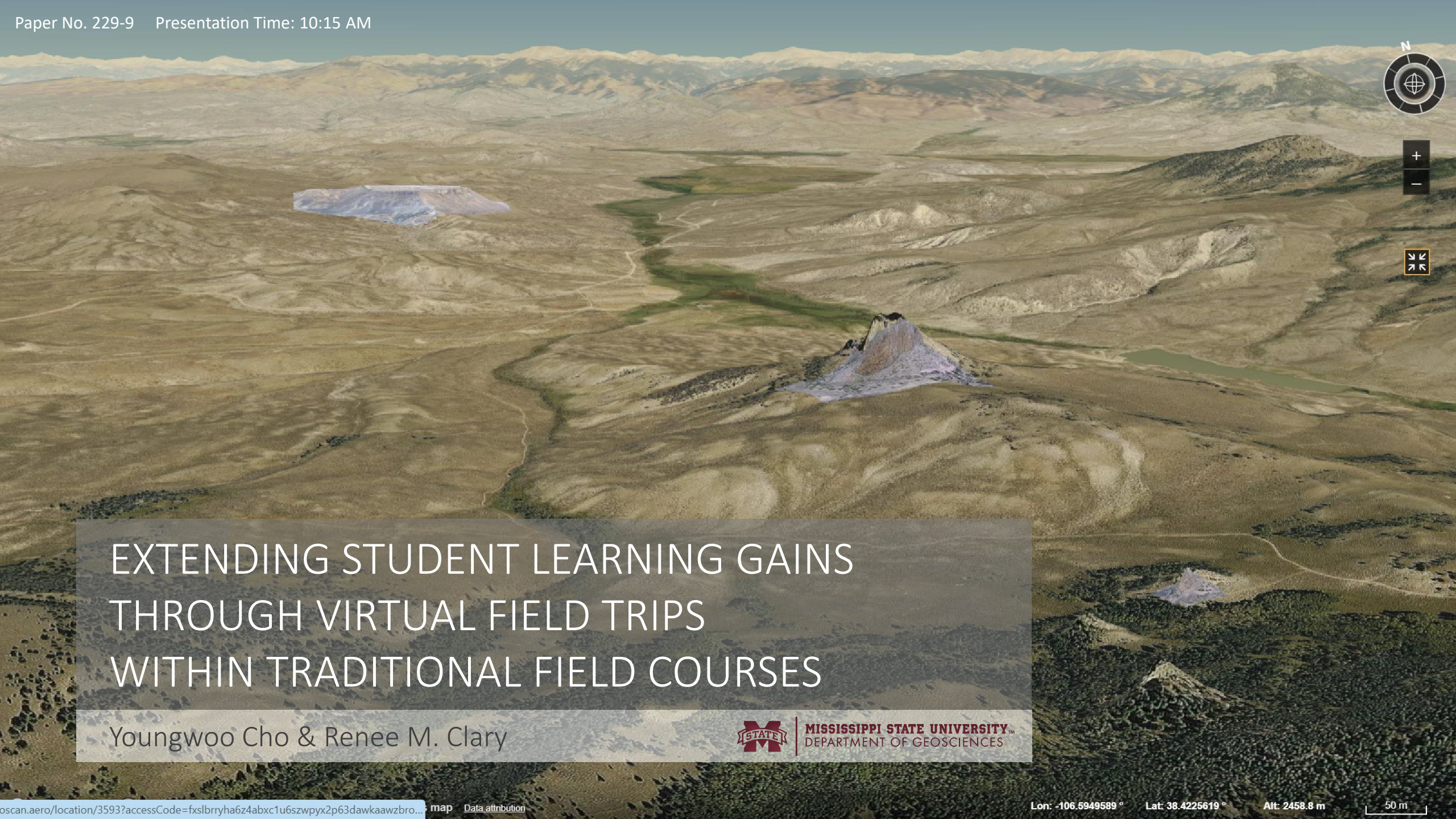
Paper No. 229-9 Presentation Time: 10:15 AM



EXTENDING STUDENT LEARNING GAINS THROUGH VIRTUAL FIELD TRIPS WITHIN TRADITIONAL FIELD COURSES

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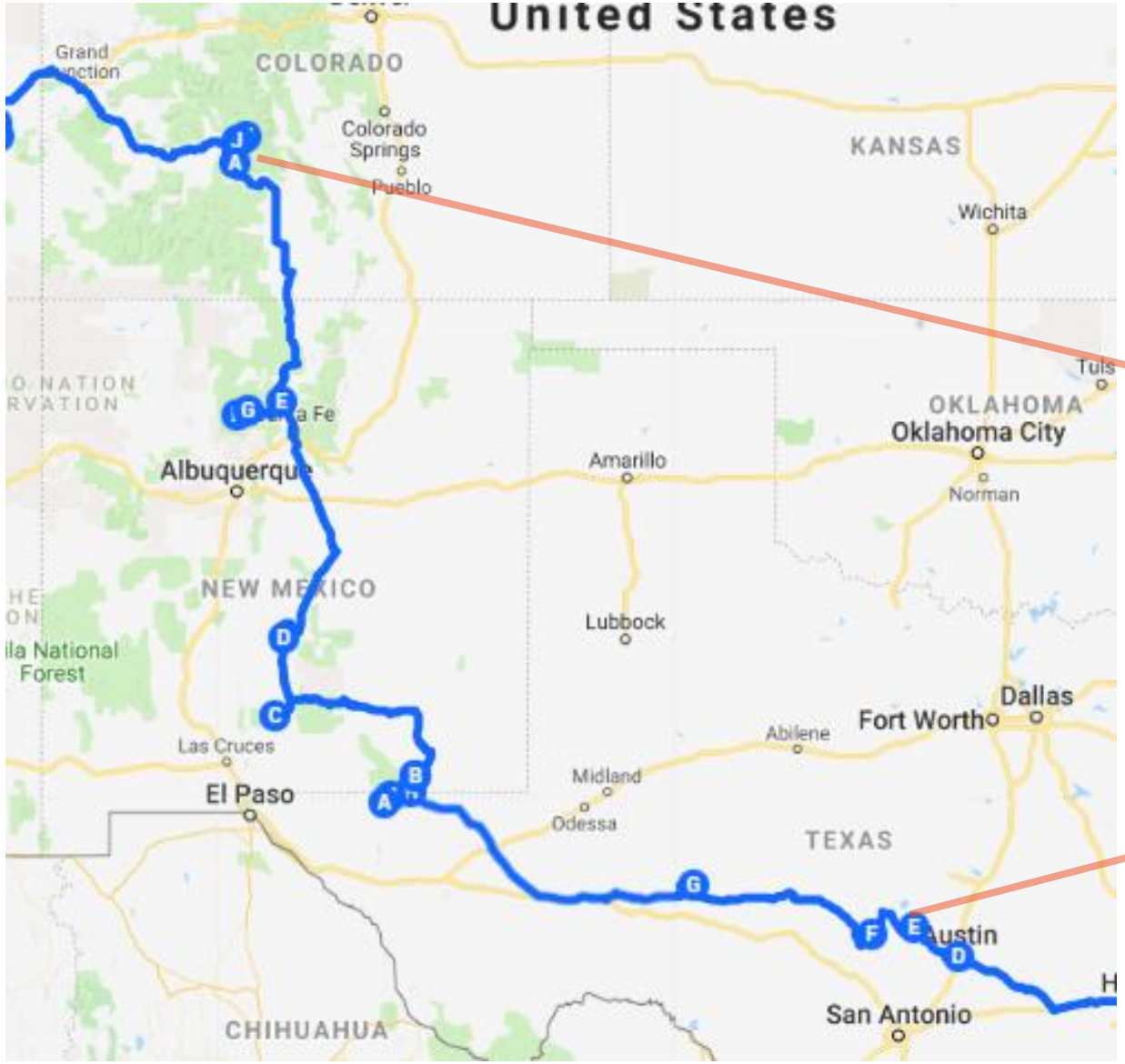
MISSISSIPPI STATE UNIVERSITY
DEPARTMENT OF GEOSCIENCES

