DIGITAL MAPPING TECHNIQUES 2018

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Automating the Import of Collector for ArcGIS Data into GeMS

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Presentation Summary

Summary of Slide Content

Slide 1 - Introduction

This talk describes work I have done over the past three years as a geologic mapper with the Maryland Geological Survey (MGS). I have designed and implemented a digital field data collection system using Collector for ArcGIS that I can easily import into ArcMAP and, with the development of Model Builder tools, the GeMS geodatabase. The Maryland Geological Survey is a relatively small survey and I do my own GIS work.

Slide 2 - Timeline

I start in 1894, detail some of the first geologic data collection in Maryland, skip about 120 years of significant advances, and then cover the three years I have been working on my digital data collection methods. I am currently on my third version of data collection, which includes automated import of field data into the GeMS geodatabase.

Slide 3 – Historical Geologic Field Data Collection

In 1984 Arthur Keith and field assistant William Gaines mapped the Harpers Ferry Folio, in the Blue Ridge of Maryland, West Virginia, and Virginia. Mapping was performed by buckboard wagon, with distance measured by counting rotations of a handkerchief tied to a wagon spoke and then multiplying it by the wheel's circumference. I presume it was the assistant who counted (illustration).

Slide 4 – Start of Digital Field Data Collection

Picking up 120 years later in 2015, after many advances in field data collection such as cars and GPS. Digital geologic field data collection was being performed by mapper Dave Brezinski using iGIS on an iPad, collecting GPS points with attached lithologic notes and structure measurements. He suggested I practice mapping on the Weverton Quartzite of South Mountain (some of the same area Arthur Keith mapped 120 years ago). I borrowed Dave's iPad and chose ESRI Collector as a data collection app – partly due to my familiarity with ArcMAP and thanks to Doug Curl (Kentucky Geological Survey) sharing his Collector set up. I was able to use hillshade LiDAR images (MDiMap) as basemaps, which made outcrops of resistant rock easy to see and find in the field regardless of thick vegetation (iPad screenshot).

Slide 5 – Digital Field Data Collection V1

I employed this data collection system in my first STATEMAP quad, Sang Run, in the Appalachian Plateau of Western Maryland. I used two feature classes, published to ArcGIS online: lithology and structure. Each time I collected a measurement, it was a new data point, even if it was from the same outcrop. These points were instantly symbolized on the iPad as if I were drawing on a topographic map (iPad screenshot). I enabled offline data collection by loading LiDAR hillshade basemaps onto my iPad, and enabled attachment of photos to data points. I did not have to consider fitting this data into a predetermined GIS database format, as none is presently in use at MGS.

Slide 6 – DMT 2016 at Florida Geological Survey

While in the process of drafting the Sang Run Quad geologic map in ArcMAP, I attended DMT 2016, was introduced to the NCGMP09 geologic database, and saw great GIS databases at other surveys being used to facilitate research, track archived materials, and streamline data collection and map building. Meanwhile I knew I had created a giant pile of digital garbage in the process of drawing a map in ArcMAP – polygons with up to 20 versions, poor topology, no metadata or projection information. I also found that drawing contacts on the LiDAR hillshade and then using a standard topographic map as a basemap for my quadrangle introduced errors due to mismatch. I was extremely discouraged and frustrated, and when Seth Bassett put up a cartoon of someone digging out a digital trash pile, I thought "yes! That's me!"

Slide 7 – First Quad Completed – Sang Run

The interim solution for the problem was to stop trying to clean up the entire digital mess and simply finish the map in time for the STATEMAP dealine. Therefore, I exported a mapview image to Illustrator, finished the layout, and submitted the map.

Slide 8 – Digital Field Data Collection V2

My husband Jeff Adams is a GIS database programmer for NOAA. I recruited his help and showed him my files – he was horrified. I also told him that there was already a geodatabase designed for this kind of data – GeMS (NCGMP09) and that I would like to use it. I felt that if I could get my data into it easily and follow the map creation process outlined, I would produce a clean product and begin a field data archive that was organized. He suggested we use Model Builder in ArcCatalog to create tools that would automatically import my data into GeMS.

Slide 9 - Digital Field Data Collection V2

The first step for automatic import was to redesign the feature classes I used in data collection. I reduced to one feature class with one point taken per outcrop that included both lithology description and structural measurements. It also included field entry of GeMS required data such as location confidence, identity confidence, and significant dimension of exposure (iPad screenshot) that I would not likely remember once I was back in the office.

Slide 10 - Digital Field Data Collection V2

Each data point (station) allowed up to 10 structure measurements, including confidence data. A drawback of this was that the structure symbols no longer appeared on my iPad when I collected them – only the lithology was symbolized for each station (iPad screenshot, V2 data collection visible on top four-fifths of image, V1 data collection from Sang Run on bottom fifth

of image). I used this data collection system in both the Friendsville Quad (western MD Appalachian Plateau) and Germantown Quad (Piedmont).

Slide 11 – Auto Import of Digital Field Data into GeMS

After creating a local copy of my field data from ArcGIS online, I run our import tool, which combines three smaller tools: Add fields, Calculate fields, and Join domains and append data. There are many details in these tools that I am not addressing here, for example a "for" loop in order to split out all 10 structure measurements at each outcrop. The tools populate the Stations and Orientation Points feature classes in the GeMS geodatabase and deletes the previous data in these classes with each import – therefore eliminating duplication.

Slide 12 – Second Digitally Mapped Quadrangle Completed – Germantown

My workflow for creating the Germantown geologic map was quite different. I imported my data into GeMS and then produced the map using the tools and instructions provided with the database. I reduced my digital trash pile considerably and had good topology and cartography. Unfortunately I started this process later than I would have liked as I did not have the tools ready until 3 months before the deadline. I also could not complete the Friendsville Quad in this same fashion, as I was sharing data collection with Dave Brezinski and the combination of two mappers' field data (not both in my data collection system) took more time.

Slide 13 – Digital Field Data Collection and Import V3

My current quad is Damascus (Piedmont). I am using the same single feature class but have now created symbolization for both lithology and structure as I collect it in the field. I can also import the field data on an as-needed basis and draw my map in the GeMS toolkit much earlier in the year. I plan to archive this year's data in both a GIS (GeMS) format and non-digital format, as I am grateful to have field notebooks from previous mappers and have concerns about archiving my data in proprietary software for the long term.

