

CREATING VIRTUAL FIELD TRIPS USING 3D MODELS, 3D MAPS, GIGAPIXEL IMAGES, AND 360-DEGREE PANORAMAS IN SAGUACHE COUNTY, COLORADO



MISSISSIPPI STATE UNIVERSITY™
DEPARTMENT OF GEOSCIENCES

Youngwoo Cho and Renee M. Clary
Department of Geosciences, Mississippi State University

yc448@msstate.edu
<http://bit.ly/indy118>



Scan me

ABSTRACT

We have created 3D maps with 3D tiling capability, 3D rock & fossil models, and 360-degree aerial panoramas (AP360) for Virtual Field Trips (VFTs) in Saguache County, Colorado. We have also created 2D tiled gigapixel images in Kingsland, Texas. These VFT tools will help students better learn the geographical and geological importance in those areas. By utilizing various 2D and 3D VFT tools with lots of geospatial data, students will be able to view the geology outcrops in a variety of ways leading to multidimensional learning. It will also help students improve their sense of place by using geographical relationship and the geospatial data.

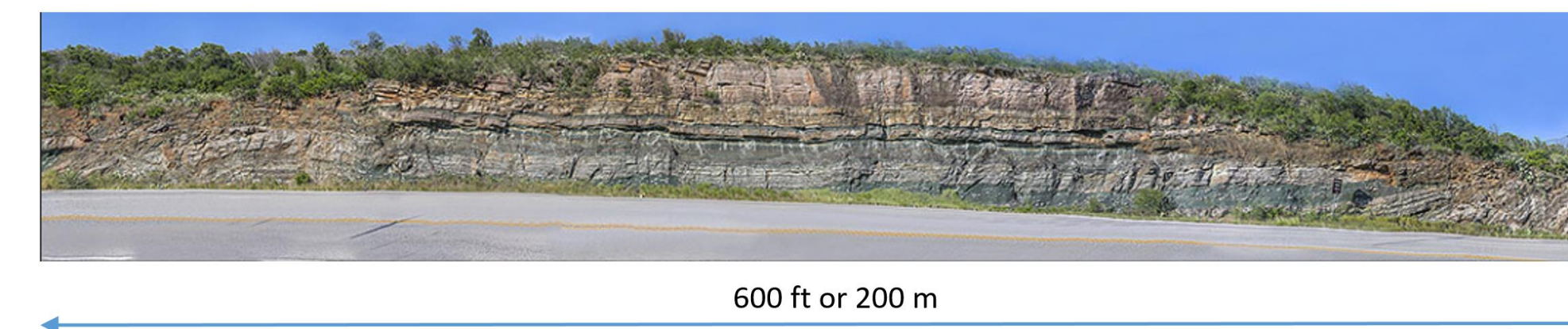
INTRODUCTION

We have created four VFT tools to organize and integrate the student learning environments that will be used in a traditional geology field camp. The four VFT tools are summarized below:

