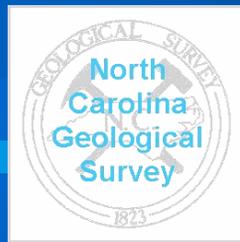


Preserving North Carolina Legacy Geologic and Topographic Maps



North Carolina Geological Survey
in cooperation with
North Carolina State University Libraries

Project Goals

- **Scan and georegister geologic maps (including theses/dissertations) and archival topographic maps**
- **Introduce resulting content into a digital repository being developed by the NC Geospatial Data Archiving Project in collaboration with Library of Congress**

NC Geospatial Data Archiving Project (NCGDAP)

- Joint project of NCSU Libraries and the NC Center for Geographic Information and Analysis
- Focus is collection and preservation of digital data resources from state and local government agencies in NC

FOR MORE INFO...

North Carolina Geospatial Data Archiving Project:

<http://www.lib.ncsu.edu/ncgdap>

NCGDAP Objectives (selected)

- **Acquire at-risk geospatial data, including:**
 - **static data such as digital orthophotos**
 - **time series data such as local land records and assessment data**
- **Ingest and manage geospatial content within a digital repository, initially using DSpace software**

Geologic & Historic Maps – Value to NCSU Libraries

- **The geologic and older topo maps have no digital counterparts and the paper copies are scarcely accessible and in deteriorating condition**
- **Geologic and historic maps are in high demand, and are critical for Geologic and other Earth Science instruction and research**

Geologic & Historic Maps – Value to NCSU Libraries

- **Digital Georeferencing provides new capabilities not possible with paper maps by overlaying other GIS data onto geologic maps**
- **Provides an imagery data collection to use for early testing and workflow development within the NCGDAP project**

Georeferencing Steps

- **Geologic maps were scanned in their entirety including margin notes and explanation (300 or 600 dpi) using large format scanner**
- **Scanned TIF images delivered to DH Hill Library via NCGS external hard drive and DVDs**
- **Images were copied to NCSU external hard drive**

Georeferencing Steps (cont.)

Using ArcMap 9.1 and its Georeferencing Extension, Geographic locations were interactively selected at no less than four points from the TIF, using coordinates and grids printed on the maps.

ArcMap creates a table of these selected coordinate values.

Link	X Source	Y Source	X Map	Y Map	Residual
1	0.636174	32.812827	0.636174	32.812827	0.00000
2	0.429413	9.997950	0.429413	9.997950	0.00000
3	19.085298	9.865556	19.085298	9.865556	0.00000
4	19.284530	32.669828	19.284530	32.669828	0.00000

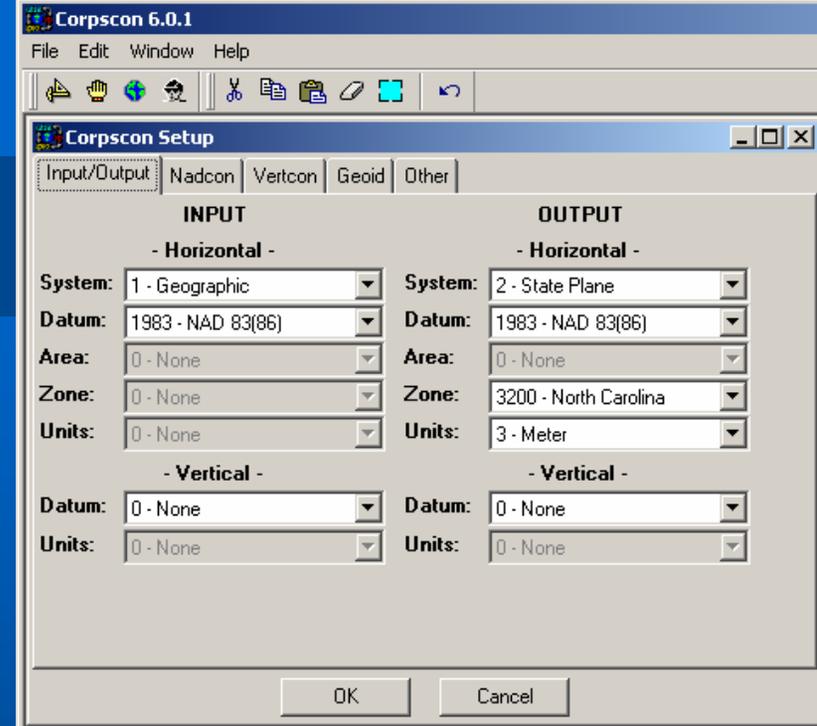
Auto Adjust Transformation: 1st Order Polynomial (Affine) Total RMS Error: 0.00000

Load... Save... OK

Georeferencing Steps

Each coordinate pair was then entered into the USACE CorpsCon to convert them to NC Stateplane NAD83 meters.