Slide 14 – DMT 2018 – Kentucky Geological Survey

Ideas I have had for future work on this tool are to turn into Python and make it portable for other mappers to use, and possibly post it on GitHub (Dave Soller suggestion). I appreciate Ralph Hauregard's hard drive hygiene guide on the the new GeMS wiki and will be following it. Notable also were the presentations of the Maine and South Carolina Geological Surveys. I plan to take their work back to my survey as a vision for what Maryland could do in terms of both GIS database management for the whole survey and getting our geologic maps into a uniform GIS database format (GeMS). Illustration of Dave and Ralph mapping the GeMS formation.

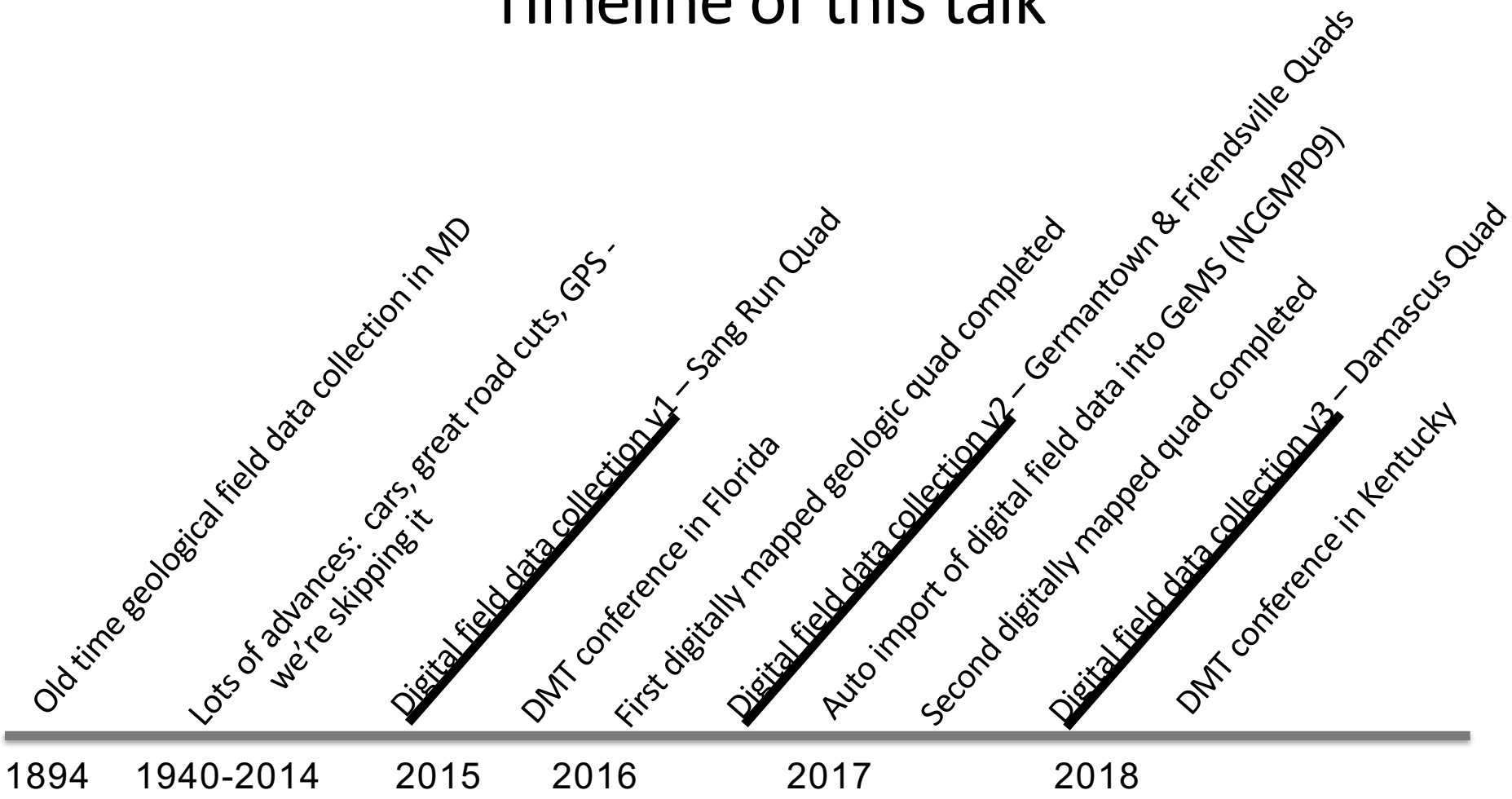
Slide 15 – Thanks

The USGS Data Preservation paid my expenses to attend the GeMS workshop (and thus part of DMT too), the Adams Boys helped critique my illustrations, and Nathan Hale's Hazardous Tales are the inspiration for drawing my story.

