DIGITAL MAPPING TECHNIQUES 2018

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The contents of this document are provisional

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

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

Potential methods for comprehensive assessment of the status of geologic mapping in the U.S.

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Abstract: What gets measured gets managed. While being a blunt instrument, rankings have consequences, mostly good. In geological mapping, as in all mapping, a status map may well be our most powerful instrument - to stimulate funding, to cause us all to strive, and to promote consensus; superb examples are the 3DEP and the soil mapping status maps. In geologic mapping, we have many excellent status maps, each for one type of mapping – built through much greatly-appreciated effort by NGMDB. What is now needed is a single map showing a composite score, that is based on facts, as well as on much needed judgement, on topics such as what level of resolution is needed for each area, and what maps need to be redone. It therefore is proposed that willing State Geologists lead an assessment over the coming year, based on needed consultation, that will produce an assessment of the status of geological mapping, onshore and offshore, that is more detailed than state geologic maps, at a resolution and currency not meant to be upgraded in the foreseeable future, for assessing status and not priority, utilizing polygons such as counties or quadrangles, according to state preference. Pending discussion, included will be geologic maps, surficial maps, and bedrock maps, with consideration of digitizing, elevation data, geophysics, statewide compilation, and database standard. Also included will be consideration of depth to bedrock and to basement, subdivision of sediments and layered rocks into strata, specification of properties needed to facilitate modeling, and basement mapping. Discussion and advice will be needed and welcomed.

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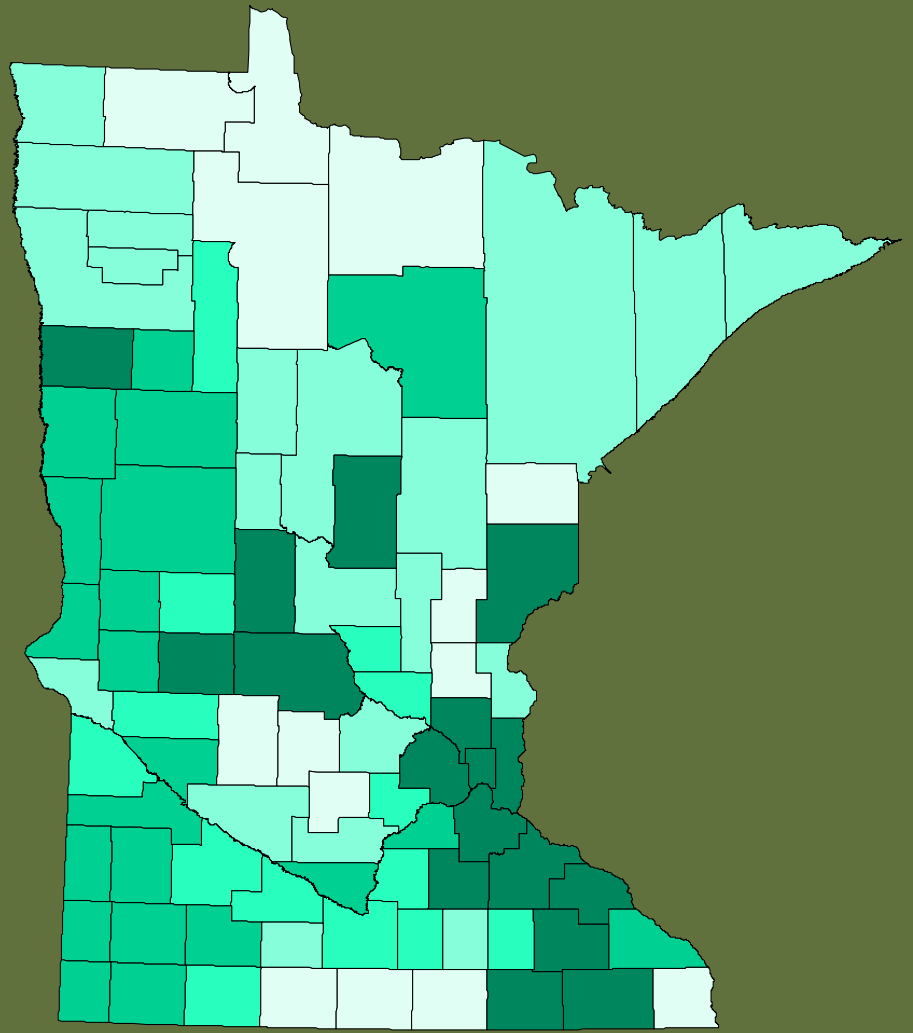
Potential methods for comprehensive assessment of the status of geologic mapping in the U.S.