Lon: -106.5949589 ° Lat: 38.4225619 ° Alt: 2458.8 m 50 m

MSU-USM's Summer Geology Field Camp 2018



Saguache County, CO

- 3D rock models
- 3D map app with DTMs
- Virtual tour

Hoover Point outlook near Kingsland, TX

- Gigapixel image of a roadcut

Virtual Tools Developed in this Project:

- Tiled Gigapixel images
- 3D Rock Models
- 3D map platform with tiling capability
- Virtual tour with 360-degree panoramas

Tiled Gigapixel Images

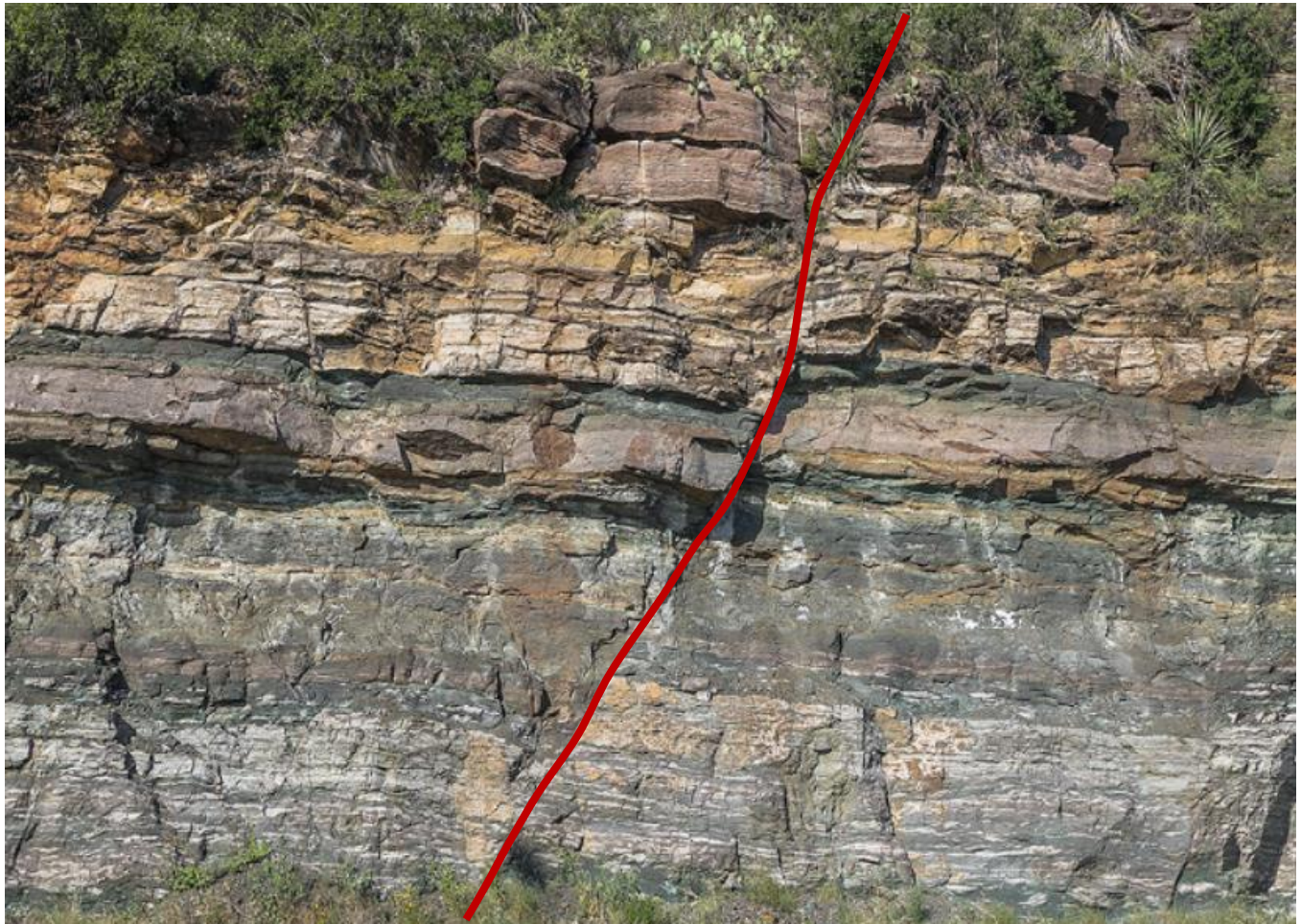
- 2-dimensional image with huge dimension which is zoomable to show the entire view and the small details of with one single image.
  - A roadcut near Hoover Point overlook
  - Canon 5D Mark IV + EF 24 mm lens
  - 126 images (An image in every 1.5 m)

600 ft or 200 m

A tiled gigapixel image put on GIGAMacro, https://goo.gl/VYqVMq

Tiled Gigapixel Images

- **Goal**: To show larger geologic features such as stratigraphy and geological structures, and smaller features such as small structures and textures.