Automating the Import of Collector for ArcGIS Data into GeMS

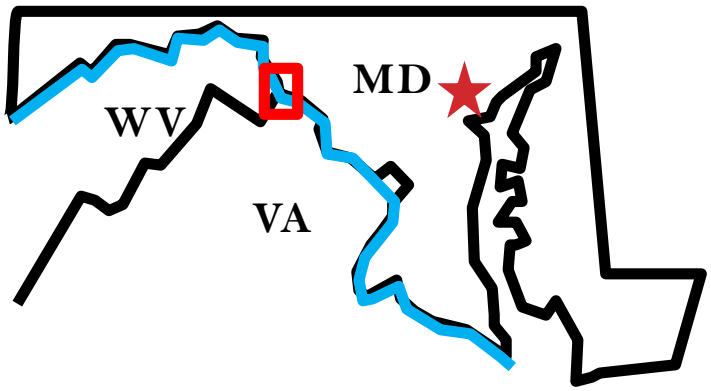
Rebecca Kavage Adams and Jeffrey Adams

Timeline of this talk



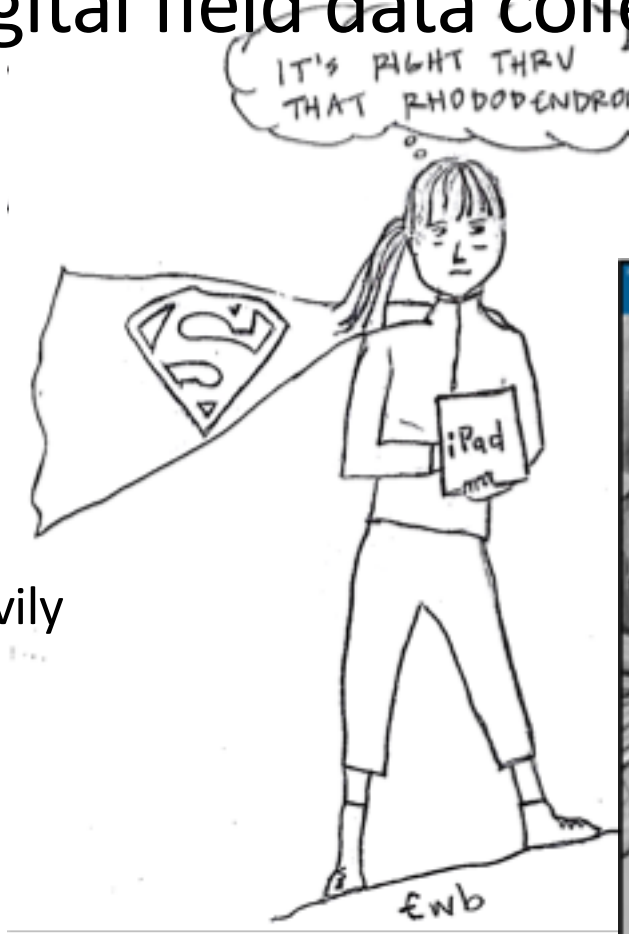
1894 - Old time geological data collection in MD

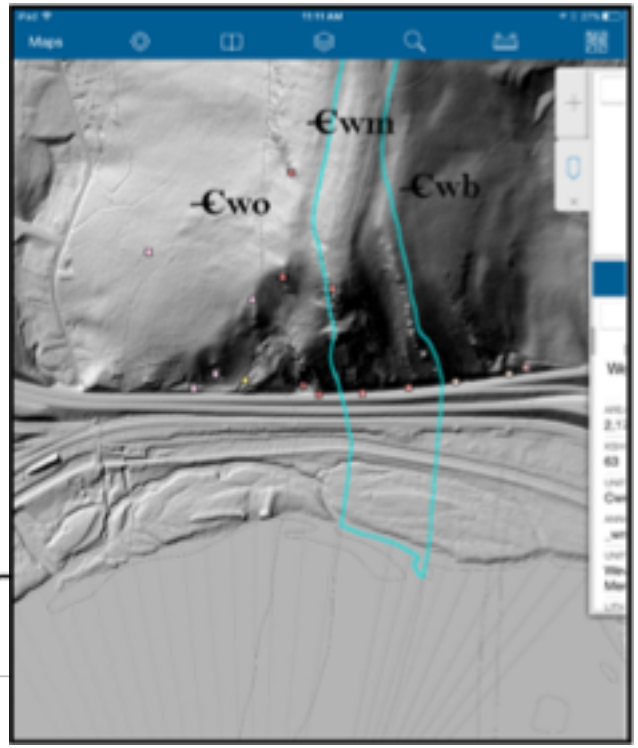
- Arthur Keith (USGS, 1864-1944) and field assistant William Gaines
- Mapped Harpers Ferry Folio (1894)
- Distance was measured by counting rotations of a handkerchief tied to the wagon wheel on a buckboard



2015 – Digital field data collection start

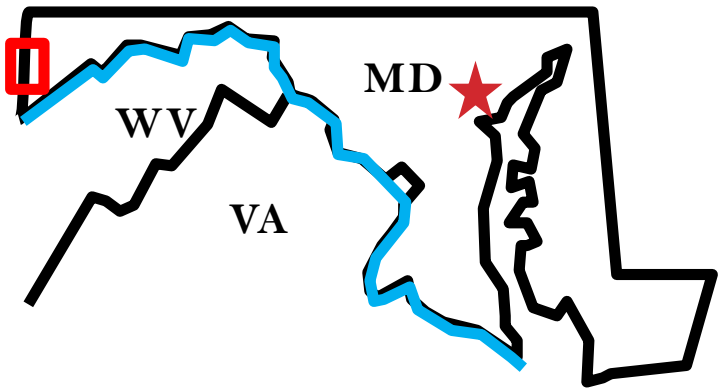
- iPad (borrowed)
- ESRI Collector (now Collector for ArcGIS)
  - borrowed ideas from Doug Curl (KGS)
- LiDAR (MD iMap)
- Worked great in heavily vegetated Weverton quartzite of South Mountain

