Chapter 3

THE IMPOSSIBLE DISCOVERY

Australopithecus africanus (3.3 to 2.1 million years ago)

In 1924, anatomist Raymond Dart of the University of the Witwatersrand in Johannesburg, South Africa, found what could not have existed. He discovered a skull with a brain capacity the size of an ape's, but with humanlike qualities of the teeth and lower jaw. Most of the anthropological establishment responded that this combination was nonsense; we knew that the enlargement of the brain occurred early, at a stage when the jaws and teeth were still apelike. We knew this because this combination existed in the Piltdown skull, found twelve years earlier.

Fifty-four years after Dr. Dart's discovery I tracked him down in Philadelphia, where he had been recently spending several months out of each year. When I was young, Raymond Dart had something like legendary status for me, and I had always wanted to meet him. This first meeting was for the purpose of taking photographs in preparation for a portrait I was painting of him. Even at age eighty-five, he had the sparkle of a much younger man. He told me the story of his discovery.

It began on an October day with what looked like a brain made of stone. This was a natural cast of the interior of a cranium, formed when sediment inside of the skull hardened to rock. The skull had been subsequently broken away. Dart received it in a crate of rocks and fossils, which was delivered to his house moments before a friend's wedding was set to begin there (he was the best man). An earlier discovery of a fossil baboon skull by quarry workers at the Taung Limeworks in South Africa had prompted Dart to request that any additional material be sent to him for examination. Now he stood, preparations for the wedding momentarily forgotten, holding the small stone brain. As he tells it, humanlike details of the brain's anatomy immediately caught his eye. But it was so small!

Dart painted a comic picture of himself as he excitedly, and only half-dressed, began to rummage through the rest of the crate as the groom-to-be tugged on his arm and threatened to find another best man. The guests had arrived, and the wedding was about to start. He found a rock that the front of the stone brain cast fit into, and he could see fossil bone in the rock. He realized that, whatever creature this was, the front of its skull was face down in the rock.

After the day of the wedding, he worked intensively for ten weeks to expose the skull, using anything useful at hand, including his wife's knitting needles. Just before Christmas 1924 he finally succeeded in freeing the skull from the rock. The face that emerged was that of a child. It had the full complement of deciduous teeth, with the first permanent molars just emerging. It was a very apelike face, with a flat nose, receding chin, and a comparatively large distance between nose and mouth.

Dart's conclusions about the skull are astonishing in retrospect, in that they presaged the criteria for recognizing very ancient hominins still in use today. Other than brain morphology, he employed essentially the same two features used seventy-seven years later to argue that *Sahelanthropus* was a human ancestor: the small size of the canine teeth and a forward position of the foramen magnum, suggesting carriage of the head on a more vertical neck. He named a new genus and species for the skull: *Australopithecus africanus* (southern ape of Africa) and proposed in an article published in *Nature* that it was a human ancestor.

The reaction of the scientific community was disappointing. Many dismissed the skull as that of a fossil ape (does this sound familiar?). A major reason was that the Piltdown skull, discovered in an English gravel pit along with stone tools

Raymond Dart at age eighty-five, with a cast of the Taung child's skull.

and the bones of extinct mammals, showed in some ways the opposite combination of the Taung skull's anatomy: a very large human-looking braincase in association with an apelike lower jaw and teeth, in comparison to Taung's small brain and humanlike teeth. Dart's new skull could not sensibly be assimilated into a tree of human ancestry which included "Piltdown Man." Given a choice between the two, the leading British anthropologists of the day preferred the Piltdown evidence. It fit well with one of Darwin's ideas, that the enlarged brain has a very ancient history. And it was English.

The Taung skull's very apelike anatomy had much to do with the scientific community's reaction. The world had never before seen a human ancestor with such an apelike face and so small a brain. For many of the experts, these features dominated, and any humanlike features, if indeed they were there at all, may have evolved independently, in parallel with those of the human lineage.