The Stateplane coordinates were next appended to the corresponding pair in the ArcMap table.



The screenshot shows the "Link Table" window, which contains a table of coordinate data and a transformation summary. The table has columns for Link, X Source, Y Source, X Map, Y Map, and Residual. The data is as follows:

Link	X Source	Y Source	X Map	Y Map	Residual
1	120726.695100	179643.957800	120725.637000	179633.271000	5.20618
2	119987.359600	165794.772400	119975.214000	165787.346000	5.19820
3	131353.113100	165186.839400	131351.120000	165177.975000	5.19820
4	132095.497400	179033.289800	132084.109000	179024.835000	5.20618

Below the table, there is a checkbox for "Auto Adjust" which is checked. The "Transformation" dropdown is set to "1st Order Polynomial (Affine)". The "Total RMS Error" is displayed as 5.20219. There are "Load...", "Save...", and "OK" buttons at the bottom of the window.

Georeferencing Steps (cont.)

ArcMap auto-creates a .TFW world file and transforms the TIF image so that it is represented in NC Stateplane Coordinates.

Approx. time to georeference one map was 15-20 minutes.

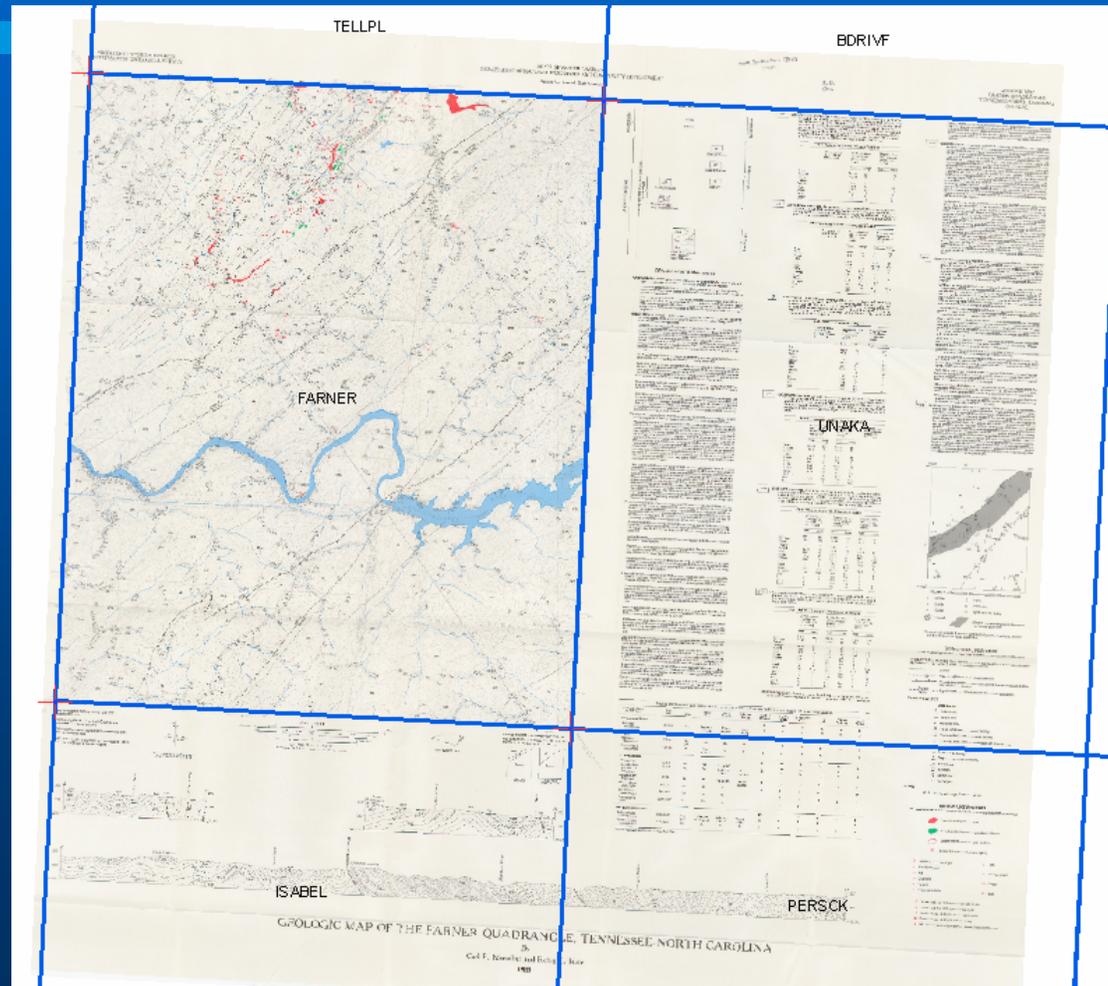


Image Compression

- TIF image compression involved first using ArcInfo workstation to rectify each TIF image to create a new rotated, scaled, and transformed image based upon the parameters in the world file
- MrSID image compression was then used to compress the TIFs at a 20:1 ratio for web downloading and easier distribution and use
- Data backed up on multiple secure servers

Documentation

- MS Excel spreadsheet was used to document map information, status, generate batch scripts, metadata, etc.