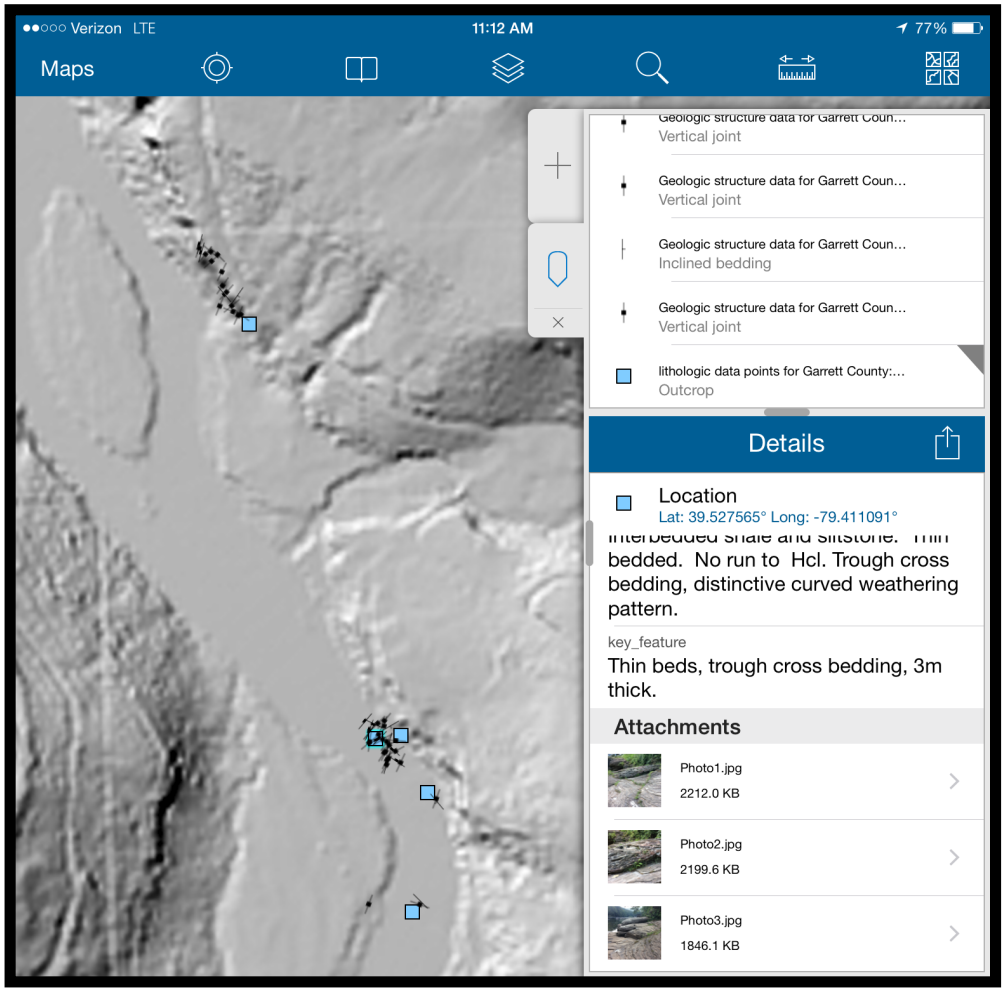




2015 – Digital field data collection v1, Sang Run

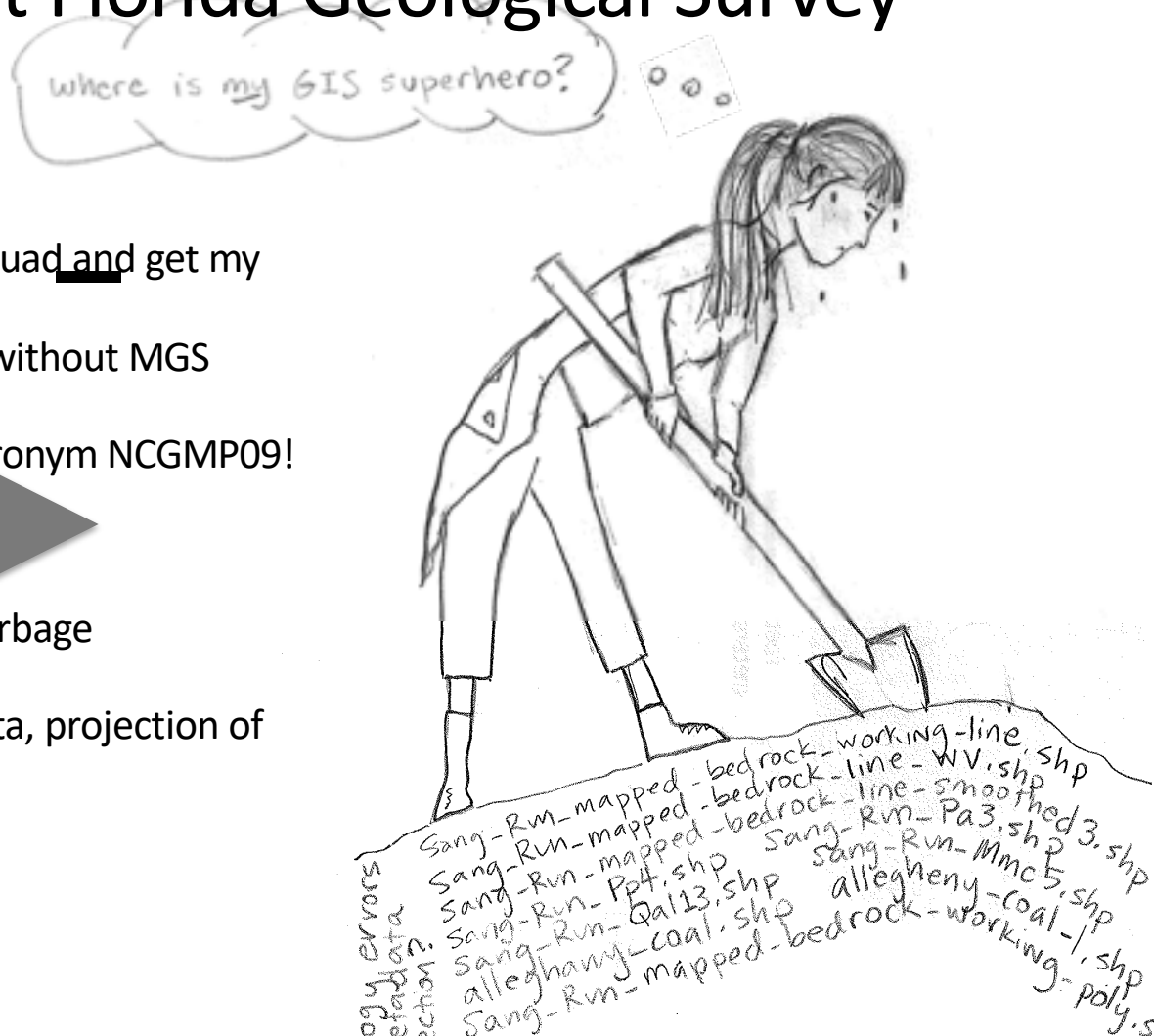
- 2 feature classes
  - Lithology
  - Structure (1 point per measurement)
- Symbolized on iPad instantly
- Offline data collection with basemap (LiDAR hillshade) loaded onto iPad
- Pics attached to points
- No GIS shop or database format to consider
- Used in Sang Run Quad for STATEMAP





