

BUILDING A DIGITAL QUARRY FOR DINOSAUR NATIONAL MONUMENT

BOODHOO, Thea, Biology, Merritt College, Oakland, CA 94619

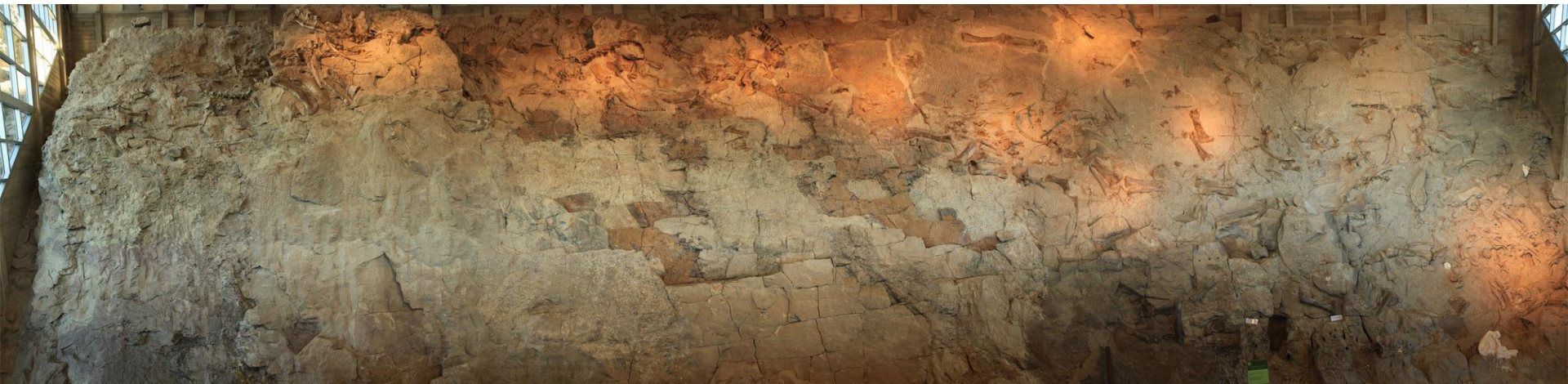
JIMENEZ, Marie, Geosciences, University of Rhode Island, Kingston, RI 02881

STIRLING, Trinity, Geological and Environmental Sciences, California State University, Chico, CA 95929

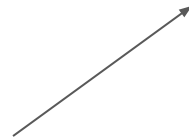
SMITH, Elliott, Geology and Geophysics, University of Utah, Salt Lake City, UT 84098