Dart was deflated by this reaction, but he lived to see most of his claims for the skull vindicated. The Piltdown skull was shown in 1953 to be a hoax. It consisted of a modern human braincase coupled with an orangutan's jaw with filed teeth, which were stained to look ancient and placed in a convincing paleontological and archeological context by someone who knew what he was doing. The identity of that someone has remained a mystery, although there are many theories. The list of suspects includes Sir Arthur Conan Doyle and visionary French Jesuit priest and paleontologist Pierre Teilhard de Chardin. The strongest current evidence points the finger at Charles Dawson, the amateur archeologist and fossil collector for the British Museum who co-discovered the find, and at Martin A. C. Hinton, a curator of zoology at the British Museum who was known for his practical jokes.

The perpetrator probably did not foresee the way his prank would rip through anthropological history like a shotgun blast, expanding as it went. Certainly he could not have predicted that the combination he chose, while in agreement with Darwin's idea that brain enlargement came early in human evolution, was the opposite of the way it actually happened. Perhaps horror at the magnitude of the damage he caused kept the prankster from revealing himself. Whoever it was, he carried his secret to the grave.

Even before the Piltdown forgery was proved to be a hoax, more specimens of *Australopithecus africanus* had been discovered, mainly the result of the efforts of Scottish paleontologist Robert Broom at the South African site of Sterkfontein. These included adult crania and mandibles, pelvic and limb bones, and ribs and vertebrae. Anthropologists had begun to give the species serious consideration as a human ancestor, and some had begun to suspect that the Piltdown find was a fake. "All my landmarks have gone," said Sir Arthur Keith at eighty-one, who had much earlier pronounced the Taung skull that of a juvenile ape related to the chimpanzee. "You have found what I never thought could be found." In a letter to *Nature* he conceded: "Professor Dart was right and I was wrong." A landmark paper published in 1950 by Sir Wilfred Le Gros Clark of Oxford University convinced many that *Australopithecus africanus* and another South African species (*Paranthropus robustus*) were more closely related to humans than to living apes. For most, the removal of Piltdown Man from the human tree in 1953 removed a last obstacle to acceptance of these australopiths as human ancestors.

The acceptance of *Australopithecus* as the most primitive of known human ancestors supported one of Charles Darwin's ideas about human evolution and refuted another. Anatomical similarities between humans and African apes led Darwin to suggest that the origin of humanity occurred in Africa. Later (but before the discovery of *Australopithecus*) fossil finds in Asia and Europe had seemed to point to other regions. If *Australopithecus* was accepted as an ancestor, it was the most primitive and presumably oldest ancestor then known, hinting that the early history of humans occurred in Africa.

Darwin had envisioned a gradual, simultaneous emergence of several human characteristics, two of which were bipedal locomotion and brain enlargement. Skulls of australopiths showed that brain size was small in these early bipeds, indicating that the evolution of bipedalism preceded brain enlargement. This was an early clue that different human qualities emerged at different times, in mosaic fashion.

In retrospect, the story of Dart and the Taung skull is an incredible one. Dart had been a demonstrator in anatomy at University College, London, where he trained under Grafton Elliot Smith, an expert in brain morphology and one of the world's few who studied hominin endocranial casts. Although the stone brain of Taung is tiny, Dart thought he saw in its shape the glimmerings of something human. The endocast of the Taung child had found its way into the hands of one of only a few people in the world capable of making such a judgment. He did so with a very humble comparative base. Although not all of Dart's proposed humanlike brain features have stood the test of time, current experts in the field of paleoneurology, with vastly more comparative information, have been able to confirm some of the human features he saw in the Taung endocast, more than eighty years later.

What Was *A. africanus?*

It can be almost overwhelming to have the remains of an ancient human ancestor spread out on a table before you. Your rational side says: Let's dive in and start measuring, but something makes you hesitate. Here is something of incalculable value. It was once alive; it felt joy, grief, and anger. It knew the sound of running water, the dreamlike motion of a running giraffe, the smell of flowers in bloom. Perhaps it briefly wondered about the stars. What remains of it holds clues about your own deep past, at an almost unimaginable number of generations before your time. It can inspire a sense of wonder and reverence that is sometimes difficult to communicate with others about; it is beyond words. Except that there *are* others who feel it too; you sometimes see it in their eyes, and not always in someone known for having a lyrical outlook.

