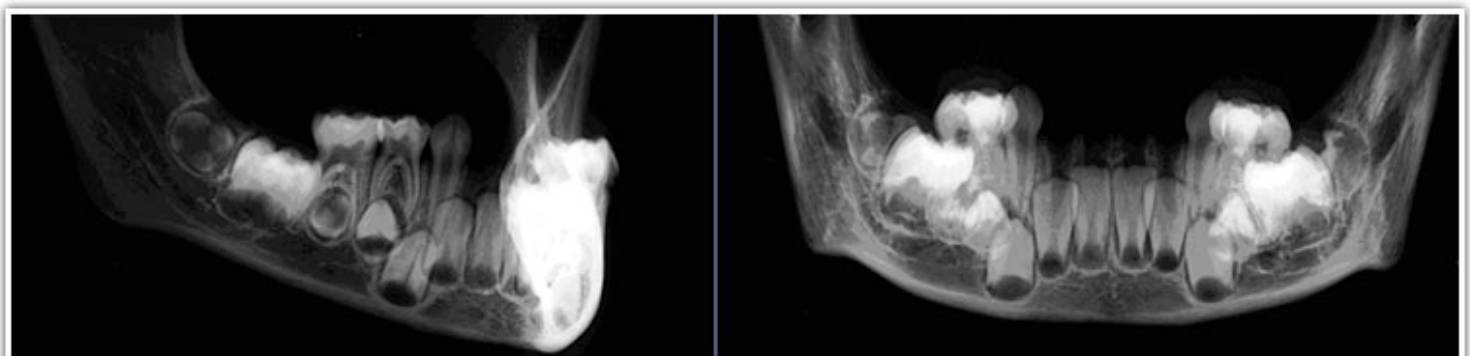


Figure 2. Dental development in the lower jaw of a four- to five-year old child.

(Source: Smithsonian Institution)

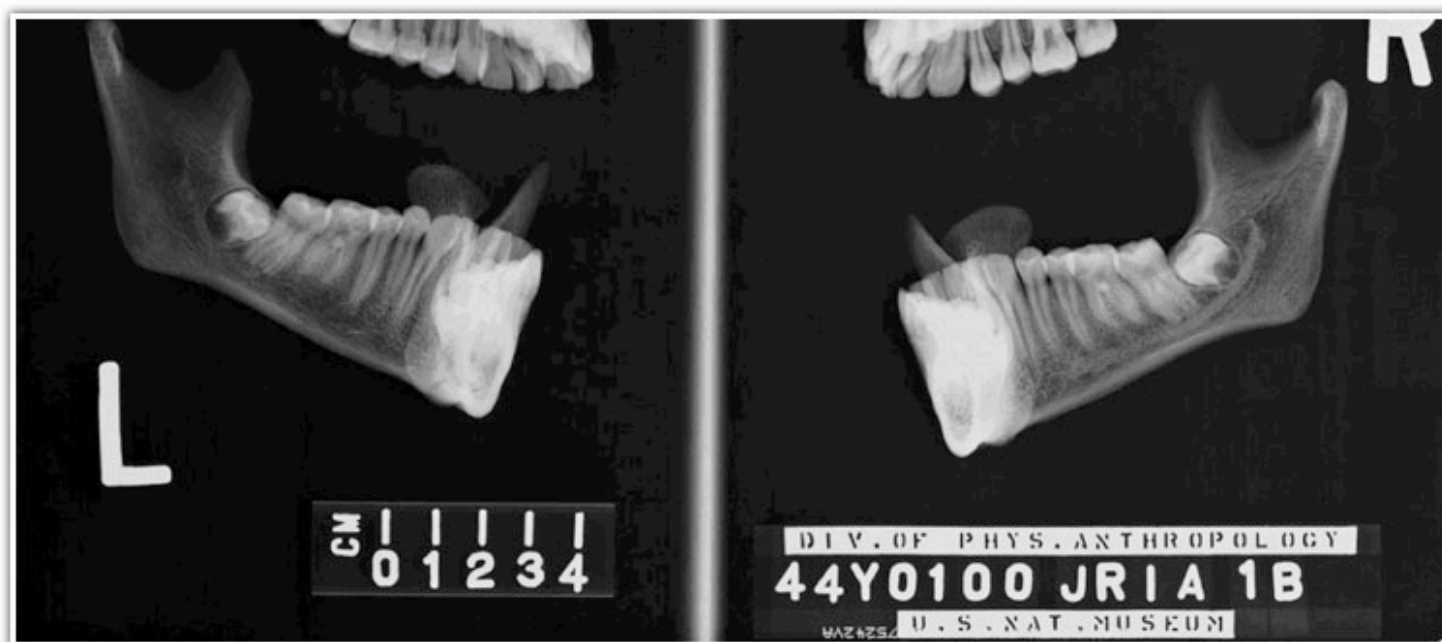


Figure 3. Dental development in the lower jaw of an 11- to 13-year old adolescent.
(Source: Smithsonian Institution)