Microsoft Excel - Master20050519_backup.xls

File Edit View Insert Format Tools Data Window Help

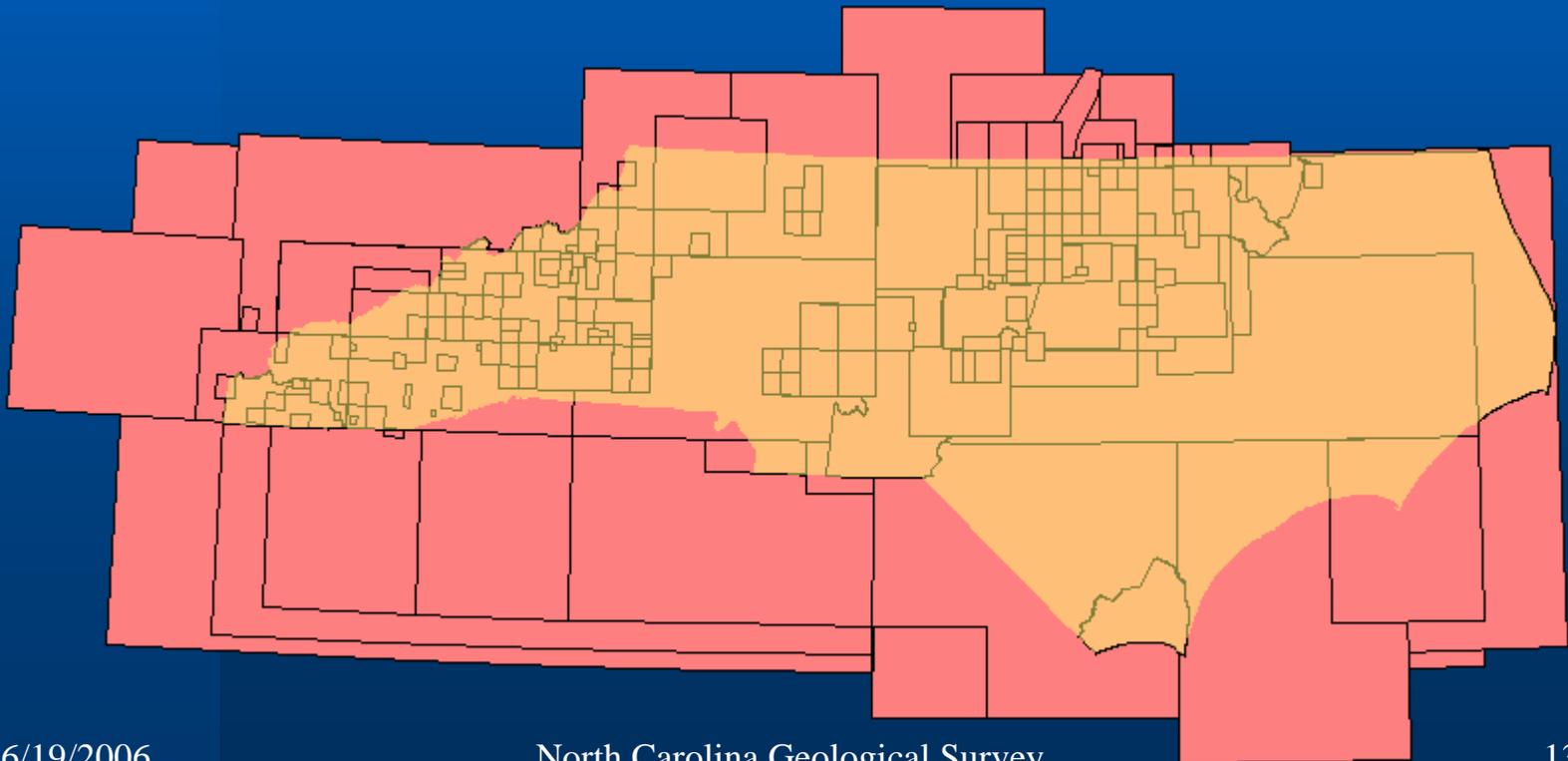
Type a question for help

Z38 5.48

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
239	219	Y	N	Y	D:\USGS	usgs map gq 243.tif	U219	Geology of The Blowing Rock quadrangle, North	Bryant, B.		un-known	1963	USGS	Blowing Rock
1														
2														
3	1	Y	N	Y	D:\NCGS	NCGS bull43 map 1.tif	N001	Map of the Gusher Knob-Brushy Creek district,	Parker, J.M. III		un-known	1942	NCGS	un-known
4	2	Y	N	Y	D:\NCGS	NCGS bull43 map 2.tif	N002	Map of the Spruce Pine -- Micaville district, North	Parker, J.M.		resonmet	1946	NCGS	Bulletin
5	3	Y	N	Y	D:\NCGS	sheet10-front.tif	N003	Map of the Spruce pine district, North Carolina,			un-known	un-known	un-known	State Bulletin
6	4	Y	Y	Y	D:\NCGS	NCGS bull43 map 4.tif	N004	Geologic maps of the Spruce Pine area and the	Olson, J.C.		resonmet	1944	NCGS	Bulletin
7	5	Y	N	N	D:\NCGS	NCGS bull43 map 5 ba	N005	Mines of Spruce Pine district, North Carolina	un-known		un-known	un-known	NCGS	un-known
8	6	Y	N	Y	D:\NCGS	ChapelHillgeolmap_a.tif	N006	Geology of the Chapel Hill quadrangle, North Carolina	Bradley, P.J.; Phillips, C.M.; Gay, N.K.;		geolgenbed	1965	NCGS	Open-File Rej
