TABLE OF CONTENTS

Test: Apache

Time: 18:06.00.2 8 July 1956 (GMT) 06:06.00.2 9 July 1956 (local)

Location: In the Ivy Mike crater, Enewetak Atoll

Test Height and Type: Barge shot

Yield: 1.85 Mt

UCRL test of a two-stage system using a Zither secondary stage. This was a prototype of the XW-27 warhead intended for the Regulus I missile and was fired in a Regulus nose cone. Used the same LASL primary design that was fired in Redwing Lacrosse (40 kt). The test device was 30.2 inches in diameter, 69.8 inches long, and weighed 2941 lb. A high percentage of the yield was due to fission.

2.9.4 Kronosaurus Queenslandicus

Dad revolutionized the way that dinosaurs are mounted. In order for you to understand how extraordinarily innovative the *Kronosaurus Queenslandicus* mount was, we need to go back and see how dinosaur skeletons had previously been mounted, i.e. during the early 1900's and the late 1800's. I was surprised today as I surfed the net to the big museums for images to show you to discover that all of the ones I could find have all done major revisions of their dinosaur mounts. I'm sure I could find some antique photos but don't know where to go so I'll use this sample of a mounts that is greatly upgraded from how it was mounted 50 years ago I can guarantee you, i.e. before dad's revolution that has spread around the world. This mount still shows at least five of the old-fashioned features that dad did away with when he showed the world -no kidding- how to 'really' mount skeletons:

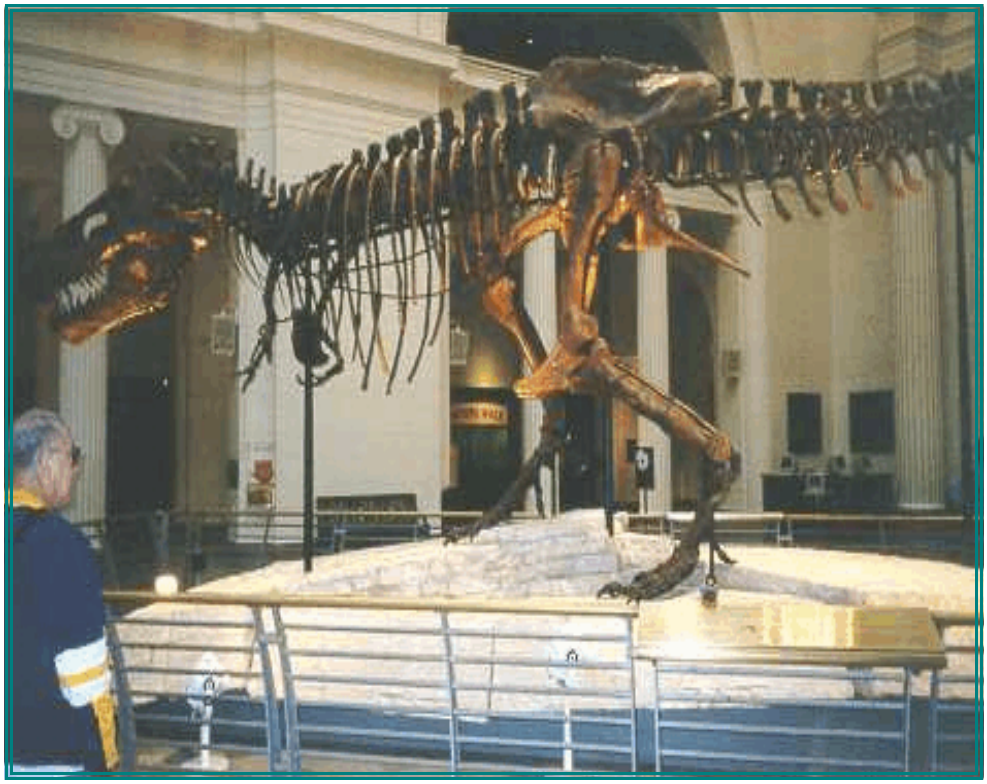


Figure 2 http://www.notduck.com/imagesNew/ducknsue.jpg

First: the two dark vertical poles supporting the skeleton, one under the shoulder girdle, the other under the pelvic girdle. I can't tell if there is one under the tail on the right end of the image, but be assured, in the past there would have been at least one such support.

Second: the horizontal straps inside the ribs. These do precisely what you'd imagine: they hold the ribs properly spaced and secured so that they don't swing inward, or fall off.

Third: This is harder to see but it's there, a heavy bar slightly contoured running parallel to a few inches below the spine, from the tiny fore arms through the pelvis and out along the tail as far as it shows in this image. The purpose of that old-fashioned device is also self-evident and was just described in the preceding paragraph.

Fourth: the vertical struts that support the feet and hold the rear legs securely in place.

Fifth: is difficult to see in this printed version of this poor quality image but is visible on a CRT. There is a heavy metal strap applied to the back side of the hind legs running from the feet up the pelvis.

The viewer accepts these artificial elements as part of the mount and understands their necessity. They keep things from collapsing into a pile of jackstraws.

Before moving on, return to the first photo: you ask me what shows that this mount has been affected by dad's method? Good question since I've just pointed out how it differs, but I also said that it showed his vision. The first observation is that the overall amount of hardware is remarkably reduced from what it used to be. I suppose that sounds to you like I'm contradicting what I just pointed out. It does. But I'm not. You just don't know how much visible steel was used to hold bones together in the old method. No support was placed inside of bones so every bit of metal used to hold ribs and metacarpals and vertebrae and limb bones together was there is front of the viewer.

The second observation is actually the more dramatic one: the stance of this mount is vastly more realistic than the old method where the animal stood up like a pile of hay, wooden, silly, unrealistic. This mount has been dramatically improved. It looks more lifelike with its body horizontal, in an attitude of flight. The legs are bent, the creature stands up on its tip toes leaning forward, ready to lunge at its prey. And the tail is not hanging down on the ground like a limp rope. That's dad's artistic and realistic approach to mounts.

Dad. He was an artist first and foremost. Do you realize that? He was

first of all an artist. He was not a paleontologist, he was not a welder or machinist. He was an artist, a lover of beauty. His whole life revolved around appreciation of beauty. That's where I inherited my own love of beauty and dedication of my life to it. Painting, sculpting, photography. Those are all expressions of love of beauty. Nothing he did was done in any other frame of reference. It was genetically and constitutionally impossible for him to do ANYTHING with his hands that was done without lengthy consideration of the elements of beauty embodied in the project.

You've seen a few of his paintings of Indians so know his love of art. He painted them because he loved the novelty of their faces and costumes, yet I believe it was the process of creation first, and second, the satisfaction of a lovely final product that compelled him to paint. He loved beauty anywhere.

When Dr. Romer and Arnie involved dad in mounting *Kronosaurus*, it was inevitable that he would take over the design and layout of this monster. It is 50 feet long and 6 feet high. Dr. Romer was doubtless envisioning the traditional-for-that-era mount that had various straps holding things in place, a set of vertical supports holding the whole skeleton in place, and a few strategically placed guy wires. That's how it was done up to the time dad embarked on his mount. Romer was trained at Amherst there in New England and had doubtless spent time at the Smithsonian, American Museum of Natural History, US National Museum, etc.

I wasn't present when it started and I don't have him to talk to, but I don't need to talk to anyone to figure out what happened. Nor do you need to talk to any one else after you think about how every dinosaur mount was done up to the time that dad entered the scene. Romer is dead and I doubt I could get Arnie to talk to me, the only one of the three left who could tell me how dad persuaded them to go in the direction they did. It was not trivial, it was not expected. Indeed, for his vision to become real, a rather extraordinary change had to be made to the building itself. I'll tell you about it in a bit.

Look at dad's qualifications a bit more. True, he was an artist. Everything he did was done from that perspective. In addition, he was familiar with dinosaur bones and had studied their mounts. He knew how it was done, and I expect that his study automatically resulted in novel ideas about how it should be done. That's how it was in a machine shop. He looked around and automatically came up with new ways to do things. He did that with the principles of dinosaur mounting that had been used up to that time. This was an innate characteristic. He did not tell himself to find things that could be improved. He just looked at things from that vantage point.

In addition to his familiarity with dinosaur bones, dinosaur mounts, his

natural inventiveness, and his intrinsic artistic bent, he brought two specific skill that no 'real' paleontologist would ever bring to the transaction:

He was a journeyman welder, and
He was a journeyman machinist.

These skills meant he could take metal and do anything he wanted with it. Put those skills together with his artistic vision and an entirely new way of mounting bones evolved. It was inevitable, really. There was simply no way he would not revolutionize dinosaur mounting.

Another subtle but significant point to make about dad and his visionary approach to dinosaur mounts pertains to these specific years. In Vernal, Dad did more painting that sculpting. He did some animal sculptures and carved linoleum blocks like this Hawai'ian fish. In 1954-56 -we moved to Boston in 1956- he started sculpting seriously and successfully in Seward. He earned first prize in sculpture in the Fur Rendezvous, admittedly a small venue, but it was a win and I imagine that it reinforced and energized dad. He fed on praise and acknowledgment so I suspect that his success in sculpting informed his determination to persuade MCZ that he had something profoundly new to offer.

The last critical element to the success of this novel mounting method was Romer himself. As just noted, his training and knowledge of dinosaur mounts was the old standard, the wooden held-together-with-wires-and-straps style. People are naturally conservative and resist innovation, even when it is presented in a favorable light. There is too much risk, too much possibility of failure, of embarrassment, of waste. Change is not easy to adopt, but Romer saw the brilliance and developed a belief or trust in dad -and Arnie- when they described the mount and the method of creating it.

I can't find any notes that identify when *Kronosaurus* mount was done but I know that it was done while we lived in Waltham because I worked on the skull and as a result had to go to the emergency room in Waltham. We moved to Belmont in the summer of 1958 so the mount was done between 1956 and 1958, Dr. Romer had only known dad for less than 2 years when he accepted dad's proposal. I am

sure that Arnie helped Romer accept it because Arnie understood what was going on and had known dad for about 8 years. The point, though, is simply that Romer had the courage and vision to accept dad's proposal -supported by Arnie, another critical factor- and to give him free rein -and a budged- to proceed.

Poor Dinosaur Mounts Today

To show that poor mounts continue to be made, I've collected two images. For some reason they are both from Brazil. The problem is not the armature even though it is the old style, external structure. The problems, major ones if the public is to be properly educated about these creatures are their musculature and posture .

This first image, *Baurusuchus salgadoensis*, is of new specie of crocodile on display in Rio de Janeiro . This is obviously the life-sized creature as the preparator imagined it would be with the skin on. There are actually two points: first is the musculature and second is the posture. To put it nicely, they are both preposterous.

Figure 4 ‹http://www.taipeitimes.com/News/feat?pubdate=2005-06-14›

Look at the humerus, the top bone, of the left front leg. The long muscle on the back side (the side of the blue shirt) of the bone as they have modeled it is probably not much larger than the thighs of these men. The men weigh less than 200 pounds and live fairly sedentary lives while Baurusuchus weighed 900 pounds and chased and shredded their dinner. These flimsy muscles could not get up enough steam to chase down and kill an anxious, animal running flat out. The heavy body is far too large for such muscles.

The posture is equally unlikely. The legs are splayed awkwardly making the creature look like it was either just started a jump into the air, or was on the verge of landing from a jump. That isn't how it looked. The rear legs don't look too bad, although the muscles are far too small. Either the creature died of massive starvation or the model is inaccurate.

Look at the neck and the large head. Does it seem likely to you that the thin

neck would be sufficient to stabalize the skull when the jaws were ripping into someone who is flailing about for all its worth? Not, it is not likely. The neck should be perhaps twice as massive. Even the muscles on the skull are woefully inadequate. Notice the 'hole' in the skull behind the eye. That hole should actually be filled with something like a powerful masseter muscle. The hole is there to allow that muscle which chomps the jaw closed to bulge out. The same observation holds for the jaw. As far as we can see, I have about as much jaw muscle as this does. Etc.