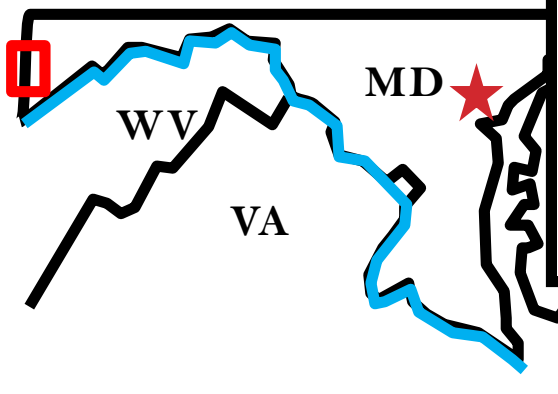
2016 – DMT at Florida Geological Survey

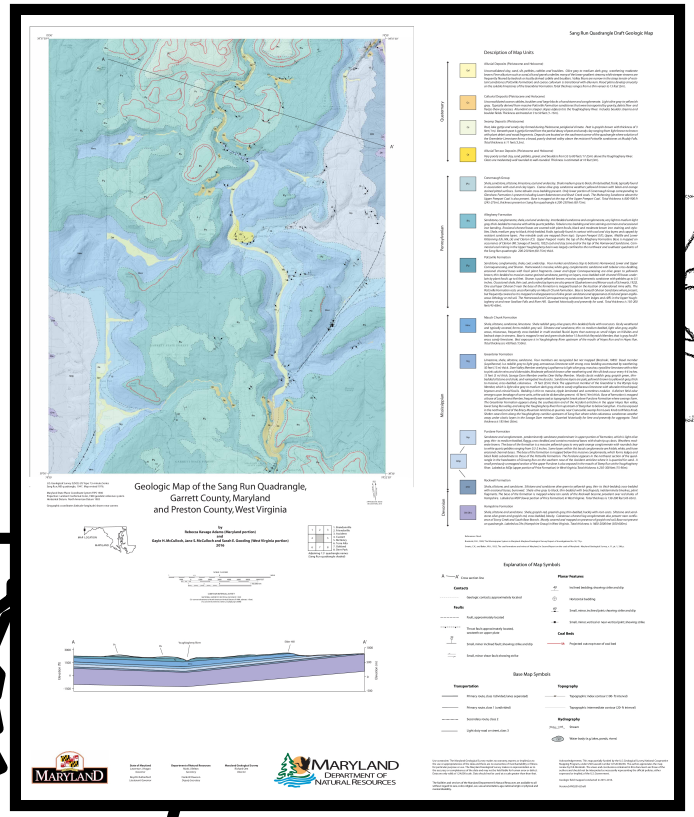
- GIS shame and frustration
  - I will never be able to map a quad and get my data into a usable GIS format
  - NCGMP09 will be impossible without MGS having a GIS person
  - I can't even remember the acronym NCGMP09!
- Seth Bassett (FGS) cartoon
- I'd made
  - An enormous pile of digital garbage
  - Many topological errors
  - Cartographic slop (no metadata, projection of layers? data frame rotation?)

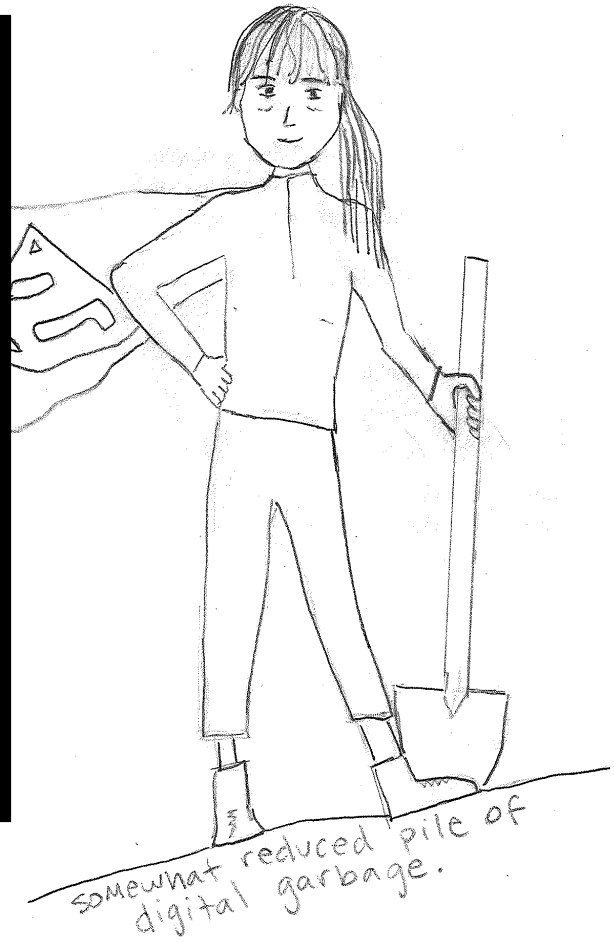


2016 – First digitally mapped quad completed

- Interim Solution:
  - Stop digging
  - Be glad to have produced a geologic map of Sang Run (PDF)