9	7	Y	Y	Y	D:\NCGS	virgilina_a.tif	N007	Geologic map of the Virgilina District of Virginia and North Carolina	Laney, F.B.; Pouge, J.E.; Watkins, J.H.		geolgenbed	1917	NCGS; VDMR	Bulletin
10	8	Y	Y	Y	D:\NCGS	OF 79-2 Wilson Co.TIF	N008	Geology of Wilson County, North Carolina	Wilson, W.F.		geolgenbed	1979	NCGS	Open-File Rej
11	9	Y	Y	Y	D:\NCGS	of 79-3 nash co.tif	N009	Geology of Nash County, North Carolina	Wilson, W.F.; Spence,		geolgenbed	1979	NCGS	Open-File Rej
12	10	Y	N	Y	D:\NCGS	snowbird.tif	N010	Project A-9A - Geology of the Snowbird Mountains between Teyahalee Bald and Moody Stamp: US 74	Acker, L.L.		geolgenbed	1995	NCDOT	NC Departme Transportation
13	11	Y	Y	Y	D:\NCGS	NCGS coweeta.tif	N011	Geologic map of the Coweeta Laboratory contained within Geologic map and mineral resources	Hatcher, R.D.		geolgenbed	1980	NCGS	Geologic Map minute quadr
14	12	Y	Y	Y	D:\NCGS	NCGS GM series 6 top	N012	Geologic map and mineral resources summary of the Topton quadrangle, North Carolina	Ausburn, M.P.; Hatcher, R.D.; Bryan, J.G.; Godfrey, S.C.; Acker,		geolgenbed	1981	NCGS	Geologic Map

Index Map

- An index shapefile was created using the ArcView 3 ply_generate extension, which generates polygons based on bounding coordinates entered in the spreadsheet



Results (Cont.)