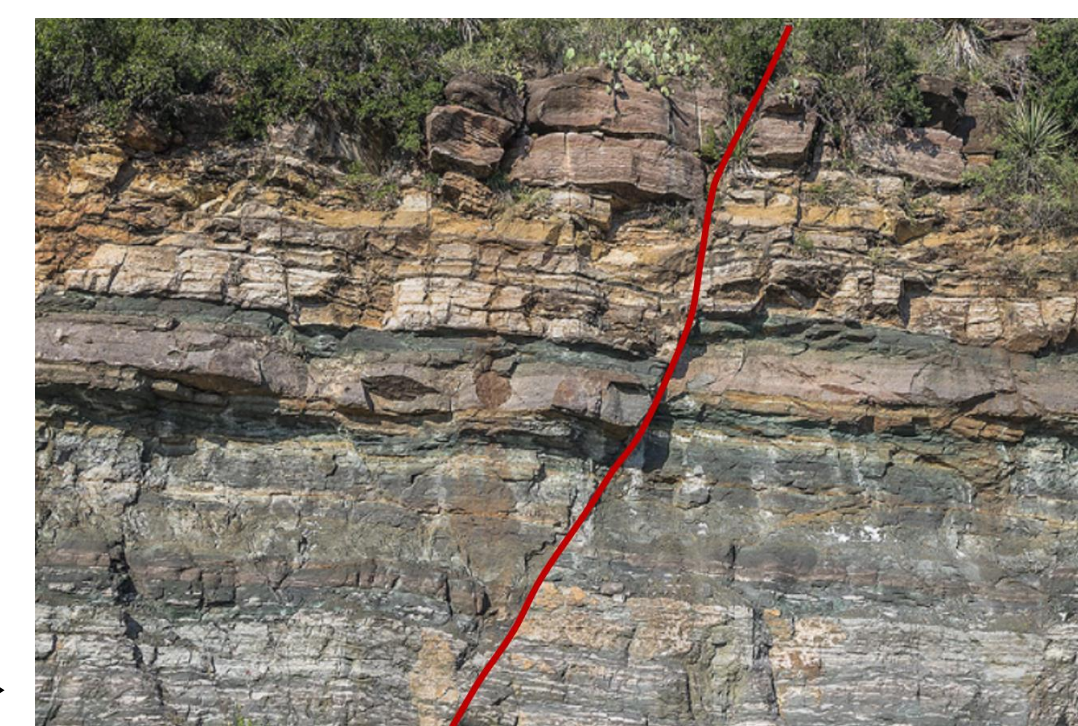
- Gigapixel images with tiling capability for quick loading in spite of their huge format.
- High definition 3D rock and fossil models reconstructed by Structure from Motion (SfM) and Multi View Stereo (MVS) Photogrammetry.
- Virtual tour web applications using 360-degree aerial panoramas with a variety of information such as PDF documents, images, videos, web links, and 3D models.
- 3D Map Platform with tiling capability. Sputnik Web and Cesium ION are web-based 3D map platforms where users can embed their geodata such as sets of aerial photographs, a single georeferenced image, 3d models, and digital terrain models (DTMs). A few of supported file formats for Sputnik Web are CZML, KML, KMZ, SHP, and TLS.

METHODS

TILED GIGAPIXEL IMAGES



We have created 2D tiled images that provide the entire view and the fine details at the same time. Tiling technologies helped the image be quickly be loaded in spite of its huge dimension (45,111 x 5,684 pixels).