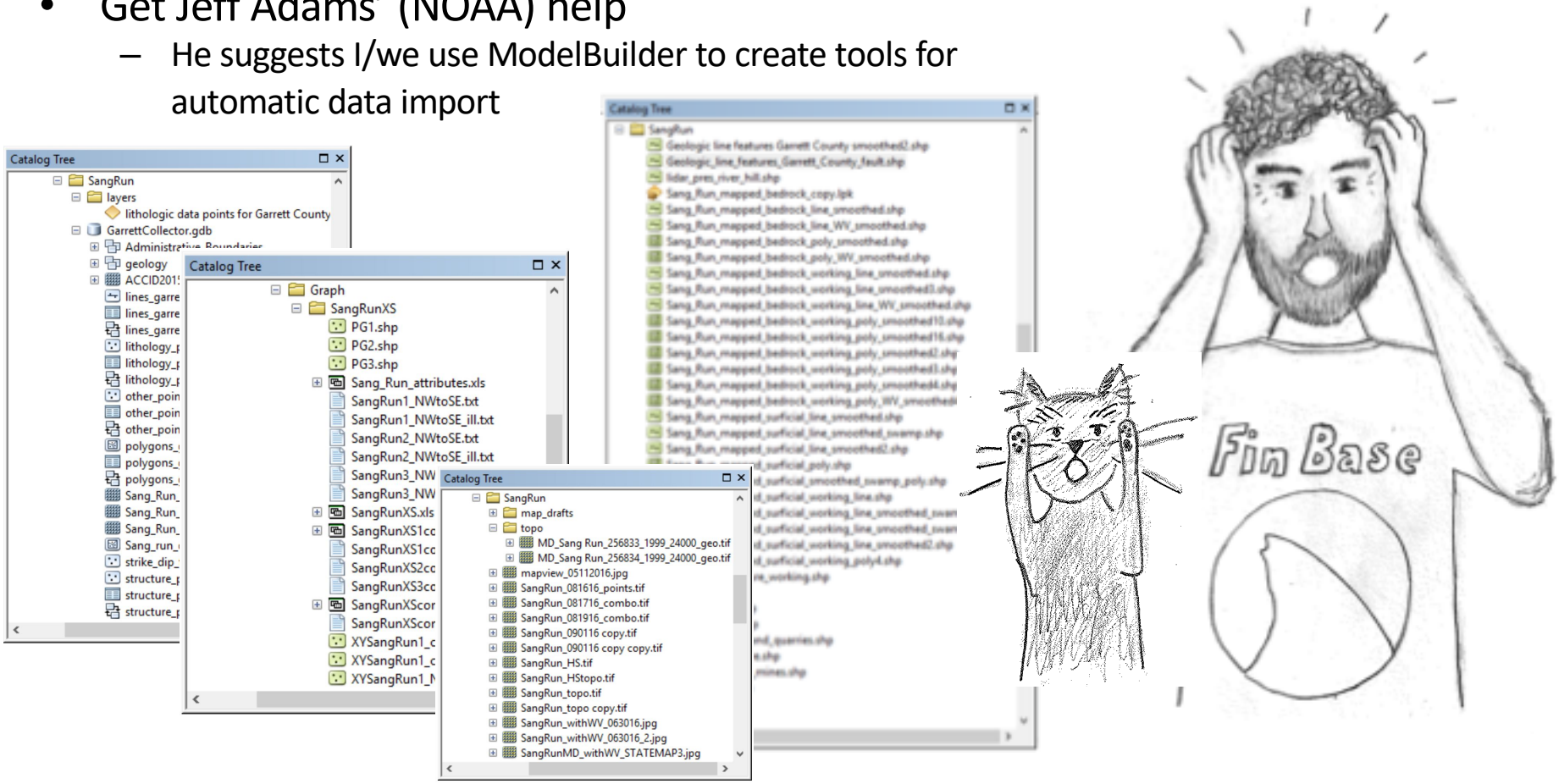






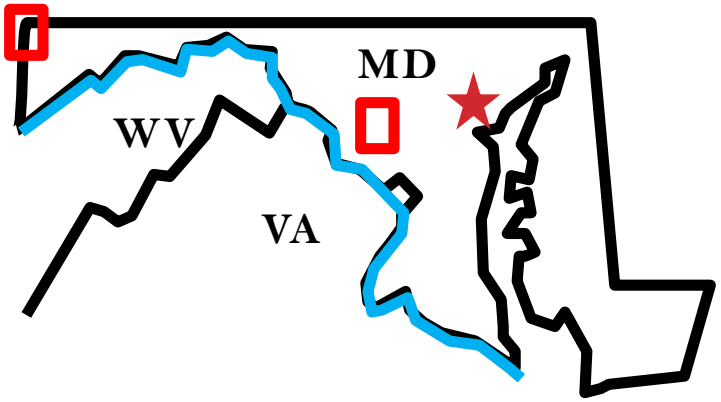
2017 – Digital field data collection v2

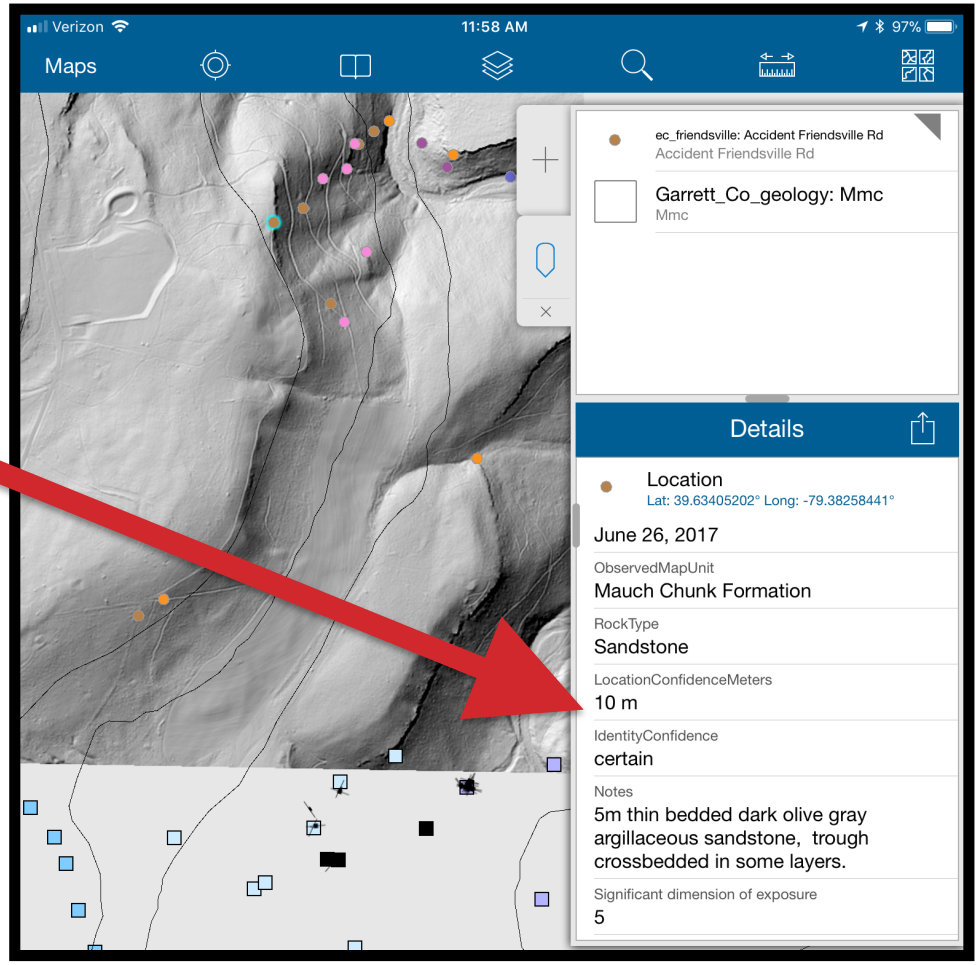
- Get Jeff Adams' (NOAA) help
  - He suggests I/we use ModelBuilder to create tools for automatic data import