This second image is from Yahoo!, a new sauropod which was named *Maxakalisaurus topai*. I first felt like laughing and then I was embarrassed at the poor stance. In this case we don't have the muscles to consider but the posture is improbable. Look at the front legs. The way they stick out to the front is not possible for the enormous barrel belly they must support. They should be positioned more or less in a straight line from the femoro-coracoid junction (the coracoid is the circular flat bone on the front of the scapula.) You try and kneel on the floow with your arms extended in front of you like these are, and hold that posture for half an hour. You will feel the tiredness from just holding the position, let alone doing any running. (Somehow I find the entire engine room unlikely. The pelvic and shoulder girdles are far too small for that enormous weight. Perhaps it's the angle.....)

Figure 5
http://news.yahoo.com/s/ap/20060828/ap_on_sc/brazil_dinosaur

Anyway, these photos emphasize the second feature of dad's method that gives life to a mount: lifeline posture. A childhood in the desert watching and chasing snakes and lizards gave him a sense of how long skinny bodies must operate. For the animals, the posture is not actually a matter of esthetics. Esthetics is in the eye of you and me. The posture is a mandatory consequence of the way bones and muscles move, given their proportions, sizes and lengths. Enough of this. You get the point.

Strutless Mounts

The entire concept was revolutionary. Here are features that I understand to be novel, i.e. never done by anyone before:

1. Drill holes through bones with a core drill so that supporting steel bars could be concealed in those spaces. The concept is simple, but the drilling is not. He had to have the right kinds of drill bits and drill press and had to figure the angles and dimensions of the bores so that the proper sized bars could be used. He did all the drilling himself, knowing how to drill, how fast, how to cool it.

2. Bend steel rods of the proper diameter so to make them conform with the core holes drilled out, and weld the cylinders together so that they would support the bones. Then conceal welds with plaster restorations that completed the skeleton.

3. Design the mount so that there was no visible metal or supports. This required that methods be developed for every single bone to be supported invisibly. That is not trivial either.

4. Construct an elaborate supporting framework out of metal bars and pipes from which to hang *Kronosaurus*.

5. Secure the heavy-duty framework against a wall so that it can be concealed entirely behind a wall of lath.

6. Design the lath wall so that there are no corners, no angles, no corners, just curved planes.

7. Air brush the lath wall with bluish and whitish pigments to create the illusion of dimensionless space so that *Kronosaurus* would appear to be simply floating in space.

All of those features -and others that I don't know, I expect- were combined to produce the most novel dinosaur mounting technique that had ever been done. I

expect you can see the underlying principle yourself but I want to emphasize it:

The essence of this method is burying the metal supports inside the bones.

That's it in a nutshell. So simple, of course, why didn't someone do that already! Every one who ever mounted a dinosaur wished s/he didn't have to use those unsightly external straps and bands and supports and wires but was incapable of doing anything about it.

Here's the corollary: in addition to understanding dinosaur bones and their articulation, the mounter had to be:

An artist
A welder, and
A machinist

That disqualifies every paleontologist in the world but that is, in fact, the job description that qualified dad -and anyone else who is going to reach the levels of sophistication he did- to do these exquisite dinosaur mounts.[1]

[1]Near the end of his life, looking back across the jobs he had and the continents he worked in, the view he took of himself distilled into a simple phrase that I don't think is fair or accurate, but it encapsulates his view of himself: "I guess I was just an adventurer." Fascinating comment, which was driven at least in part by the fact that he felt that he didn't receive recognition for contributions he had made. He didn't articulate any reasons for that conclusion, but I enter it here because I do know that he felt undervalued, under-appreciated, and this particular contribution should be memorialized and studied. Every recent dino mount I've seen shows the influence of his technique. You have to go back to 1950 to get it, however, because the changes were not linked to him, nor were they immediate. But the 1950's style was wooden, external, etc. He was a genius in developing this method. What I find interesting is just how complete the conception was in kronosaurus. This was the first time he'd mounted a dinosaur, but he didn't take just baby-steps. He jumped into a new universe of mounting techniques, setting the bar high for those who followed.

I need to tell you something important here. When I allow my inner child to contact his dad, I see dad first and foremost as a machinist at a huge lathe in LT Payton's machine shop, staring intently as he spins little cranks and watches the wire coils come off the slowly turning steel stock, smoke rising from the slow drip of cutting oil. Or I see him as Vulcan fearlessly suited up and using the fiery harsh fearsome power of creation to join heavy metal. Or I see him as an artist. To me he is not a paleontologist, only incidentally and sort of accidentally and laterly.

My real Dad has a shiny mike in his oily hand, wiping it on his pants, large leather gauntlets, goggles, shield, smelling of cutting oil with a distant look in his eyes as he looked at the beauty of whatever it was he did. Here's an example of his attraction to metal and art. This is a "kris" in the style of the Indonesian original that I won't bore you about. He made this in Hawaii when he was 26 years old. Look at it. He did that out of flat stainless steel, engraved the surface, made the tang, the hilt, carved the handle out of white mastodon ivory and then inlaid it with copper-salt dyed ivory. This artist loved metal work which was essential to the success of his mounting technique.

Anyway, paleontologists are paleontologists, not artists, machinists, or welders. Had they wanted to learn those trades then would have gone to technical schools. But do you understand that these abilities are absolutely necessary to implement this vision? I feel like I'm over-doing this but I'm not.

Look again at the first photo above of the intermediate-style bipedal

dinosaur mount. It shows the influence of dad's technique but it isn't possible to know whether it's a new mount done after 1958, or is an old mount that was refurbished after 1958, nor does it ultimately matter. Dad's influence in it is self-evident. But as noted there are at least five throw-backs to the old methods. The reason they persisted in spite of the fact that the mounters were familiar with the *Kronosaurus* method, was that the mounter was NOT -guess what:

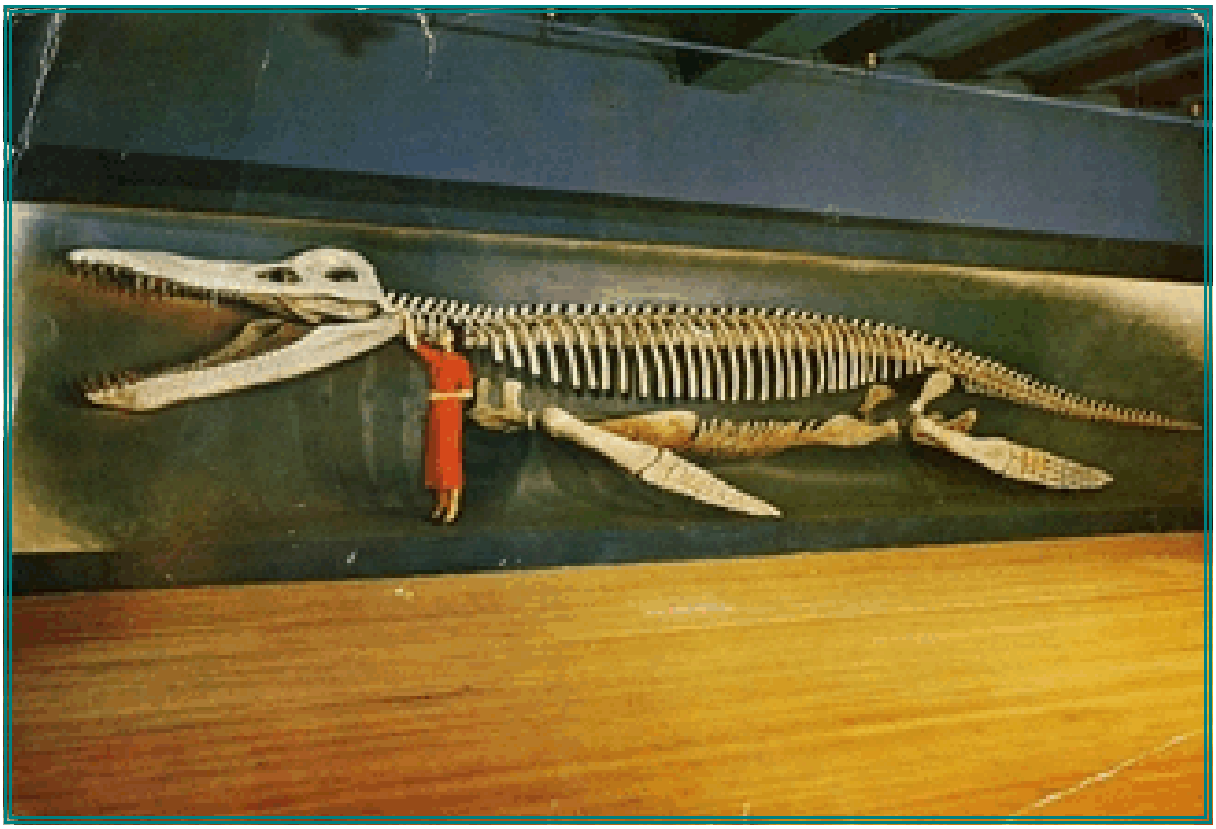
An artist,
A welder, or
A machinist.

What subsequent mounters had to do was blend the understandings and abilities of various individuals. Dad simply existed as multiple specialists in one body. The subsequent mounters could understand the simple shiny principle of burying the supports inside of bones and the skeleton and doubtless wished they could do it, but they were unable to make it so because he was none of these things. Universities don't teach PhD. Paleontologists to weld or bend metal. So the palaeontologists had to dig up associates who had the skills which could be melded with their vision of what they wanted the mount to look like.

As I"ve worked on several mounts with dad and studied his process, I see that his method can be roughly divided into three stages. I'll describe them for you so you can see the evolution of his vision. It took 20 years to reach its pinnacle in a mount of two specimens.

Stage 1:

The first stage of his technique was that adapted to *Kronosaurus*. This was



the maiden voyage of his vision. This beat up postcard shows how *Kronosaurus* looked after dad had finished air brushing the background but before the glass front had been installed. The woman is a point of reference to show how large the creature is. The skull itself is 9 feet long, the front paddles are 10 feet long. Note the high ridge on the top-back of the skull.

There are no edges or corners, no struts, wires, straps, bars in the gray wall. Nothing to give the eye a point of reference. For example, the curtain you see underneath the belly of the beast is actually about 3 feet closer to you than is the curtain you see through the abdomen but because the surfaces are all curved, your eye can't make that distinction, can't see the difference. The only way you can see the difference is to look for a thing which you can also see in the postcard behind the woman's legs. There you can see a vertical surface perpendicular to the back wall that gives your eyes leverage to work out the difference in position of the different planes. But even when you can work out the difference there, you still

can't translate it into a difference between the two portions of the curtain I just described, can you. *Kronosaurus* just floats there. There is nothing that intrudes on the shape of the skeleton.

That was dad's vision. Create a mount that had no evidence of man's hand in it. No one had ever done that before, and only an artist with understanding of bones and his resources who was a welder and machinist could do this thing. Today museums everywhere have learned from his method and now conceal the bulk of the supports. Yet no one that I have seen yet has reached the level of perfection he did. Because no individual possesses all of the skills and vision necessary to pull all of the elements of a dinosaur mount together in the manner he did. In time a team -it will have to be a team of specialists because no individual from this era will possess all the skills again- will be pulled together to match him. That's sure to happen. But no one will exceed him as you will see below in the double mount of Stage 3. Because it's impossible.

In addition to the concept of concealing the supports, the other predominant feature of Stage 1 is dad's use of a trompe d'oeil to make the *Kronosaurus* appear to hang in space: he bolted the steel framework that held *Kronosaurus* to a wall. Then he concealed the framework by a cleverly contoured stucco curtain that denied the eyes points of reference. This stage was the simplest because he did a mount that gave him the option of hiding massive supports. I'll show you below from his photos just how massive the framework was for *Kronosaurus* and you'll see why it was a luxury to be able to conceal it behind a wall. This luxury was obviously not available when a free-standing mount. In that case, the support could not be hung from a wall or ceiling or hidden behind a nice wall.

This stage was defined, then, by that supporting framework anchored to a wall, from which the skeleton was hung with all supporting steel buried inside the bones, all of which was concealed behind a stucco curtain.