tharkibo@gmail.com

THIS IS CARNEGIE QUARRY



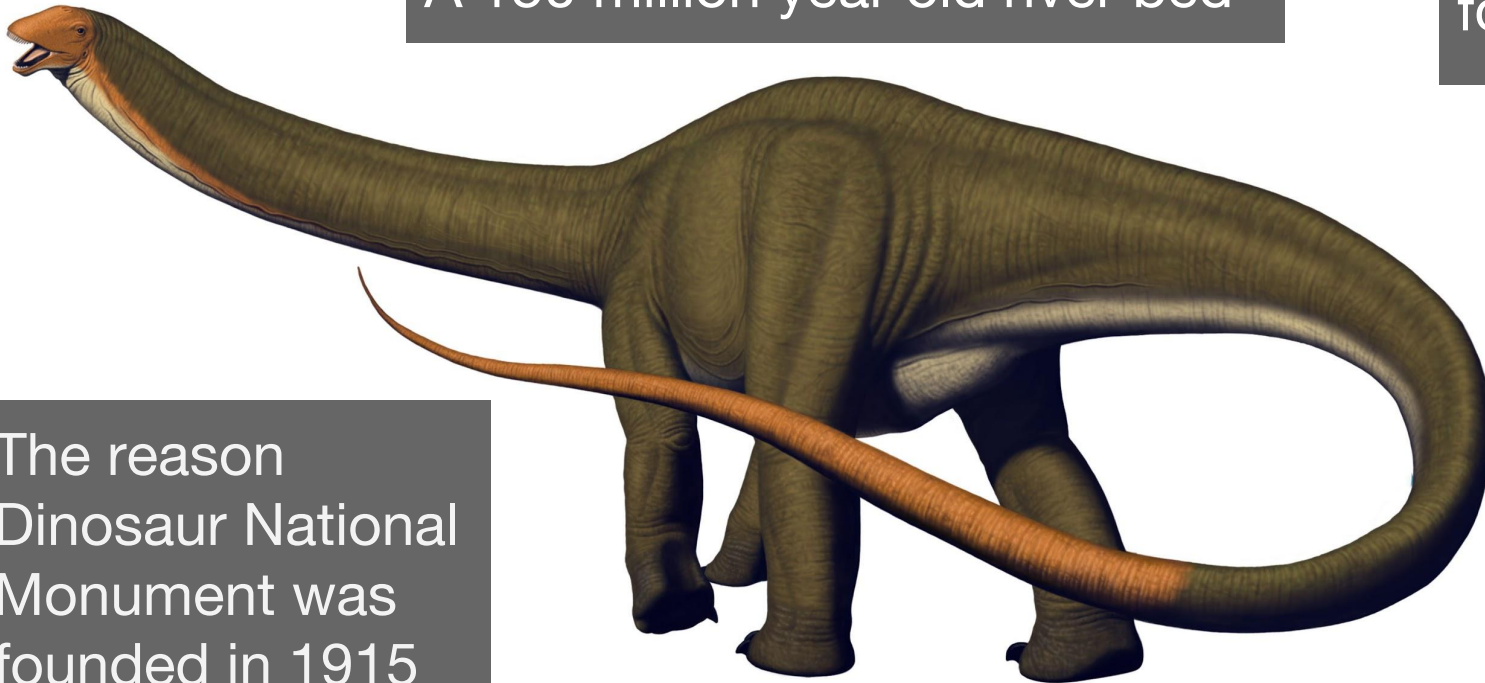
This is a sign as tall as your head



A slice of the Jurassic Morrison Formation

Originally
held 5000
fossils

A 150 million year old river bed



The reason
Dinosaur National
Monument was
founded in 1915

1500
fossils
remain
in the
quarry

IT USED TO LOOK LIKE THIS



ONE PALEONTOLOGIST'S VISION

“How appropriate that they, or part of them, be exposed in relief as they were buried...how appropriate to build a fair sized building over them ...”

Earl Douglass, 1915

First Paleontologist to excavate Carnegie Quarry
(Referring to the fossils of Carnegie Quarry)



ANOTHER PALEONTOLOGIST'S VISION

“To make the vast scientific, historic, and photographic record of the Carnegie Quarry readily available to the scientific community and the public across the globe.”

Dan Chure, 2015

Current Dinosaur National Monument Paleontologist



TWO YEARS OF WORK

That other people did:



Nicole Ridgwell 2014



Ron Shugan 2013



Ben Otoo 2014

Also: Dan Chure, Lorraine Chure, Brooks Britt, Beth Shugan and Erin Cahill - not mention the dozens of men and women who excavated the quarry in the first place and created a century of invaluable documentation.

FOUR 2015 GEOCORPS PARTICIPANTS



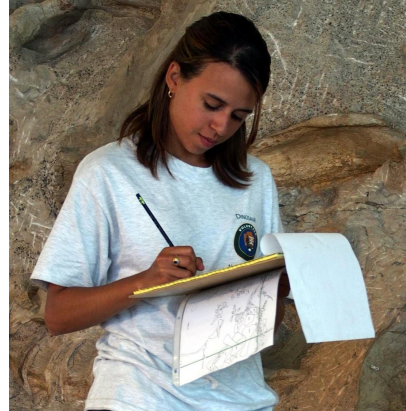
Trinity Stirling

BS in Geology and
Environmental at
Science California State
University of Chico, 2015
(apparently immune to
gravity)



Thea Boodhoo

AA in Advertising at
Academy of Art
University, 2008
(only one who
remembered Star Wars:
Knights of the Old
Republic)



Marie Jimenez

BS in Geology at
University of Rhode
Island, expected 2016
(did basically everything)



Elliott Smith

BS in Geology at
University of Utah,
expected 2017
(memorized the park's
entire geologic column in
three days)

FIRST WE ARCHIVED



THEN WE ARCHIVED SOME MORE



THEN WE... ARCHIVED



BUT DON'T FEEL BAD FOR US



THEN WE DISCOVERED A MAP



IT WAS A VERY SPECIAL MAP

Created by the 2014 GeoCorps Participants,
this Adobe Illustrator document contained the
magic ingredients needed to begin a live demo
of the Digital Quarry:

- 2000ish illustrations of the fossils of
Carnegie Quarry
- Each one a unique vector path
- Capable of export as an SVG file

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WHAT'S AN SVG FILE?