This is the kind of reverie I was having in June of 1990, as I had my first look at a partial skeleton known as Stw 431, newly discovered at Sterkfontein and not yet announced in the scientific literature. Before starting the measurements, I wrote in my notebook:

> Sterkfontein, the next generation: so exciting; almost overwhelmed. Before I begin, a few words about the new specimens. . . . This individual who lies in bits before me; what was he? A string of vertebrae. A pelvis—looks like not much wider than tiny Sts 14. . . . But we will see. My calipers are articulated, warmed up and humming; ready to go. We will see what the numbers say. Over the years, the identity slowly revealed . . .

This was during the years when the Smithsonian project had stalled and each year brought us no closer to getting it moving again. But in good faith that the hall would one day be realized, Rick Potts and I maintained an ongoing trickle of work on it. I was in the process of creating body blueprints for adult males and females of a number of ancient hominin species, to be used as templates for art in the hall. I had gone to South Africa especially to study fossils with implications for postcranial anatomy. The number one mystery I needed to solve concerned *Australopithecus africanus*. Several fossils had made it clear that the smaller, presumably female members of the species were about the size of Lucy. But how big were the males at the other end of the body size range? Was sexual dimorphism in body size in this species of *Australopithecus* like that of *A. afarensis*?

Based on a very few fossils, I had thought it might be close. There is an associated set of remains from a single larger individual from Sterkfontein that includes a fragmentary mandible, the upper half of an upper arm bone (humerus), and a partial shoulder blade (scapula). My length estimates for the humerus were longish. Primatologist Adolph Schultz had shown years ago that the humerus is the most conservative of the limb bones, in that its relationship with the length of the trunk is the most constant across species. Any reasonable prediction of trunk length from this humerus resulted in a large-bodied individual, whether ape or human numbers were used to make the prediction. But there was a problem. If there were large-bodied *A. africanus* males at Sterkfontein, where were their heads? The use of any of the published skulls of *A. africanus* with such a body resulted in a pin-headed figure, with a head that was smaller relative to trunk length than in any of the humans or apes I had measured. I began to doubt my prediction of large-bodied *A. africanus* males.

An associated humerus, scapula, and mandible of a large *A. africanus* individual known as Sts 7.

The trip to South Africa in 1990 was my second visit there. Unbeknownst to me, a magnificent large skull had been discovered since my first visit in 1987. Not only that, but there was also a newly discovered partial skeleton that confirmed the existence of large-bodied individuals of *A. africanus.* This was the Stw 431 skeleton, which preserved parts of a pelvis, clavicle (collar bone), scapula, humerus, radius, ulna (the radius and ulna are the two forearm bones), and nine vertebrae from the trunk. The lower half of the humerus preserved with the new skeleton has mid-shaft dimensions near the break that are similar to those of the previously known large humerus. And the partial pelvis and nine vertebrae from the trunk in this skeleton indicate a trunk length close to that which I predicted from the earlier-known humerus.

This was very satisfying. Incorporation of the new skull into the growing body blueprint for adult male *A. africanus* resulted in head to body size ratios in line with those of living apes

This composite large *A. africanus* skeleton includes newer discoveries, such as the Stw 505 skull and the Stw 431 partial skeleton.

and humans, and with what we can estimate for *A. afarensis*. The work of Henry McHenry at the University of California at Davis has indicated that *A. africanus* is like *A. afarensis* in that it is characterized by greater sexual dimorphism in body size than that in modern humans.[1]

The relationship of *A. africanus* to other hominin species is not definitively resolved, but many consider it a candidate for the ancestor of *Paranthropus robustus* and/or the genus *Homo*.[2] Support for this latter relationship has come from the recent discovery at the new site of Malapa in South Africa of two spectacular partial skeletons that are similar to *A. africanus,* but that also uniquely share some features with the genus *Homo*. These seem to show that something very like the Malapa individuals descended from *A. africanus* and is closely related to the ancestry of *Homo,* even if the Malapa fossils themselves occur too late in time to be ancestral to all of the fossil hominins now widely considered to belong to *Homo*.