Tiled Gigapixel Images

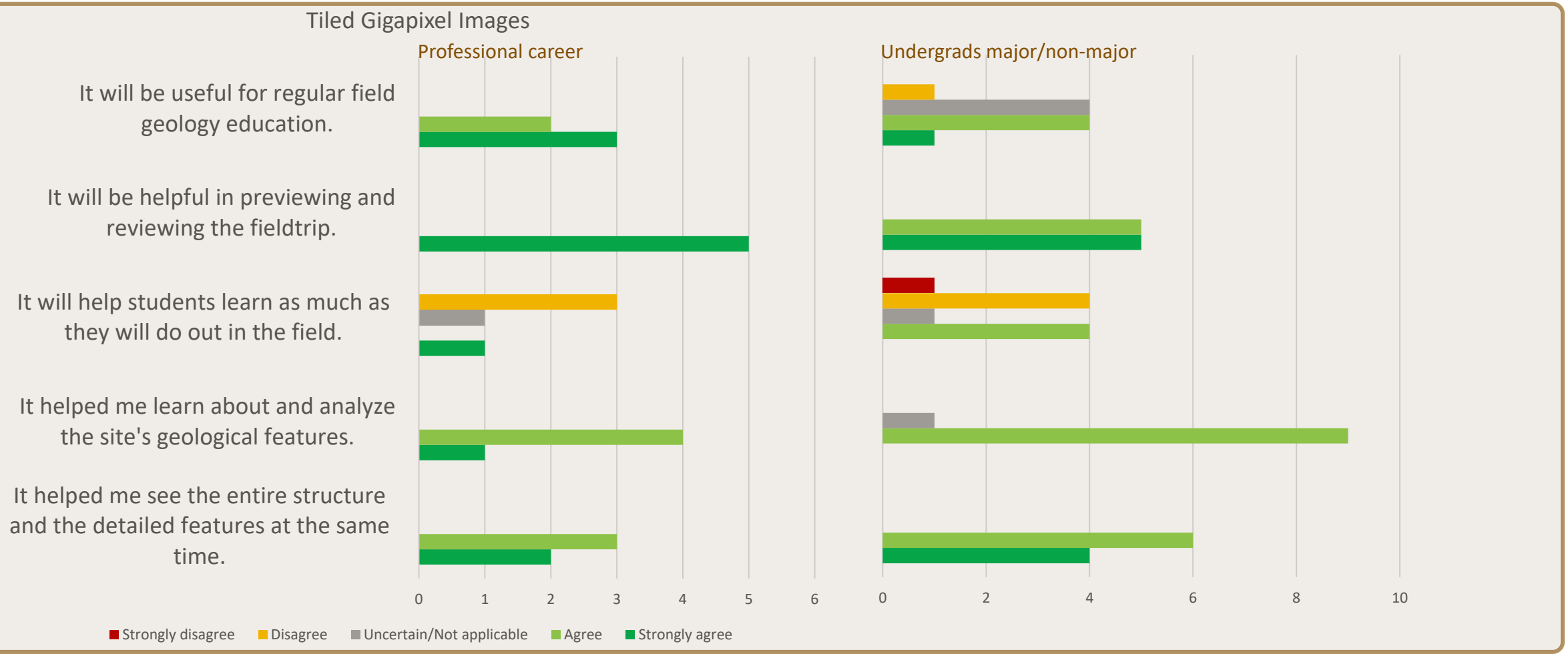
- **Actual field analogy**: we want to see the entire view from far and want to get closer to see more details.
- **Features**: Continuously changes between the entire view and the detailed view “very quickly” due to the tiling capability.

Tiled Gigapixel Images

- **Tool**: Software stitching images into a panorama (Autopano Giga or another panorama stitching software)
- **Data**: High quality images captured on stable support and with enough overlaps.

Tiled Gigapixel Images

Feedback



3D Rock Models

- Virtual 3-dimensional representation of specimens of rocks and fossils

Rhyolite from Prosser Rock, https://skfb.ly/6CGHq

https://sketchfab.com/yow

3D Rock Models

- **Goal**: To provide visual inspection of specimens of rocks and fossils.

Fossiliferous limestone from the laboratory repository, https://skfb.ly/6CvUU

3D Rock Models

- **Actual analogy**: Holding a hand sample to inspect it (without a magnifier).
- **Features**: Rotatable and zoomable.

Petrified wood from Table Top, https://skfb.ly/6CJZU

3D Rock Models

- **Tools**:
  - 3-axis motion control hardware and turntable, lightbox, and Canon 5D Mark IV DSLR + EF 50mm 1:2.8 Macro Lens
  - Software packages for photo-shooting with exposure and focus bracketing capabilities, High Dynamic Range (HDR) image composite, focus stacking, retouching, and Structure-from-Motion (SfM) and Multi-View Stereo (MVS) photogrammetry.

- **Data**:

  For petrified wood specimen - total 11,972 raw images, 3,801 HDR images, 277 focus-stacked images (Upside 109 + downside 118 + common 50)

3D Rock Models

Feedback

3D Map Platform with 3D Tiling Capability

- 3-dimensional map platform for tiling 3D geospatial data (terrain models)

3D Base Map

3D Terrain Model

Table Top
https://bit.ly/2QlHrFG

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3D Map Platform with 3D Tiling Capability

- 3-dimensional map platform for tiling 3D geospatial data (terrain models)

