

Mid-Atlantic Appalachian Orogen Traverse Virtual Field Trips

Notes for Instructors

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The Mid-Atlantic Appalachian Orogen Traverse is a series of 4 virtual field trips that travel across the Blue Ridge and Valley and Ridge geologic provinces in northwestern Virginia and northeastern West Virginia. These virtual field trips cover the same territory as a series of on-location field trips that are part of a capstone project for an upper-level course in the Department of Geology and Environmental Science at James Madison University. The course is called “Stratigraphy, Structure, Tectonics”, and the field trips explore the stratigraphic and structural data in evidence at each outcrop in order to synthesize the tectonic history of the Mid-Atlantic region. The virtual field trips are designed to reproduce the on-location field trips as closely as possible, including extensive note taking, data recording, and synthesis discussions.

Each of the virtual field trips is organized around a web-based Google Earth project (presentation) that shows the route of the trip, the location of each stop as a placemark, images (aerial views, Street Views, outcrop photos), and orientation information (strike and dip of bedding or foliation, etc.) Additional materials, such as an exercise handout, PowerPoint presentation(s), handouts of pertinent diagrams, etc. are also provided for each virtual field trip (see the other Mid Atlantic field trip webpages on the [Teaching with Online Field Experiences](#) site.) The Google Earth projects and other materials are made available to the students prior to the day of the field trip, so that students can preview the information that will be featured.

Links to each Google Earth virtual field trip are below:

Field Trip 1 (Overview of stratigraphy):	Field Trip 1
Field Trip 2 (Blue Ridge Province):	Blue Ridge Field Trip
Field Trip 3 (Rt. 211/259 transect):	Rt 211/259 Field Trip
Field Trip 4 (Rt. 33 transect):	Rt 33 Field Trip

An advantage for outcrop-based structural analysis is that although the structures can be complicated and challenging, the structural evidence is commonly exposed and relatively apparent on the outcrop. Field trip participants can see bedding, foliation, slickenlines, folds, faults, etc. that are the basis for interpretations. This is not true for stratigraphy and basin analysis, because we cannot see a basin at a single outcrop. The tectonic evidence of basin evolution is indirect and has to be built up with stratigraphic data observed and synthesized from many outcrops. In addition, the stratigraphic evidence required for environmental interpretations requires many observations at many scales of observation. Each on-location outcrop takes a lot of time with students examining it, walking back and forth, at a distance and close-up, to collect and synthesize as much information as possible.

The goal of the instructors was to accomplish a similar experience in virtual field trips as students have with on-location field trips. With on-location trips much of the syntheses and interpretations are handled as “chalk talks”, which consist of posters attached to the sides of

vans or handouts. Chalk talks are done at strategic field sites after students have gathered enough data to think about synthesis and interpretation. Posters and handouts contained the background theoretical models and summary diagrams, and the question was how to format these materials for virtual field trips. A practical limitation with Google Earth projects is that they allow only 8 photo images to be included with each placemark, although Street Views and aerial overviews can enhance that. Eight images are commonly sufficient to explore the structural geology at each stop, but are insufficient to also explore the stratigraphy/basin analysis and tectonics. It was clear that to produce an effective “chalk talk” required more than 8 images or slides; thus the instructors recreated the Chalk Talks as PowerPoint presentations. Students are provided with these PowerPoint files at the start of each virtual field trip and use these in conjunction with the Google Earth project at the appropriate field trip sites/locations.

Other Considerations

Prior to these field trips, the instructors assume that students have taken introductory physical and historical geology courses, as well as a mineralogy or earth materials course. The Mid Atlantic Appalachian Orogen Traverse is a multi-week capstone project, and thus students will have been presented with theoretical background material on stratigraphy, structural geology, and tectonics which they are expected to use to synthesize the field trip data and information in the capstone project. However, during the field trips, the instructors still have to mentor the students in several ways, such as:

- *Field trip etiquette, safety, etc.*
- *Making good observations.*
- *Clearly understanding the difference between observation and interpretation.*
- *Using classification systems with which they are unfamiliar.*
- *Applying tectonic and basin analysis theoretical models.*

At each outcrop students are prompted with questions, such as:

- *What do you observe?*
- *How would you classify the rock(s)?*
- *How are the rocks oriented? What measurements should you take?*
- *Where are you in the stratigraphic sequence? What units are above/below?*
- *What is a possible depositional environment? Flow regime?*
- *What kind(s) of basin(s) of deposition are possible?*
- *What is a possible tectonic setting? Possible tectonic processes?*

Significant time is spent at each outcrop teaching observation skills, introducing new classification systems and models, and encouraging students to think about processes that might be mostly new to them. All of this is necessary at virtual field trip sites, similar to on-location field trip sites. Thus, the instructors dedicate the same amount of interactive time for virtual field trips as for on-location field trips; virtual field trips are led via collaborative Zoom meetings with students, and all participants progress sequentially through each field trip site in the same manner as an on-location field trip. Each of the virtual field trips can be run as day-long field trips or can be broken into multiple shorter field trips as desired by the instructors.