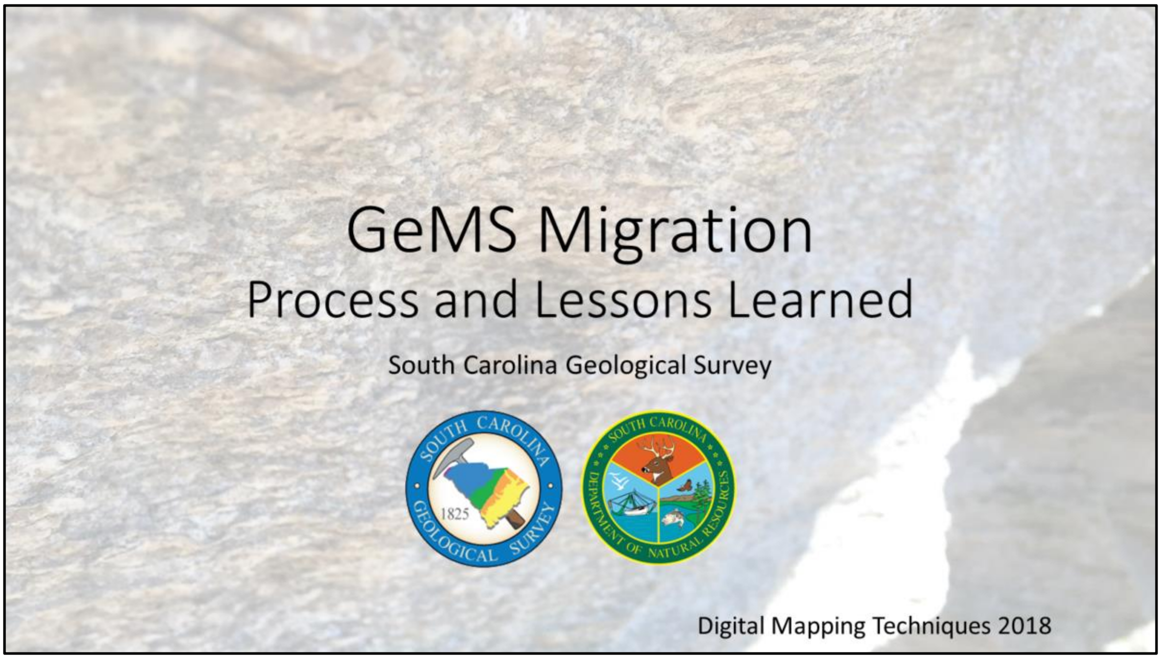
DIGITAL MAPPING TECHNIQUES 2018

The following was presented at DMT'18
(May 20-23, 2018 - University of Kentucky,
Lexington, KY)

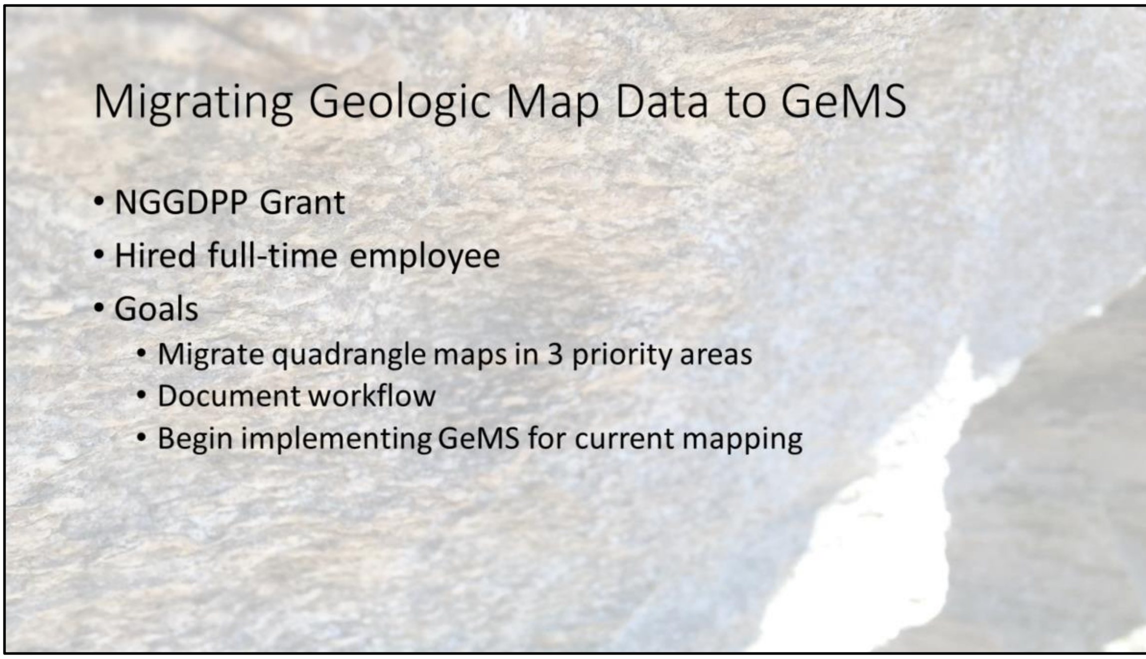
The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2018)

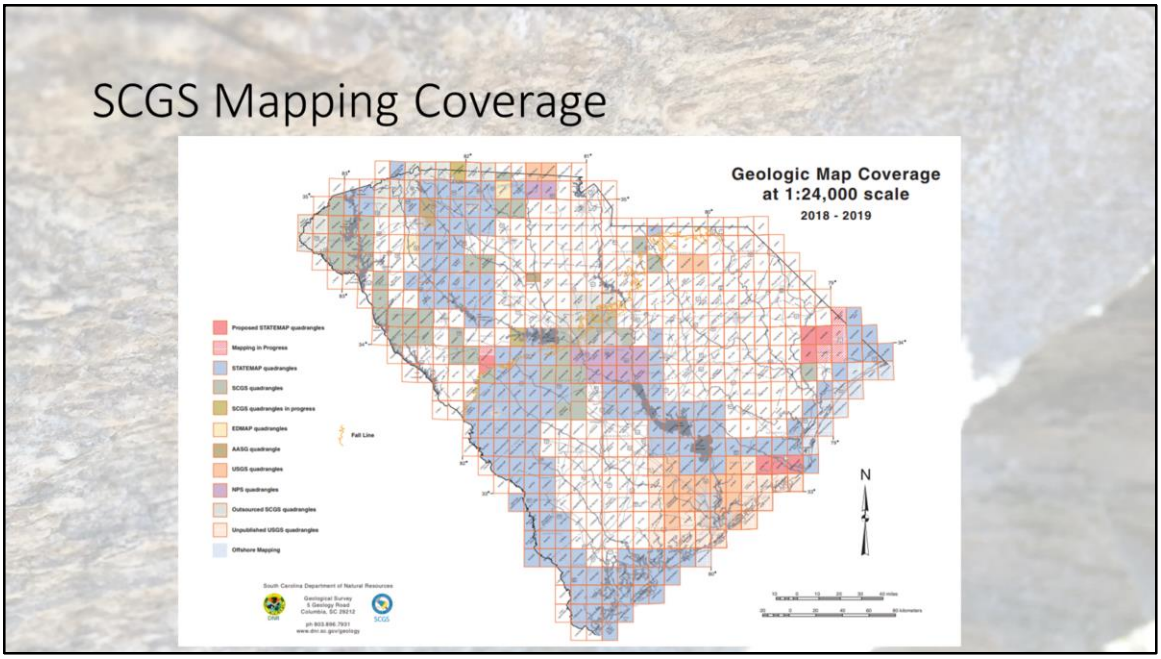
http://ngmdb.usgs.gov/info/dmt/



Abstract: The South Carolina Geological Survey (SCGS) received a grant from the National Geologic and Geophysical Data Preservation Program (NGGDPP) of the USGS to migrate existing GIS databases for geologic map data into the Geologic Map Schema, or GeMS. This presentation highlights the progress that was made over the course of 9 months. 130 quadrangles have bee migrated and are in the process of review. The presentation highlights lessons learned, challenges that were faced in the process, and future plans. Documenting is being written for the migration workflows, and the GeMS schema is being implemented on new mapping projects.