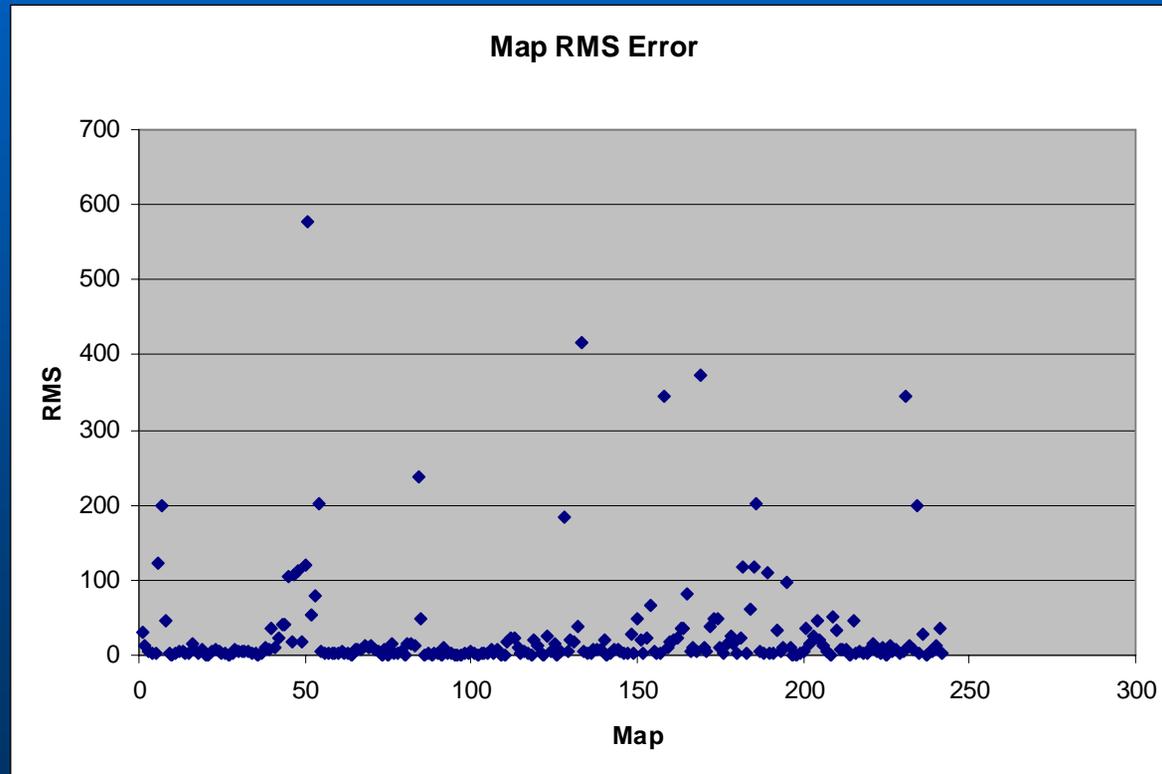
- 101 - USGS maps complete
- 130 - NCGS maps complete
- 47 - theses and dissertations
- 8 - NC Dept. of Transportation – Geotechnical Unit
- 165 - 15-minute legacy topo maps
- 451 Total georeferenced maps (June 2006)

Results (Cont.)