MINNESOTA GEOLOGICAL SURVEY

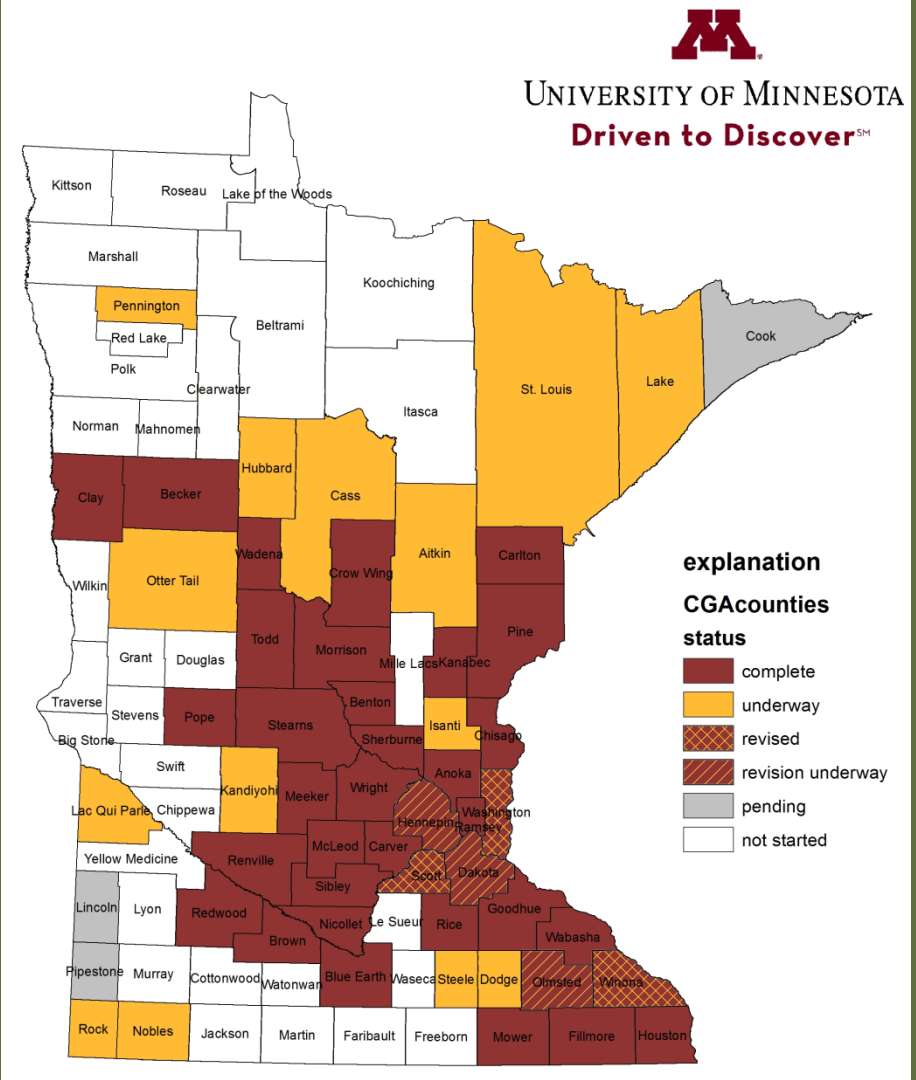
COLLEGE OF Science & Engineering

UNIVERSITY OF MINNESOTA

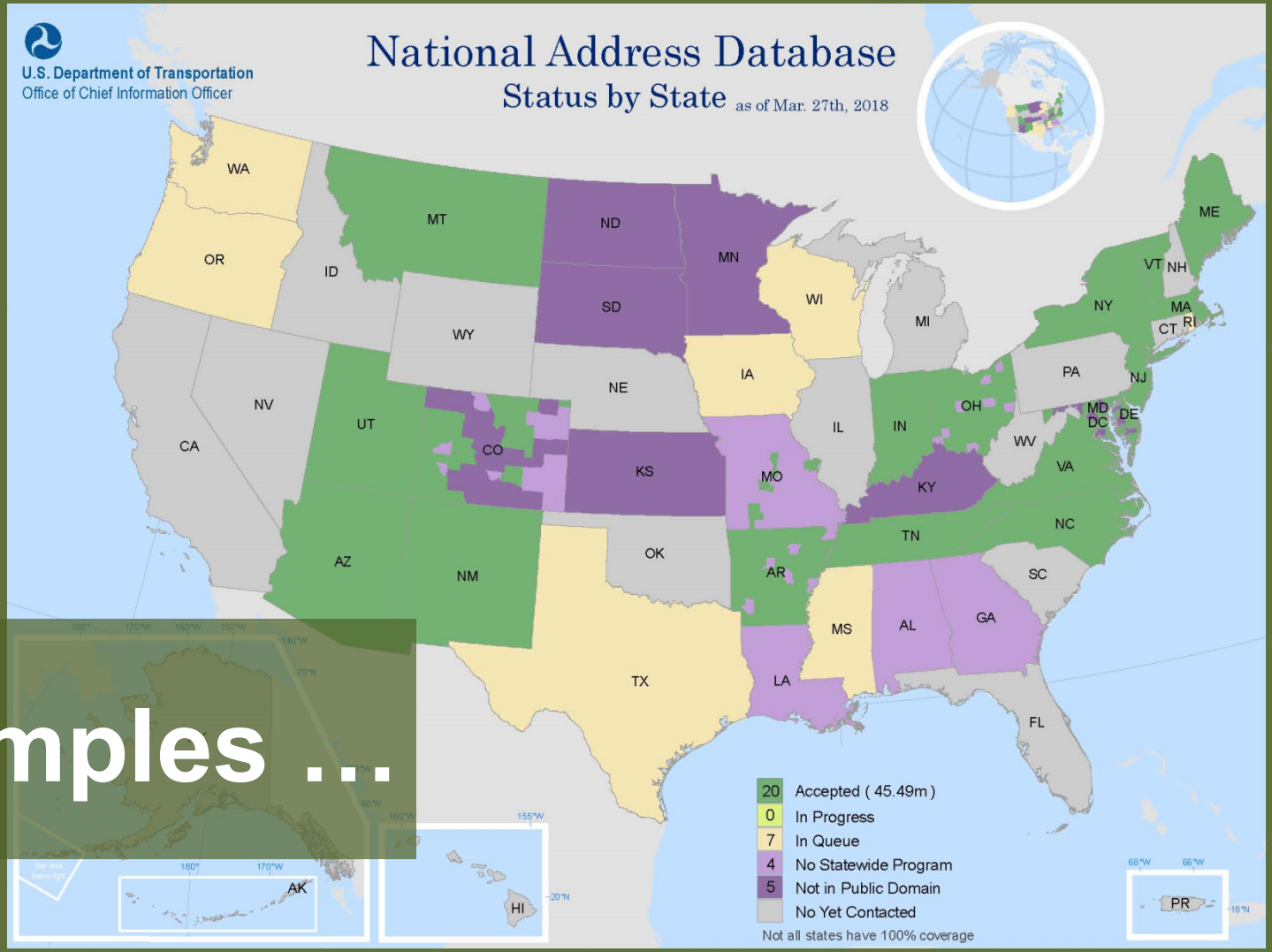
- **What gets measured gets managed**
- **While being a blunt instrument, rankings have consequences, mostly good**
- **In geological mapping, as in all mapping, a status map may well be our most powerful instrument - to stimulate funding, to cause us all to strive, and to promote consensus; superb examples are the 3DEP and the soil mapping status maps**
- **In geologic mapping, we have many excellent status maps, each for one type of mapping – built through much greatly-appreciated effort by the NGMDB team**
- **I suggest that what is now needed is a single map showing a composite score, that is based on facts, as well as on much-needed judgement, on topics such as what level of resolution is needed for each area, and what maps need to be redone**
- **It therefore is proposed that willing State Geologists lead an assessment over the coming year, based on needed consultation, that will produce an assessment of the status of geological mapping, onshore and offshore, that is more detailed than state geologic maps, at a resolution and currency not meant to be upgraded in the near future, for assessing status and not priority, utilizing polygons such as counties or quadrangles, according to state preference**
- **Pending discussion, included will be geologic maps, surficial maps, and bedrock maps, with consideration of digitizing, elevation data, geophysics, statewide compilation, and database standard**
- **Also included will be consideration of depth to bedrock, where defined, and to basement, subdivision of sediments and layered rocks into strata, specification of properties needed to facilitate modeling, and basement mapping**
- **Discussion and advice will be needed and welcomed**