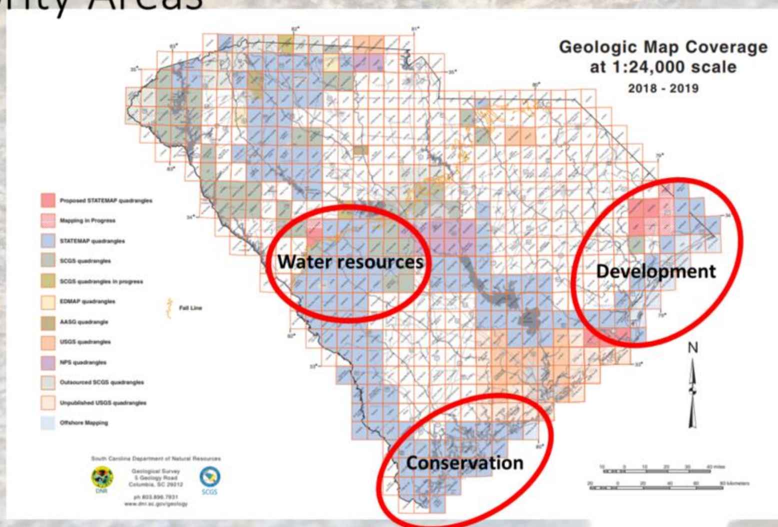


The South Carolina Geological Survey (SCGS) received a grant from the National Geologic and Geophysical Data Preservation Program (NGGDPP) of the USGS to migrate existing GIS databases for geologic map data into the Geologic Map Schema, or GeMS. The SCGS hired a full-time employee to do the migration work, document the workflow, and help in implementing processes for ongoing and future mapping projects.

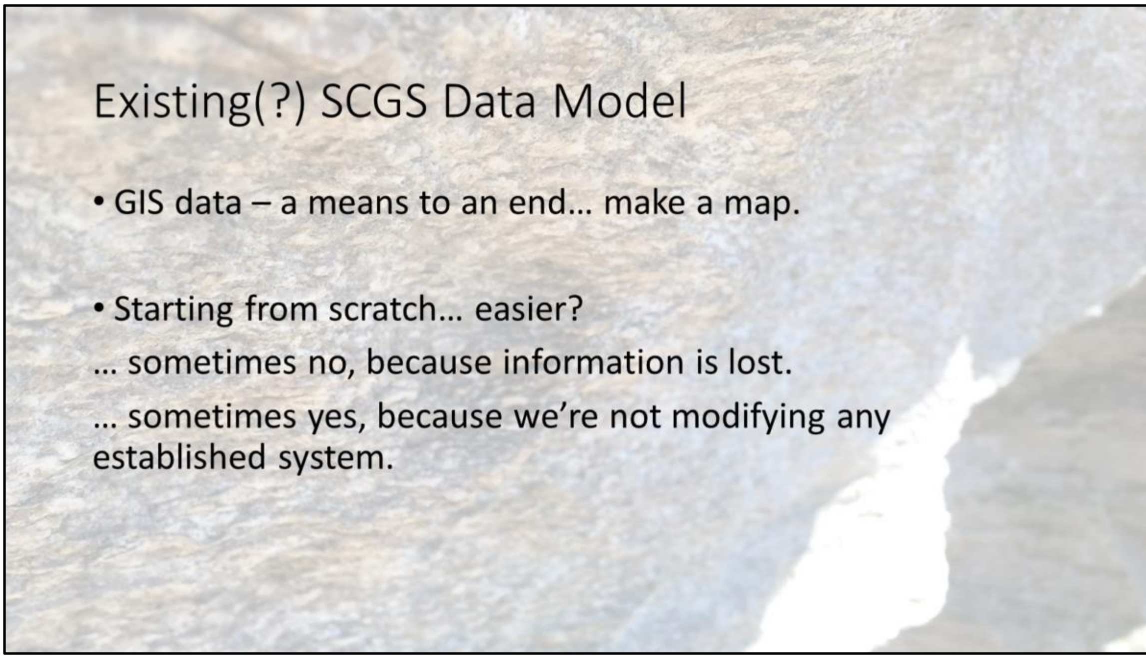


South Carolina has about 1/3 coverage for geologic mapping at 1:24,000, through different programs that include STATEMAP, FEDMAP, AASG mapping, and others. Mapping has generally occurred in areas of high population, increasing development, and those with economic interests. Sensitive environmental areas have also been a focus, such as the SC coast.

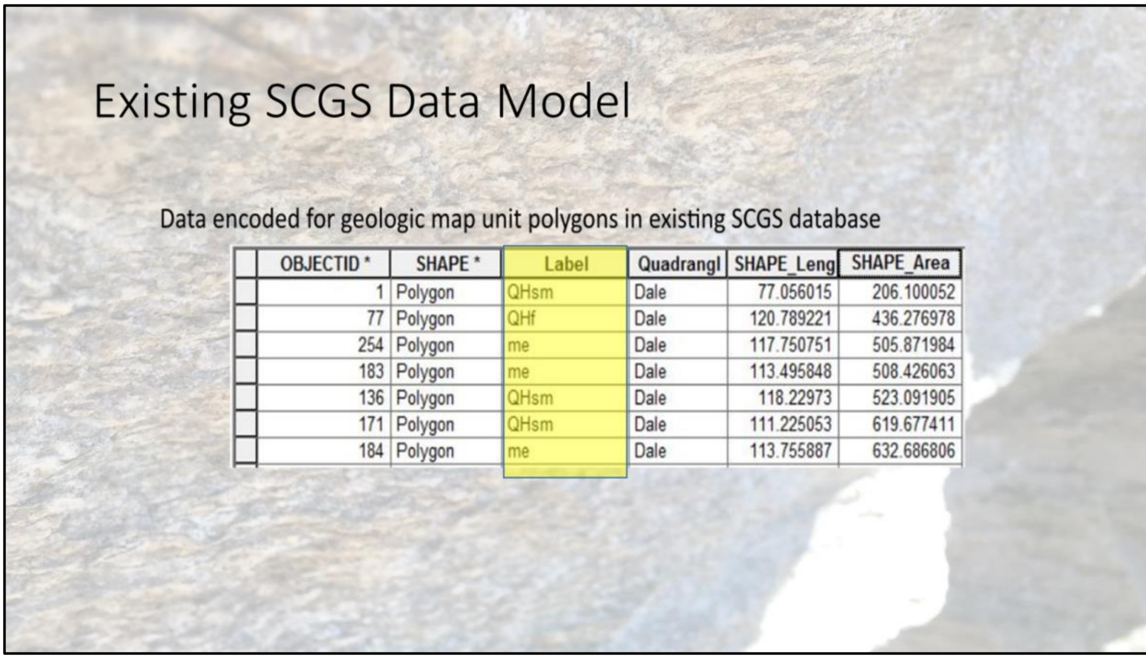
Priority Areas



This project focused on migrating data from three priority areas that have quadrangles that have been mapped through STATEMAP. Two priorities are along the SC coast. One is a major conservation area and the other is currently seeing rapid development. The other priority area is important for water resources, specifically groundwater recharge.