	Teeth	Unerupted	Unerupted	Unerupted	Unerupted	Unerupted	Unerupted
15-17	Crown Enamel	Complete	Complete	Complete	Complete	Complete	Complete
	Roots	Closed	Closed	Open	Closed	Closed	Closed
	Teeth	Erupted	Erupted	Erupted	Erupted	Erupted	Erupted
> 18	Crown Enamel	Complete	Complete	Complete	Complete	Complete	Complete
	Roots	Closed	Closed	Closed	Closed	Closed	Closed
	Teeth	Erupted	Erupted	Erupted	Erupted	Erupted	Erupted

Notes from the skeleton's forensic file:

The left 3rd maxillary molar has incomplete root formation but is partially erupted. The right 3rd mandibular molar has three-fourths of its root formed and remains unerupted. All other represented teeth are fully erupted with complete crown and root development.

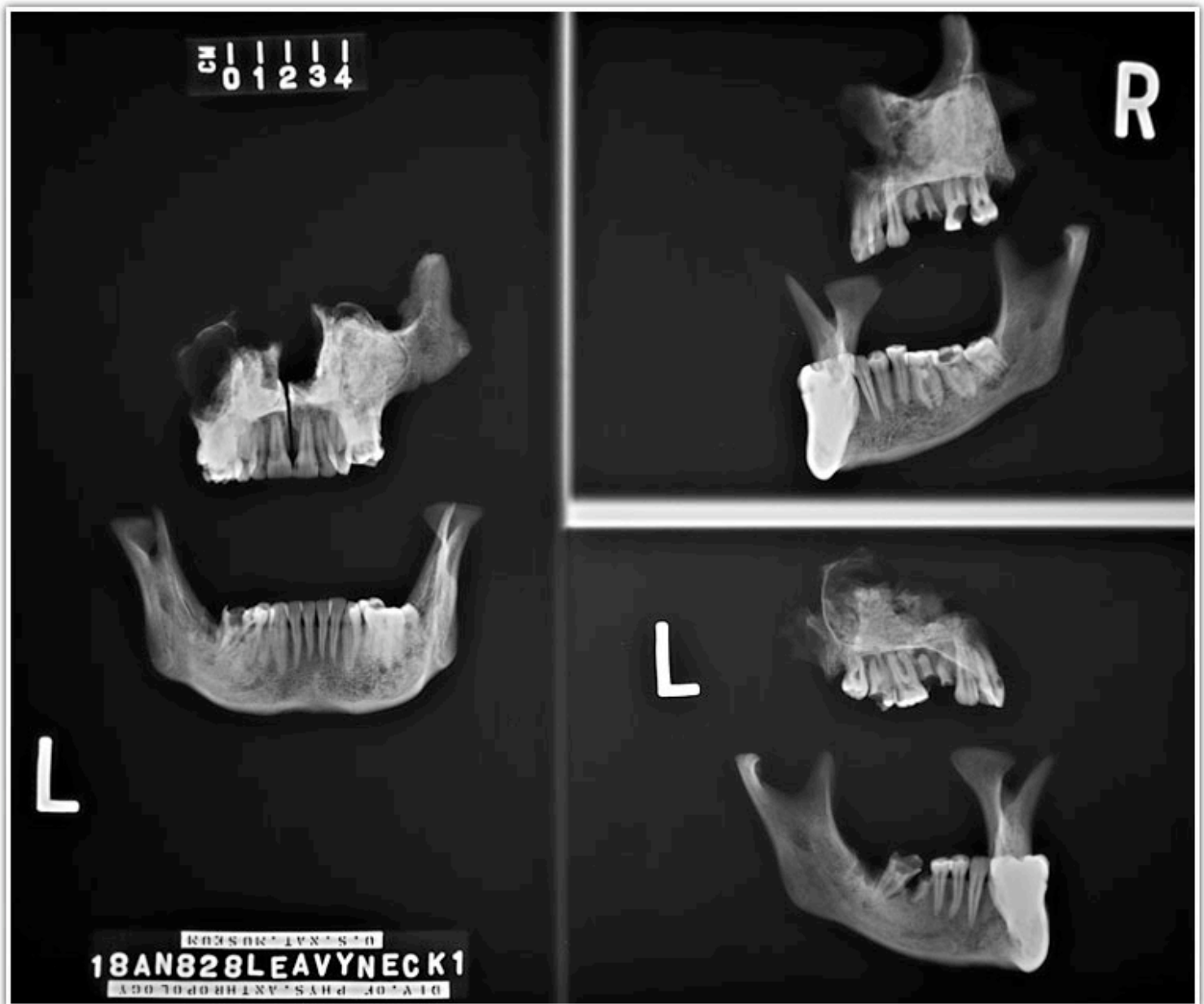


Figure 5. Upper (maxillae) and lower (mandible) jaws of the skeleton in the cellar.
(Source: Smithsonian Institution)

What do you think?

Based on the dental evidence, what is the age of the skeleton?

Infant - 10 years

10 - 18 years

Adult

How Bones Reveal Age

Like teeth, bones mature at fairly standard rates. A baby's bones begin to grow in the womb. At birth, the skeleton is partially formed and many bones are still in parts. Throughout childhood, the bone parts grow and unite. The process is complete between 17 and 25 years, when normal growth stops. At this point, you and your skeleton are as tall as you are going to get - with many fewer bone parts than you started with!

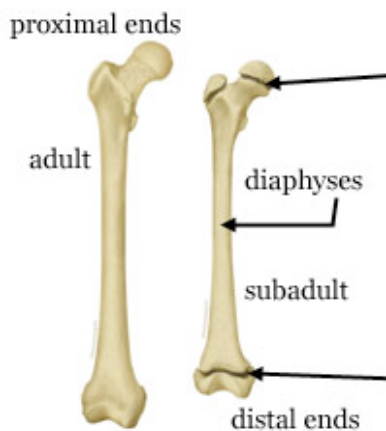


Figure 6. Proximal (near to the torso) and distal (far) ends of adult and subadult (adolescent) femora (thigh bones). (Source: Smithsonian Institution)

Some of the separate bone parts in immature skeletons are called epiphyses, which are the ends of the bony shafts (diaphyses) of the arm and legs (the long bones). Epiphyses are growth centers, often evident on the ends of long bones. At birth, the ends of the long bones are mainly cartilage (a firm, elastic type of connective tissue), with centers of bone beginning to form inside. As a child grows, the shafts get longer, and bone gradually replaces the cartilage epiphyses. Through the growing years, a layer of cartilage called the growth plate, separates each epiphysis from the bone shaft.