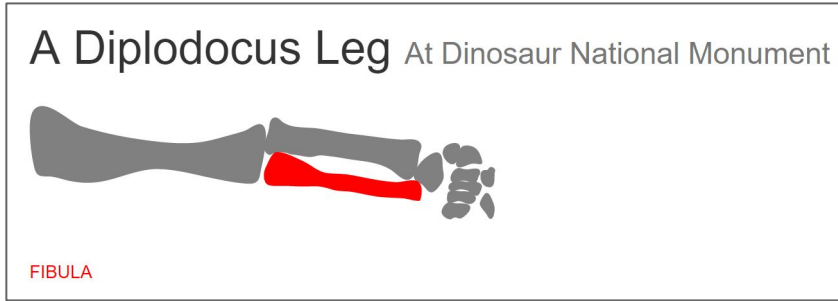
- Translates vector images into XML
- Allows addition of CSS selectors
- Lets you make each path interactive
- Makes a rad slide background

```

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c3.8,5.7,8.7,10.7,12.6,16.3c3.8,5.5,13.2,13.3,10.5,20.9c-2.2-0.1-5.9-5.2-7.3-6.9c-2.1-2.5-4.1-5.5-9.7-6
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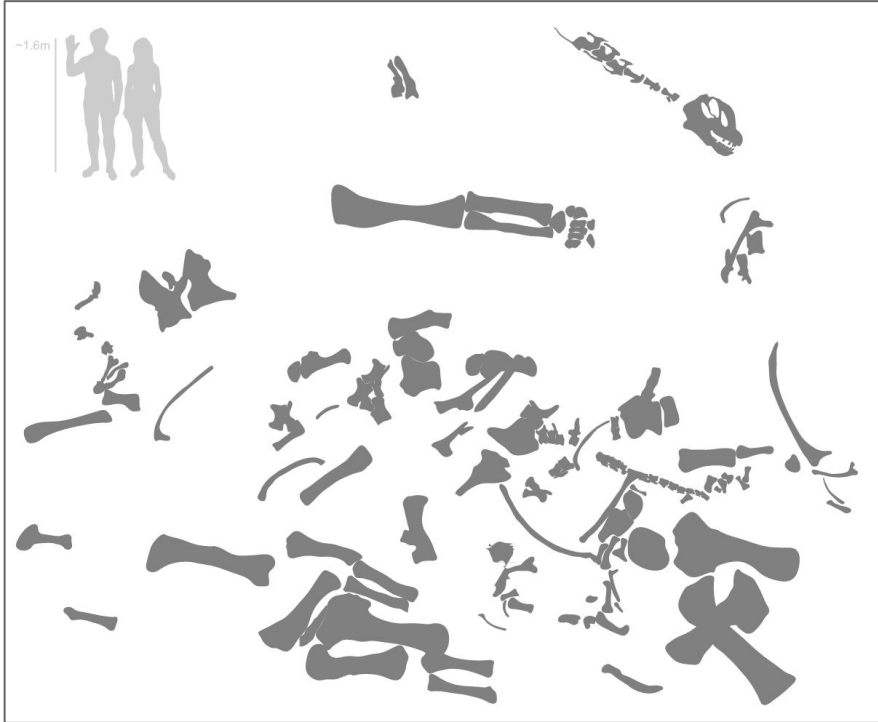
WE USED IT TO MAKE A PROOF OF CONCEPT



You can still see this live here:

<http://cretaceousmantua.com/tharkibo/test.html>

WE USED THE PROOF OF CONCEPT TO MAKE A SMALL-SCALE DEMO



THEN WE WONDERED
WHAT TO DO WITH
ALL THE ARCHIVES
WE SCANNED



SO WE SET UP WORDPRESS

- The world's most popular content management system
- Free
- Tons of pre-made themes to make websites look good out of the box

AND WE GOT SOME WEB HOSTING AND A DOMAIN NAME

- We brainstormed a bunch of names and decided on CarnegieQuarry.com
- We used Bluehost
- They gave us lots and lots and lots of storage space for our thousands and thousands of archives and fossil photos

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1938-1957

Early Structures at Carnegie Quarry



Carnegie Quarry before any structures were built along the wall

Shortly after the excavation, led by **Earl Douglass**, began to excavate the west wall faceless locally for dinosaur remains that the world had never seen, when the members of an aristocratic of Slovenian National Museum began to here. They approached including the Museum, a part of them was impressed and they were invited... the agreement to build a new world building was born... (Douglass wrote on October 21, 1915)


Douglass, 2009 Douglass would not let the quarry until some, which is not of more than twenty four years after his death.

During the last two decades of excavation at the quarry, there were no featured exhibits and the quarry remained virtually the same. **1929**

An exhibit from the Los Angeles Chronicle gives the credit of the as a valuable site only to **Dr. Barnum Brown** of the American Museum of Natural History. **These, 1937**. The construction of a museum building for the quarry was clearly your mission. Following Brown's lead was the National Park Service's plan to build a new museum building (also) to come to fruition.

A Temporary Museum

Before the creation of a museum building, the Slovenian National Museum quarry had a suitable site of visitors, moved to the water tower **Bloch, 1940**. (During the days of the New Deal programs at the quarry, with the director **Dr. Earl Lusk**, temporary storage building was constructed, which would eventually be replaced with the museum.)



Sketch of Earliest Bldg.
Earl 1917

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CLARK UNIVERSITY

After President Joseph R. Biden announced the transfer of the Slovenian National Museum to encourage the Green and Tampa Bay, the Museum received national attention and national recognition.

During the day by **New England** offices of the quarry under the September 15, 1940, the building was then constructed to generate a project for the new building of the quarry. In the early 1940s, construction began on the new building, which was a temporary structure, which was built by the construction company. During the construction of the temporary structure, attention to the existing building.

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Earl Douglass

Earl Douglass was the paleontologist who discovered the Carnegie Quarry and supervised excavations for fifteen years.

Historic image of 1890s Carnegie Quarry. All rights reserved.

Born in Medford, Minnesota in 1862, Douglass studied wildlife paleontology and taught physics and geology courses at the University of Minnesota. Douglass was hired by the Carnegie Museum of Natural History in 1893 to paleontologist field work (Douglass, 1993).