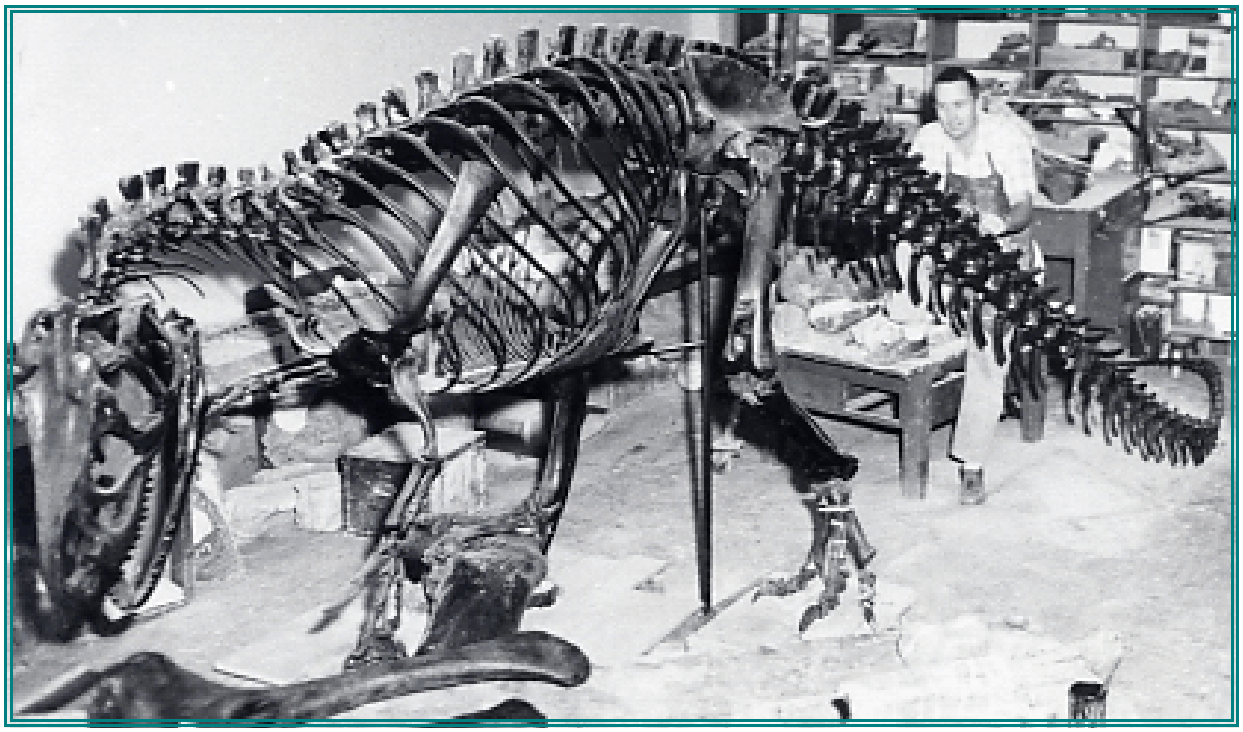
Stage 2:

The second stage of his method is exemplified by a mount that he and Arnie did for Princeton in the late 1950's. It's standing here in the MCZ lab, half completed. You can see that the *Kronosaurus* method has been adapted to a free standing model. Notice the big anvil to the left of this lady. Is that what you expect to see in a paleontology lab? Perhaps, but imagine that dad used it more than most would have. In this image you see steel tripods supporting the legs and tail while they were working on the support structures that would make it stand alone. This model was sort of the first phase of Stage 2 because he still had not gotten rid of all of the external steel supports. There were steel bars up the back of the legs when he was finished. In the second phase all external steel was gone except for a single support for the pelvis as appears in the following mount.

In this Stage, he also did an *Antrodemus* mount for the Price, Utah museum -down in the center of the state. This is a recent photo from their website <http://museum.ceu.edu/images/allosaurus2.jpg>. the Princeton and Price mounts, he figured out how to conceal all supporting steel for every bone of a skeleton which he refined in this mount. But he still hadn't figured out how to remove the

pelvic support, the critical one that anchored the entire construction.

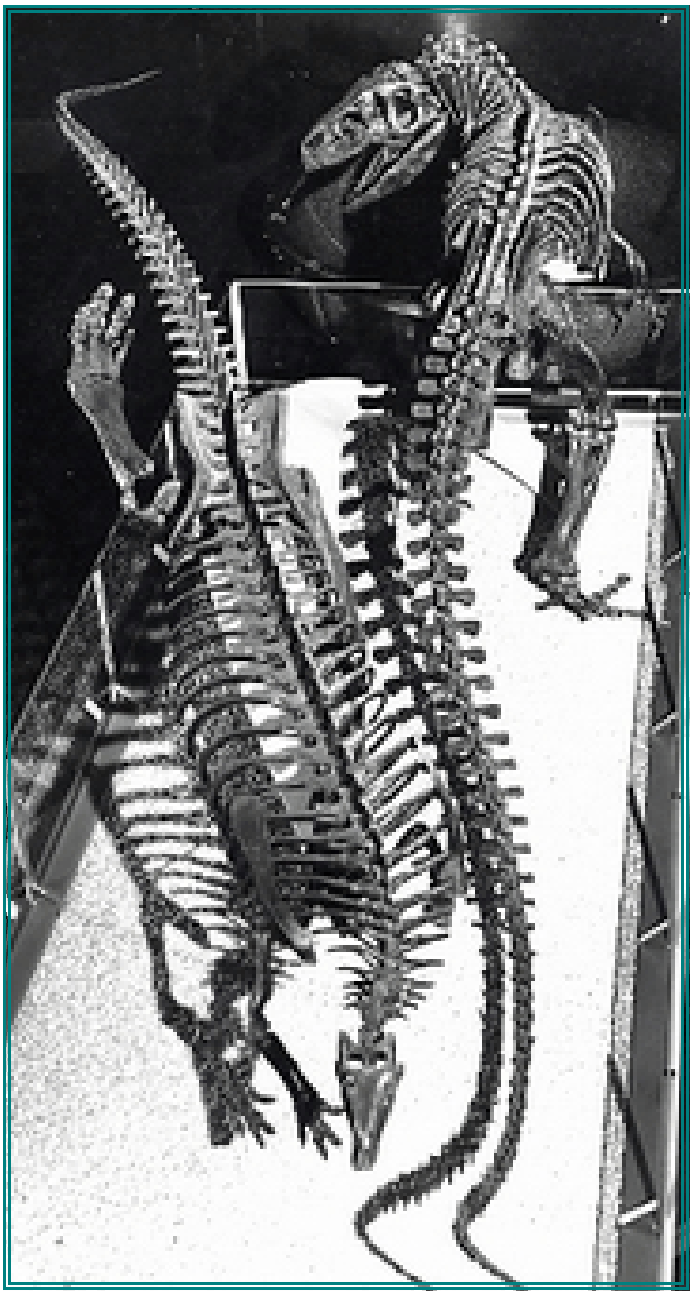
I helped him finish this particular mount in January-May 1964 after I returned from Finland and will talk about it in the appropriate volume. I did all of the ribs, listening to the new smash hit, "I wanna hold your hand!" In this photo,



the mount was still in the back room of the Eyring Science Center museum space where we finished preparing it. The difference between these two stages is obvious. He worked with free-standing specimens, but still required one visible support under the pelvic girdle. He still had not figured out how to get around that, but this mount actually constituted a laboratory experiment for him. This experience helped him determine how to remove all visible supports.

Stage 3:

I can't find a photo taken from of this pair from the floor, the pinnacle of his method, so will show you this photo taken from above. This is a pair of free-standing bi-pedal dinosaurs without a single visible support for either. The one on the right is a carnivorous *Antrodemus,* the other a vegetarian *Camptosaurus*. Notice the differences in the skulls which illustrate the different diets. The first is chasing the second to invite him to lunch.



I look at this pair, and I think that dad is actually thumbing his nose at the whole damn world. By creating the first totally free standing mounts, especially in a pair, with one of them balanced over a minuscule 8 inch long point of contact, he is shouting, he is screaming, he is challenging the world, "Let's see anyone of you top this!" No one ever will. There will be more beautiful settings, there will be different materials, but no one will be able to surpass the artistic and engineering elegance of this pair.

When seen from the side, *Camptosaurus* actually appears to be jumping into space, elevated on one foot, practically suspended. Not a single visible support in either creature! Astounding accomplishment. To show yourself just how revolutionary this was, go back again to the first photo in this section. That particular mount is a nice one done at a huge museum with a huge budget and all the

experts it could find. That mount was a vast improvement over the old methods, but can you see how primitive it really is compared to these mounts? Forget the setting, forget everything. Just l-o-o-k at it, and then l-o-o-k at this pair. One is sophomoric, the other sophisticated and mature.

The fact that he was a Man of the Desert taught him how to pose lizards. He was raised in a desolate dry hot empty desert and spent his childhood knocking around in the foothills and mountains[2]. Naturally, he encountered hundreds of lizards of various types and observed them run, and interact with their environment. The memory of lizard and snake sinuosity burned itself into his view of members of that tribe. This photo of a Utah lizard shows many "S"-curves. He believed, based on the freedom of movement in the spinal column that dinosaurs moved in the same way. But most dinosaurs were posed as if they were wooden mannequins[3]. Compare the pose of this lizard to the BYU pair and to the Smithsonian mount at the beginning of this chapter.

Figure 12 http://utahpictures.com/

When describing the pair of mounts, dad explained that the difference in the weight in front of the pelvis in *Camptosaurus* and that behind the pelvis was perhaps 75 pounds, a remarkably small difference, one that was critical to his success. Can you see the right foot of *Camptosaurus* splayed out behind himself back along his tail? The weight of that leg and foot contributed to the balance and also gave a powerful impression of movement. That leg counterbalanced the weight of the fore girdle. Brilliant man.

---

[2] See Vol 2. Leamington on the Up Hill Both Ways website for a lengthy description of his childhood: <http://uphillbothways.org/html/volume_2_leamington_1918.html>.

[3] Chuckle. I have to laugh today when I compare KQ against the little lizard. It is about as stiff as the sauropod and here I am preaching about how superior his method was. However, I believe that there is at least one mitigating circumstance that prevented him from elevating the neck so that the head was poised above like a sail, the same problem that prevented him from curving the body laterally, turning the tail into an "s" as much as he could: space. Space. The thing took all of the vertical space! And the thing took all the lateral space. He could not do the job on the neck, head, paddles and tail becauses there was insufficient space. He was just luck to have persuaded Dr. ROmer et al of the necessity to un-obstruct the view. To ask for vertical space was impossible. This was on the fourth floor and it would be impossible to raise the roof - though he did that, too.

Notice the other remarkable feature of this pair, a feature that was an expression of his artistic nature. Both skeletons are mounted with the sinuosity that he observed in lizards and snakes. He grew up with them in the desert, catching and examining them, observing how they ran, how they held their tails, how they moved. Go back to the comparison photo at the top. It is, again, remarkably superior to the old mounts that were more or less collections of bones standing woodenly, because this skeleton has a nice posture, leaning forward in the attitude of flight. But it lacks the serpentine shape of dad's mounts. It's spine-tail are basically flat. Compare it to the graceful curves in dad's mounts. His are more realistic and graceful. Look at the tail of *Antrodemus*. It is curved in three dimensions - just like real lizards and serpents. That's precisely what anything will look like when it is long and thin and moving.[4]

After dad had perfected his method in this pair, he rested. He never mounted another dinosaur. He had achieved the ultimate. He had achieved the ultimate in mounting techniques. Really. How can you beat that, a free standing, sinuous dinosaur, fleeing an attack, not a scrap of visible steel - and supported on an 8 inch-long support, grasping a narrow ledge with the toes of one foot, perfectly balanced?[5] Note the fact that he mounted TWO dinosaurs in this outrageous show of virtuosity. No will ever do better - with or without a Ph.D. Because there is nothing left to achieve. The artist-welder-machinist excelled and no one will exceed him - and only a rare one will even come close.

---

[4] I need to make one small point about something in the photo of *Antrodemus*. There is a dark line that appears to extend to the left from the middle of his right Tibia. You might wonder if that is the shadow of a vertical support that isn't otherwise visible. It is not. That line is actually a sliver of shadow created by a narrow strip that starts rising upward rig ht at the end of that foot. It is the same one that extends up toward and under *Camptosaurus* who left foot is grasping its end with his toes. There were no visible supports for these two.

[5] 5-19-2005: I've seen a photo of another dinosaur mounted with visible supports, a lovely job done bu the specialists. So his level has been equaled. To surpass him, however, will require Dune-like technology as in suspensors.