In the teenage years, the epiphyses unite to the main bone shafts, as the cartilage growth plate is completely replaced by bone. This process occurs slightly earlier in females than in males. The age of a person can be estimated by looking at the stages of union for the

epiphyses in the different bones and comparing it to the standard growth tables.

Age of Union for Epiphyses of Some of the Long Bones

	Female Initial Union - Years	Male Initial Union - Years	Female/Male Union Complete - Years
Proximal humerus (upper arm)	14 - 20	14 - 21	18 - 25
Distal radius (outer forearm)	16 - 19	16 - 20	18 - 22
Femur head (thigh)	13 - 17	15 - 18	18 - 20
Distal femur	14 - 17	14 - 19	18 - 22

Proximal tibia (shin bone)	14 - 17	15 - 19	18 - 23
Distal tibia	14 - 16	14 - 18	18 - 20

Age Markers in the Skeleton in the Cellar



Figure 7. Proximal humerus of the skeleton in the cellar.
(Source: Smithsonian Institution)

Notes from the skeleton's forensic file:

The top (proximal) epiphysis of the humerus is unfused, as are the end (distal) epiphyses of the ulna (outer forearm bone) and radius.



Notes from the skeleton's forensic file:

On the bones of the legs, the right lesser trochanter (node where muscle attaches to bone) has united, but the line of union is still clearly visible. The femoral heads have begun to unite, but the distal epiphyses of the femora are unfused. The epiphyses of the tibiae are united with the shafts, but only recently, as clear lines of union are still visible.

Figure 8. The femur and tibia of the skeleton in the cellar.
(Source: Smithsonian Institution)



Figure 9. Skeleton in the cellar arranged in anatomical position. (Source: Smithsonian Institution)

What do you think?

What is the skeletal age of specimen in question? Consider how this compares to your estimate for the dental age.

- Infant - 10 years
- 10 - 18 years
- Adult

Vote



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This page is part of the [Smithsonian's The Secret in the Cellar Webcomic](#), an educational resource from the [Written in Bone](#) exhibition, February 2009 - 2011.