In 1893, Douglass was sent by the United States to search for fossil vertebrates, primarily *Carnegie* specimens. In the spring of the next year, he was assigned to prospect historic exposures by Carnegie Museum Director William J. Holland. During this time, Douglass made his first discovery at the Quarry. In the United States Geological Survey in 1893 within the United States (Holland, 1928). The following year, with the help of locals, Douglass was directed by the same person to discover "right" of the hill known as Dutchman's road (Earl, 2004). Douglass would spend the rest of his paleontological career collecting a wealth of dinosaur fossils that would be sent to the Carnegie Museum to be mounted in exhibit halls.

Douglass brought many thousands to the quarry of Dinosaur National Monument. He established a grid system for diligent mapping of all fossil material that was produced by the quarry. By the end of his work at the quarry in 1904, he had mapped over 300 acres of fossils known to Pittsburgh, weighing more than 700,000 pounds (Holland, 1981).

Further reading about Earl Douglass:

Douglass, G.E. 1903. *Species in the Earth and it Will Teach You The Life and Times of Earl Douglass 1862-1951*. **Book available on Amazon**

Holland, J.E.C. 1928. *DGP Library*

Holland, J.E.C. 1981. *Dinosaur Fossils, Together Found at the Dinosaur, The Quarry*


Dinosaur National Monument Archives regarding Earl Douglass

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For full text, you can go to the "NPS Admin" page. There are also a number of ways to be a part of the Digital Quarry Project. **Contribute** now on **GitHub project page**.

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Allosaurus fragilis




FACTS

Allosaurus is the most common predatory dinosaur from the Morrison Formation

Allosaurus is Greek for "different kind"

Allosaurus is the state fossil of Utah!

Adult *Allosaurus* grew up to lengths of 30 feet




Allosaurus fragilis remains a possible *Morrisonan* taxon, a possible predator (see introduction in the [Morrison Correlation](#))

Allosaurus fragilis is the most common species of carnivorous theropod dinosaur in the Morrison Formation from the Late Jurassic of North America. Although only its bones are exposed in the present day quarry at Dinosaur, one of the best localities ever found comes from the Carnegie Quarry and its skull is on exhibit in the Quarry Exhibit Hall.


Allosaurus fragilis is the most common species of carnivorous theropod dinosaur in the Morrison Formation from the Late Jurassic of North America. Although only its bones are exposed in the present day quarry at Dinosaur, one of the best localities ever found comes from the Carnegie Quarry and its skull is on exhibit in the Quarry Exhibit Hall.

Allosaurus fragilis is one of three theropods found at the Carnegie Quarry the others being *Coelophosaurus* and *Sauroposeidon* (never). Although thousands of *Allosaurus* bones have been excavated at the Cleveland Lloyd Dinosaur Quarry in Ohio (Cady, 1966; Whitlock 1978). None are represented and the bones here, is considered the most complete skeleton and best preserved of Dinosaur.

Specimens of *Allosaurus fragilis* from the Carnegie Quarry:

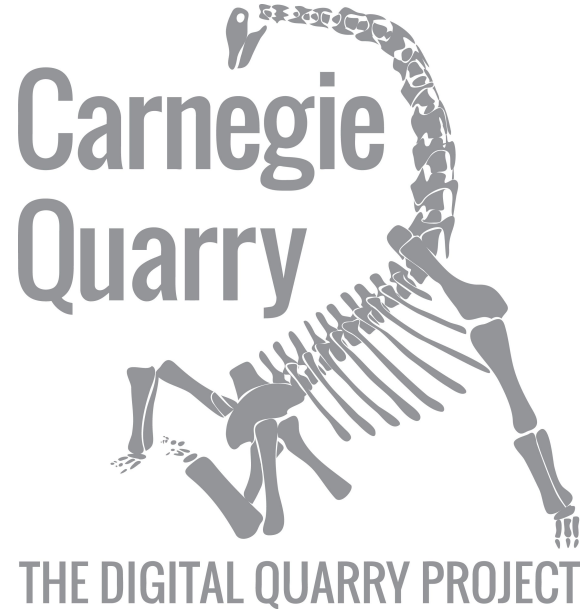


The best preserved and most complete skull of *Allosaurus fragilis* is on display at the Quarry Visitor Center.



The mounted cost of *Allosaurus fragilis* based on the specimen from the Carnegie Quarry, and is an exhibit at the Quarry Visitor Center.

TRINITY DESIGNED A LOGO



AND A LOT OF LOGOS WE DIDN'T USE



MARIE MADE A
DATABASE FOR THE
ARCHIVES AND
WROTE
DESCRIPTIONS FOR
THE ARCHIVES AND
UPLOADED ARCHIVES
AND NAMED THE
ARCHIVE FILES AND
SCANNED MORE
ARCHIVES