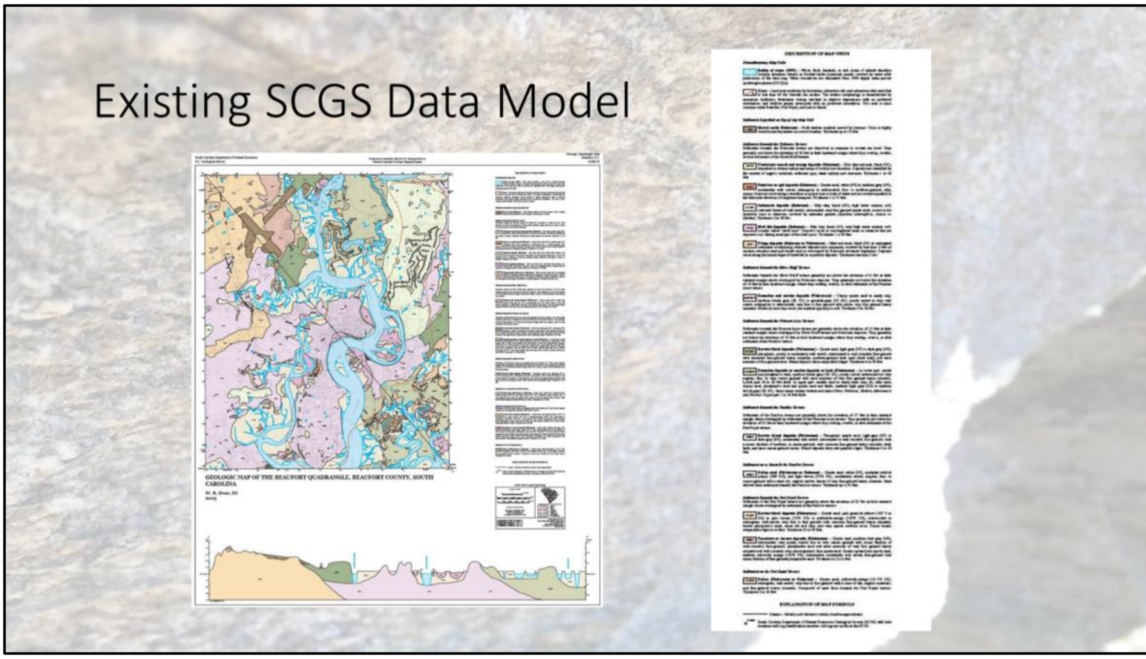


The SCGS has had no existing data model for geologic map GIS data. The GIS data were effectively a means to an end, which was a PDF geologic map. Starting from scratch made things easier, because we did not have to migrant from some well-established data model. However, the lack of an existing data model means that some information was lost in the GIS in some maps, because GIS data were not maintained.

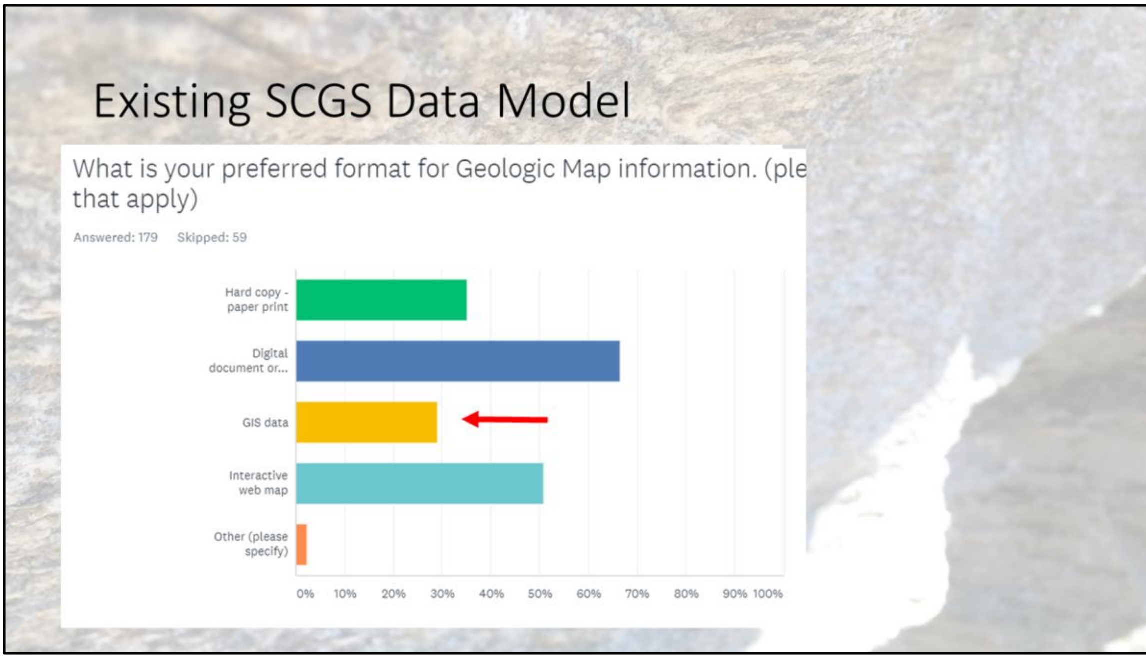


OBJECTID *	SHAPE *	Label	Quadrangl	SHAPE_Leng	SHAPE_Area
1	Polygon	QHsm	Dale	77.056015	206.100052
77	Polygon	QHf	Dale	120.789221	436.276978
254	Polygon	me	Dale	117.750751	505.871984
183	Polygon	me	Dale	113.495848	508.426063
136	Polygon	QHsm	Dale	118.22973	523.091905
171	Polygon	QHsm	Dale	111.225053	619.677411
184	Polygon	me	Dale	113.755887	632.686806