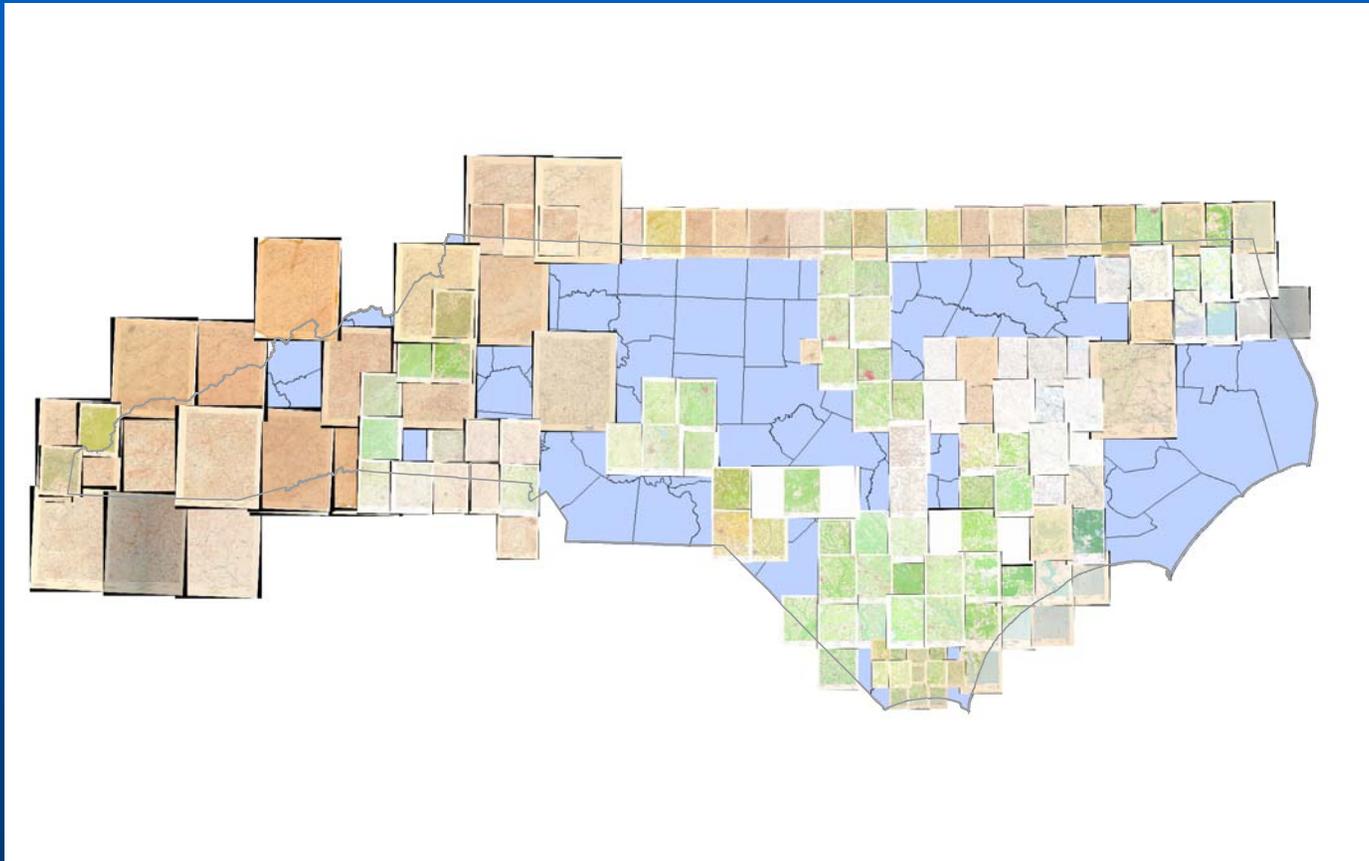
- All maps georegistered (Stateplane meters NAD83) and accompanied by world files comprise 40.0 GB storage (uncompressed .TIF files)
- 165 legacy 15-minute topographic maps comprising 16.4 GB storage (uncompressed .TIF files) also georegistered
- All TIF files have been rectified and compressed to MrSID format, 1 GB storage