```
<g></g>
<a rel="leanModel" xlink:href="#model"><path id="DINO_4537" class="fossil" d="M1161.3,922.2c0.4,1.2,0.6,2.4,0.9,3.6c0.2,0.8,0.2,1.9,1.3,1.9c0.7,0.1,5.1,2.2,1.2-1.2
c1.0,2.1,5.0,7.2,5.0,9.1c1.0,3.1,1.7,0.2,7.0,5.1,7.0,9.3,7.2,4.6,3.8c1.2,2.1,4.3,1.5,9.0,0.9,0.7,1.6,1.3,2.6,1.6
c-0.9,0.2,2.2,0.1,2.6,1.6,2.9,3.3,1.8,4.4,1.4c-1.7,0.6,3.7,1.6,4.8,3.1c1158.5,918.5,1160.5,920.1,1161.3,922.2z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_4845" class="fossil" d="M3722.9,814c-0.1,1.6,0.3,3.2,0.2,4.8c0.1,1.4,0.1,3.1,1.5,3.3c-1.4,0.2,2.9,0.5,4.2,0.1
```

AND I WENT SLOWLY MAD TRYING TO CODE THE DIGITAL QUARRY

```
c-4.4,4.4,7.8,9.5,12.9,13.4c-1.6,1.2,3.3,2.9,5.4,2.7c-2.0,2.3,2.5,4.5,3.8c-2.5,2.4,4.8,6.6,6.8,1.1,10.5c2.2,1.6,4.5,0.8,7,1.6
c2.4,0.7,4,3,2.5,9.4,7c2.2,1.8,4,2.2,8.6,9.3,4c1.3,0.3,2.6,0.5,3.8,1.2c1.7,1.1,3.3,2.4,5,3.5
C1538.4,367.1,1540.5,367.7,1542.2,369z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_4016" class="fossil" d="M1497.1,356c2.7,0.3,5.3,1.1,7.7,2c2.8,1.1,5.5,2.2,8.3,3.2c2.5,1.5,9.2,2.8,1.3,7
c1.6,1.1,2.6,2.4,4.6,3c3.2,1.7,7.0,8.7,9.3,5c0.1,2.4,4,1.3,6,2.3c-0.5,4,2,1.6,2.6c-0.6,0.6,0.7,1.1,1.6,1.5
c-1.0,4,2.5,0.1,3.6,0.4c-5.4,1.3,10.7,3.1,16.2,4.2c-2.2,0.4,4,4,0.6,6.7,0.7c-2,0.1,3.9,0.3,5.9,0.3
C1488,355,1494.8,355.8,1497.1,356z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_4905" class="fossil" d="M1474.4,334.2c2.4,3.4,4.9,6.7,7.8,9.6c2.6,2.7,3.8,5.9,6.1,8.9c0.9,1.1,2.1,9.2,8.2,9
c0.7,0.9,1.9,2.5,1.4,3.5c-0.6,1.2,2.4,1.1,3.5,0.7c-3.2,1.3,5.3,2.5,1.5,9c-2.7,4.4,5.8,8.6,8.4,13.1c-2.5,4.4,6.3,8.1,8.6,12.7
c-1.3,2.5,3.2,5.7,3.5,8.4c0.0,3.1,6.0,3.1,7.0,4c0.7,0.4,0.7,0.9,1.1,6c0.8,1.4,1.5,2.9,2.4,4.3
C1470.3,329,1472.5,331.5,1474.4,334.2z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_4010" class="fossil" d="M1698,377.7c1.4,0.4,4.3,1.7,5.5,0.5c1.3,1.3,0.3,4,1.4,4.4c-2.5,2.7,7.1,4.1,10.3,5.8
c-4.1,2.2,6.4,3.8,1.8,4c-7.3,14.7,9.3,32.2,7.48,4.3,1.16,1.5,8.24,2c1.2,9.3,7.7,7.3,3.10,8.0c-0.7,5.9,5.8,4.8,6.4,6.5