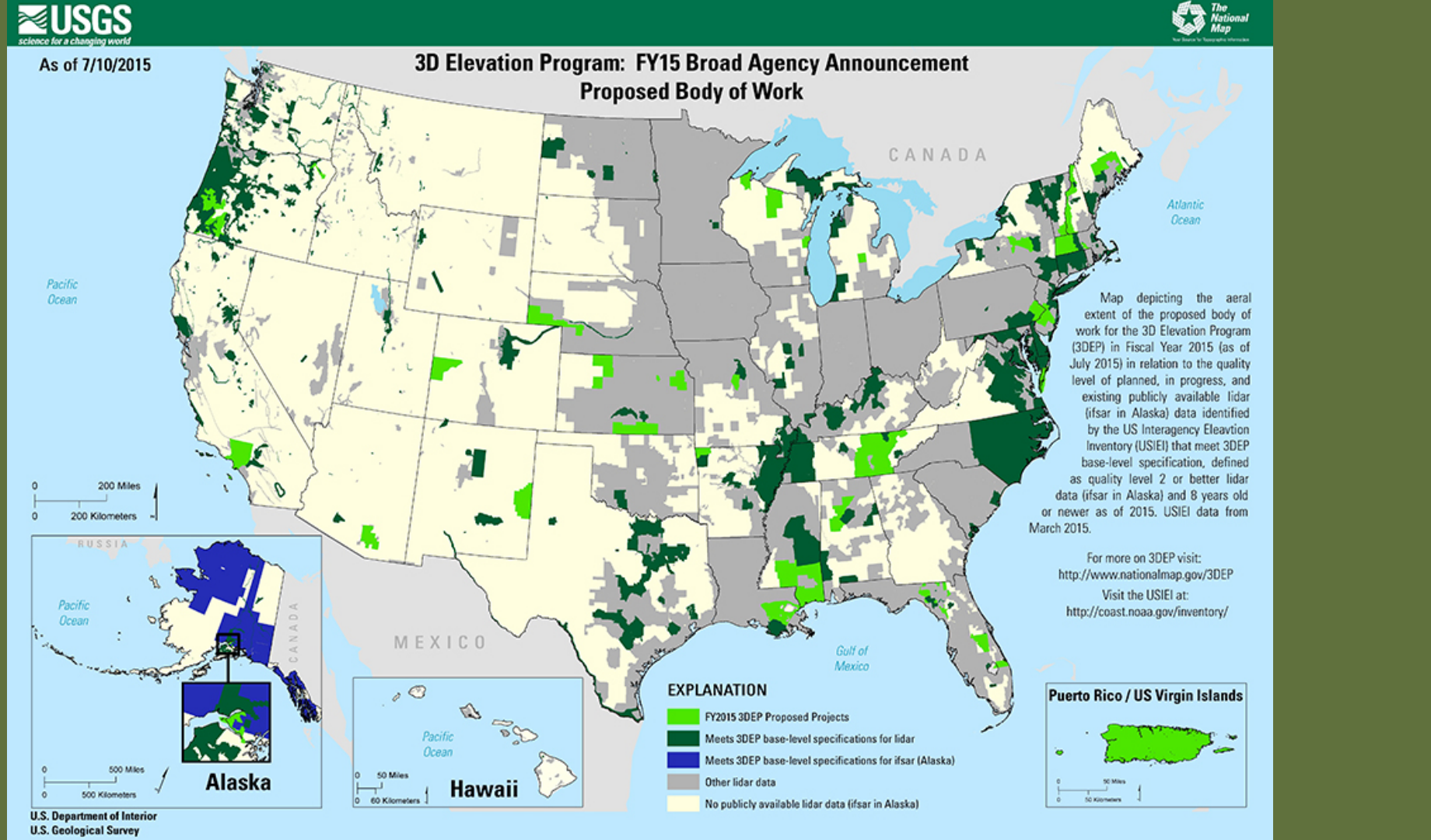
In Minnesota, initially, over a decade ago, we chose 4 factors to assess the status of geologic mapping and associated databases needed for groundwater management – our top priority issue - in each county: 1) the database of well construction records, 2) surficial geologic mapping, 3) bedrock geologic mapping, and 4) mapping of potential sand and gravel aquifers within the glacial sequence. Each component received a score of 1 or less depending on the adequacy of the map or database. A composite score of 4 indicated an optimal status