Test:	**Tewa**
Time:	17:46.00.0 20 July 1956 (GMT)
	05:46.00.0 21 July 1956 (local)
Location:	Over reef between Namu (Charlie) and Yurochi (Dog) Islands, Bikini Atoll
Test Height and Type:	Barge shot
Yield:	5 Mt

This device, the Bassoon Prime, was a "dirty" three stage design, the first U.S. three stage design. This was actually the second test of this design (the earlier "clean" version, Bassoon, was test fired in Redwing Zuni). The fission yield was 87%, the highest known fission yield in any U.S. thermonuclear test. A uranium tamper was used around the tertiary stage instead of the lead tamper used in Zuni. The predicted yield was 6-8 Mt. This design was later developed into the Mk-41 bomb, the highest yield (25 Mt) weapon ever deployed by the U.S.

Planning the *Kronosaurus* Mount

Well, I'm pretty damn biased here, aren't I. He was extravagant. This revolutionary mounting method is actually his greatest contribution to the field of paleontology. Really, and it is a major contribution for museum goers, in particular. His concept, hence method, has spread throughout the world. Not through publication or lectures, rather through osmosis. Museum makers simply look at what is, and emulate it. My own research on the internet at major institutions everywhere suggests that his method has influenced them all. I suppose this is because the old style was so pathetic looking that these institutions feared being considered out-dated if they didn't keep up with the Joneses, in this case, with Jensen.

I want to go back to the beginning of his vision and tell you the story of the extraordinary creativity of James A. I want to reconstruct it for you. There is genius in it that is obscured by his personality and by time, but it is pure genius.

In dad's records, I found sufficient documentation for this story and it is fascinating. There was a set of about 2 dozen black and white photos of the mounting process which make me think he intended to write an article about it, or at least prepare a lecture. Nothing of that type has turned up so I'm going to use those photos, my imagination, and my own work on the mount to create a plausible description of the steps that he went through to get *Kronosaurus* mounted. The

photos are some of the poorest in his collection because the lighting was so poor - they were taken indoors, most in the actual space where *Kronosaurus* was mounted which had low light levels to begin with. Let me explain why that was because it isn't obvious.

In the 1950's, there were obviously no digital cameras, and no electronic gizzmos like you grew up with. There were none of these neat little flash tubes all cameras have today. The only source of light for photos was either photo flood lights or flash bulbs. So: in order for dad to get sufficient light, he either had to cart in a bunch of incandescent lights or he had to buy a bunch of these flash bulbs. They were expensive. My estimate would be a dollar or more apiece in today's currency and since we were living on a shoe string, he simply could not afford to use our limited money to buy what would have been perceived as a frivolous hobby. And since these photos were his personal ones, he couldn't ask Dr. Romer to pay for them. Why would the museum buy him expensive flash bulbs for his personal use? So dad took photos using ambient light and in most of the cases it was inadequate. The few photos you'll see that are minimally well lighted were done with half a dozen lights as you will see in the photos.

Figure 13
http://www.ozcamera.com/photo%2010/1036.jpg

Back to the vision. It is obvious that dad did not simply embark on this huge process without extensive plans. I watched for any drawings of *Kronosaurus* in his papers and didn't see any even though there are many rough drawings of other ideas that came to his mind. That was how his mind worked, visual and tactile, so drawings were natural for him to use to lay out this project. They were just discarded when the project was completed.

The mounting process took into account a wide variety of factors including but not limited to these:

1. The dimensions of the room where it would be mounted
2. The dimensions of the creature - he naturally had to have a catalog of all the bones in the creature which include in general the 9-foot long skull, the 4 paddles, the shoulder girdle and ribs, the spine consisting of 80+ vertebrae running from the skull to the tip of the tail, the abdominal structure (probably termed 'gastralia'), and the pelvic girdle

3. The weight of the various bones and their location
4. The size and shape of the frameworks that would support the various elements of the skeleton

5. The types of stock and steel that would be necessary to fabricate the frameworks
6. The location and method of mounting the frameworks on the walls

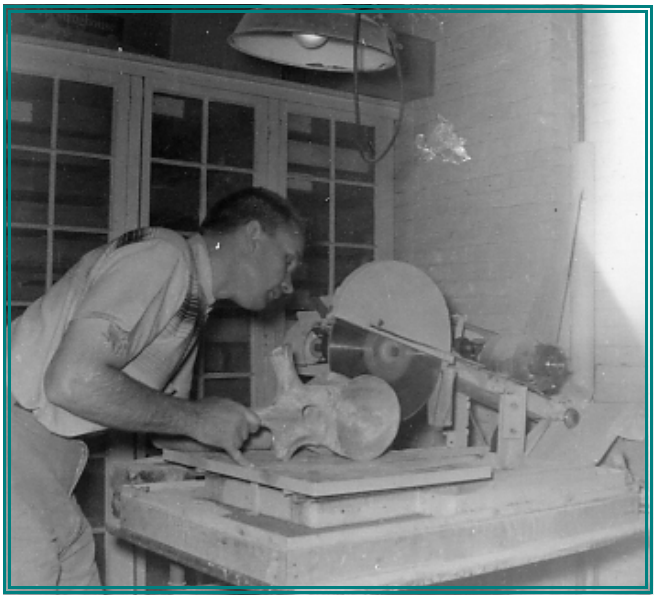
I never saw a mock-up of the mount so doubt he made one. The diagrams would have served that function.

First step: Prepare the bones

The skeleton was doubtless incomplete. I never saw one that had all the bones when it was dug up although I've heard of them. This meant that dad and Arnie had to create the bones that were missing so that the skeleton would be complete when mounted. This was fairly straightforward. If they were missing a mirror-image bone, i.e. the left femur, they could reconstruct it by reversing all the traits of the right one that they had using plaster of Paris and whatever portions of the bones were available. If they were missing bones in a series, as in the spine, they could extrapolate from the vertebrae they had and make replacements for those missing. Arnie is adjusting a spine on a vertebrae. Note the bow tie.

This work was done down in the lab which was in the MCZ basement. Arnie and dad cleared benches and hung pipes and wires to hold the vertebrae securely. That allowed them to see how things were matching, so that they could adjust ones that needed attention to be sure that the dimensions and characteristics were proper. Dad is checking out the alignment, dimensions and joints of the thoracic series so that the final series will be visually correct.

Anything that was constructed of plaster of Paris, even one of the hard varieties like Hydrocal which was his preferred one, could be modeled with rasps, saws and chisels. Actual fossilized bone was too hard to model that way so a diamond saw was used. Judging from the size of the vertebrae that Dad is cutting on in this photo -which is from the series of *Kronosaurus*- I judge it to be a proximal caudal. I'd even hazard a guess that it could be just caudad to the sacral series, based on its size. But without others for comparison it's hard to say. However, if you compare how large it is to his hands here to how large the vertebrae are in the photo above where he's standing by the suspended thoracic series, you can see that this one is considerably smaller. Look at one of the photos of the completed animal and locate the three vertebrae just above and behind the pelvis in the direction of the tail. They have no "chevrons" hanging from them, nor are there ribs. This vertebra looks to be one of those though I suspect it's still too



small in which case it would fit further back in the tail. Anyway, he's cutting something into the centrum -the round center portion- of a vertebrae. To complete your education, he's holding the vertical spine -the one that you feel as bumps in the center of your own back- which is part of the neural arch, a T-shaped structure that sits on top of the centrum. You can see a hole in the neural arch here. That is where the spinal cord ran in the live critter.

Ah yes, there is another feature of the neural arch in this photo that suggests that the vertebrae is about where I suggest. The post-zygopophysis that is to the right side of dad's hand extends fairly significantly away from the plane of the spine. This means that this vertebrae mated with the mirror image of another vertebrae at that point, and -this is the real point- this "joint" obviously experienced substantial pressure. Far out in the tail, there is little pressure on a joint because the vertebrae basically sit side by side and do not need to be constructed with massive anterior-posterior pads to bear weight/pressure like this is designed to do.

This point illuminates something critical about anatomy that Dad pointed out years ago. It is a simple, obvious, and profound truth: every feature of every bone tells a story, and based on these traits you can deduce a great deal about the physiology of the animal. In this case the anatomy, i.e. the structure, I'm referring to is the pre-zygopophysis (I know you are dying to know that these deals mate with the post-zygopophysis on the adjacent vertebrae) and the associated physiology , i.e. function or purpose, is the weight bearing function that demands massive bone pads of that sort which were obviously faced with cartilaginous pads in life.

Second Step: Collect Tools and Materials

The next step was to collect the materials that would be necessary to install the skeleton. Based on what I saw and what you can see today, I'd say that the list included at least these items:

A. Tools:
Hammers of various types and sizes
Screw drivers, wrenches,
Electric tools - drills, grinders, sanders
Arc welder with electrodes, shield, protective gear
Acetylene torch set up which included two variable pressure,

pressure-reducing regulators, oxygen tanks, acetylene tanks, a variety of rods, glasses, gloves with long gauntlets
Chain hoists for several tons
Saw horses
Compressor with hoses and various attachments
Moveable lights
Rolling carts

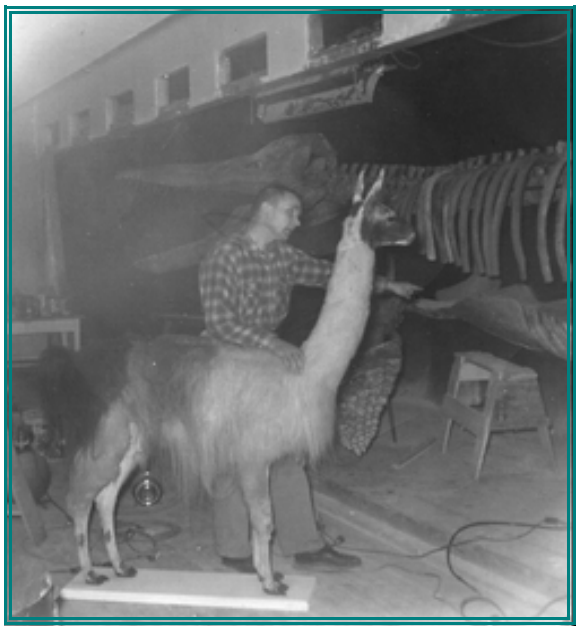
B. Utilities:

Water was hauled by bucket from down the hall
Sewer was in the bathrooms nearby
220 volt 60 cycle power had to be installed to power the arc welder

C. Materials:
Nails of various sizes and types
Screws of various sizes and types
Nut, bolts, washers of various types and sizes
Sand paper
Wood: 2 x 4's, 2 x 10/12's, one by's
Plaster of Paris
Sheets of wire mesh
Cement and sand for stucco
Steel: angle iron of various sizes, rods, pipes, bars, sheets
Asbestos sheets

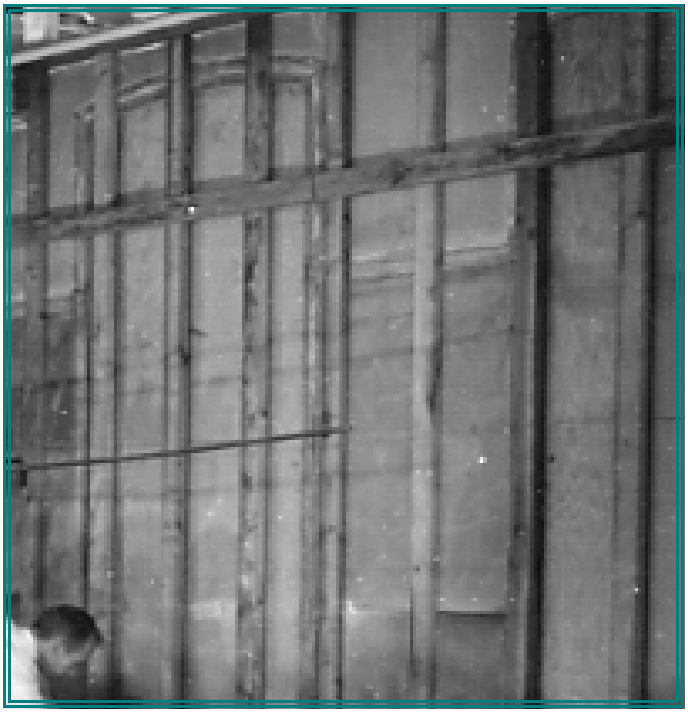
This cost a lot of money and took a lot of space. The latter wasn't a problem, however, because the exhibit hall was enormous and had been cleared out of all other exhibits in anticipation of starting an entirely different type of exhibit.