c-3.1,8.2,4.6,16.5,6.3,24.9c-1.6,7.9,3.15,9.2,6.4,2c0.5,13.3,2.3,29.1,12.1,38.8c1687.5,375,1692,376.1,1698,377.7z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_4800" class="fossil" d="M1775.4,440.8c2.4,4.0,1.5,8.1,5.8,1.8,9.1c-4.0,8.4,4.6,12.7,8.8,18c1.5,1.9,1.2,9.1,5
c0.1,0.9,3.7,0.7,5.5,0.4,4.5,2.8,8.6,4,3c4.2,4.6,2.4,10.5c-1.6,2.4,4.5,1.7,5.1,7.5,5.2,3.3,2.2,10.7,7.3
c-3.4,1.1,7.1,2.2,10.5,3.5c-6.2,2.3,12.5,5.5,17.9,9.1c-12.2,7.8,25.5,14.7,36.7,23.5c-2.9,2.3,6.2,4.1,8.6,6.9
c-2.1,2.6,2.1,7.8,5.1,9.1c-1.4,0.6,4.2,0.3,5.1,2c-0.8,1.7,0.8,3.1,8.4,4c2.1,7.2,4.4,5.6,5.7,7c3.8,6.4,6.7,9.9,9.9
c3.6,3.4,7.6,9.1,11.3,9.4c5.7,3.2,11.2,7.16,7.10,4c4.5,2.8,9.1,5.4,13.7,8c5.7,3.2,10.9,8.2,15.8,12.5c3.5,3.1,6.5,6.7,9.3,10.3
c2.8,3.5,5.9,9.9,9.12,2c1769,447.6,1773.6,444,1775.4,440.8z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_4150" class="fossil" d="M1767.7,739.9c-1.7,5.4,3.3,10.7,4.4,16.2c-2.2,11.2,0.7,24.3,2.6,34.9
c2.0,9.3,6.9,24.3,16.7,28.2c2.7,1.15,3.3,11.7,7.9c1.5,2.1,5.6,1.6,7.7,1.4c-1.4,0.1,2.2,0.7,3.6,0.4c-1.1,0.3,1.9,1.7,2.8,1.9
c-4.7,1.9,6.6,11.5,10.2c-3.1,4.4,5.2,10.6,9.15,1c-3.7,10.7,7.4,19.7,8.6,31c-1.2,10.6,0.9,21.3,5.3,31.4c1.1,4.5,2.8,9.2,4.7,13.3
c1.2,2.2,2.4,7.4,6.5c3.2,3.4,6.2,5.7,2.1c1770.7,759.3,1769.1,744.5,1767.7,739.9z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_4126" class="fossil" d="M2027.1,418.5c0.6,3.2,2.3,6.7,3.4,9.8c2.2,6.9,5.3,13.8,9.19,2c3.5,6.2,7.6,12,11.6,18.1
c3.8,5.7,8.7,10.7,12.6,16.3c3.8,5.5,13.2,13.3,10.2,9c-2.2,0.1,5.9,5.2,7.6,9c-2.2,0.4,1.5,5.9,7.6
c-3.9,5.6,7.9,11.1,11.5,17c-1.8,2.9,4.4,5.2,6.4,8c-1.8,2.6,3.4,5.3,5.3,7.9c-4.2,5.7,7.2,11.8,11.4,17.4
c-1.3,1.8,2.4,3.7,3.7,5.4c-1.2,1.6,3.3,2.7,4.1,4.2c-1.6,3.1,1.8,5.1,11.2c1.1,1.3,2.8,2.3,4.6,2.4
C2027,414.4,2026.7,416,2027.1,418.5z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_3941" class="fossil" d="M2906.9,659.9c1.1,1.4,1.6,3.5,2.2,5.2c1.3,3.6,2.1,7.4,1.10,3c1.9,3.2,3.8,6.3,5.9,9.4