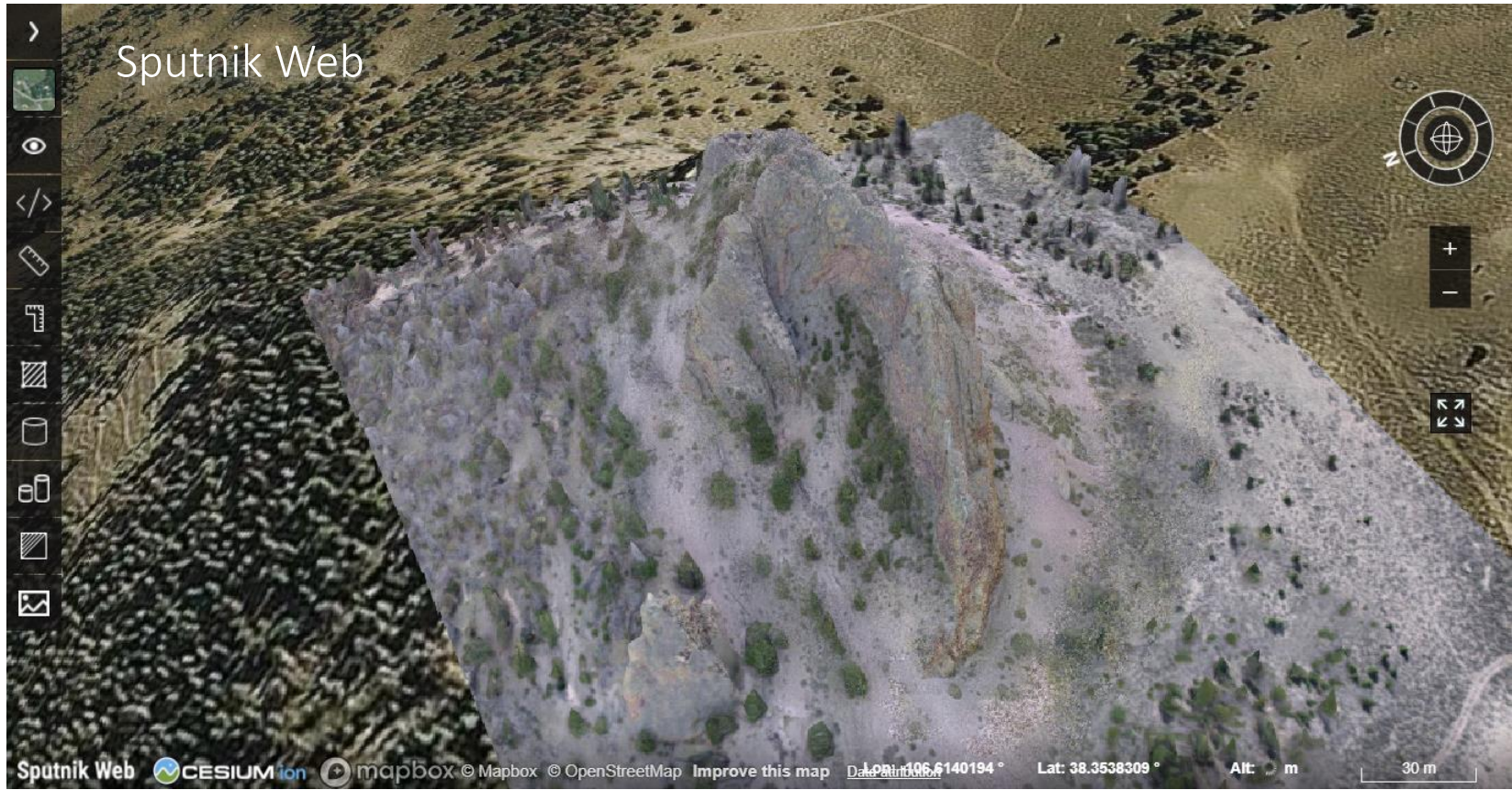
3D Base Map

3D Terrain Model

Table Top,
https://bit.ly/2QlHrFG

3D Map Platform with 3D Tiling Capability

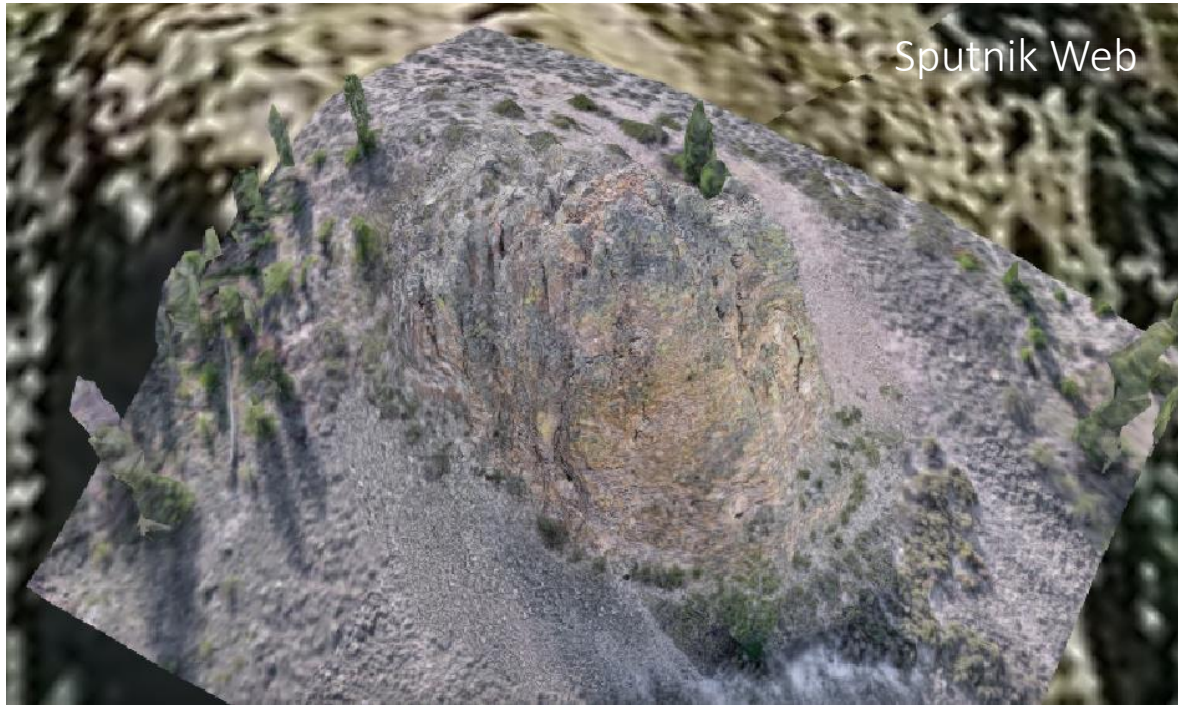
- **Goal**: To look at geographical relationships and to measure geospatial quantities such as location, direction, distance, height, length, area, and volumes; plus visual inspection with a higher resolution than the base map.



Prosser Rock, https://bit.ly/2F0ByMO

3D Map Platform with 3D Tiling Capability

- **Actual analogy**: Take a helicopter hovering over an area of interest inspecting geologic features with geospatial information.
- **Features**: 3-dimensional base map which is overlain by terrain models with higher resolution.