Third Step: Preparing Space



The next step was to prepare the large room assigned to *Kronosaurus*. This meant taking out the old exhibits that had been there for generations. I don't remember precisely what was in the room. One was this Llama that hung around till *Kronosaurus* was mounted at which point dad introduced them. Apparently the crew that was assigned to remove all of the previous specimens from this room was distracted for a few months, so odd things sat around across the room, affording James A another chance to ham.

There was a sad part to this remodel. When the time came to clear out all of the specimens, it turned out that one of them was too large to go through the door. A wall had been built after it had been mounted and the double doors weren't large enough. So a magnificent six-foot wide, 5 foot-tall white brain coral had to be hacked into halved with hammers and cold chisels, taking out a 6 inch wide swath that could not be replaced later.



Some limited demolition necessary to have access to the bearing walls. After removing the unnecessary elements they started to create the structure that would bear the weight of *Kronosaurus*.

The first element was a set of 2 x 4's that were spaced on 16-18 inch centers. They represented the basic framework for this mount, and were securely fixed to the brick walls. This photo shows the east wall with these studs in place, looking like someone was going to put sheet rock up next. That's Arnie

leaning over the abdominal cavity. Note on the left half of the photo near the top a curve behind the wall studs. That's the frame of one of the exterior windows that was permanently -obviously- covered as part of the preparation of the room.

The second element was designed specifically for the skull. The whole skeleton is immense, but most of the elements were not exceedingly heavy. The skull was the exception. I do now know how much it weighed but it was heavy, particularly with the armature of steel that had to be buried inside to hold the 9-foot long skull together, and to support the immense mandible that had to be secured.

The whole mount illustrates dad's conception of concealing supporting structures from view. You see that when looking at the photo in Stage 1. But most viewers won't be able to understand that the skull and mandible represent a fundamentally different method from the ribs, paddles, and spine. In order for the immense skull and mandible to be free of external steel structures, the steel structures had to be embedded inside the skull. That was the first time dad had to actually figure out how to do it which I'll discuss in a bit.

Fourth Step - Mounting *Kronosaurus*

Kronosaurus was about 45 feet long. It was a major mount. After the bones had been prepared, the materials collected and the space prepared, they started on the mount which took most of a year to complete. Dad, Arnie and Dave did the job with some week-end help from Dick and me. The complexity of a skeleton was such that it did not lend itself to a simple one-two-three creation. Parts are installed in orders that are dictated by various factors, in this instance, primarily by the nature of the structural framework, NOT the articulation of the bones.

The skull required the greatest amount of energy and time, but not for the simple reason of its size. I will set it out in detail. Once the skull had been mounted, the steel rod that was to support the vertebrae could be put in place. At that point several procedures could be done simultaneously. The abdomen had to be installed before the 9-foot long paddles could be placed and so on. I'll start with the skull and then go to other elements.

Test: Shasta

Time:	12:00 18 August 1957 (GMT)
Location:	NTS, Area 2a
Test Height and Type:	500 Foot Tower
Yield:	17 kt

This was a UCRL developmental test of a two stage thermonuclear design. A DT gas boosted Swan primary was fired in a mockup of the thermonuclear system. Shasta was nearly identical to Diablo, except for changes in case materials and pit geometry. Predicted yield was 11-15 kt. Device dimensions were 16.9 inches in diameter and 69.2 inches long. Total device weight was 1435 lb.

Repair the Skull

The skull was the most difficult element to prepare but not simply because of its size and the challenge of supporting -without visible supports- the heavy skull and mandible. Notice that it looked like a bullet. As Arnie and dad developed their plans for mounting the skull, they decided that they would have to open it up, and cut channels into it, so that they could install a steel framework inside it. It has already been cut open here with the armature half installed, mounting struts protruding from its right side in anticipation for being

welded to the steel framework bolted to that wall.

The problem was the way it had been prepared years before by a paleontology grad studentDr. X(name withheld to protect the guilty although he's probably gone before) [6] who later became the head of the Dinosaur National Monument. I remember the skull in the state it is here, dad and Arnie talking about it.

Since the basic skull has been left intact in this photo, it is clear that at this juncture both Arnie and dad were simply trying to install the internal armature. But at some point thereafter, something profound happened. They unexpectedly discovered that the skull had been improperly mounted. That was a shock. One does not expect to find that there had been some intellectual anarchy like there has been, particularly at ivy covered Harvard. There are two basic reasons for this conclusion.

The first, a disarmingly simple obvious one is the remarkable smoothness of the skull. Dad and Arnie accepted that peculiar, featureless configuration as what it was and started to excavate channels in the places they believed most appropriate to locate the steel pieces. In hindsight, one wonders why anyone would believe that a featureless skull like this could possibly be authentic. In particular, the large 'holes' where the eyes (front) and the masseters (back) protruded would never be so smooth and flat. As a sidelight, look at that photo again. The surface of the snout from the tip of the nose back to about the orbits is pitted and rough, but from that point to the stern, it is paper smooth. Odd, isn't it, when you actually focus on this difference. The skull looked like someone had used a plane from the front of the orbits to the back of the skull to give it a flat, uniform surface. That fact didn't sit well with them, but they weren't the degree'ed paleontologists so they deferred to their superiors.

The second reason for this profound change in opinion was a huge chunk of bone that Dr. (name withheld) had buried down inside the skull. Arnie and dad knew that as they opened the skull to install an armature that they would encounter bone fragments. Of course. This was a skull, for cryin' in the rain barrel, so there darn well BETTER be some bones down there. They didn't worry too much about the various fragments that they excavated and explored - until they ran into what was really a block, a large chunk of bone that didn't seem to be in the right place.

---

[6]Later, in 1964, dad and I visited Dr. Xin the Quarry. After finding out that I was a classical Greek student, he gave me his beaten up copy of Goodwin's GREEK GRAMMAR - it's in my collection somewhere, a gem.

While neither had a degree, both knew what they were doing inside that skull. They understood skull anatomy, what structures would be present, orbits, nasal septae, maxillary sinuses, etc. No problem, until they hit this odd-looking chunk. They dug it out and set it on the table because they had become suspicious. Examination revealed that some of the surfaces of the block had to have been exterior bone (I assume it was something like cancellous bone you see on skulls and scapulas today). It bothered them that exterior surfaces would be down inside the skull and it bothered them that the various planes of this chunk didn't articulate with adjacent internal structures. The more the looked at it and thought about its surfaces the more troubled they became both because of the apparent dishonesty - and because they had to put it back somewhere in the skull.

September 2006: I need to interject something. I have heard a rumor that dad is being blamed in the paleo world for the present state of the skull by a man in Australia. He has figured out that the skull is a foot or so too long. The way I know that the thing is being hung on dad is simple:

Well, they drug Dr. Romer up to jaw about this anomalous chunk of bone. All of them accepted the basic premise that the piece of bone actually was part of this skull. That may sound like a silly thing for me to suggest but it isn't. When you are in a quarry, there can be all kinds of critters in one bone pile and it is not that unusual for bones to be assigned to the wrong creature or labeled wrong out in the quarry. Witness Diplodocus' skull, improperly assigned for a hundred years by a most prominent paleontologist. For whatever reason, these men accepted that this chunk was *Kronosaurus*.

Next, they talked about shapes and surfaces. They looked at Dr. (name withheld)'s skull -yeah, HIS- and began to wonder, "Why did he put it there?" They finally agreed that it just didn't fit where it was placed. They were puzzled about why Dr. X d would have placed this bone down inside of the skull, buried the bone under plaster, when it should have formed the exterior surface. It finally became painfully clear that Dr. X sort of fudged when he reconstructed the skull.

Instead of positioning this large fragment with external surfaces on the surface of the skull, he chose to create a skull shaped like a bullet, smooth from the nose to the base of the skull over the foramen magnum. It was as if he had a preconception that this monster had a stream-lined, sleek skull, even though no skull known for an dinosaur specie had such a skull. In fact, this bone ended up being part of the high arch above the eyes, making a bony ridge over the skull:

Dad was a ham as you've seen in his other photos. Remember him standing in his briefs on top of the mountain looking out into the Gulf of Alaska? Well, he's hamming again here. But this picture gives you the whole picture. (Gag) His hand is holding onto the bottom rim of the orbit (eye socket). To the right of the orbit is another massive 'hole'. That's where the masseter protrudes when the beast bites hard - the masseter (the big muscle you feel on your jaw when you clench it - yours is outside the skull) is attached to the jaw to the right of dad's head and is the muscle the exerts the enormous force needed to shred its dinner.

Here's the point of that photo vis-a-vis the errant skull fragment: you can actually see the fragment itself, and it is huge. It is the darker block of bone that forms the back wall of this pit and forms the top section of the skull, the crest you see here. The grayer segment and you see that it even extends to and constitutes the back of the skull.

Compare this photo to the above to see how Dr. Xdid it. You can't even find that huge fragment! What Good Ol' Dr. X did -but shouldn't a otta did- was simply bury it down inside of this skull. That's what Dr. X did and it made for some pretty unpleasant talk around there about him for a while. Ornery cuss. He wanted a

configuration just like a bullet. Absolutely tubular.

The only conclusion they could reach, which is not favorable to Dr. X , was that Dr. X knew what he was doing, and had intended to do what he did. That wasn't nice of him. The only reason they could come up with the explain this was expediency. Dr. X wasn't stupid, nor was he malicious. He was a man of integrity normally. He must have been in a rush to get a project finished? If he had taken time to model the skull so that this was properly incorporated into the external planes and surfaces, the skull would have been much more complex as you can see. Was he up against a deadline? Or else he was just plain lazy? And academically and intellectually dishonest? I don't think so. I personally think it was expediency, a lack of resources or time or both. There was no way to determine. Nor did it ultimately matter. The skull was what it was and it had to be remedied.

The really interesting consequence of re-constructing the skull with this segment in its proper place was how it altered the internal anatomy of the skull. Go back to the second photo above of dad in the jaws and look to the right of him. Find the highest part of the ridge and then look down a bit and you see a hole running through the center of the skull. That isn't even present in Dr. X's reconstruction. Tsk tsk.

Emergency Room Trip

During the process of rehabilitating the skull, Dad hired Dick and me to work for him in the lab on Saturdays. We were common laborers which is all we were suited to be as teenagers. I carried stuff, and swept and handed tools and so on. Pay was 50 cents an hour, not bad for that era. I went in to MCZ with dad to work which was a good thing. He decided one fine day to have me do some of the rough work on this skull. That was fine with me.

Dad gave me a large heavy electric drill to use because the plaster was too thick and hard for a standard home-model. The drill must have weighed 15 pounds and had a shiny silver housing. Instead of the usual small pistol-grip where the trigger was located, the trigger was on the body beneath the heavy-duty handle that stuck out the end. In addition to the huge handle on the back, two one-inch thick, 6-inch long handles had been screwed into the body about half way down. That allowed me to hold the drill securely with two hands rather than one hand.

I was assigned to go after the whole skull to drill out the old plaster, hunting for any other fragments of bone. The bit that I used for this job was not the tubular twist-bits you usually associate with drills. This one was actually a wood bit.

It was a flat sheet of steel that had a shaft fitted on to allow it to be mounted in the Jacob's chuck of the drill. The other end had a sharp spike in the center and a sharp point on each of the outside corners. Those spikes dug into the plaster and allowed me to work more quickly than with the spike-like kind of bit. I got to work and spent several hours. I kneeled on the work surface by the skull to get more of a purchase on the drill because it was getting heavy.

I suppose it was because I was too tired that it happened. Since I was holding the drill by the two opposed handles I had to lock the trigger in the 'on' position to keep it running. That way, as I knelt over the skull with my shoulders over the drill, leaning forward, I held onto the two handles, pushed the bit down in as far as it would go, pulled the drill back up, moved an inch to the side and repeated the motion. Somehow as I lifted the drill this one time, one of the tiny spikes on the corner of the bit caught in the fabric of my jeans, about 3 inches to the right side of the bottom of my zipper. I didn't realize that. Before I could understand what had happened, this huge drill and bit grabbed the fabric and twisted it tightly. I was sort of stuporous because I didn't realize what was happening until I felt the bit dig into my groin. I started to enter the right hip joint an inch from my you know what.