c1.3,1.9,2.9,3.6,4.4,5.4c1.6,1.8,3.1,3.8,4.8,5.5c3.6,3.6,7.3,7.2,11.3,10.4c1.5,1.2,3.2,3.4,5.3c1.7,1.3,3.4,2.9,5.2,4.1
c1.6,1.3,2.3,4.7,3.2c1.6,0.8,3.1,1.9,4.6,3c0.7,1.5,1.0,8.0,6.1,6c0.3,0.6,0.8,1.2,1.4,1.2c-0.9,0.2,6.1,2.3,3.1,6
c-1.1,0.7,2.3,1.3,3.3,2.1c-1.2,1.2,6.7,1.3,9.2,6c-3.3,2.3,6.9,4.5,10.7c-3.3,2.7,6.8,5.2,10.8,2c-2.6,2.5,5.5,4.9,7.9,7.6
c-0.8,1.1,9.1,7.2,7.2c-0.8,1.1,7.2,2.5,3c-1.3,1.5,2.4,4.1,3.1,5.4,8c-2.2,3.3,7.7,5.3,10.7c-1.1,2.6,2.1,5.2,3.2,7.8
c-0.4,1.1,2.1,2.3c-0.1,1.1,1.2,5.1,9.2,8c2984.4,661.7,2986,661,2986.9,659.9z"/>
<a rel="leanModel" xlink:href="#model"><path id="DINO_4266" class="fossil" d="M3635,760.8c3.5,2.6,2.7,5.4,1.9c-2.7,5.8,5.3,13.7,13.3,11.7c7.7,1.7,10.4,8.3,9.8,15.3
c0.2,2.4,1.3,3.3,3.3,4.3c2.4,1.3,3.3,6.2,9.5,7.4,6c3625.4,767.1,3631.9,763.1,3635,760.8z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_4883" class="fossil" d="M3857,616.2c-1.1,0.1,2.1,0.4,3.1,1c-0.5,0.3,1.3,0.7,1.1,4c0.2,0.7,1.4,0.8,2,0.9
c1.4,0.1,3.0,0.4,2.7,0.1c1.5,0.4,1.2,1.5,0.6,6.2c3859.5,615.9,3858.1,616.1,3857,616.2z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_3844" class="fossil" d="M3746.6,725c3.3,3.1,6.2,6.3,8.8,10c1.2,1.7,2.5,3.3,3.2,5.4c0.4,1.3,0.7,5.2,2.5,6
c1.8,0.7,4.1,3.5,2c1.9,0.8,3.1,7.1,7.3,8c2.3,1.4,7.5,8.7,3.8,4c-2.4,2.4,4.5,5.2,7.1,7.5c1.4,1.3,2.9,2.3,4.2,3.6
c-1.2,2.1,2.1,3.3,5.3,2c-1.5,0.9,3.2,1.4,4.8,2.3c-1.2,0.7,3.2,7.4,5.1,9c-2.4,1.4,0.6,5.7,1.9,6.9
C3740.9,722.4,3744.3,722.9,3746.6,725z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_3838" class="fossil" d="M3775.1,734.5c3,2.5,6.1,3.4,7.8,5.1c2.5,2.5,5.8,4.5,5.8,6.3c3.4,2.7,4.2,8,11.1,3.9
c1.9,0.5,3.7,0.9,5.8,0.8c1.7,0.1,4.1,0.2,5.6,0.5c1.5,0.5,7.7,5.8,8.4,2.2c0.2,1.2,1.3,2.2,0.4,3.6c0.6,0.9,1.9,1.2,2.5,2
c0.9,1.2,0.2,2.6,0.1,3.8c-0.1,1.2,0.3,2.6,0.3,3.7c0.0,0.1,0.0,0.3,0.1,0.5,0.3,0.8c-1.7,0.4,3.4,1.1,5.3,0.7