Some scholars have proposed an ancestor/descendant relationship for *Australopithecus afarensis* and *A. africanus*. When *A. afarensis* was initially named, some argued that there were only minimal differences between it and the already known *A. africanus*. Some even argued that there was not enough difference to warrant a species distinction. With further study and additional finds, the differences between *A. africanus* and its possible ancestor *A. afarensis* became clearer.

If *A. africanus* might be a descendant of *A. afarensis,* what has changed? A number of features seen in *A. africanus* fossils differ from those of *A. afarensis* in one of two ways. Some seem to involve greater specialization for heavy mechanical loading of the teeth and jaws than in *A. afarensis,* perhaps representing further adaptation to fallback food resources of hard or abrasive foods. Other features are more *Homo*-like.

A. africanus has larger chewing teeth with thicker enamel than those in *A. afarensis*. The body of the lower jaw is relatively thicker, with fuller contours. Cresting patterns indicate that the emphasis on the posterior fibers of temporalis seen in most *A. afarensis* individuals has shifted in *A. africanus* to more anterior fibers that concentrate force on the chewing teeth of the cheek. The cheek bones have shifted forward, bringing the chewing muscles they anchor (the masseter muscles) closer to the action. In the face of *A. africanus,* strong pillars have emerged on either side of the nose in an A-frame arrangement which frames the nasal opening. This may relate to resisting high chewing forces which are now transmitting greater stress to the face, as masseter muscle action has moved more anteriorly in *A. africanus*.

Microscopic analysis of tooth wear suggests that leaves and soft plant foods such as fruit, flowers, and buds were still important in *A. africanus*'s diet. Chemical studies of the teeth indicate a varied, opportunistic diet that included grassland resources, which might mean grasses, the mammals which ate them, or termites.

Australopithecus africanus appears to be more *Homo*-like than *A. afarensis* in some features of the teeth, skull, and hands.[3] The teeth are more human-looking, with smaller, spatulate canine teeth and fully bicuspid, more oval-shaped premolars. The upper dental arcade is often parabolic in shape, with tooth rows that diverge in back (unlike the more U-shaped arcade of *A. afarensis,* which may converge at the back ends), and usually lacks a diastema (a gap between the upper canine and the upper lateral incisor, which functions as a spacer for the lower canine tooth in apes and is still fairly common in *A. afarensis*).

When large male crania were discovered for both species (*A. africanus* in 1989 and *A. afarensis* in 1992), it became especially clear that claims for cranial similarities between the two had been overstated. A number of features of the face and cranial vault are more *Homo*-like in *A. africanus*. These include a more globular braincase, cheekbones with less flare to the side, and a palate that is, on average, deeper in *A. africanus*. The brow ridges of the large male *africanus* skull known as Stw 505 display strong swellings near the midline that can be seen in some early *Homo* skulls, and even in some male humans living today. These are absent in known skulls of *A. afarensis*.

Studies of endocranial casts of *Australopithecus africanus* have resulted in a decades-long debate about whether certain patterns of folds and fissures indicate a cerebral cortex that was reorganized in a human direction, but there is agreement that details of brain shape are more human-like than in living apes. It is especially interesting that Dean Falk sees an area which corresponds to Brodmann's area 10 in humans and chimpanzees as elongated in endocasts of *Australopithecus africanus*. In humans this area of the frontal lobes is twice as large as in chimpanzees, with greater interconnectivity between neurons, and it is involved in higher cognitive functions. Measurements of the internal spaces within the crania of *A. africanus* have indicated that there is little or no difference in brain size in comparison with its potential ancestor *A. afarensis* (this is true whether absolute sizes are compared, or they are mathematically made relative to body size).

Intriguingly, the hands of *A. africanus* seem to show additional features that might be related to toolmaking and use. There is debate on the physical traits that indicate the capacity for humanlike "precision grips" like those used in making stone tools, and on which anatomies characterize various species, but when the dust clears, three features of the *A. africanus* hand appear to show improvements in the capacity for humanlike precision grips over those seen in *A. afarensis*. The head of the first metacarpal (the nearest long bone of the thumb) in *A. africanus* is relatively broader, which would provide a firmer hold in precision grips. The terminal bone

Hand remains attributed to *A. africanus*.