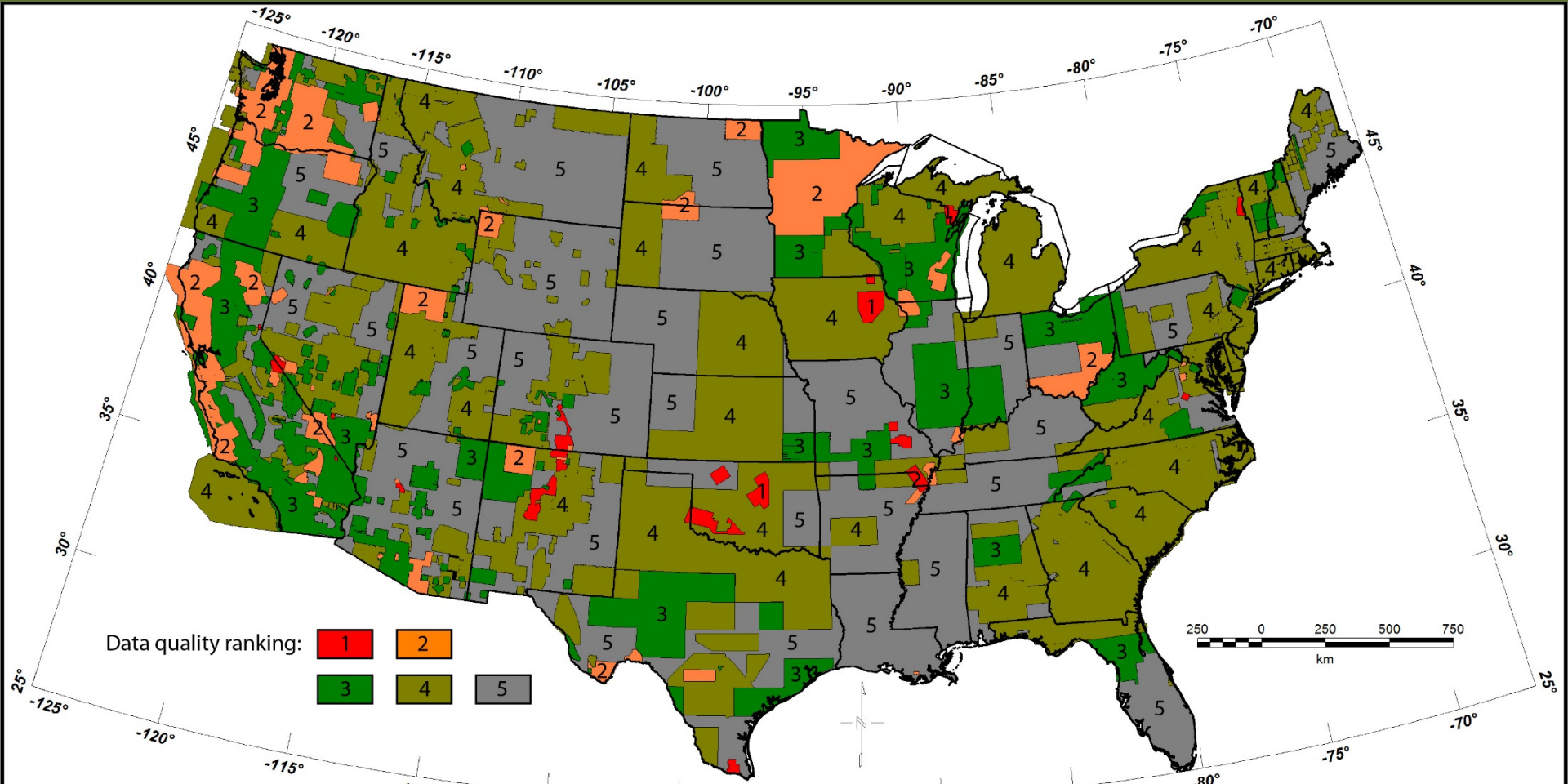
- **Now, we have simplified our story**
- **We have established that a multi-layered County Geologic Atlas is a package of information that every County should have, so as to protect drinking water**
- **Our mapping of status thus has been simplified as a map showing where a County Geologic Atlas is available**
- **This map is a very well known and highly influential instrument at the Legislature, that has caused our funding to increase significantly**
- **The status of geologic mapping in Minnesota can thus largely be summarized as follows: 38 counties are complete, 32 are not started, 3 are pending, 3 are revised, 3 revisions are underway, and 14 new Atlases are in progress**
- **Atlases are being completed at a rate of ~5 per year, so with ~50 completions remaining, statewide atlas coverage will be achieved within a decade, depending on the pace of revisions and accompanying research – we foresee that we will then focus on Atlas revisions and associated activity such as statewide databases**