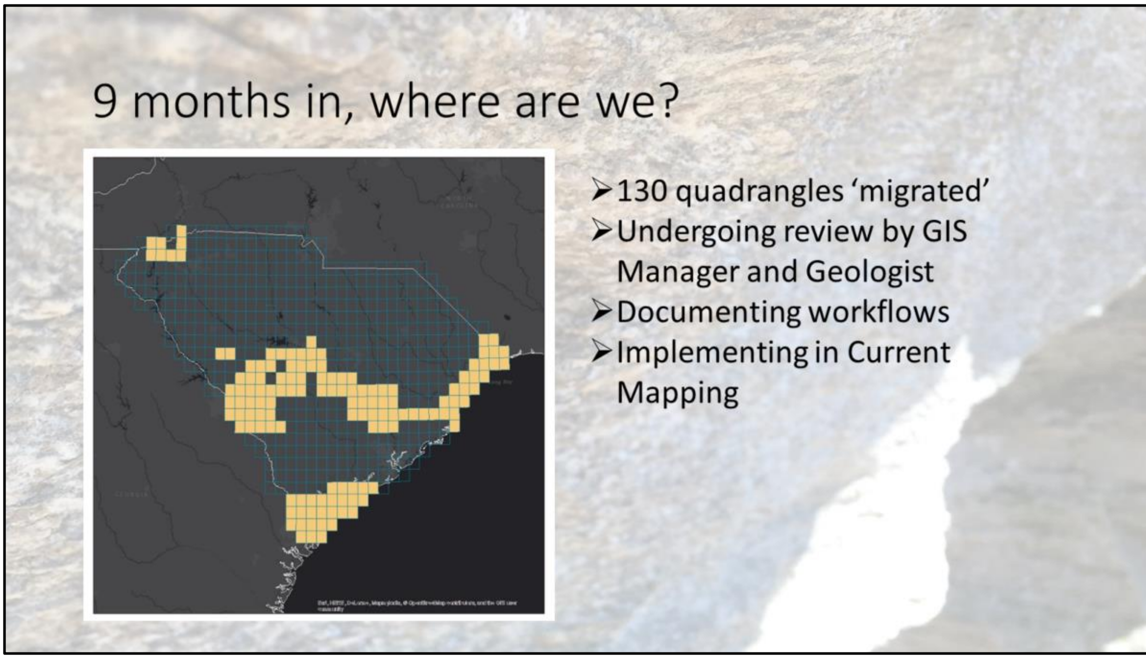
The only field in the Map Unit Polygons feature class for our old GIS databases was "Label", which is the Map Unit Symbol. No other data were included in the GIS that go into the map. That means there is no age, description, certainty, etc in the old databases.



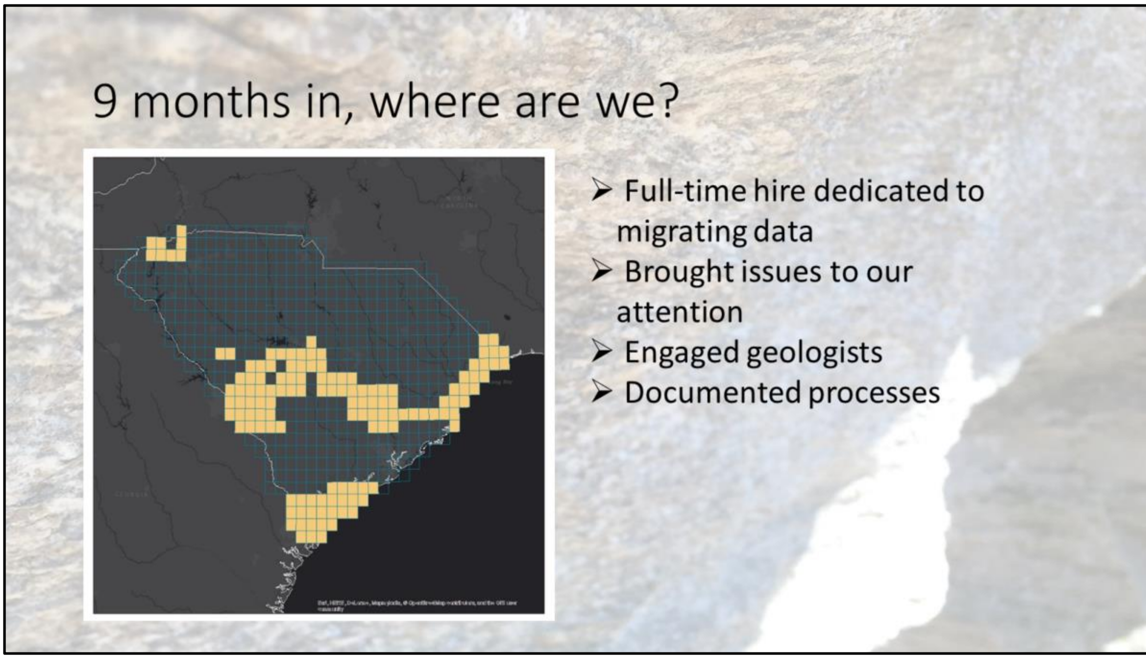
This means that we had to extract all of that information from the PDF map. The goal of GeMS is to get all the information from the PDF encoded into the GIS data. GeMS also is helpful for additional data that may be useful in a GIS context, but did not make it to the PDF due to cartographic choices, or other reasons, such as more information about the drill-holes plotted on the map.



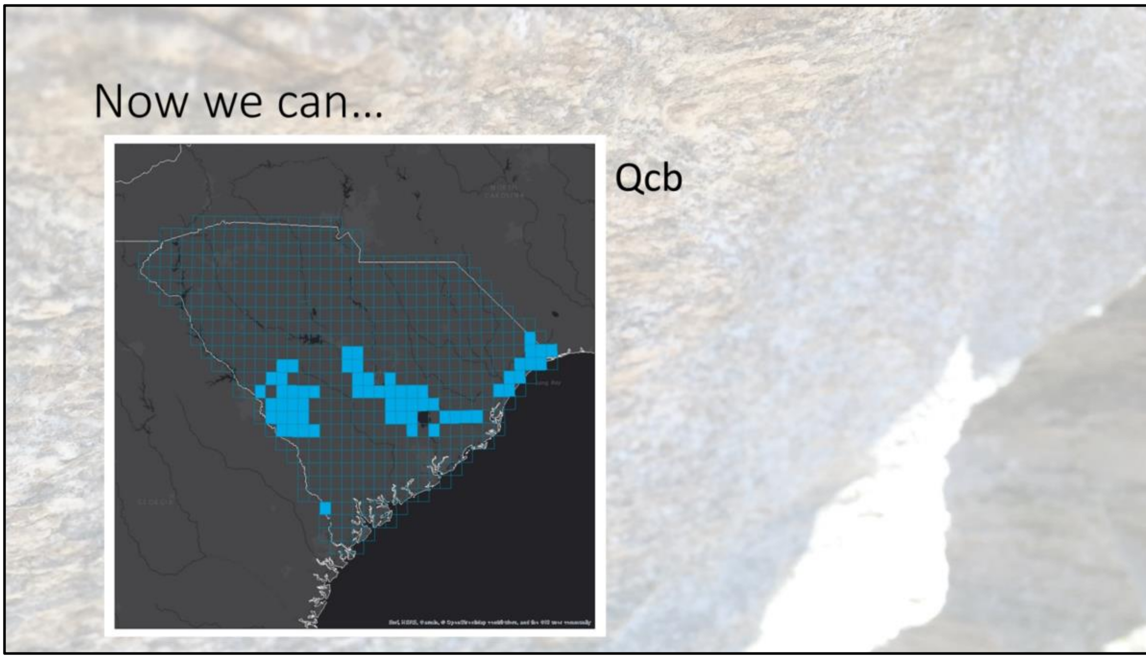
A survey for website users sits on the SCGS website. One of the questions we ask is "What is your preferred format for Geologic Map Information?". The respondents can choose all that apply. Thirty percent of respondents say that GIS data is the preferred format, while 50% indicate that interactive web maps are preferred. Both of these answers indicate that the public will benefit from a more robust GIS database for geologic map data. Interactive maps on the web require a data model to serve the information.