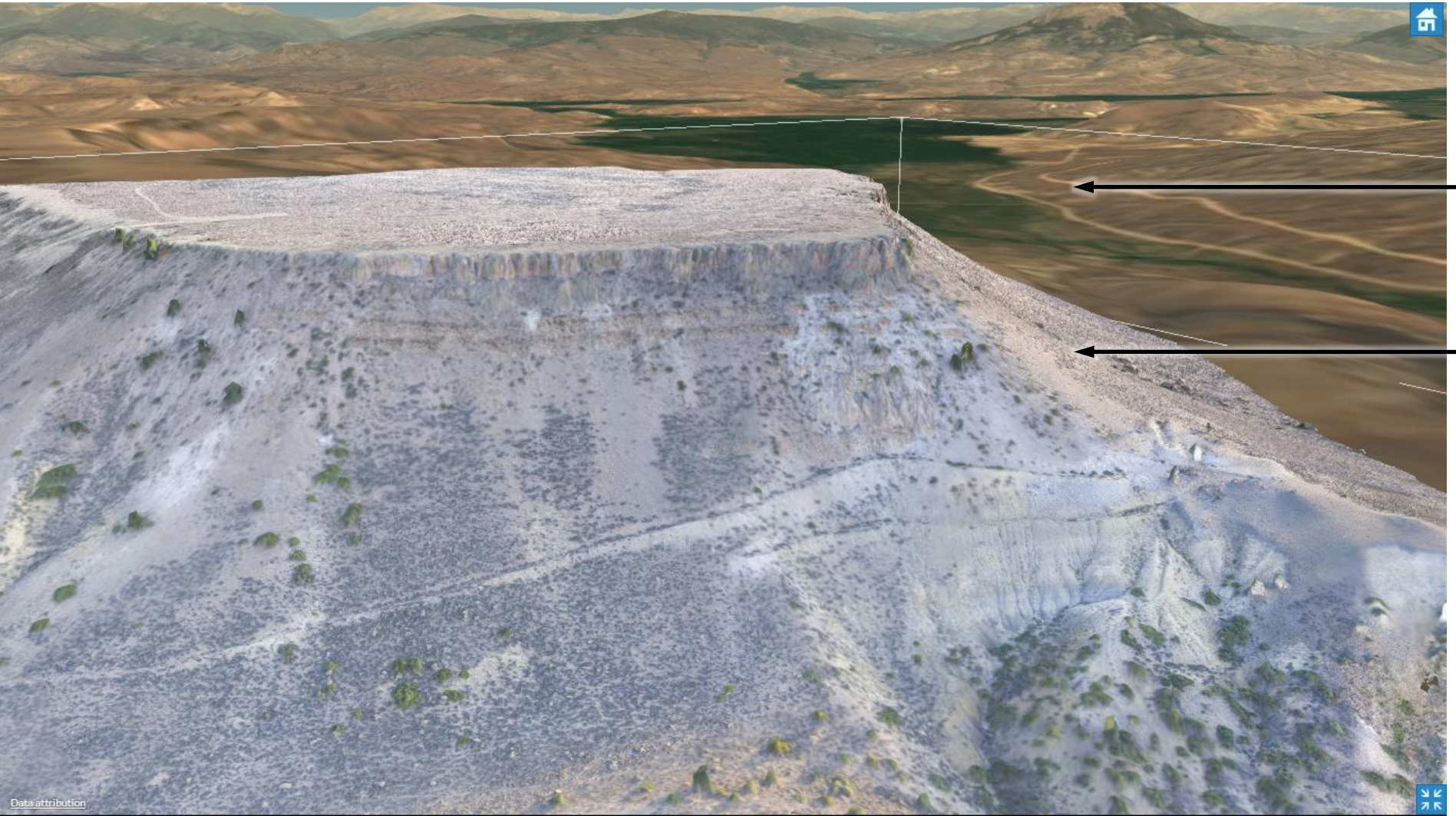
P2, https://bit.ly/2QkF5H7

3D Map Platform with 3D Tiling Capability

- **Tools**:
  - UAV (DJI Phantom 4)
  - Software packages for photo-shooting with exposure bracketing capabilities, High Dynamic Range (HDR) image composite, retouching, and Structure-from-Motion (SfM) and Multi-View Stereo (MVS) photogrammetry.
- **Data**: For P2 - total 1,305 raw images, 435 HDR images

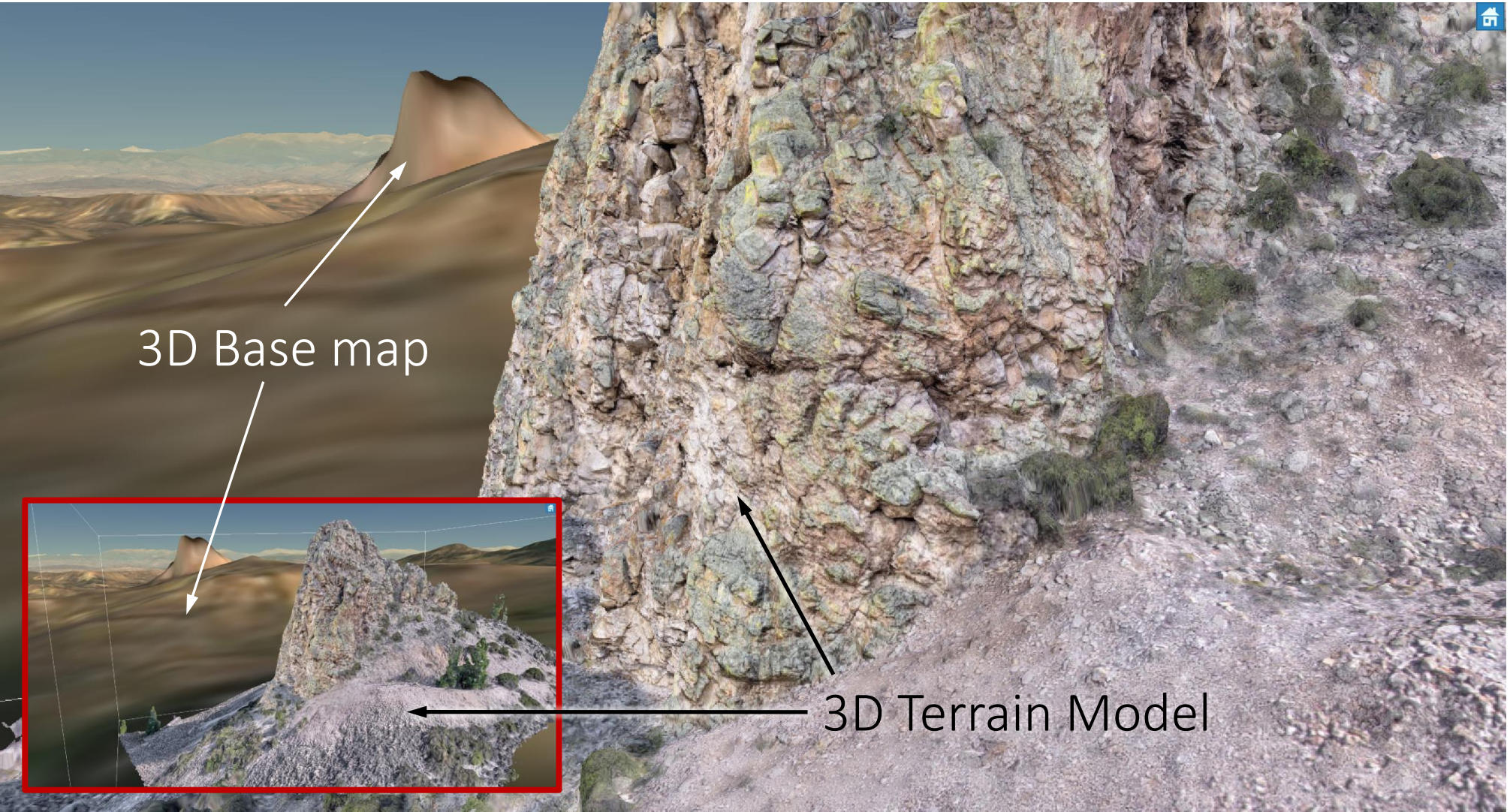
3D Map Platform with 3D Tiling Capability