2017 – Digital field data collection v2

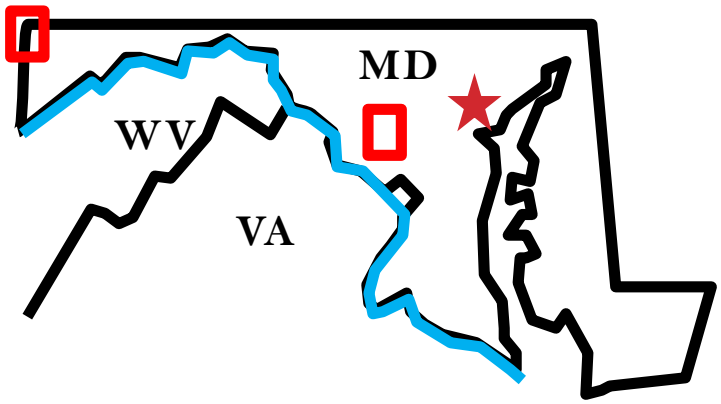
- Collector for ArcGIS feature class redesigned for automated import into GeMS stations
- 1 feature class
  - 1 point per outcrop with lithology and multiple structure measurements
- Field entry of GeMS required data

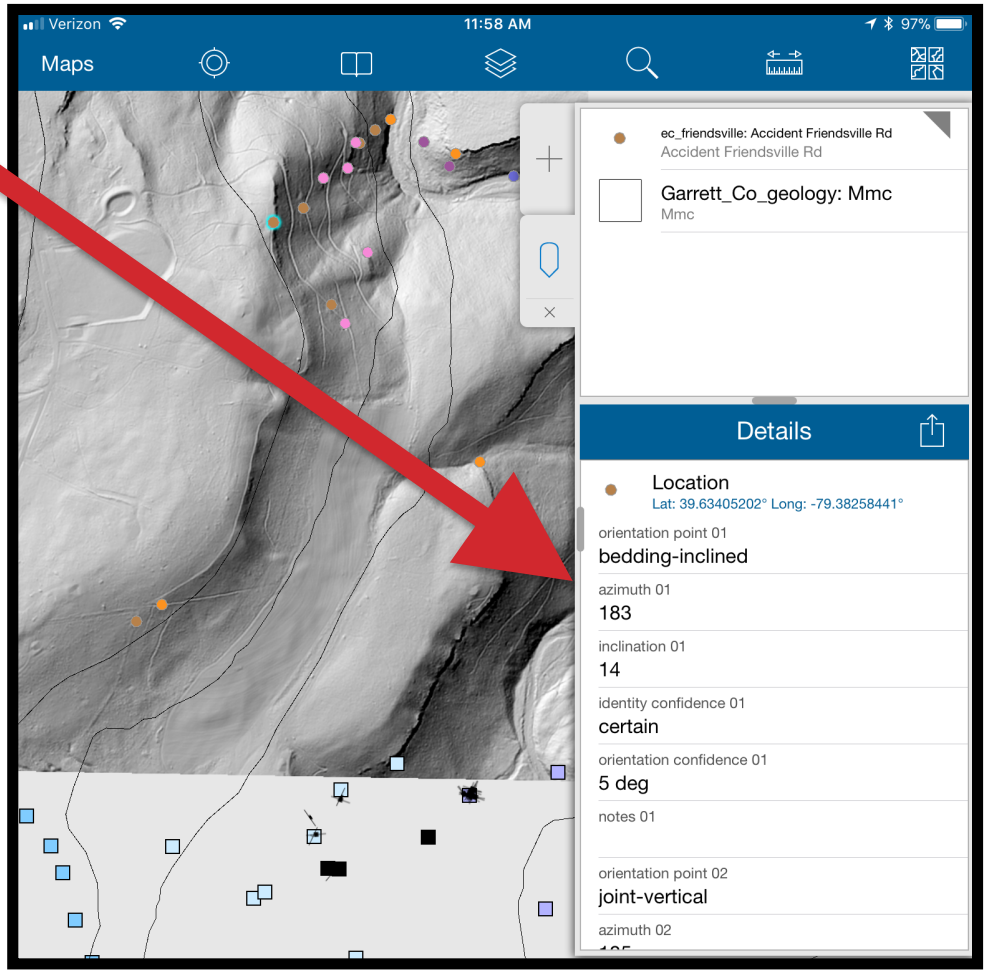




2017 – Digital field data collection v2

- 10 sets of orientation point data for each station
- Drawback: no structure symbols appear on iPad while mapping, only lithology
- Used in Friendsville and Germantown Quads for STATEMAP