Magnified view of the road cut ▶

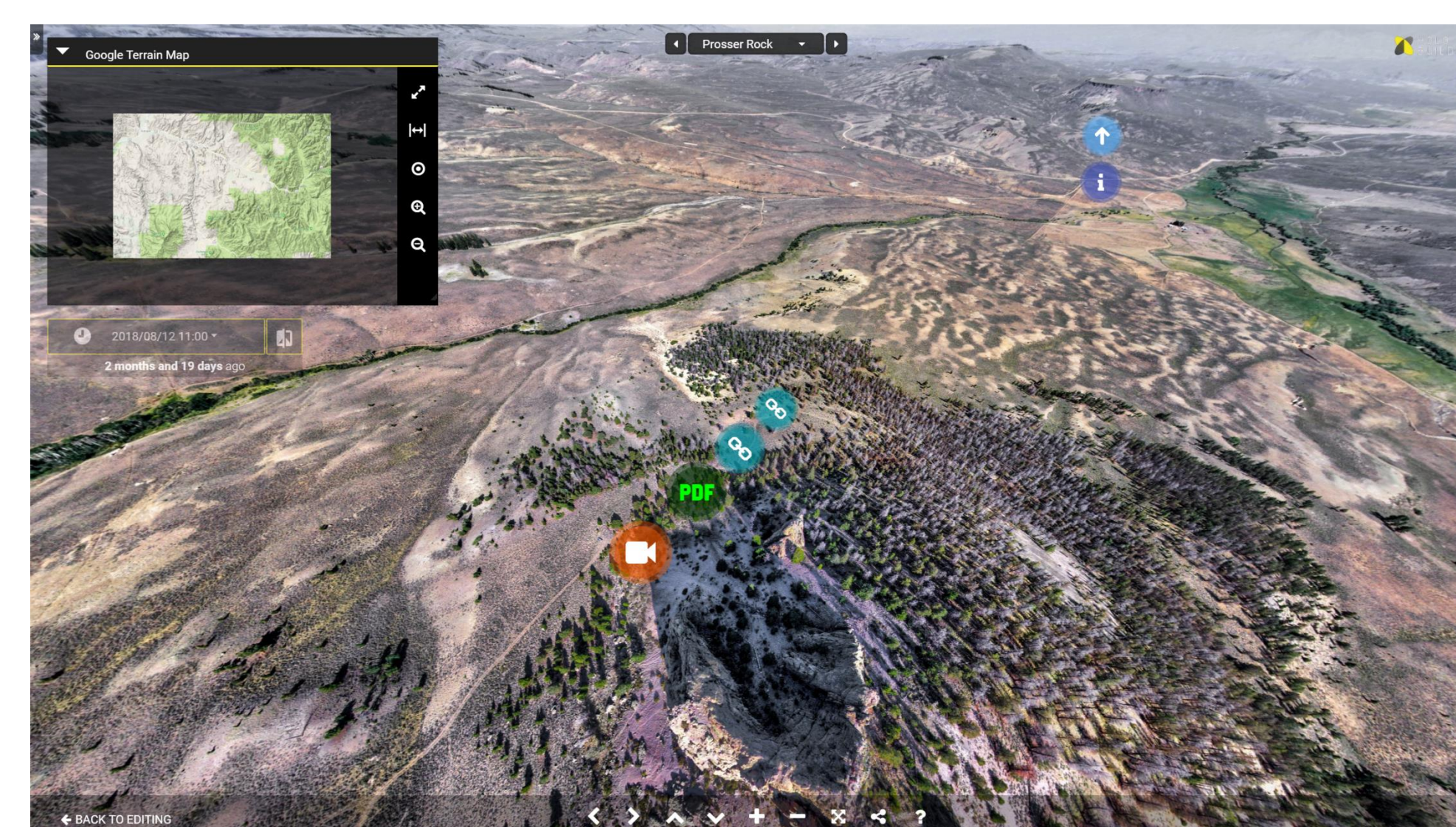
3D ROCK AND FOSSIL MODELS



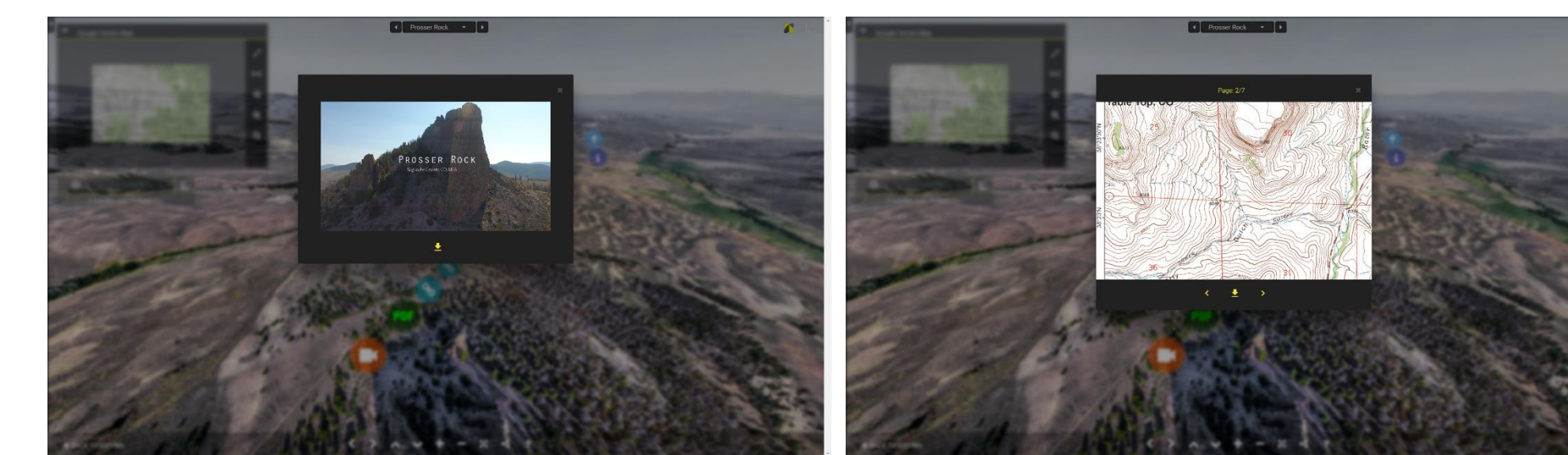
3D models of rhyolite (left) and petrified wood collected from the Prosser Rock and Table Top, Saguache County, CO.