Nine months in to the project, we have approximately 130 quadrangles migrated into the GeMS schema. These quadrangles are under review by the GIS manager and geologists. The workflows for migrating and setting up mapping projects in GeMS are being documented for future SCGS mapping projects.

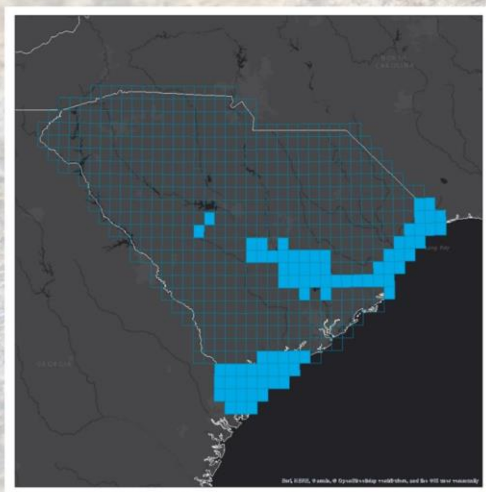


A few things we learned:
It was helpful to have a full-time staff person dedicated to the data migration process, because she was able to learn the data model and documentation well and become very efficient at the process.
The migration process also brought issues to our attention in the GIS data that we only caught because of the in-depth assessment of the data required for the migration. This was a unintended benefit, but a very helpful one.
The geologist were engaged in the process, which made the work much easier. We had the support of geologists, who see the value in the project. They answered questions and helped out as we worked through the quadrangles.
It was helpful to document the process along the way, and keep good notes. The notes are being turned into more official documentation for SCGS reference.



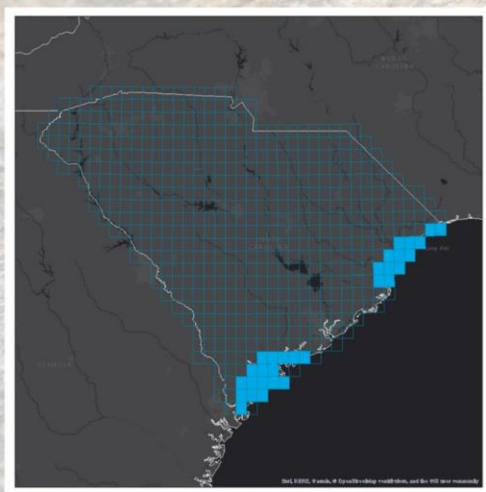
Once we had the quadrangles migrated over to GeMS, we were able to run some scripts and collect a lot of metadata about our geologic maps that we have not had before. We compiled a quadrangle index that included for each quadrangle: map units, ages, geomaterials, authors, publication number, and more. That makes it possible for us to find quadrangles with certain units, ages, geomaterials, etc. While this may seem simple, this was not something that were able to do in the past, because this information was not encoded. It only existed on the PDFs. The following slides illustrate a few queries on this quad index.