c-1.8,0.4,3.9,0.6,5.6,0.2c-1.7,0.8,3.2,1.7,4.9,2.4c-1.8,0.8,3.8,1.1,5.7,1.5c-2.5,0.6,5.1,6.7,5.2c-3.2,2.1,7.2,3.3,10.7,4.8
c-2.1,0.9,4.2,1.9,6.3,2.9c-1.4,0.7,3.4,1.4,4.3,2.8c3772.4,741.7,3772.7,736.5,3775.1,734.5z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_3767" class="fossil" d="M4159.8,787.1c1.2,0.7,1.9,2.3,2.8c1.1,0.8,2.3,1.3,3.1,2.5c-1.8,2.7,7.1,1.7,9.6,0.9
c-1.6,0.5,6.2,3.5,5.4,6c4151.4,706.2,4158.2,706.2,4159.8,707.1z"/></a>
<a rel="leanModel" xlink:href="#model"><path id="DINO_3860" class="fossil" d="M4019.5,653.8c1.3,0.9,2.4,1.7,3.9,2.2c1.5,0.5,2.3,0.3,2.6,2.1c0.3,2.2,0.5,6.3,1.6,3
```

THEN WE RAN OUT OF TIME

It was very sad.

But we knew that we had accomplished far more than any of us had expected for the short 12-week program.

We only wished we could launch the website for the public.

BUT AT THE LAST MINUTE, INHA SAVED THE DAY

They funded several more weeks of work to make the website ready for a public launch that coincided with the 100th anniversary of Dinosaur National Monument.



AND ON OCTOBER 7, 2015...

One hundred years after the National Park Service officially preserved the fossils of Carnegie Quarry for the world...

WE LAUNCHED CARNEGIEQUARRY.COM

To make sure the whole world finally has access to the fossils of Carnegie Quarry.



LET'S CHECK IT OUT.

CarnegieQuarry.com

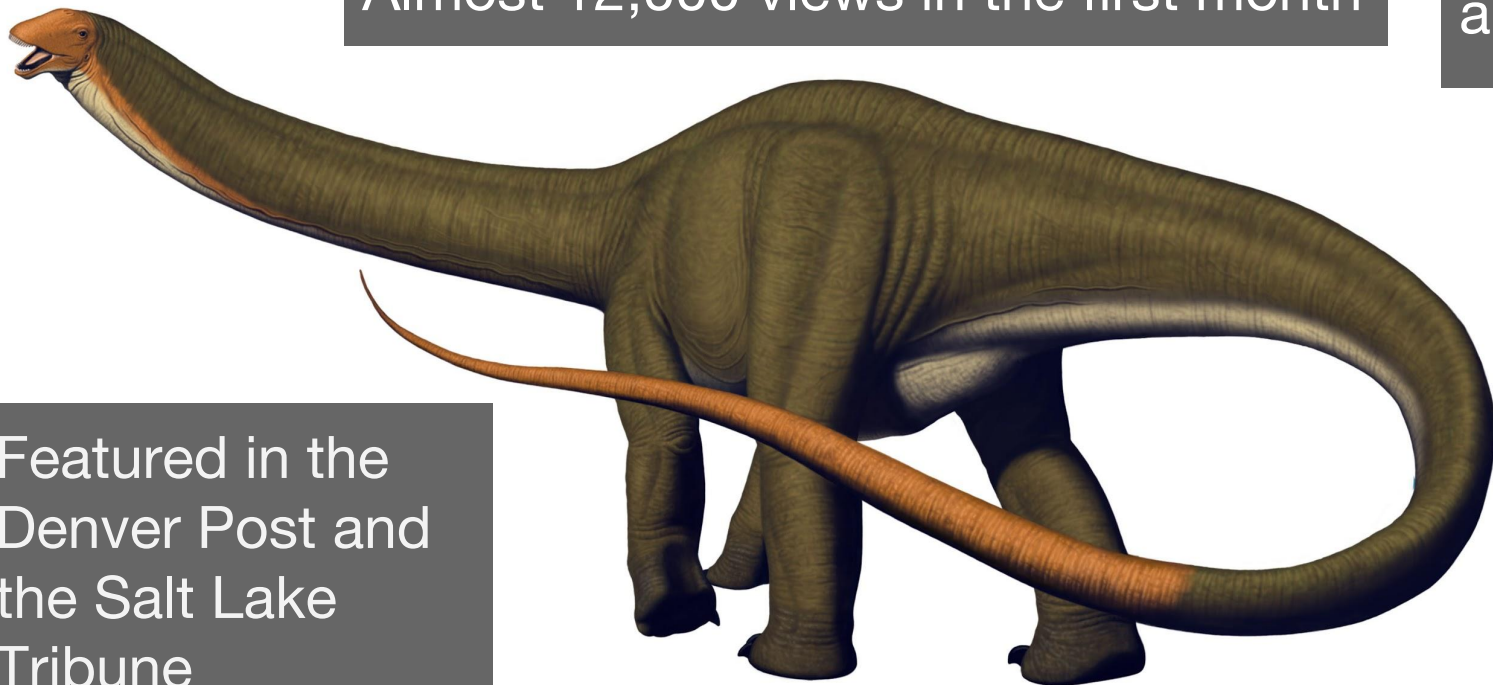
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news
articles

Almost 12,000 views in the first month

One
new
coder
through
GitHub

Featured in the
Denver Post and
the Salt Lake
Tribune



WHAT'S NEXT

- We've open-sourced the digital quarry and we invite all coding fossil fans to contribute to the GitHub repo
- We have lots of data entry planned with Brigham Young University
- We just 3D-scanned the whole quarry with LiDAR and it would make an amazing virtual reality experience
- Oh and the extra 5000 fossils from the old quarry need to be added (Hello GeoCorps 2016!)

THANKS!