- Cesium ION



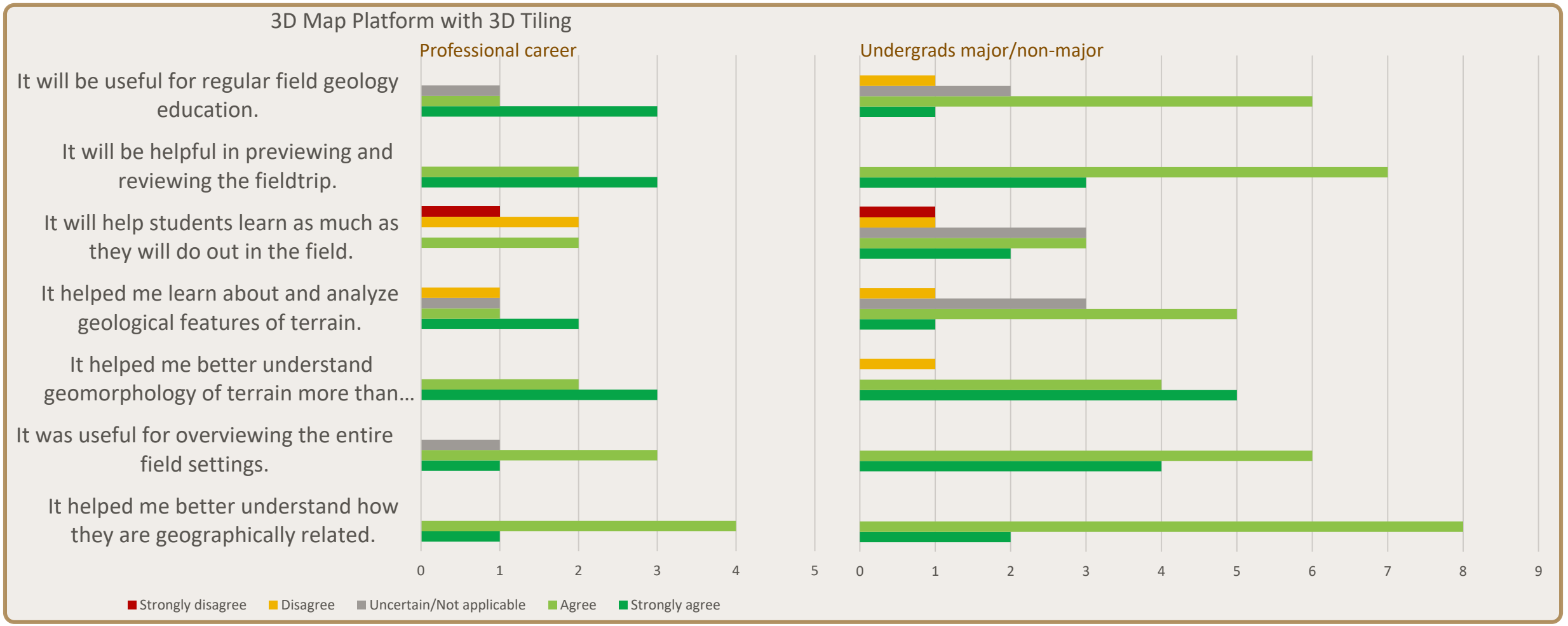
3D Map Platform with 3D Tiling Capability