U.S. Department of Transportation
Office of Chief Information Officer
National Address Database
Status by State as of Mar. 27th, 2018
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
MD
DC
DE
NJ
CT
RI
MA
VT
NH
ME
AK
HI
PR
20 Accepted (45.49m)
0 In Progress
7 In Queue
4 No Statewide Program
5 Not in Public Domain
No Yet Contacted
Not all states have 100% coverage

Examples …


USGS
science for a changing world
The National Map
As of 7/10/2015
3D Elevation Program: FY15 Broad Agency Announcement
Proposed Body of Work
CANADA
Atlantic Ocean
Pacific Ocean
MEXICO
Gulf of Mexico
0 200 Miles
0 200 Kilometers
Map depicting the aeral extent of the proposed body of work for the 3D Elevation Program (3DEP) in Fiscal Year 2015 (as of July 2015) in relation to the quality level of planned, in progress, and existing publicly available lidar (ifsar in Alaska) data identified by the US Interagency Eleavtion Inventory (USIEI) that meet 3DEP base-level specification, defined as quality level 2 or better lidar data (ifsar in Alaska) and 8 years old or newer as of 2015. USIEI data from March 2015.
For more on 3DEP visit:
http://www.nationalmap.gov/3DEP
Visit the USIEI at:
http://coast.noaa.gov/inventory/
RUSSIA
Pacific Ocean
CANADA
0 500 Miles
0 500 Kilometers
Alaska
Pacific Ocean
0 50 Miles
0 60 Kilometers
Hawaii
EXPLANATION
FY2015 3DEP Proposed Projects
Meets 3DEP base-level specifications for lidar
Meets 3DEP base-level specifications for ifsar (Alaska)
Other lidar data
No publicly available lidar data (ifsar in Alaska)
Puerto Rico / US Virgin Islands
0 50 Miles
0 50 Kilometers
U.S. Department of Interior
U.S. Geological Survey