Now we can…



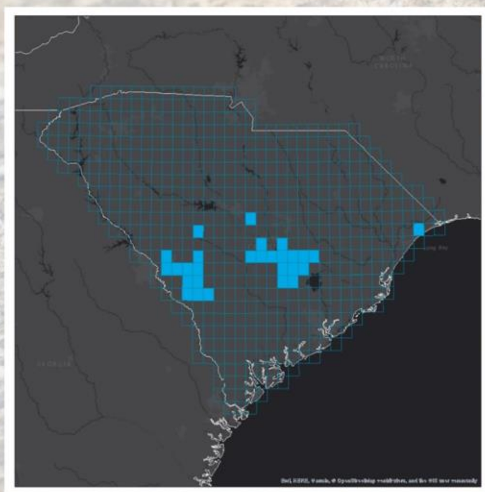
Qhf

Now we can…



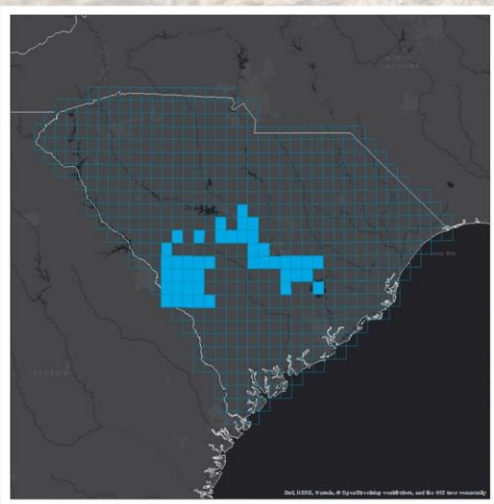
QPpas

Now we can…



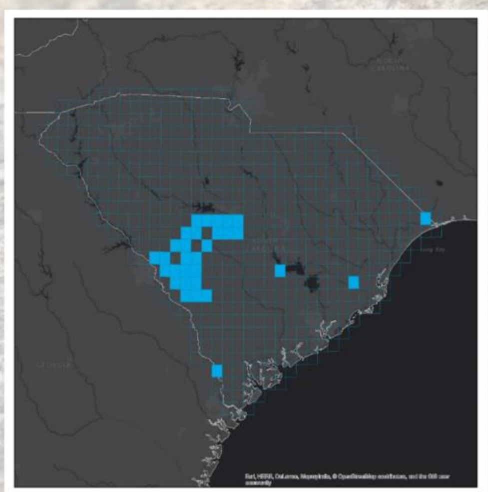
Pliocene

Now we can…



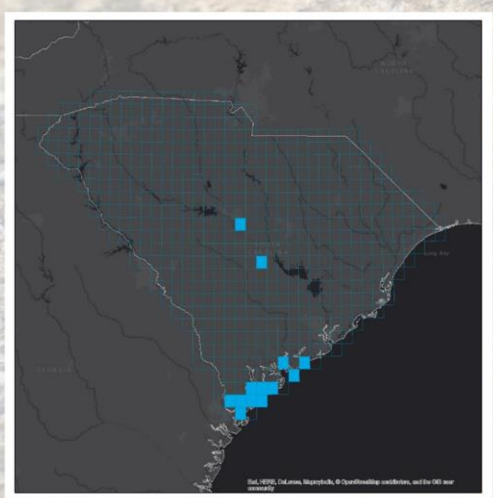
Eocene

Now we can…

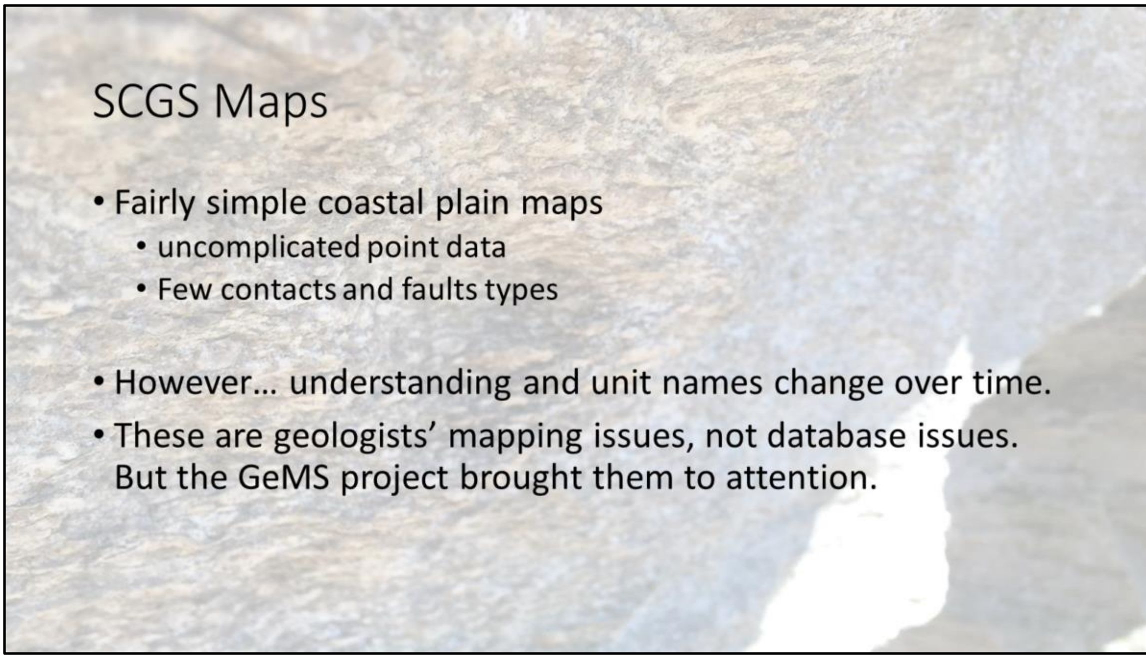


Dune
Sand

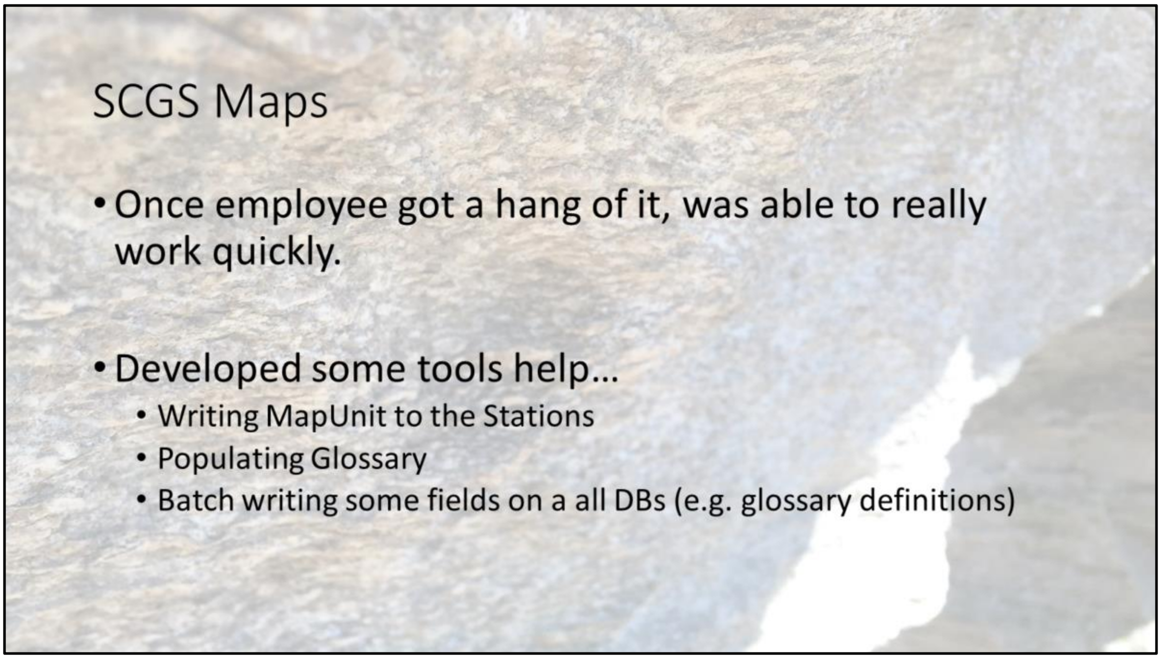
Now we can…



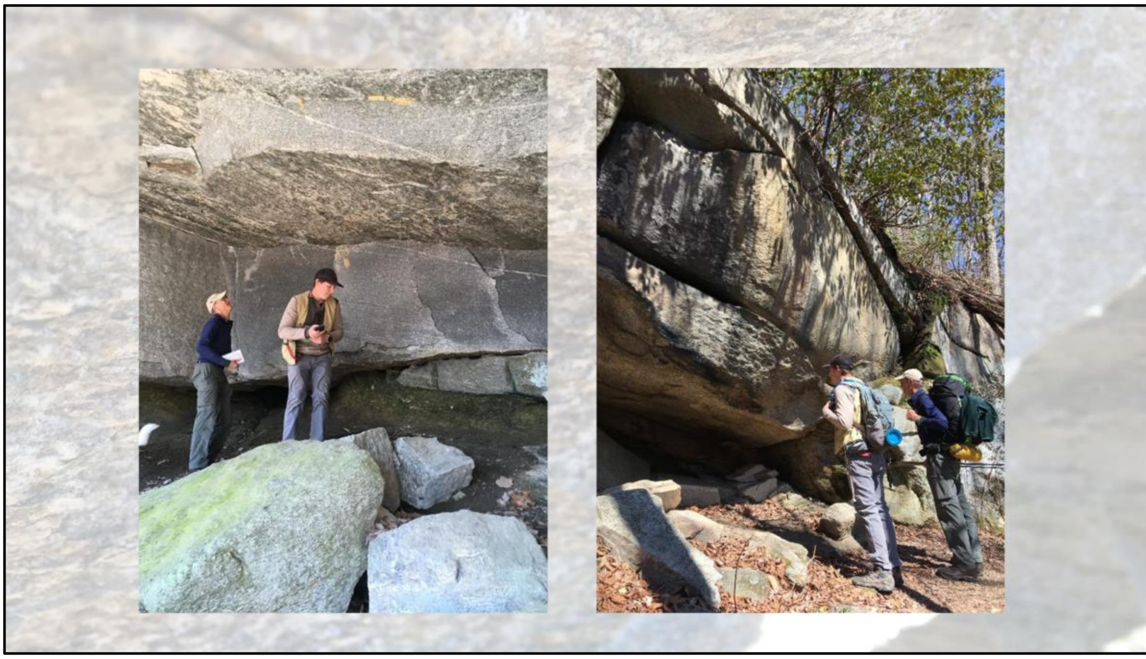
Coastal zone sediments, coarse



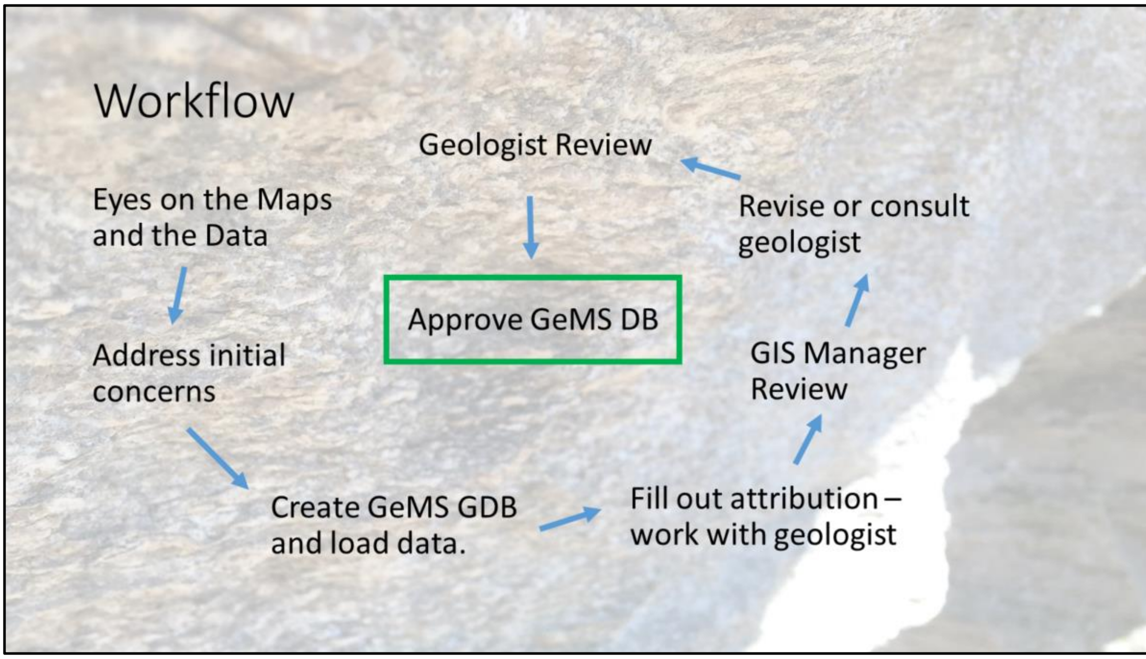
We were able to migrate a large number of quadrangles in 9 months. This is because many of the quadrangles are fairly simple maps; the geology is not simple, but the GIS data were simple. The point data are drill holes and are not complex, and there are mostly just ‘contacts’ for lines. However, we did run into some issues that required consulting the geologist, including areas where map unit names have changed, and the understanding of the geology has changed such that maps were drawn differently.



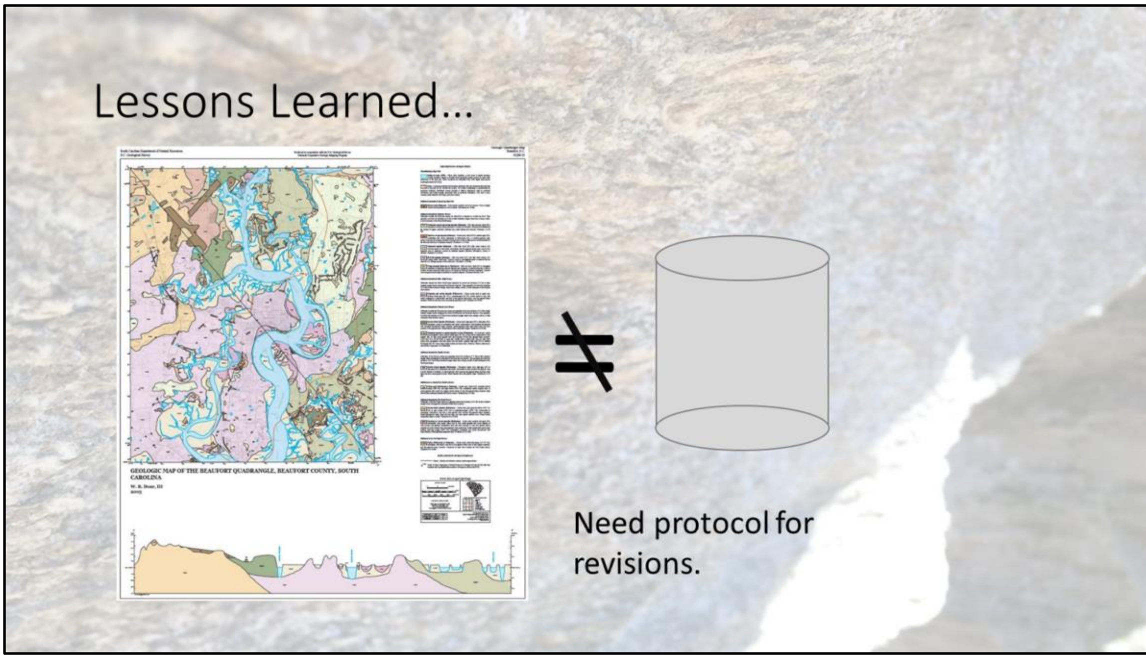
Having one employee dedicated the project was very helpful because she worked quickly once she learned the process. We developed some tools that were specific to our workflow that automated some of the tasks.



Picture of some rocks to break up the database slides…



The workflow was as follows :
1 – Eyes on the maps and the GIS data – get a feel for the map
2 – Address any initial concerns. Does the map have any mistakes, is the GIS databases as expected, are there any glaring differences between GIS and PDF?
3 – Create GeMS geodatabase and load in the data from the existing SCGS database
4 – Fill out attribution. Work with geologist if necessary to complete the GeMS attributes
5 – GIS Manager reviews the GIS to makes sure it is complete, that coordinates systems are correct, and that attribution is generally correct for GeMS
6 – Revise maps based on review, or continue to consult geologist to fix issues or address questions
7 – GIS manager works with geologist on final review of the quadrangle
8 – GeMS database is approved and becomes the new archived version of the GIS database for a geologic map



One lesson learned is that the GIS data did not always match the PDF map. Cartographic decisions were made in production, or revisions made at a later date, that did not make it back to the database. This is not good if the GIS database is as important as the map itself. The website survey results make it clear that the GIS data are indeed important.

We are exploring some sort of protocol for map revisions to make sure this doesn't happen.