Fortunately, this was a comparatively slow speed drill. That gave it a lot of power, but in this case it had the advantage of turning comparatively slowly. That way it did not dig as deeply as it would have if it had been a high speed drill. Thank heavens for small favors. Ha. If it has been a high speed drill, the thing would have been half way to china by the time I got it stopped. With the thing digging into me, I dropped it and tried to get to the trigger to turn it off. In dropping it, still hanging from my levis and grinding away, the axis of the bit changed so it no longer gouged in my flesh. Instead, it bunched the levis and my underwear up, twisting them like a tourniquet around my leg and shredding them aiming more directly at the family jewels.

I screamed. No one had been paying attention to me up to that point. I was doing my job and they were doing theirs. Dad jumped down off his ladder and came tearing over as did Dave -a really nice man who said the way to remember the position of the ilium in the pelvis is to remember the flower "trillium", i.e. it sticks "up".[7] I was in agony and I don't even remember how they got the drill turned off or the bit out of my jeans or how I got to the hospital, but I got another of my

[7] 5-27-05: I just talked with Arnie and he said Dave's last name was "Roberts".

fairly frequent -compared to normal kids anyway- visits to the hospital. I was about 16 so was really embarrassed at the accident not just because of the stupidity but because of the location of the lesion. Can you think of any place on your 16 year old body that would embarrass you more to have injured, knowing that people had to look at it and touch it and treat it? I doubt it.

When I got to the ED, of course the first thing I had to do was to go into a room and under the supervision of a pretty nurse -had to be pretty- take off my jeans and briefs. Now was I humiliated? In addition to hurting so bad I couldn't stand it, I had to lay on a table on my back, exposed to the cameras and lights of all the TV stations and newspapers in Boston - at least that's how it felt for this 16 year old when the nurse and doctor came. I was spread eagled on the table without any under wear over my sensitive embarrassing parts as they cleansed and poked at the spot right there where the hair was torn out and a hole was bleeding.

The crowning insult was that the doctor, who meant well, decided to experiment with a new "spray-bandage" he had just received from a salesman. It was a clear plastic that one just sprayed out of the can like spray paint onto whatever needed to be protected. The doctor apparently thought that this would obviate the need for lumpy bandages that would come off and would be unsightly, sort of suggestive even. Nice of him. Really. The problem was that while the plastic did make a really nice tight seal, it only worked for a day or so. Then it began to crack. And get infected and the only way to get it off was to tear it off a tiny bit at a time taking bits of tissue.

I don't know how it is that I had so many bad experiences with my health like this, but I did. Mom said it was because I was too impetuous and wouldn't wait. I'd just rush out to do things regardless of the risk. This accident was entirely my own doing, however, not to be laid at Dad's feet. It was the sort of thing kids do while they are learning what not to do. But the drilling episode wasn't the only excitement I had while working on the skull with dad.

Test: Boltzmann

Time: 11:55 28 May 1957 (GMT)

Location: NTS, Area 7c

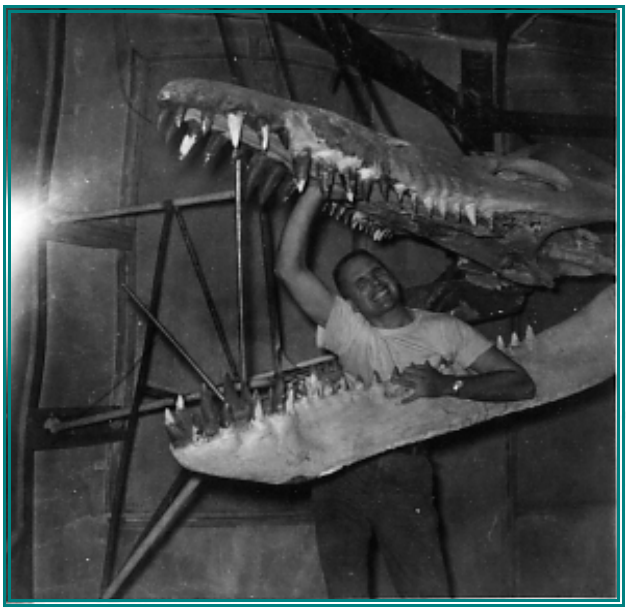
Test Height & Type: 500 Foot Tower

Yield: 12 kt

XW-40 light weight boosted fission warhead test. The device, developed by Los Alamos Scientific Laboratory (LASL), weighed 295 lb (total weight), the nuclear system by itself weighed 144.6 lb. Device width 18 inches, length 31.6 inches. The shot cab held 9 tons of sand, and 15 tons of paraffin as instrument shielding. Predicted yield was 11 kt.

Acetylene Torch Hell

Ever stood in front of an acetylene torch that's cutting steel? I don't recommend it. But my dad was like Christopher Plummer in the Sound of Music - without the whistle. So when he told me to do something, I did it, in spite of my fears because his anger could be worse than whatever experience awaited me. This torture involved an operating acetylene torch.



As dad prepared the armature to mount the beast he obviously had to weld thick bars of steel together and onto the wall. The skull in particular required a large amount of steel because of its weight. Since it was to hang free without any supports on the floor, it had to be secured in a cantilevered fashion from a steel frame on the wall. You see the bulk of that framework here. There

is a heavy I-beam bolted high to the wall to which steel bars are welded. Then angled down toward the skull where they are several weight-bearing points he constructed for that purpose. To his left you can see one of those points with half-a dozen steel rods coming together.

In some instances when he was working on the wall-end of these rods, his acetylene flame was directed directly at it, not a good idea. He ordered me to take a 3 foot square piece of asbestos that was about half an inch thick - in those days asbestos wasn't toxic[8]- and protect the wall from his flame. I had to stand behind the joint he was making and to hold this tiny sheet of asbestos -with my bare hands and arms- between the wall and the flame.

The flame was the usual carburizing, scorching pencil of white-blue flame in this image, blowing hard against the steel armature where it was welding, at which point it obviously flared around it and blew in all directions. That meant that I had to hold the little asbestos sheet with gloved fingers over the edge. So there I stood, holding the asbestos sheet up over my head trying to not drop it, while the flame screamed and whined and popped on the thin asbestos sheet, bits of red-hot molten metal flying off, the board cracking and popping with the terrible flame half an inch across from my fingers. It was un-nerving. When I winced, he only got mad and ordered me to hold it up and not to worry.

Figure 25
http://www.artmetal.com/enrique/wrought/tables/nouveau/console/torchcu1.htm

If you think I'm exaggerating with this image, you're wrong. That is precisely what it's like when a torch is cutting steel and even when it's welding it still produces sprays of molten metal sparks. Dad depressed a lever that blew additional oxygen through the tip so that the molten metal blew away like water. It was hell to stand under that stuff. In the end, I only experienced some small burns on my arms so I wasn't really hurt. Just unnerved.

Another shameful memory is that I remember doing the same sort of thing

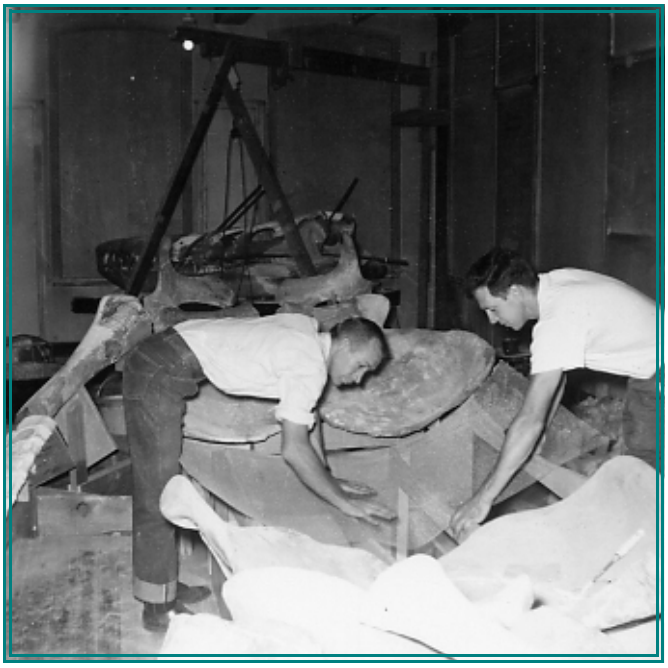
[8]Really, I mean that, and it isn't today even though the stupid media and the stupider feds made us all believe it was - unless of course, one was idiotic enough to smoke two packs of unfiltered Camels for 30 years in an enclosed space like submarines under shedding asbestos. Then it's to nicotine anyway!

to you sons in the early 1980's when I burned 5-6 cords of wood for heat each winter. I bought some skids of butts of 2x4's and had to cut them to size for the stove because they were a half a foot too long. So I made you two, about 6 and 8 years old, hold the 8 inch long end that I was cutting off with a skilsaw because otherwise it would fly up and hit me or something. You were afraid then like I was back when, but were even younger than I was at the time. But I angrily made you do it. Some sort of a pattern there, isn't there, one that I'm not proud of.

Back to the -other- beast.

Gastralia, Pelvis & Shoulder Girdle

Kronosaurus was one of those species, like *Antrodemus* talked about above, that actually had armor over its abdomen to keep other creatures out of its engine room. Given the size of this abdomen these bones were most helpful because there were doubtless a large number of others who tried to take pokes and bites along the way. The gastralia are basically ribs that fit across the abdomen. Arnie and Dave are leaning over the bed they are constructing for the gastralia. Arnie is on the left. They are holding in place a piece of wire mesh that they nailed onto the wooden framework. Then they applied a mixture of plaster that they modeled to reproduce the gastralia found in the quarry. It was easier to do this than to try to install the original gastralia.



The large flat bones to Arnie's left that are curved are the coracoids which are the analogue of the clavicle in a mammal like you. Behind Arnie you can see the front left paddle. The bones at the bottom of the photo are part of the pelvis. I don't know whether they are the ischia or pubes - but do know they aren't the illia, thanks to Dave.

There in the background you can see a temporary framework that was installed to elevate and hold the skull while it was being positioned and secured in

place -pre-remodeling state. Dad's experience on docks and in machine shops stood him in good stead. He could erect whatever type of rigging he needed to do that job. He even used one of the chain-driven winches like are used in machine shops to hoist heavy steel items.

This photo is taken from the skull end of the beast and gives you more idea of what a complicated process it was to create the abdomen. This was taken on another day because Dave has a white hat on. You can see three separate cradles here. Nearest to you is the curved cradle with the basis of the shoulder girdle, the coracoids pointed out above. Behind and to the right of the shoulder girdle is the cradle with the gastralia now in place. Then to the left and behind the gastralia just in front of Dave is the cradle with the bottom of the pelvis.

These three cradles were ultimately lined up to form the bottom of the thorax, abdomen and pelvis. The cradles have been slid into place and are oriented where they sit today. I remember today that there were in fact two small external supports on this mount. A 6 inch

long bar was inside of and used near the tip of each paddle to stabilize them even though there were internal supports.

Suspending the Skull

Dad didn't take a lot of pictures of the mounting process so I am cutting and pasting from the few photos he provided to create this description for him - for you. This is one he took to show you the machinist-like set up he used to hoist and secure the skull. Notice how orderly and well constructed things are. There is a heavy I-beam welded diagonally across the corner up near the ceiling.

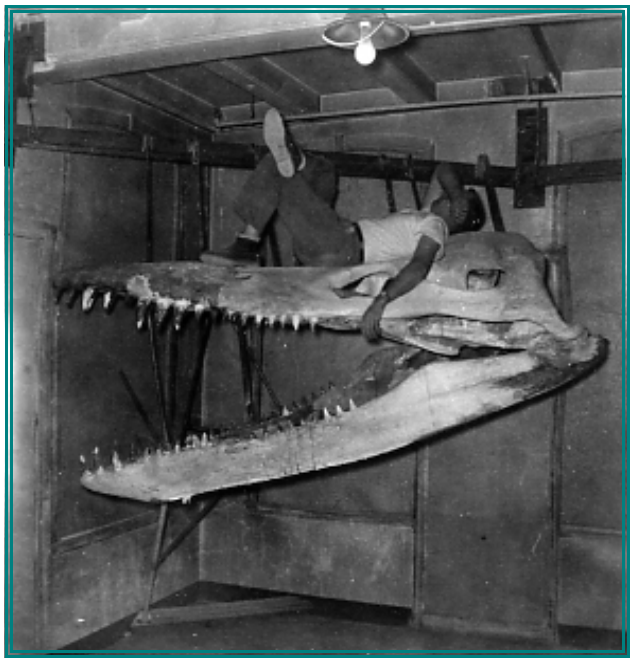
He created two A-frame sets to serve as the outer 'legs' of the temporary lifting-holding structure. The A-frame on the right has a long black 8 x 8 beam resting in the crotch, which is resting on the other end over that I-beam. The massive beam was necessary because it supported the bulk of the weight of the skull. The other A-frame has a narrower board resting in the crotch and over on the I-beam because it supports the nose only. He secured two chain hoists like this one on the cross members to raise and hold the skull. The one on the right frame is heavier than the one on the left.