- Cesium ION



3D Map Platform with 3D Tiling Capability

Feedback



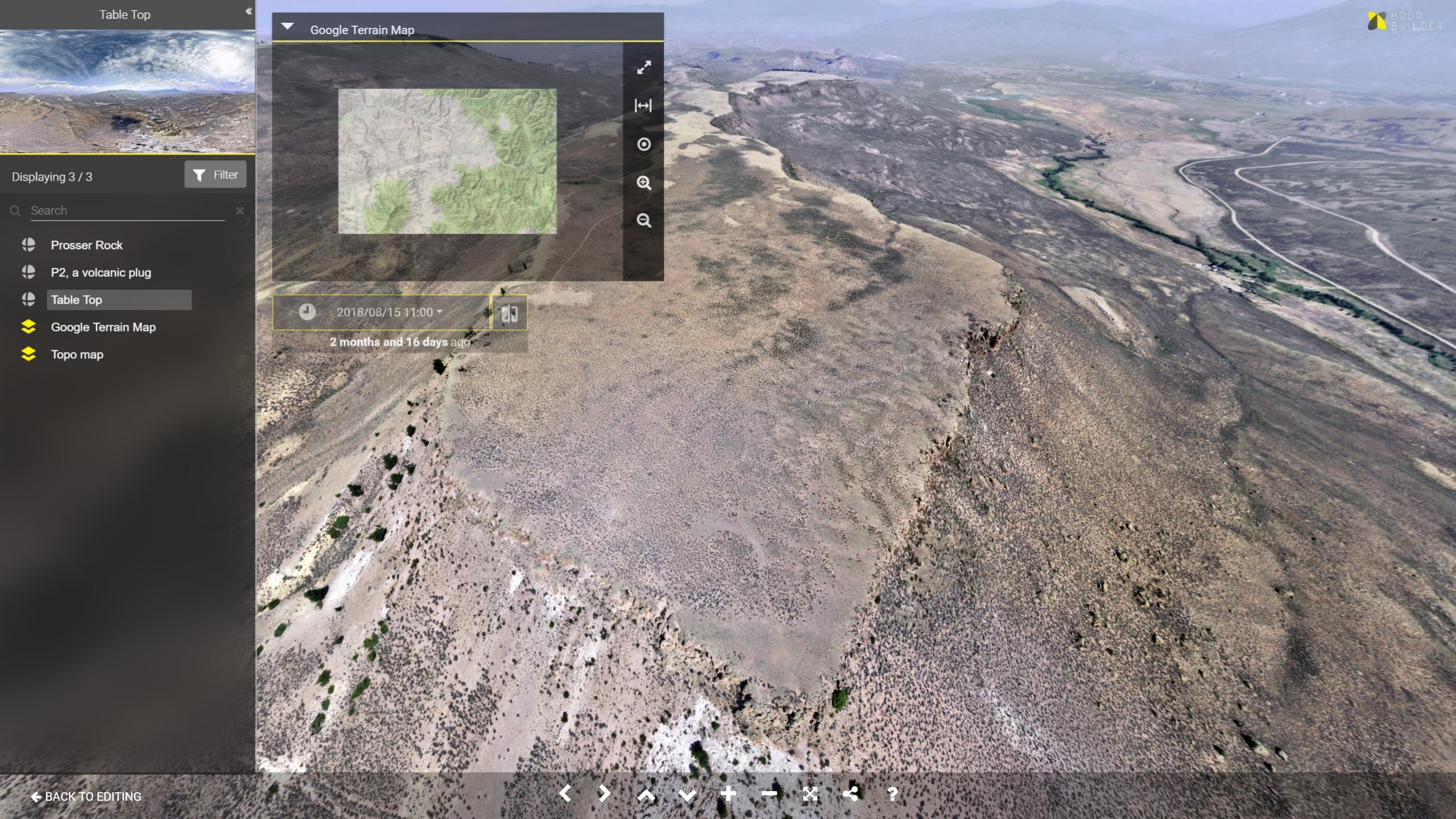
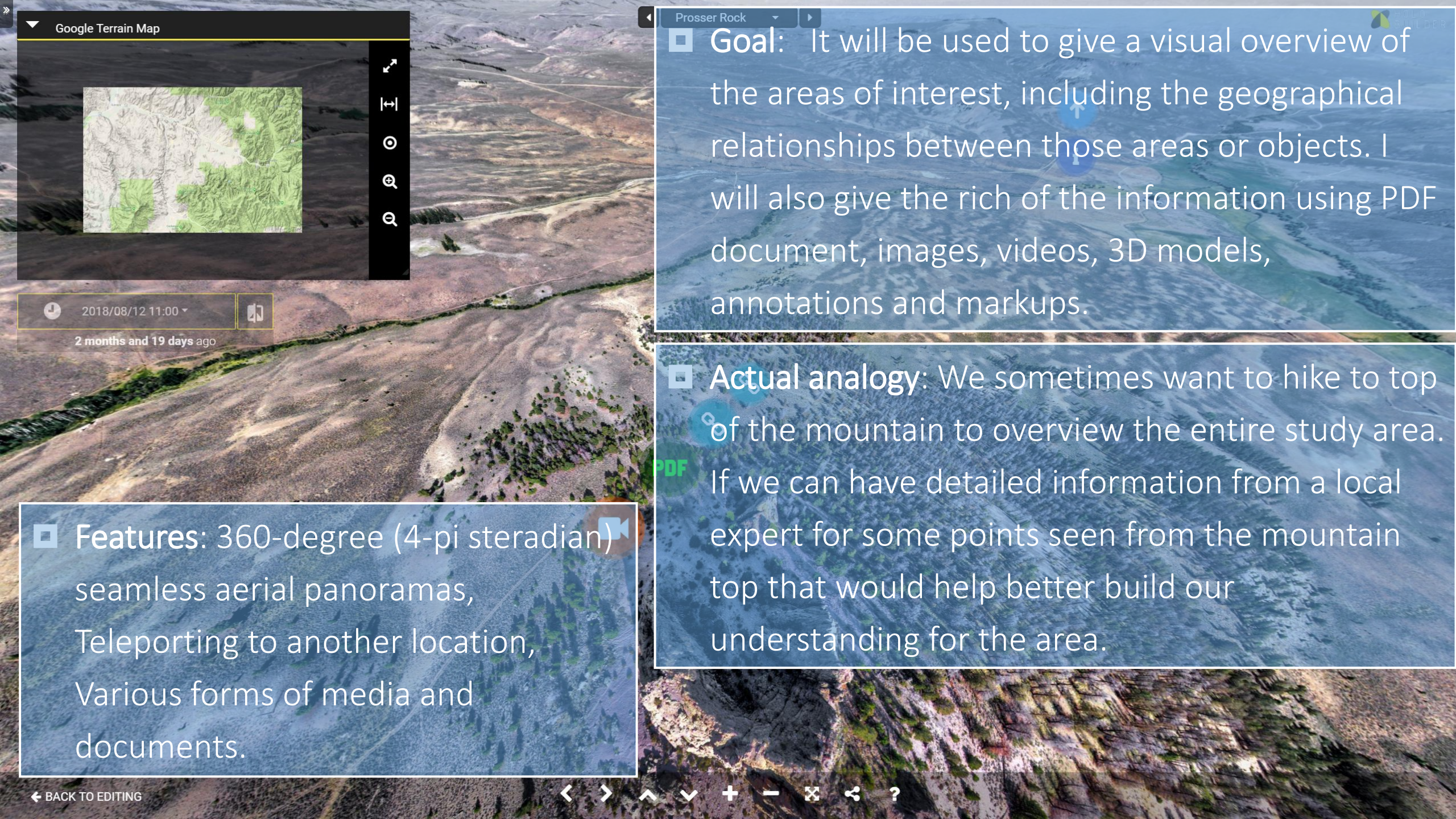


Table Top
Google Terrain Map
2018/08/15 11:00
2 months and 16 days ago
Displaying 3 / 3
Filter
Search
Prosser Rock
P2, a volcanic plug
Table Top
Google Terrain Map
Topo map
BACK TO EDITING


Google Terrain Map
Prosser Rock
2018/08/12 11:00
2 months and 19 days ago
PDF
BACK TO EDITING



Goal: It will be used to give a visual overview of the areas of interest, including the geographical relationships between those areas or objects. I will also give the rich of the information using PDF document, images, videos, 3D models, annotations and markups.

Actual analogy: We sometimes want to hike to top of the mountain to overview the entire study area. If we can have detailed information from a local expert for some points seen from the mountain top that would help better build our understanding for the area.

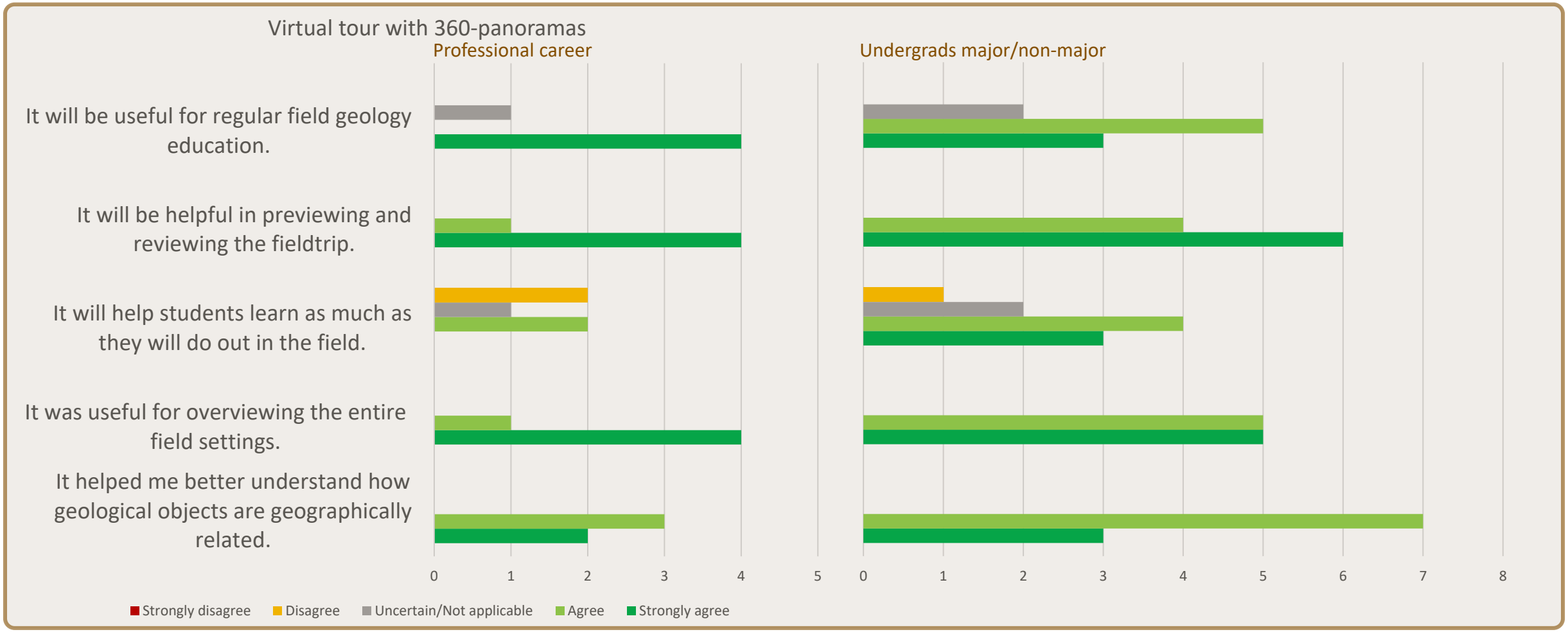
Features: 360-degree (4-pi steradian) seamless aerial panoramas, Teleporting to another location, Various forms of media and documents.