We have created 3D models of rocks and fossils using SfM-MVS photogrammetry. The quality of 3D models has greatly improved by enhanced photographic techniques.

VIRTUAL TOUR USING 360-DEGREE AERIAL PANORAMAS AND A VARIETY OF INFORMATION EMBEDDED IN SCENES



Scene for Prosser Rock: Hotspots to Table Top, information, web page links, PDF documents, and videos are available in the scene. The 360-degree aerial panorama was created from pictures taken by a UAV.



Scene for Prosser Rock: Videos can be played inside a scene.

Scene for Prosser Rock: PDF documents can be played inside a scene.

We have created AP360 for Prosser Rock, P2, and Table Top using pictures taken by an UAV, DJI Phantom 4.

Lots of objects that link to the information, web links, PDF documents, and videos are available. 3D models were embedded in a scene as well, but they are not active objects which can be rotated or zoomed.

Terrain, topographic, and geologic maps were added to give students the geographical and geological understanding on the areas of interest.

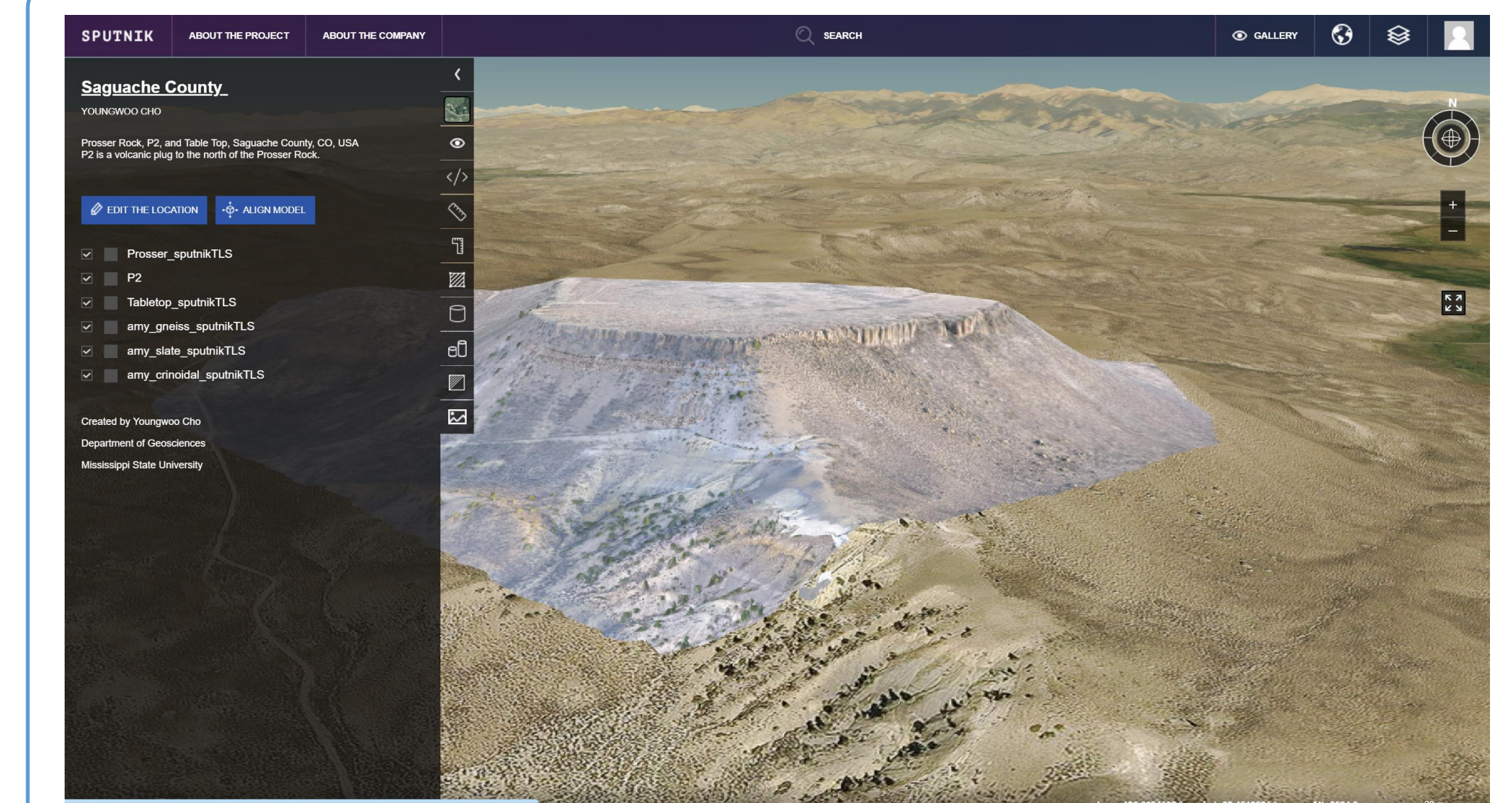
3D MAP PLATFORM WITH GEOSPATIAL DATA AND 3D TILING CAPABILITY

We have created 3D map platform with 3D terrain models embedded as layers in the map environment. The 3D map environment is powered by CesiumJS Javascript engine. The 3D tiling capability of the platform allows quick loading of the area that is currently in the view.

We have used a UAV, DJI Phantom 4, to scan Table Top, Prosser Rock, and P2 in Saguache County and created their 3D models.