Results

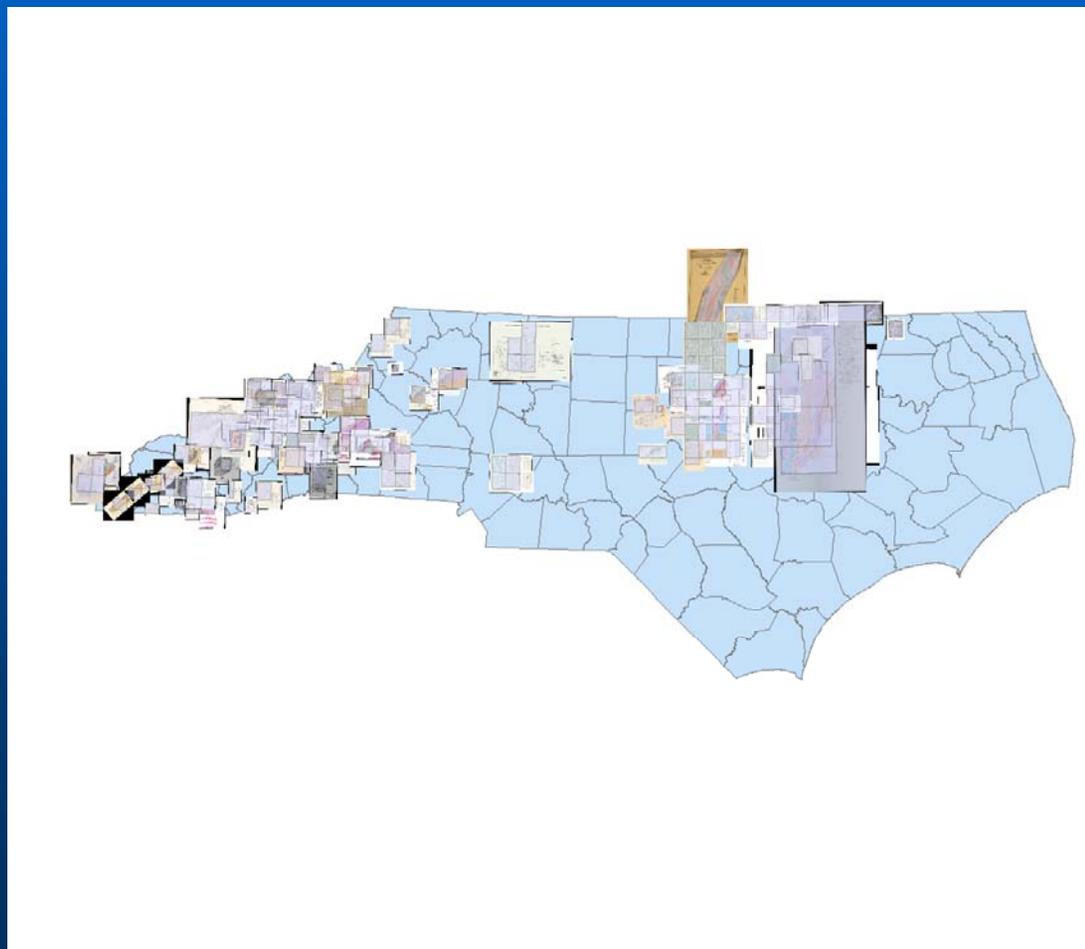
- Avg RMS: 28.2
- Range: 0.14 – 577
- High Average RMS due to some maps having no coordinates, insufficient coordinate labels, age and past storage of maps