Figure 30
http://www.1stchoice-hoists.com/hand-chain-hoist.html

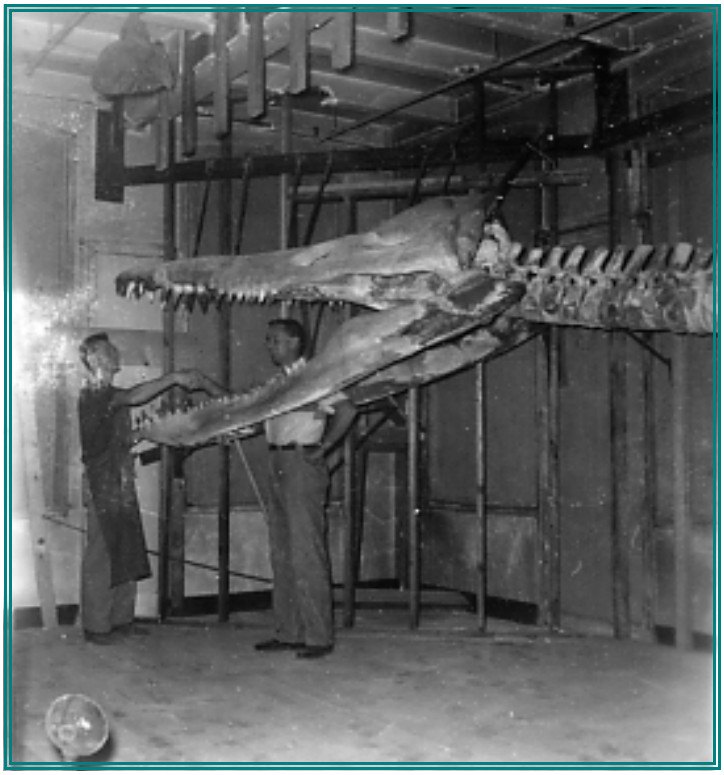
This is a closeup that Arnie took, Dad standing over the skull with his arc welder's shield on, electrode in his gloved hand. The chain hoist is to the left of his head, as he looks to see what else needs welding. These chain hoists are neat. You just pull on one side of the loop of chain dangling over the skull. That turns gears up inside of the joist turn and raises the item on the hook. The remarkable thing is how little energy is needed to get this to happen. You can lift the skull with one hand through this hoist.

Note that dad's using an arc welder, not the acetylene torch. This is the one that uses enormous amounts of current to create an arc between the tip of the electrode and the metal that needs to be joined, causing the tip to melt and flow into the crack for the brief instant his hand is over the place.

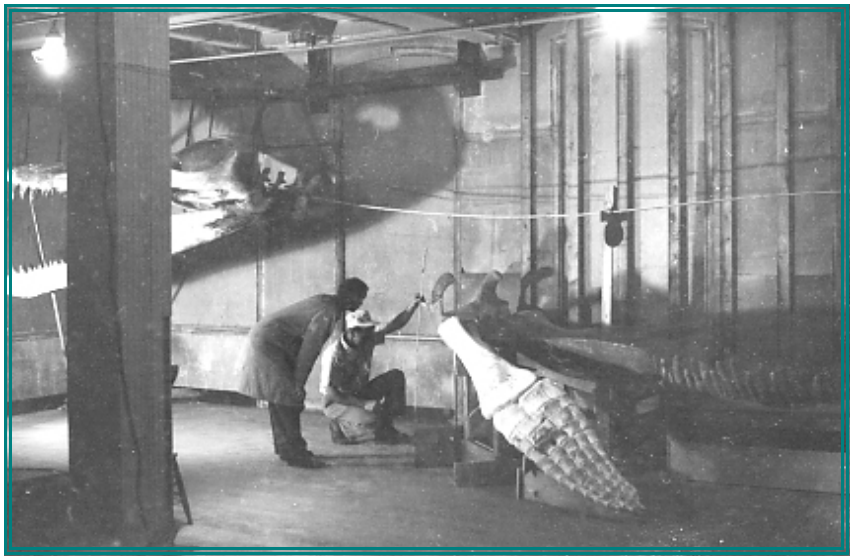
On the seventh day he rested. Always the ham. Don't know why he didn't let me do that, too. The wooden frame and hoists have been removed so the skull is now hanging entirely from the steel structure on the wall, appearing the hang in space. Go back to the photo of the whole mount and it really does hand in space.



More ham. Arnie is shaking dad's hands in congratulations for what they have done. They are now ready to attack the rest of the skeleton that has been neglected until the skull was in place.

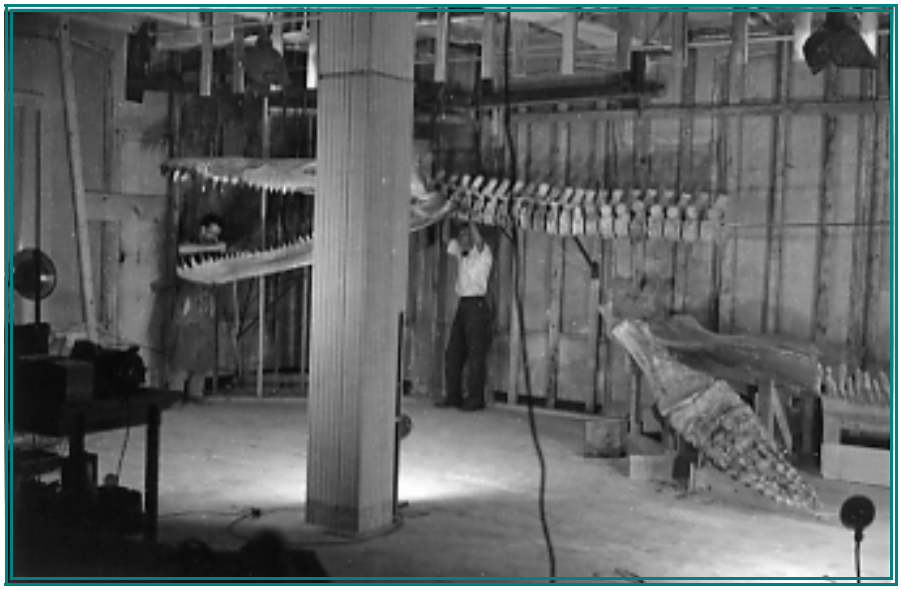


This photo shows how much had been done on the rest of the skull up to that time, mostly by Dave but also by Arnie. Dad focused on the skull since it required so much welding. You see the steel rod that has been shaped and welded into the foramen magnum of the skull - the hole the spinal cord sticks out of, in you, too. A cardboard vertebrae is stuck on the "spinal cord" above the coracoids as Dave and Arnie examine the pectoral girdle. They were now ready to assemble the vertebrae.



Stringing Beads

The vertebrae had been prepared for this time back in the beginning while they were preparing the bones for the mount. Now that the spinal rod had been secured, they could be assembled. It was a bit like stringing beads, just sliding one at a time up the rod, in the right order, to create the spinal column.



Note the nice detail here about the vertebrae. The vertebrae just above Arnie's head have spines that are tilted to the right, and that the centers are narrower that the vertebrae further back. Those traits mark the cervical series, the neck series. They didn't need to be as robust the later ones, the thoracic series, that supported the entire body. Dad is apparently brushing the creature's teeth.

You can see here how the gastralia were eventually completed, short ribs projecting upward from the central, knitted section that served as armor for the contents of the abdomen.

Steel I-beam Caper

I'm not sure - a Cabot, or a Lodge? I asked Arnie in 2005: it was Cabot. Are you familiar with this pair of families? Not having lived in Boston you may not be, but if you lived there in the 1950's you heard their name, and not always in a complimentary fashion. They were among the oldest families, hence the wealthiest in most settlements if you think about it, living up there on Beacon Hill, in Louisberg Square. The saying was:

"The Cabots only spoke to the Lodges. And the Lodges only spoke to God."

Maybe the names were the other way around. It doesn't matter, you get the idea. Snooty, blue-bloods who looked down on and patronized the rest of us unwashed flotsam and jetsam of the world.

This aspect of the mount was one of the enormous risks that Al Romer took

when he endorsed dad's ambitious plan[9]. Dad's vision called for a clear view of the thing. To go to this extraordinary effort to create a floating sea monster that could then only be viewed in thirds because of pillars that obstructed the view, was simply unacceptable to dad. And apparently to Al as well. This photo gives you an idea of the obstacle they had to overcome. No matter how visionary the mount was, if those two pillars had remained in place, people would have missed the effect, so

[9]Dr. Romer developed a deep affection for dad, far beyond that of an employer and employee. It was as if he adopted dad as his own son. He taught him, protected him, and supported him. This particular instance was the first of many where he took on a risk that he didn't need to because he saw and believed dad's vision and ability even though dad had never mounted a dinosaur before. He came from driving jitneys on the wet dark docks of Seward to Cambridge. How could Romer have developed the trust and belief needed to allow this to happen? True, Arnie was there and I imagine that the chemistry of Arnie, a quiet man with immense integrity, assuring Romer that Jim could do it was how it all worked out. In the end, when dad told Dr. Romer that he was leaving, Dr. Romer wished him well, with tears in his eyes. I have the file on my desk of their correspondence over the next years.

they had to go.

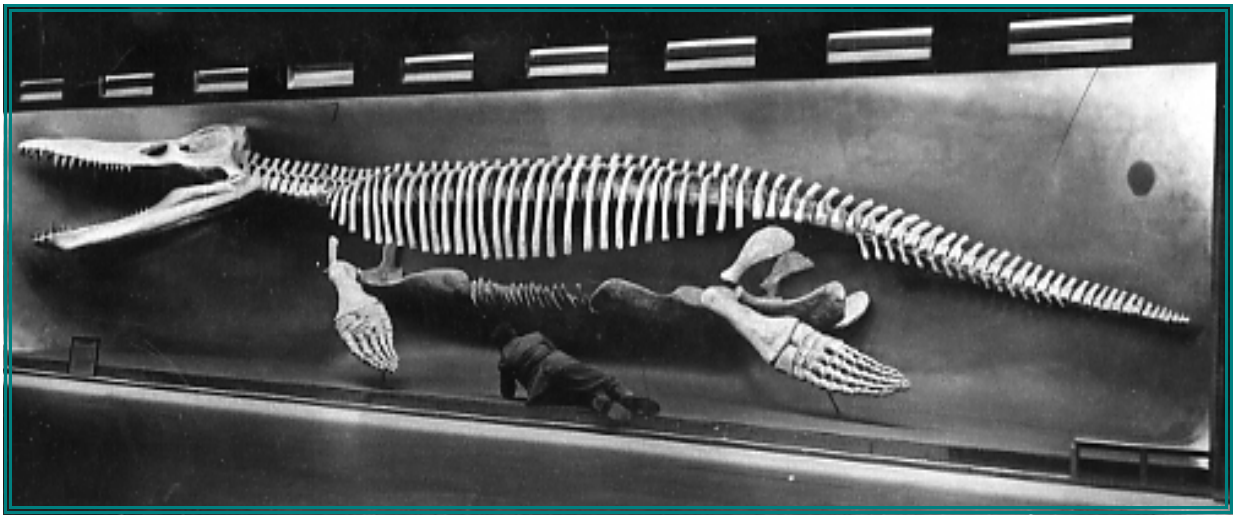
Remember. This room was on the 3rd or 4th floor. Of a hundred old building. Constructed primarily of bricks with reinforcements. And lots of big old trees growing up around it. And no parking lot on the outside wall. Etc. This was not a simple matter of changing the blueprint during construction. It was a wholesale modification of the entire structure that had to be worked out by structural engineers first, and then set out in blueprints, with the proper materials selected, with a competent general contractor and equally competent subcontractors. It would not do for a Harvard Museum to collapse. Which is precisely what was likely to happen if the whole thing was not properly analyzed and blueprinted and implemented.