The 3D model of P2, a volcanic plug to the north of the Prosser Rock, has been created and embedded in Cesium ION's 3D map platform. The Prosser Rock and the Table Top can be seen beyond P2.



Sputnik Web showing 3D terrain model of Table Top

Geographical relationship can easily be understood with high definition 3D terrain models embedded on the 3D base map. The geospatial data help students measure the quantities such as length, height, distance, area, and volume of geospatial data.

DISCUSSION & CONCLUSION

- 2D Tiled Gigapixel Images were very useful in investigating detailed texture and structures in road cuts along together with the entire view. However, lens focal length should be carefully chosen to provide a full details of the texture.
- 3D rock models proved to have sufficient resolution for visual inspection of specimens primarily due to the enhanced photographic techniques we have used.
- Virtual tour using 360-deg aerial panoramas is particularly good in overviewing the areas of interest. But, 3D models in HoloBuilder should be given a way that allows rotation and zoom.
- 3D map platforms were quite good to geospatially investigate the targets. Combined with some more coding, it will serve as the integrated environment for geologic mapping and visual inspection of areas of interest.

ACKNOWLEDGMENT

We want to acknowledge the support from the Department of Geosciences, Mississippi State University for high-performance computing and travel funds to Colorado. We also acknowledge the travel grants for the GSA Indianapolis from the following institutions and organizations.



REFERENCES

- Listed in <http://bit.ly/indy118>