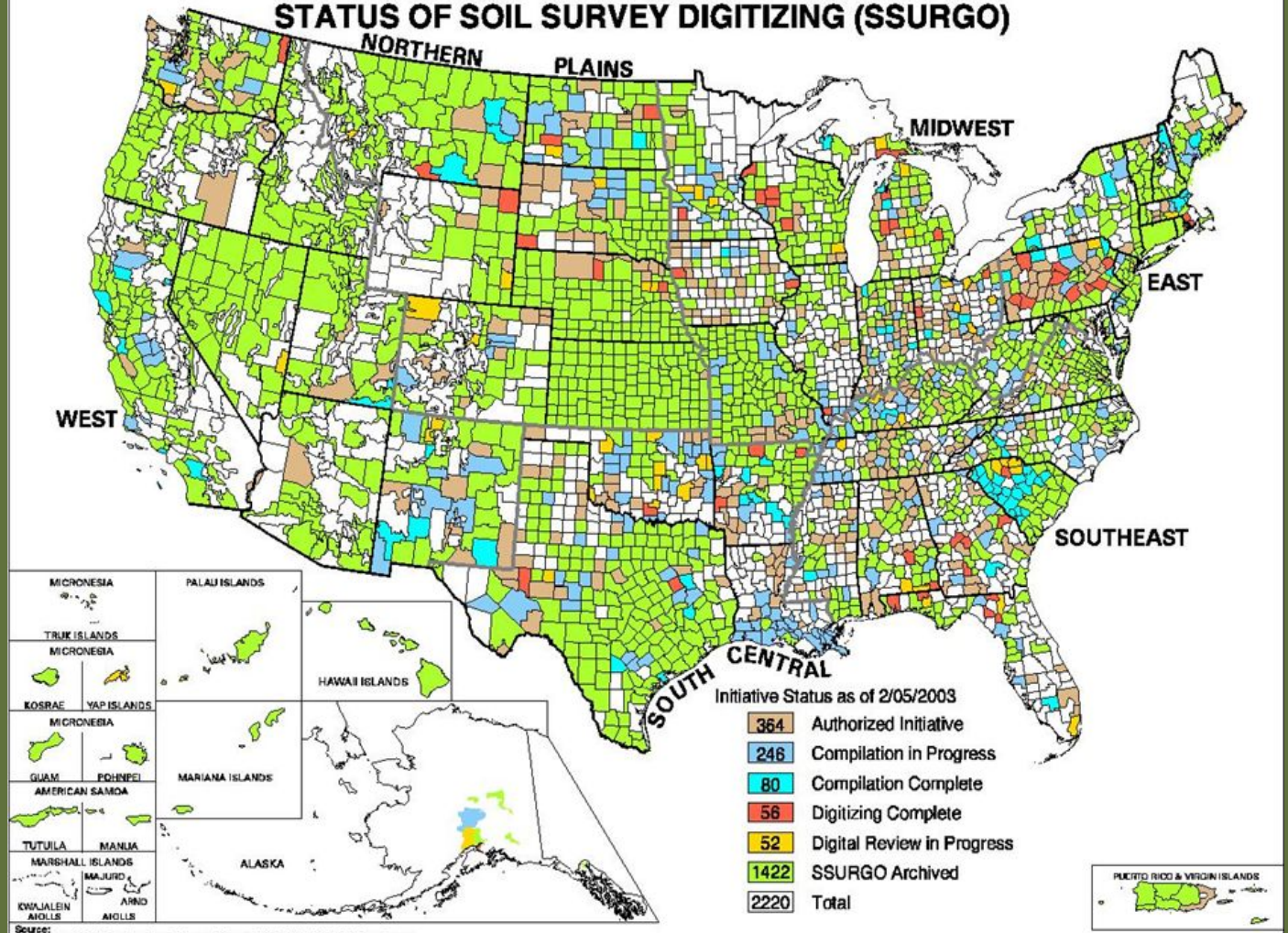
Magnetic data quality ranking for basement mapping