I obviously don't know the sequence of the steps involved here nor does it ultimately matter I suppose. Just offends my sense of propriety to not be able to nail it down. Be that as it may, we will all of us admit that there was a relationship between the studies and blueprints and estimates and the final figure that Dr. Romer had to work with. Then Dr. Romer had to come up with a likely deep-pocket to underwrite this hair-brained scheme. Did he really understand the length to which dad would push him when he allowed dad free rein to design the mount? I have no way of knowing. Regardless, the fact remains that whatever the deal was in this regard, Al and the powers that be at Harvard did find a deep pocket to pay for this extravagance. And it was pure extravagance, indulging dad. No one else. Arnie was part of it. I wasn't present, but I suspect it was his vision of (1) what he wanted to do and (2) his confidence that he could do it, with Arnie's assurance to Dr. Romer that dad could do what he said he could do that drove the whole thing.

Al and the money diggers at Harvard had a few lunches at the Harvard Club I suppose to plot and to lay out their plan of action to scrounge the dough needed to do the deed. This is what the deed entailed in general terms:

1. Go out and buy a real heavy, real big, real long I-beam and lay it on the ground outside the museum to excite the students.
2. Move heavy equipment of the right kind up to the wall.
3. Locate the right floor. And locate the right spot in the wall for that floor.
4. Knock a hole through the wall - without bringing the building down- about where the beam will have to go in
5. Knock another hole through the wall on the other side of the room and try to make them line up.

6. Then hire 5 supervisors and two workers to hoist the beam up and stick it through the hole on the outside and push it in -how they did that I have NO idea- and stick it into the hole across the 50-foot wide room.
7. Take down the two vertical pillars you see above.
8. Put the I-beam under the floor-ceiling joist that had been held in place with the two vertical pillars real quick so the ceiling doesn't cave in.
9. Then close in the beam and paint it so it disappears from view. This is what you get:



Dad lying on the floor in front of the critter. You can see that a soffit (?) has already been hung from the beam to conceal the trick lights.

So that was the project that the money boys had to peddle slickly to some sucker. An suckers with that kind of money were hard to come by. Even in Boston. Someone, god bless his eternal soul, had a brainstorm. Perhaps he cashed in a chip, bought an old friend a dinner, who knows. The plan was laid out and the money boys decided to ambush one of these Cabots - or Lodges. Can't remember and it doesn't matter.

The final and most risky part of the whole I-Beam Caper was to actually meet face-to-face with an old boy from the designated family and make a sales pitch that had been crafted and rehearsed half a dozen times I'm sure. Trying to get him ready to agree to pay to have a hole chopped in the third floor wall of this old building. As I remember the story, the plan was built around an aging member of one of those clans, a descendant of a sailing family who remembered the slight his

family felt at the hands of the newspaper such as they were and the uneducated public at large at the time.

What had happened, as I remember the story, was that a sea captain of this clan had returned to Boston with an extravagant story of things he had discovered and experienced over the last year while he had sailed the high seas in his fine China clipper (I made that part up). One of his stories involved an enormous sea dragon (I didn't make that part up). He claimed to have seen it and that was good enough for his relatives. They, too, knew that he had seen a sea serpent. His story found its way into the media which was just as scruffy and disrespectful then as it is now. He was ridiculed, people scoffed at him. The very idea. A sea serpent. Who does he think we are? We know the world had been explored and it's been proven that there ain't no such things.

Well, that stuck in the collective craw of the family. Ol' Uncle Abraham said he had seen a sea serpent, therefore he had. But the besmirched escutcheon of the family's veracity would not be un-smirched by their protestations, by their defenses, their assurances. That's how matters stood until the Harvard money boys got hold of this "last member ".

He was reportedly nigh unto death when the MCZ boys called that afternoon and spun their own tale for him - no doubt cashing in on the sense of wounded pride and family hurt that was nourished over the generations. Well, when they got to the part about this big dinosaur that "was really a sea serpent if you'd like to know the truth," he got a glint in his eyes. Like they hoped he would. So he slyly allowed as how his great-grandpappy had seen one of them, too. Then the two sides were hooked and bargained and negotiated and pretended to not understand -or TO understand, as he case may be- until around 5pm, quitting time, they all agreed the meeting had been a pleasant one, and why don't we make it lunch next Tuesday at the Harvard Club, Al's buying that day, and we can seal the deal. So they all did.

They all did (I made all that up again) and that time Mr. Cabot/Lodge got a promise that Harvard really did have a sea monster and that they were in the middle right then of mounting it for the public to view, at which time he offered a promise to underwrite the insertion of the I-beam so that the public would really get a clear view of how large the sea serpent was that his great-grandpappy had seen. The family reputation/escutcheon would then be un-smirched.

In the end he really did cough up the rubles, handsomely, and you can see the wonderful result. Was he taken advantage of? Perhaps, but isn't that how human affairs function best? We all pretend to be objective and fair and equitable while we are each cupiditous and duplicitous, trading things, giving and receiving what we

want and need. So the world goes around. And Al got his I-beam. For dad. And they lived happily every after - that's how I want to end it.

Test: Doppler
Time: 12:30 23 August 1957 (GMT)
Location: NTS, Area 7
Test Height and Type: 1500 Foot Balloon
Yield: 11 kt

LASL gas boosted implosion device, possible XW-34 test. Satisfactory performance. Device dimensions: diameter 17 inches, length 26 inches. Nuclear system weight 144.6 lb, total device weight 275 lb.

Comments about *Kronosaurus*

Now a few observations about this revolutionary mounting technique. Dad never published anything about it. Perhaps it didn't strike him as worthy of publication? I don't think so. He found it newsworthy to publish his article about using foam to cast dinosaur bones, a trivial exercise compared to this monumental innovative mount of *Kronosaurus*. So why not *Kronosaurus*? Perhaps the implementation of the concept was itself sufficient recognition for him.

I stated above that his method has influenced all dinosaur mounts since then, an extravagant thing to say, isn't it, particularly when I haven't done any real research into the matter. So what do I mean when I say that and why do I say that? Simply because up to that time, mounts were the old "Stand them up Harry, hold him! while I put a wire on 'im, strap bands on them, make them look like bone scarecrows". No beauty, no verisimilitude, no artistry, no refinement. Just a properly articulated pile of bones, order created out of a boneyard.

You see, up to the time of dad's mount, dinosaur skeletons were assembled for purely scientific reasons. Study of articulations and bones didn't require beauty and metal supporting structures didn't really detract from that type of study as long as the person could visualize each bone and the entire skeleton. When the public saw these extravagant creatures, even with their grossly ugly structural supports, it was enchanted. Dinosaurs capture the imagination of everyone as witnessed by the perennial flood of new dinosaur books every year. The public has an unsatisfiable fascination in and affection for these giant creatures, so it will put up with the ugly just to see the skeletons.

But dad transformed that method, brought beauty, created a new way of introducing these creatures to the world. The reason I say that his method has transformed mounts is that every mount I've seen recently shows that the amount of visible structural steel has diminished remarkably.

Now, I have to point out that he was at a nexus in time, one of those seminal moments when something is in the air, when several people come up with the same idea. For example, Peabody Museum on the ethnology side was undergoing dramatic renovations. In the Maya-Inca section entire rooms had been painted black, all lights removed and replaced by focused spot lights shining narrowly on Mayan stelae sitting on top of simple bases. Most dramatic effect to walk into a dark room and see those mysterious items. Well, *Kronosaurus* was coming to life at the same time on the other end of the massive long building.

Museum displays were all being examined and revised. There seems to have been two fundamental purposes to this renaissance: give life to the lifeless, and add beauty or artistry. Dad's mount did those things, in spades. So his method was going to either be copied or duplicated to some extent by others. What has happened, in terms of his model, is that the next generation of mounts done by people who saw his method, incorporated his concepts. Then the next generation of mounts done by people who saw the first generation imitators, also imitated it but by that time the origin of the method was probably lost. That has continued until dinosaur mounters today probably have no inkling about this original mount that has influenced mounts permanently.

October 2005 Footnote

During a google expedition, I located a webpage about Kronosaurus Queenslandicus which was managed by Mike Everhart, a curator Sternberg Museum of Natural History in Hays, Kansas:<http://www.oceansofkansas.com/kronosar.html> We exchanged emails about the mount and as a result a question that's teased me has been answered. Here's one of my emails:

> "Mike-
>
> I also figured something else out. I was wondering why an article published in 1959 wouldn't have photos of the actual process, especially since there was that one photo of the bizarre preparation of the tubular bullet head. The explanation for the lack of photos back then is probably that Arnie was not into photography back then. I've

known him since 1949 and don't have specific memories of him using a camera but that could be faulty childhood memories. But I do remember that in the Harvard era of dad's professional life, dad was the only one taking photos. So it is likely that the collection of photos in this set is all there is of the actual preparation and mounting process. (Dad's slides filled a medium size box - I estimate they run between 5-6,000 and I'm going to scan them all somehow! Am I glutton for punishment or what! anyway, the magazine didn't have better photos because there probably weren't any. Dad was the one who took photos in the lab while the hung the spinal column and photographed the stages of the mount. Knowing him, and his ego, it would not surprise me if he hadn't actually taken then in anticipation of writing and article that he never did. I noticed the footnote you provided on your page of the Romer-Lewis 1959 article which surprised me. Dad was still there and since he was PROBABLY (I obviously cannot say this with certainty because I was a teenage) the artistic director of that striking mount, I would have expected him to have participated in the article. But then, he'd been working for Romer a mere 3 years so perhaps wasn't judged seasoned enough? Whatever, they wrote the article, and dad had the photos. And since they didn't include him, they couldn't very well ask him for photos, and since an article had been published -which he naturally was aware of- he probably felt there was no room for him to write another one. This is pure, 100% speculation of the best kind, i.e. not limited by FACTS! But this does make sense. But now that I know about the 1959 Romer-Lewis article things fall into place...Thank you to you. I can add that speculative footnote to the article now. Jim"

Dad took a fairly complete series of photos of the mounting of Kronosaurus. Why? Certainly it is not unreasonable to take photos of a particularly large preparation but to photo it through the preparation stage down in the labs and track the installation of the armatures, the preparation of the segments of the abdominal series, etc. suggests a purpose. The only obvious purpose was to publish an article about it, otherwise there was no other rationale -for him- to have invested the time and money and energy he spent in buying film, setting up temporary lighting in the exhibit area for photos over time, and then paying to have the film developed and printed..

This makes sense because dad published his article about the use of plastic foam to make casts. He had started publishing in the "Alaska Sportsman" in Seward in the early '50's so he was obviously on the way to more publications.

The key to the answer to the question, "why didn't he write an article?" is found on Mike's Kronosaurus page:

"*Romer, A. S. and A. D. Lewis. 1959. A mounted skeleton of the giant plesiosaur Kronosaurus. Breviora 112:1-15.*"

Arnie and Dr. Romer themselves wrote an article about the mount. Mike also reported that an article was also published in 1959 in a Harvard newsletter which was the source for the photos on Mikes.

Note that dad was not included which suggests several things. First, since Arnie wasn't much of a photographer in those days, he probably didn't have any photos of the project. Any he used would have been from dad. But Dad was still at Harvard when Romer and Arnie wrote this article, yet dad was not included in the project. Dad didn't leave Harvard until 1961 but I wouldn't be surprised if this "oversight" by in his mind by Romer and Arnie contributed to his decision to leave two years later.

Test: Franklin

Time:	11:55 2 June 1957 (GMT)
Location:	NTS, Area 3
Test Height and Type:	300 Foot Tower
Yield:	140 Tons

This LASL test was a fizzle, yielding only 7% of its predicted 2 kt yield. This was a test of the XW-30 warhead. The device was a boosted all-oralloy fission design. The diameter of the device was 20.8 inches, length 38.4 inches, and the nuclear system weight was 303.8 lb (total device weight 448 lb). A modified and enlarged version with more fissile material in the core and a different combination of high explosives was successfully retested in Franklin Prime.