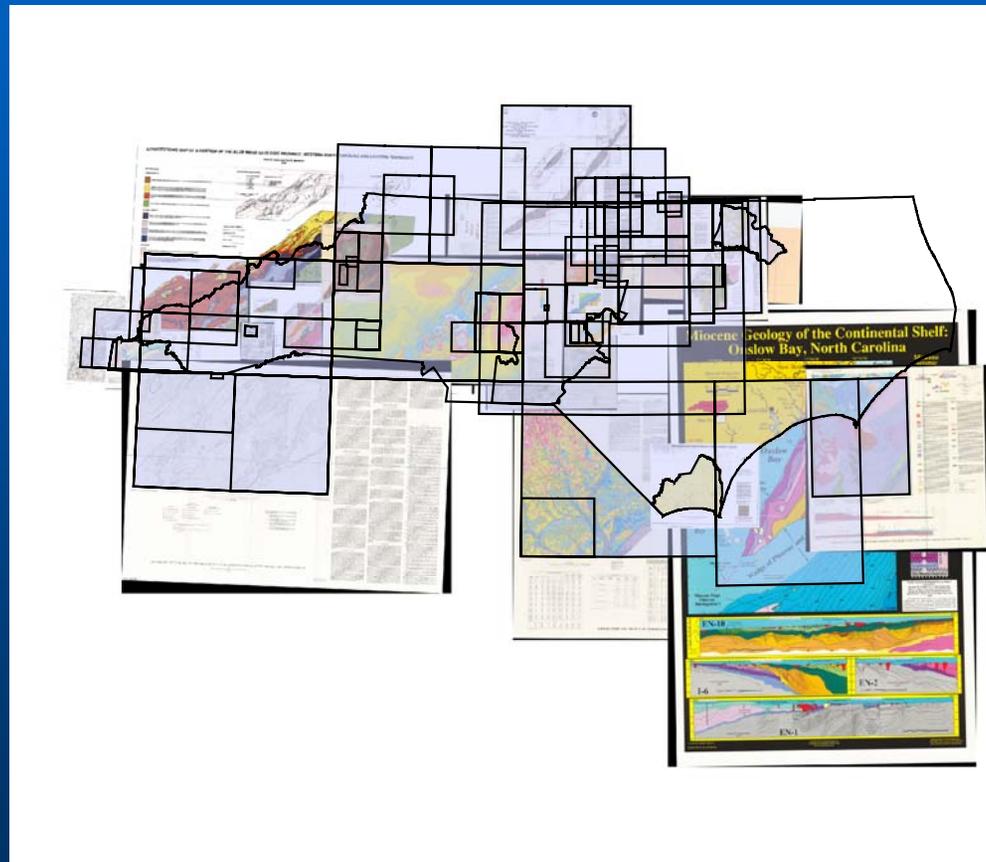
15-minute legacy topo maps



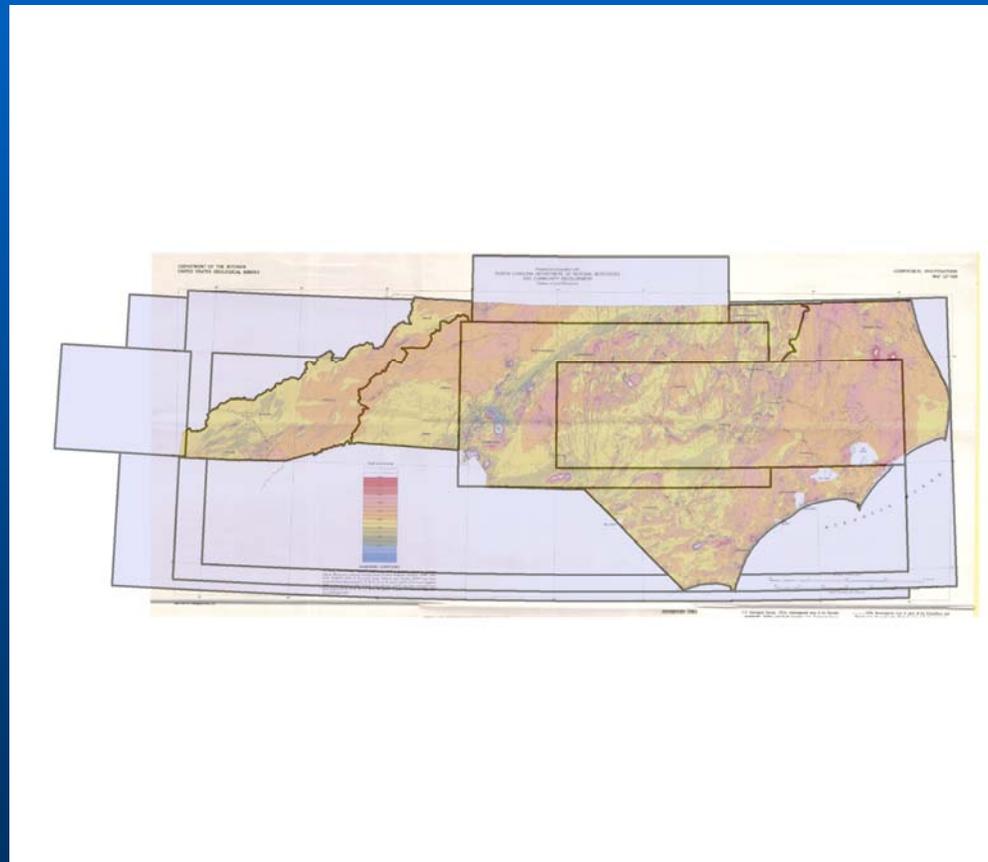
Geologic maps: 1,200 – 24,000



Geologic maps: 1:31,680 – 1:430,000



Geologic maps: 1:500,000 – 1:2.5 M



Schedule

- Complete documentation (June 2006)
- DENR ITS to provide online access (June 2006)
- Provide data to National Geologic Map Database and Map Image Library (June 2006)

FOR MORE INFO...

National Geologic Map Database and Image Library:

<http://ngmdb.usgs.gov>

Data delivery and access

- DVD (NCGS OFR 2006-01)
- Internet (DENR and NCSU-DH Hill Library)
- Internet delivery selection elements
 - County search
 - Theme (basis USGS NGMDB elements)
 - Foot print
 - Spreadsheet data file (geographic coordinate sorting, etc.)

Contact persons

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