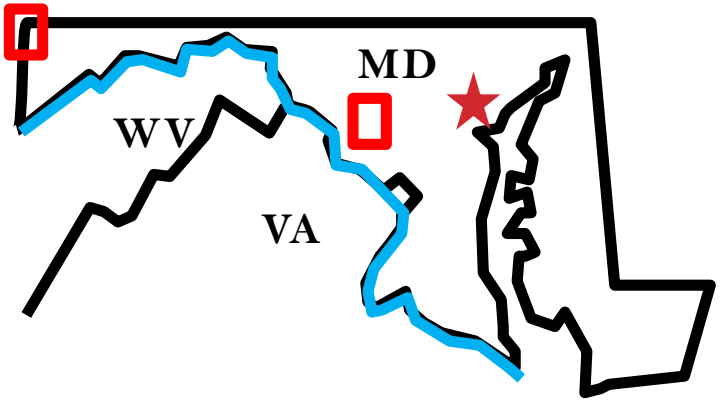


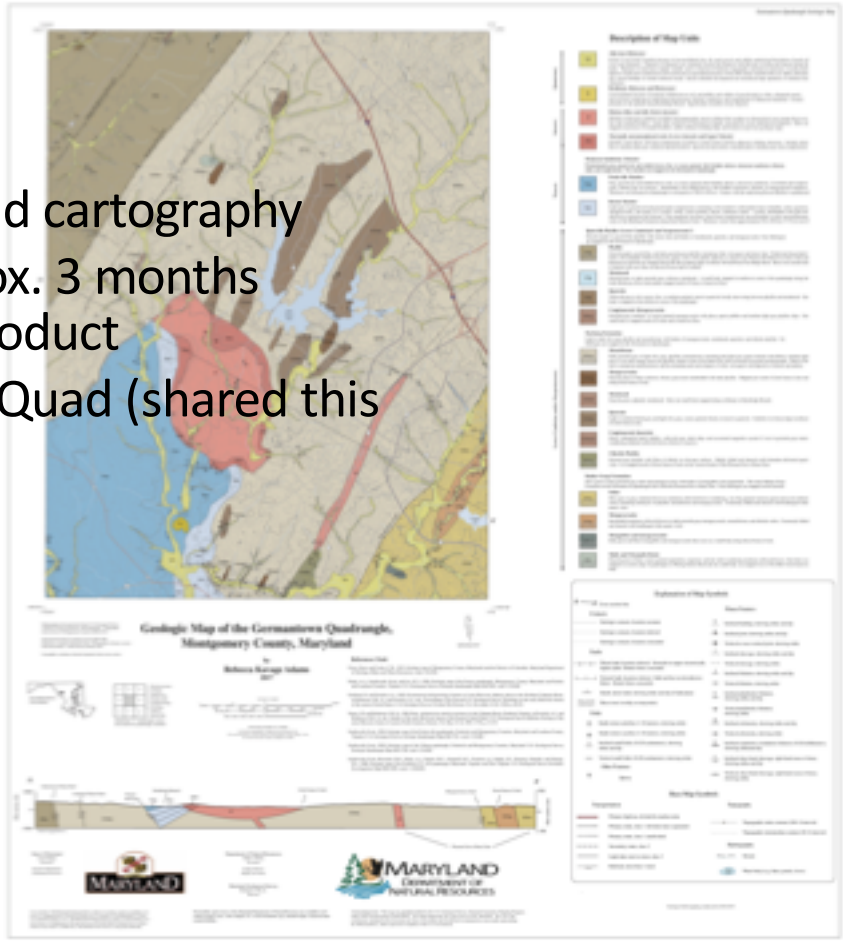
2017 – Auto import of digital field data into GeMS

- Create local copy of field data from ArcGIS online
- Model builder tool runs 3 smaller tools
  - Add fields
  - Calculate fields
  - Join domains and append data
- Populates Stations and Orientation Points feature classes in GeMS geodatabase
- Deletes previous data with each import

2017 – Second digitally mapped quad completed

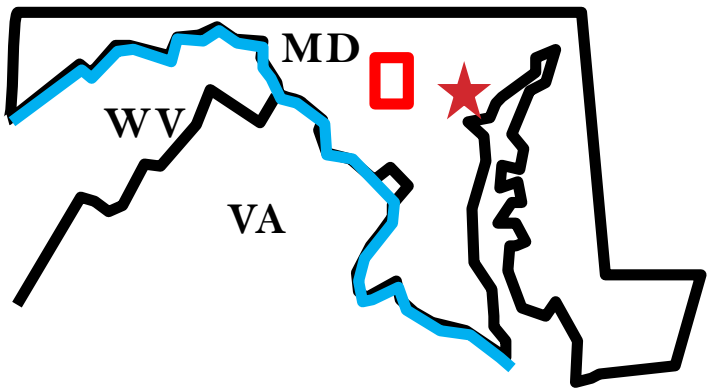
- Germantown Quad workflow:
  - data import into GeMS.gdb
  - map production using GeMS toolkit
- Digital trash reduction, good topology and cartography
- Unfortunately no data import until approx. 3 months before STATEMAP deadline, still a PDF product
- Couldn't make it happen for Friendsville Quad (shared this quad with Dave Brezinski)

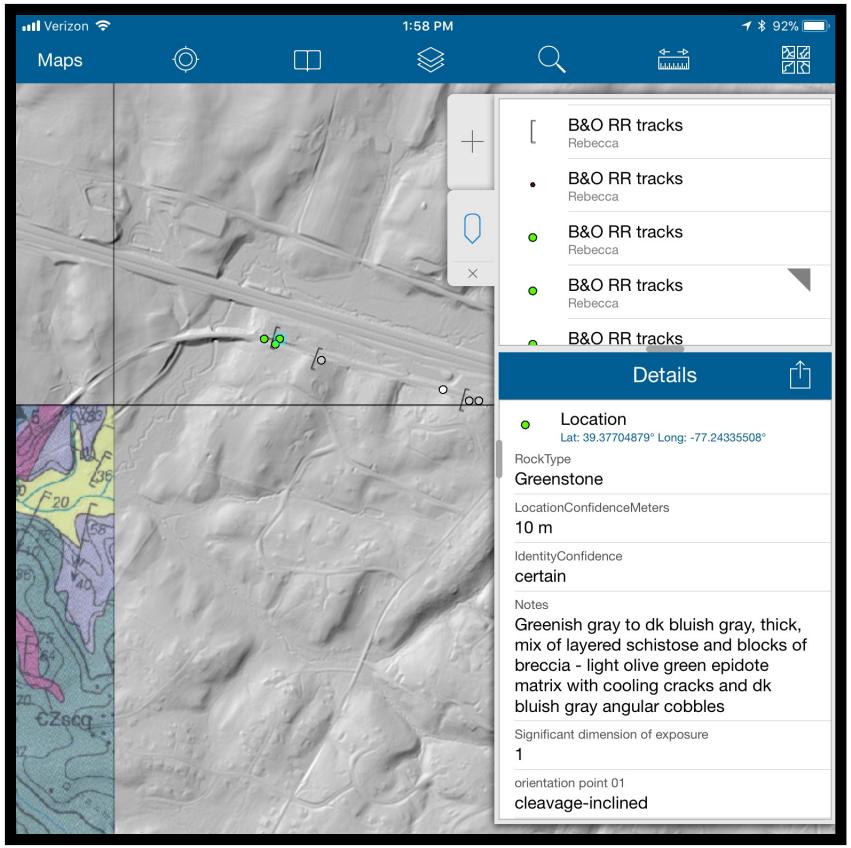




2018 – Digital field data collection and import v3

- Damascus Quad workflow:
  - 1 feature class
  - Structure and lithologic symbolization on iPad
  - Data import into GeMS after each day/week
  - Draw and redraw my map in ArcGIS using GeMS toolkit
  - Archive in GIS and non-GIS format





2018 – DMT at Kentucky Geological Survey

- Turn import tool into python, work on portability
- Possibly put this tool on GitHub
- Work on hygiene (on my hard drive, thanks Ralph)
- Continued GIS envy of other state surveys
  - –Maryland Geological Survey needs to commit time and resources, hire a GIS superhero
- Stay tuned for 2020 DMT

Thanks

United States Geological Survey

The Adams Boys

Nathan Hale's Hazardous Tales