(distal phalanx) of the thumb has a broader tuft at its end, indicating a broad, fleshy pad at the thumb's tip, and this is commonly seen as a sign of improved capabilities for precision grips.[4] An additional detail of this terminal bone's anatomy rotates it into opposition to the fingers when it is flexed.

Body proportions in *A. africanus* may be intermediate between those of living apes and humans, as they are in Lucy's kind, but as yet we have no *A. africanus* individual as complete as Lucy's 40 percent to confirm this. However, upper limb joints in *A. africanus* remains appear to be even larger (in comparison to the lumbosacral joint) than in *A. afarensis*. Fragmentary radii and ulnae attributed to *A. africanus* suggest that the forearms were long, as they were in *A. afarensis,* and this is echoed by the long forearm elements in an adult female skeleton discovered in Malapa, South Africa, representing *A. africanus*'s proposed descendant *A. sediba* (see Interlude). Some scholars take these proportions as evidence that climbing was still an important part of the locomotor repertoire of *A. africanus*.

More accurate determinations of body proportions must await the discovery and publication of more complete skeletons. A spectacularly complete *Australopithecus* skeleton is currently being brought out of the rock at Sterkfontein by Ron Clarke of the University of the Witwatersrand, and it may help resolve these issues for *A. africanus*. That is, if it is attributable to this species; it is from a rock formation different than the one that has yielded most of the other hominin specimens, and so it may represent a different hominin species.

One additional intriguing piece of evidence relates to locomotor behaviors practiced by *A. africanus*. The proportions of the semicircular canals within the ear are like those of living apes and *A. afarensis*.

Recently, evidence has been presented that challenges an ancestor/descendant relationship for *A. afarensis* and *A. africanus*. At the annual meeting of the American Association of Physical Anthropologists in April of 2012, two surprising presentations argued for features of the foot that appear more primitive in *A. africanus* and its presumed descendant *A. sediba* than in *A. afarensis*. This would imply evolutionary reversals in any proposed lineage with *afarensis* as ancestor and *africanus* and *sediba* as descendants. Perhaps more likely is that *A. africanus* and *A. sediba* are of a different lineage, rather than descendants of *A. afarensis*. The evidence presented also suggests that although members of both *A. afarensis* and *A. africanus/A. sediba* were bipedal, their style of walking would have been different.

What we seem to see in *Australopithecus africanus,* then, is a creature much like *A. afarensis* in many ways, but with some features which show further adaptation to hard object feeding, and some that are subtly more like those of *Homo*. Perhaps one of the most important messages to emerge from studies of the bones of *A. africanus* is one of stability. Like *A. afarensis, A. africanus* is a small-bodied, small-brained hominin with long arms. These two species of australopith are also similar in their flaring hip bones (wide in relation to trunk length) and in many of their adaptations for efficient bipedal walking, combined with the retention of some features related to climbing.

The persistence of these characteristics shows that a Lucy-like body plan endured in *Australopithecus* for over a million and a half years.

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Initially, the Smithsonian team wanted a bronze figure of an *A. africanus* mother and child. The mother was to be pregnant, suggesting an early appearance of the capacity of human females to conceive while still nursing a child, thus allowing closer birth spacing than in apes. There was to be a social learning component to the sculpture, indicating the communication of some aspect of culture from mother to child. In the end, it was felt that both of these were too speculative for such an early hominin, and that we might better communicate the social learning aspect with a later hominin for which evidence for such behaviors was more solid. I was relieved not to have to create a hominin for which our understanding of body proportions seemed to be in a state of flux (see, however, the rug pulled from under my feet regarding hominin proportions in chapter 4).

This move left only a head reconstruction representing *A. africanus* in the new hall. What important features of this species might we highlight? If the facial expression is one that exposes the front teeth, the smaller, more humanlike canine teeth would be clearly visible, as would the absence of a gap between them and the incisors. Some of the differences in the A. *africanus* skull from that of *A. afarensis* relating to further specialization as a hard object feeder will show in a head reconstruction. Would the subtly more *Homo*-like details of the face and head result in something that looks more human than *A. afarensis*? Before digging in and doing the reconstruction, it was too close to call.