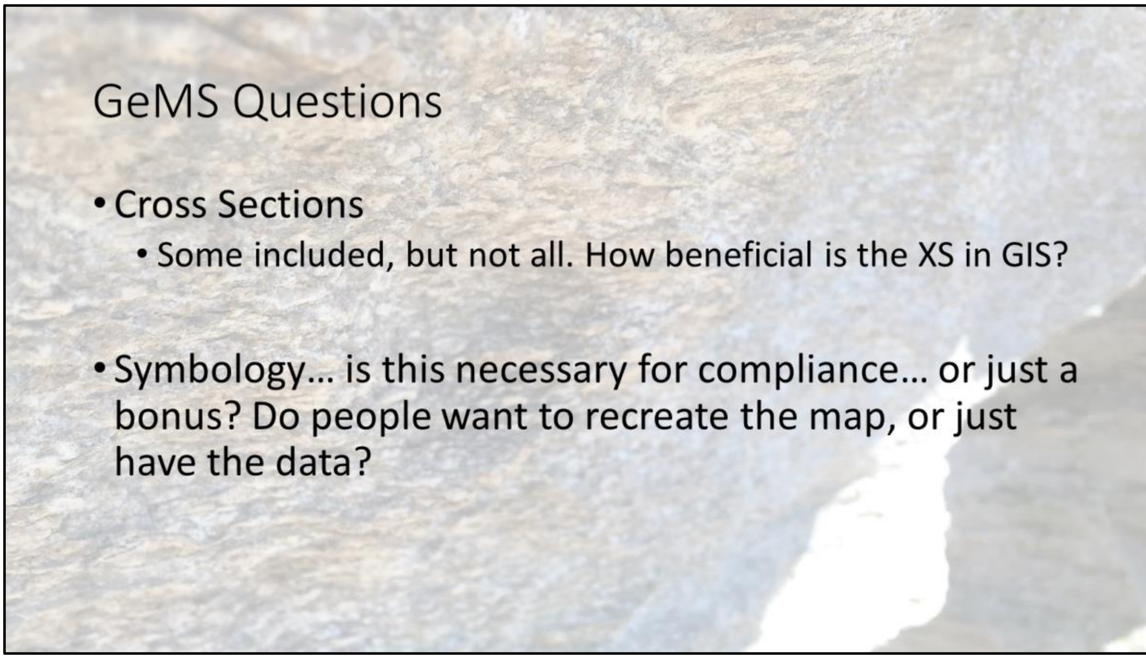
Lessons Learned…

- Need protocol for revisions.
- Some projection issues and topology issues

- Where we need to prioritize revisions based on new understanding?
- Where can we easily revise a map (e.g. changing unit names to new nomenclature)?
- Getting geologist to cooperate wasn’t that hard – but we only have a few of them.

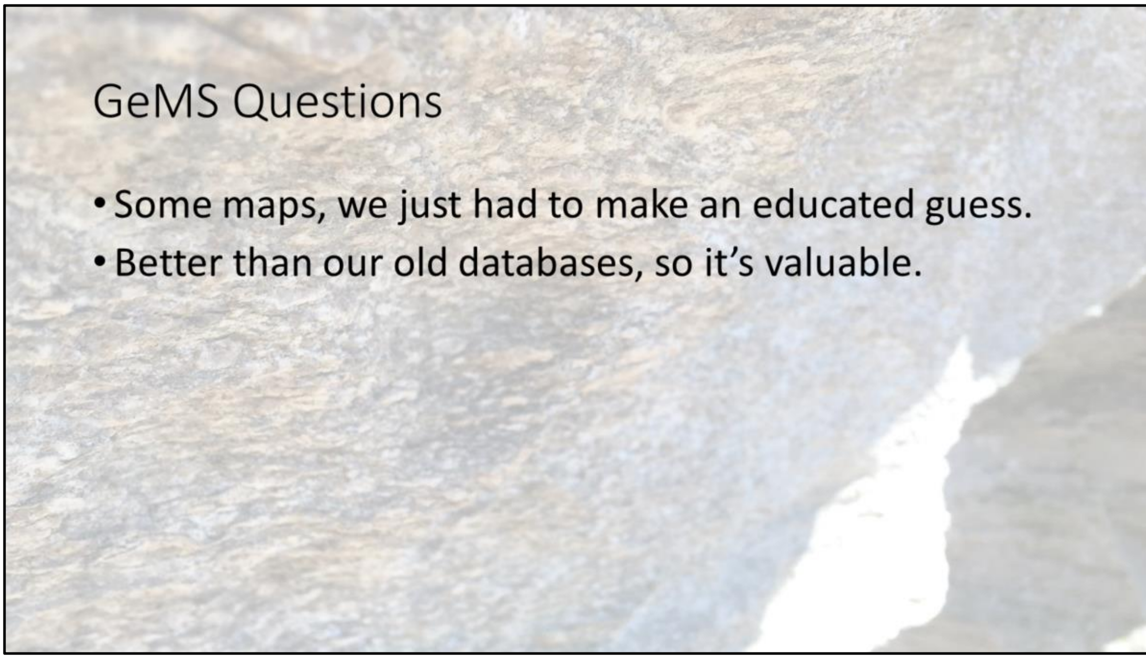
A few lessons learned…

Another picture of rocks to keep you interested…

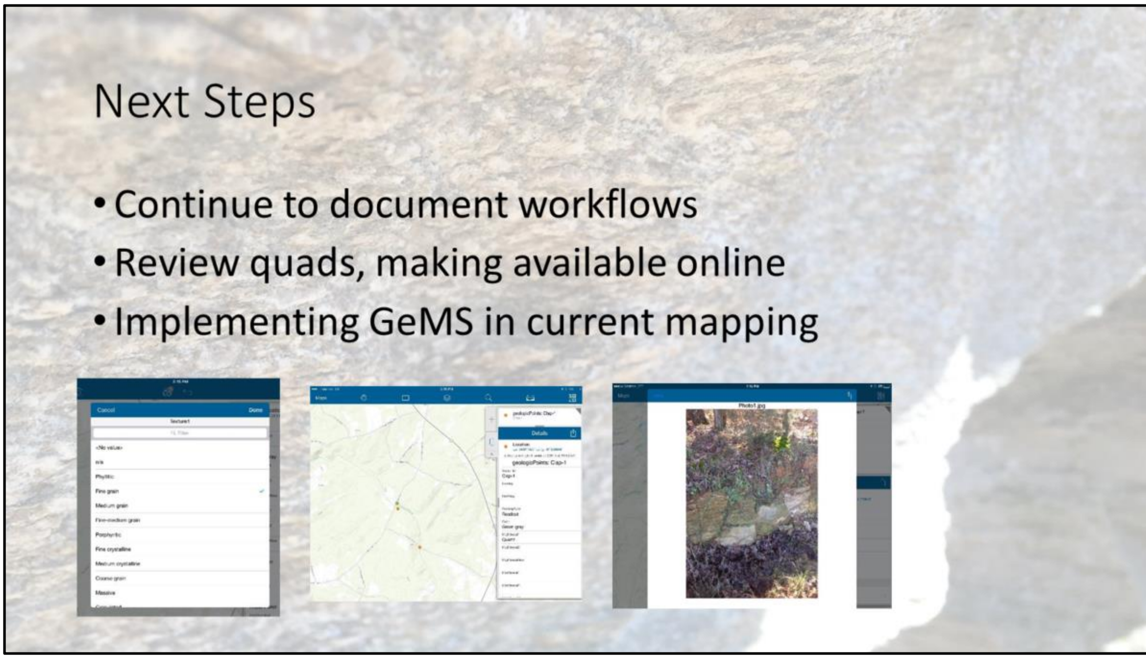


Some questions that were raised in the process are:

How beneficial is the cross section in GIS? And is the symbology information that important for GeMS? Do people really want these two things to reproduce the map, or should the GIS be focused on more GIS-y use cases, such as the data. A GIS user likely will be combining the datasets with others layers anyways. They probably won’t be reproducing the map. However, as an archive of the geologic map, it could be helpful to have cross-section and symbology.



For some older maps, we had to make educated guesses for some values because the map author is no longer around. But that’s ok, because it’s better than nothing, so it’s still valuable.



Next steps include continuing to write documentation and implementing the GeMS schema into current mapping. Currently we are working on workflows for mapping in the field with an iPad and ArcGIS Collector, with many GeMS attributes being recorded in the field.

Thanks.