Virtual tours using 360 panoramas

- **Tools**:
  - 360-degree panorama stitching software, virtual tour creation software or virtual tour hosting website.
- **Data**: About 30-50 aerial images taken over an area of interest, sky panorama pictures to build hemispheric sky.

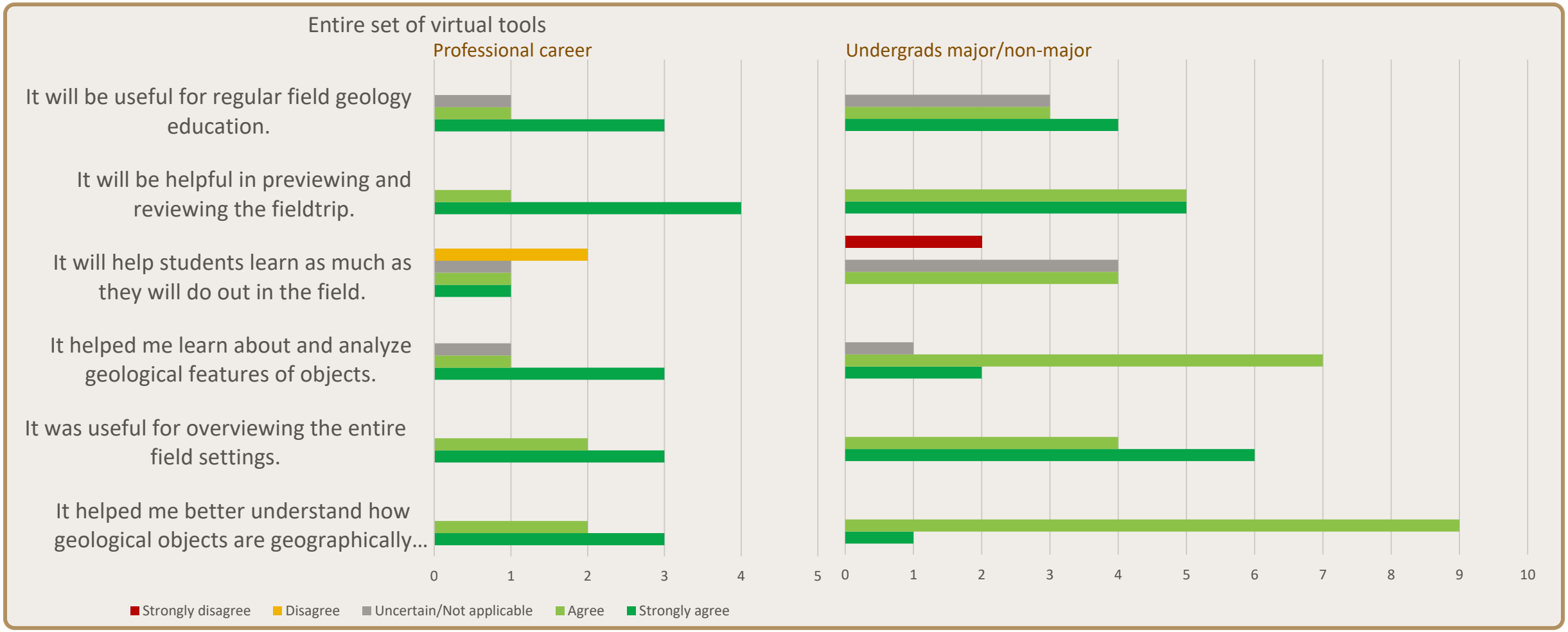
Virtual tours using 360 panoramas

Feedback



The Entire Set of Virtual Tools collectively

Feedback



The Entire Set of Virtual Tools collectively

- Feedback
  - Collectively, these materials will certainly be appropriate for a field overview and provide good levels of detail. Small, but essential, geological details (i.e., slickensides, physical declivities, textural gradations) are not fully captured at both the outcrop and study area scales....Overall, this work is important and I'm optimistic that it will contribute much to geological education.
  - There is certainly a lot of good things happening with this work and the ability to be a supplemental or supportive resource is very exciting. However, optimization of the visual elements or perhaps an external source that does not rely on internet may be something worth looking into. The internet at Pitkin is about as good as what I have at home.

The Entire Set of Virtual Tools collectively

- Feedback
  - The design and layout of some items could also be improved slightly to allow more control by the user. I don't think it could ever replace the field camp experience, but certainly if a field camp was monetarily limited some field work could be done with this material in order to help teach the methods of field geology and how one may approach a particular investigation of the rock material. More than anything, I think this is a great resource for outreach and would be great for helping people/students gain a passion for the geosciences.
  - I think the strength of visual tools like these lies in the collection rather than the individual components. By compiling all of these different visual and informational components it makes the topic easier to see and understand as a whole.

Conclusion and Discussion

- All virtual tools need to have an appropriate scale. (In preparation)
- All virtual tools need to have appropriate annotations and markups. (In preparation)
- Tiled Gigapixel images still need to be improved by providing better details when it was zoomed into the maximum possible level.
- 3D rock models have good resolution but in some cases they lack detail. (Those dead areas should be carefully inspected and need to have more overlapping pictures.)

Conclusion and Discussion

- 3D map platforms need to be improved most in visually aspects. (Aerial pictures need to be taken with even higher details; need to get closer and more overlaps)
- Virtual tour with 360-degree panoramas need to allow movement inside the scene? – technically not possible yet and partially can be solved by adding more scenes and time-travel options.
- Virtual tools can prove their worthiness collectively as a set.

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