The Long Road and Winding Road: The Reconstruction of Sts 5

The reconstruction of the head of *Australopithecus africanus,* based on the specimen known as Sts 5, was begun in 1986 and reached its final form in 2008, making it by far the longest hominin reconstruction I've ever worked on (possibly the longest in human history). During this time, as new information came to light, the face changed.

When I began the work on *A. africanus,* I had dissected a number of humans, but only five great apes: two orangutans, two chimpanzees, and a bonobo. By the time I finished the sculpture in 2008, I had much more extensive dissection experience. The dissections were performed mostly through the generosity of Adrienne Zihlman at the University of California in Santa Cruz. She is best known for her work on great ape anatomy and body composition, and their implications for human evolution. No study of primate anatomy or body proportions is complete without citing her work. I made inquiries, and she kindly invited me to work with her team.

Through the years, Adrienne and I have had some pretty schizophrenic phone calls. She might begin a call by telling me sadly about the death of a chimp or gorilla at a zoo. We would stay for a moment in this emotional zone, before letting ourselves give vent to our excitement about the opportunity this gave us to study the animal. By the end of the call, we would be breathlessly discussing the logistics of dissecting it.

It was a high-octane work environment in Adrienne's lab, typically with several people each dissecting different areas of a single animal, each trying to wring as much information as possible from the animal in a short time. I concentrated especially on the anatomy of the face. Exhausting hours, but an exhilaratingly steep learning curve and an exciting atmosphere of discovery dominated in her lab. I took hundreds of measurements during a typical facial dissection. I also made notes and drawings and took photographs of each step in a dissection. Each stage of the dissection was molded and cast in dental plaster before taking a face down to the next layer. This extensive documentation would theoretically allow me to rebuild each animal's face in accurate detail. But of course that's not what it was for. It was to allow me to answer current and future questions about how the animal's face was built, and to serve in the search for patterns in all of this data that are common to apes and humans.

My great ape and human dissections continued through the years, in Adrienne's lab and in labs around the world. The new information

The Sts 5 skull.

gathered had profound implications for the reconstruction methodology. As I learned more about how faces are constructed, it became obvious that, in creating the initial version of the *A. africanus* sculpture, I had made a number of unwarranted assumptions about the face. In all cases these amounted to the supposition that, since *A. africanus* is more closely related to humans than it is to any ape, human anatomy would make a better model for it than great ape anatomy. As I learned more about facial anatomy, these assumptions, one by one, fell away.

One of the areas most affected was the nose. The anatomy of human and ape noses is similar underneath the skin. The curled form of the largest cartilages of the external nose (the greater nasal or alar cartilages) is similar, and it is easy to see the form of the human nose as a reengineered ape's nose. The nasal area of an ape's skull is flat, or nearly so, with the nasal bones and the nasal aperture lying in parallel (or identical) planes. To create a human nose from an ape's, the entire structure, including bone and cartilage, must be pulled forward so that it overhangs the lower face. This creates a marked angle between the nasal bones and the nasal aperture. The bulbous tip of the human nose is formed by a partial walling in of the now-extended openings framed by the greater nasal cartilages on both sides. Since this change involved alterations of bony anatomy, it can be detected in the fossil record.

My earliest version of the nose for Sts 5 followed the efforts of other paleoartists working in the early 1980s in having an incipient bulbous tip. The more I learned about the anatomy of the nose in apes and humans, it became obvious that to build a nose that projected slightly, enough to allow room for the partial walling in that would create a small, bulbous tip, I had to cheat. I had to violate soft tissue/bone relationships observed in the dissections. While it is *possible* that the nasal area was built like this in australopiths, it would require bone/cartilage relationships not seen among living apes and humans. It began to seem to me like special pleading to reconstruct the nose this way simply because it was a hominin, possibly ancestral to later hominins with projecting noses. Comparative studies indicate a number of bony features which reflect a projecting nose in humans and which are absent in great apes. I thought these were also absent in casts of australopith crania. But casts of fossil skulls often obscure portions of the nasal anatomy. I needed to look at the real thing.

In summer 1987 I traveled to Africa to study fossil hominins from east and South Africa. I paid special attention to the nasal areas, where preserved. I found that in every specimen of *Australopithecus* and *Paranthropus* preserving this area, the plane of the distal nasal bones was close to parallel with (sometimes identical with) the plane of the nasal aperture, as in apes. All of them lack any indication of a projecting nose. Building any reasonable nasal cartilages onto these skulls would not result in a nose that projected enough to have room for both a nostril *and* a bulbous tip.

During the following year, new research on nasal projection in fossil hominins, published by Bob Franciscus and Erik Trinkaus, then both at the University of New Mexico, likewise concluded that the bony signs of a projecting nose were absent in australopiths. As new information continued to come to light, I rebuilt the nose of my *A. africanus* sculpture several times. As I learned more, it became flatter and more like the nose of an African ape.

Another change had to do with the use of soft tissue thickness values from modern humans for reconstruction of such an ancient hominin. Humans have a blanket of subcutaneous fat, which is thought to have evolved partly as a buffer against nutritional stress in an animal which grows and maintains a very large brain. Chimpanzees, bonobos, and gorillas have little facial fat, so the soft tissue is thicker in many areas of the face in humans than in African apes. Since australopith brain sizes were apelike, it is probably not appropriate to use human soft tissue thickness values in reconstructing these areas, so these had to be thrown out.

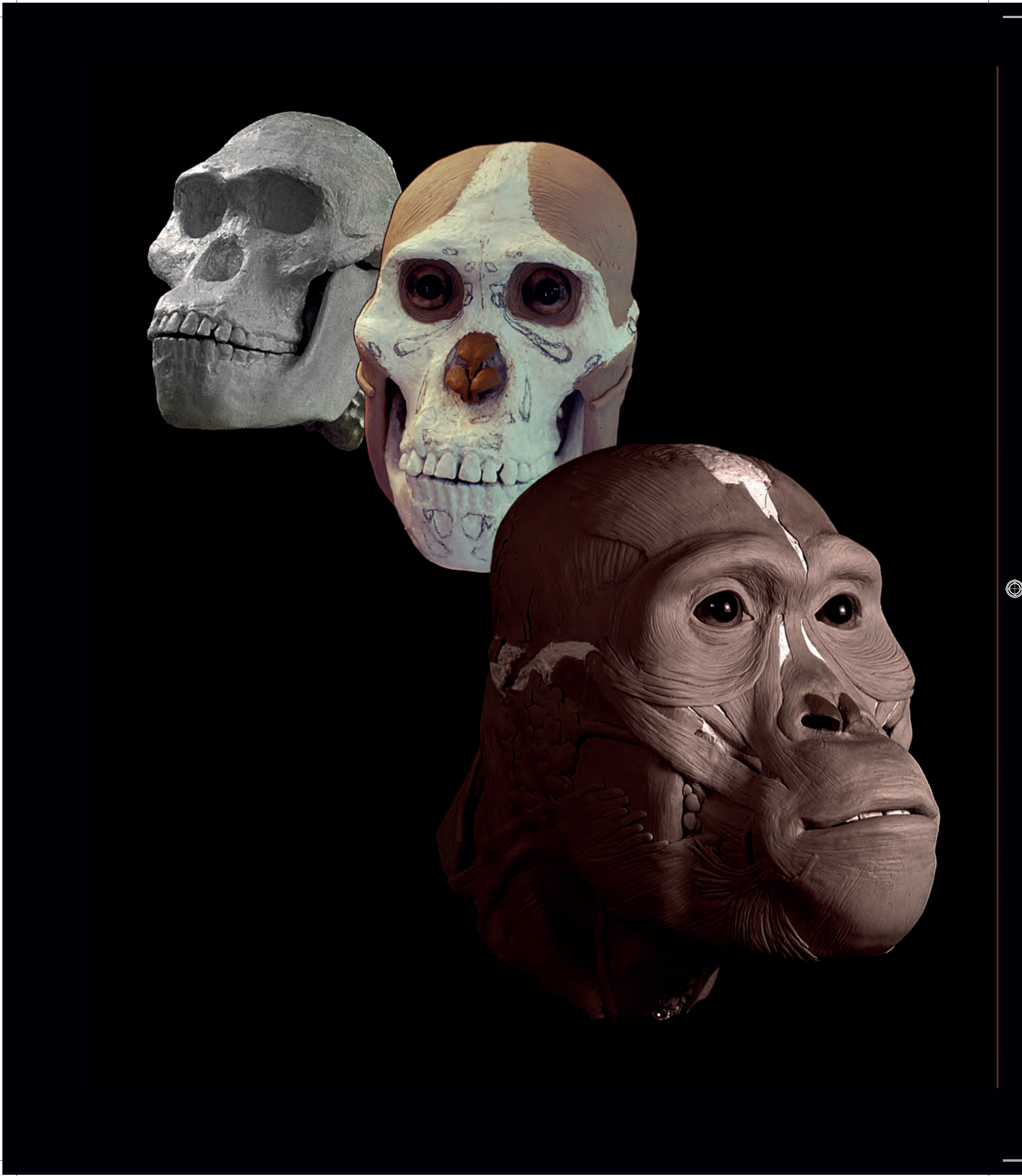
The *A. africanus* reconstruction initially had a humanlike placement of the corners of the mouth, resulting in a narrow mouth. The canine teeth of *A. africanus* are larger than in modern humans and, based on my hypothesis that placement of the mouth's corners is related to upper canine size, the mouth had to be widened. The width of the nose, based initially on the notoriously unreliable nasal aperture breadth, had to be redone using better predictors, and use of either the chimpanzee or the human values for these ratios indicated a wider nose for Sts 5. All of these changes had the effect of making the sculpture look more apelike. Over twenty-two years the face de-evolved.

Rick Potts and I thought it might be a good idea to open the mouth and show some teeth for this reconstruction, as those on either side of it in time have closed mouths. Since the Sts 5 specimen preserves no teeth, I cast those of another individual with a comparably sized tooth row, known as Sts 52, in order to make paleodentures for transplant into Sts 5's mouth. These were subtly stained as a nod to tooth wear studies indicating that fruit was an important part of the diet for this species (I was thinking of figs).

Paleo-dentures made for the Sts 5 skull using the teeth of Sts 52.

With these changes made, the version of *A. africanus* that was finished in 2008 had come a long way from the one I began in 1986. Stripped of humanlike characteristics such as an incipiently humanlike nose and a narrow mouth, the final form had lost ground in terms of its resemblance to humans. When I compare its final gestalt to that of the reconstructed A.L. 444-2 male *A. afarensis* head, however, my own impression is of a subtly more humanlike head for Sts 5, reflective of some of the more humanlike details of the *A. africanus* skull.

We don't know what facial expressions were practiced by early hominins. The face that now peers from within a Plexiglas case above the label *Australopithecus africanus* in the new Smithsonian hall has an expression that is in the area of overlap between those typical of chimpanzees and those practiced by humans, so it is a fairly safe bet for early hominins. This expression is analogous to a chimpanzee's "fear grin." The human equivalent is the nervous smile. This is a smile with a lot of tension in it, and I've sculpted it so that it changes subtly with different lighting. When the head is lit from the side, the furrowed brow is emphasized. The stress in the smile is at a maximum, and you can tell that the individual is uncomfortable. When it is lit from directly above or from the front, the furrows vanish; the tension seems to melt away and the smile looks warmer. As the *A. africanus* head's case is lit by several spotlights, the movement of museum visitors outside of the case can cause subtle changes in the lighting angle that appear to change the expression. This is one additional way of making the sculpture come to life. I wish that I could have had the pleasure of showing it to Raymond Dart. He was still living when I began the reconstruction, but he died in November 1988 at age ninety-five, twenty years before I finished it.



The anatomical reconstruction of Sts 5.