U.S. DEPARTMENT OF AGRICULTURE

NATURAL RESOURCES CONSERVATION SERVICE

STATUS OF SOIL SURVEY DIGITIZING (SSURGO)

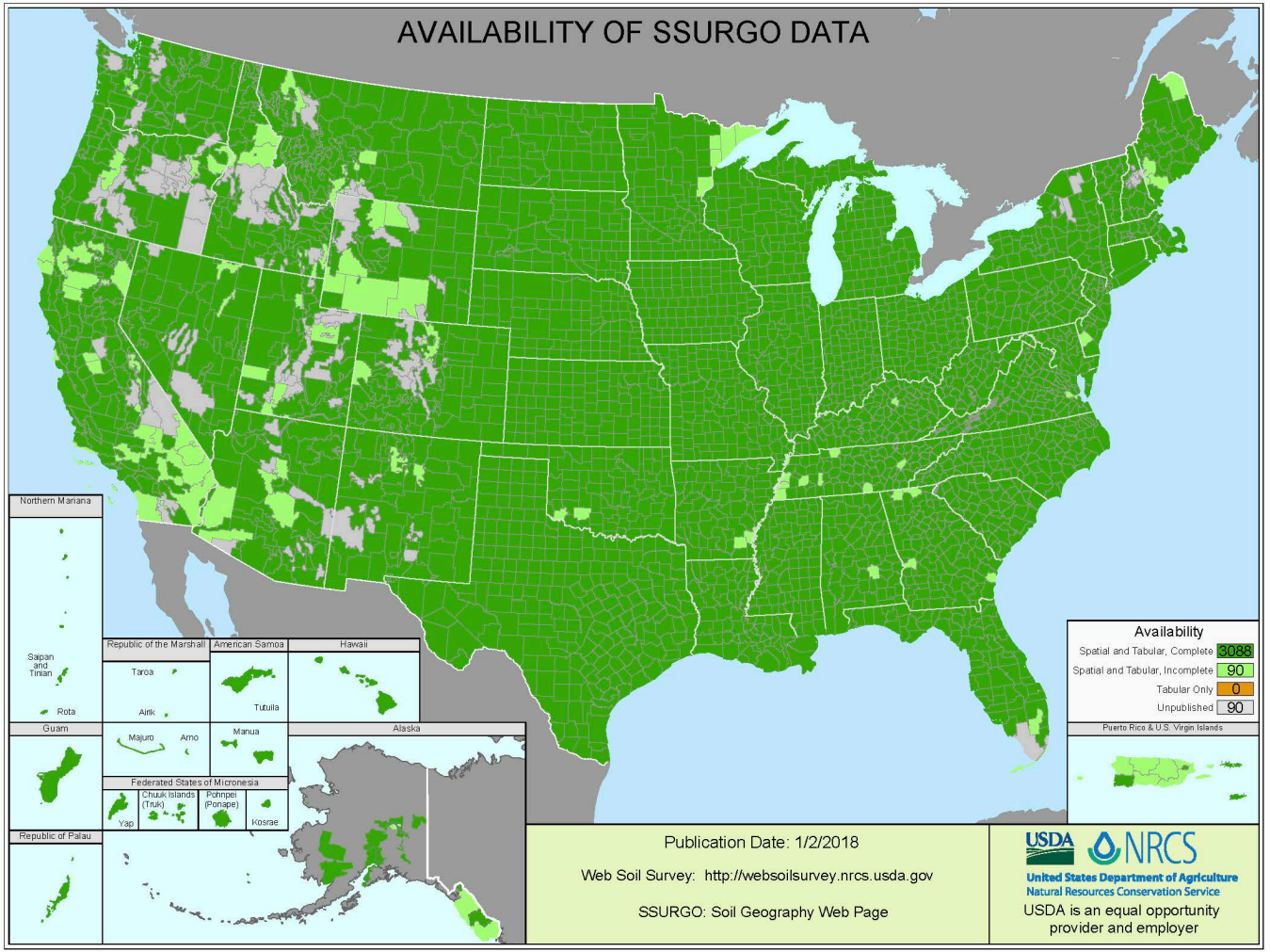


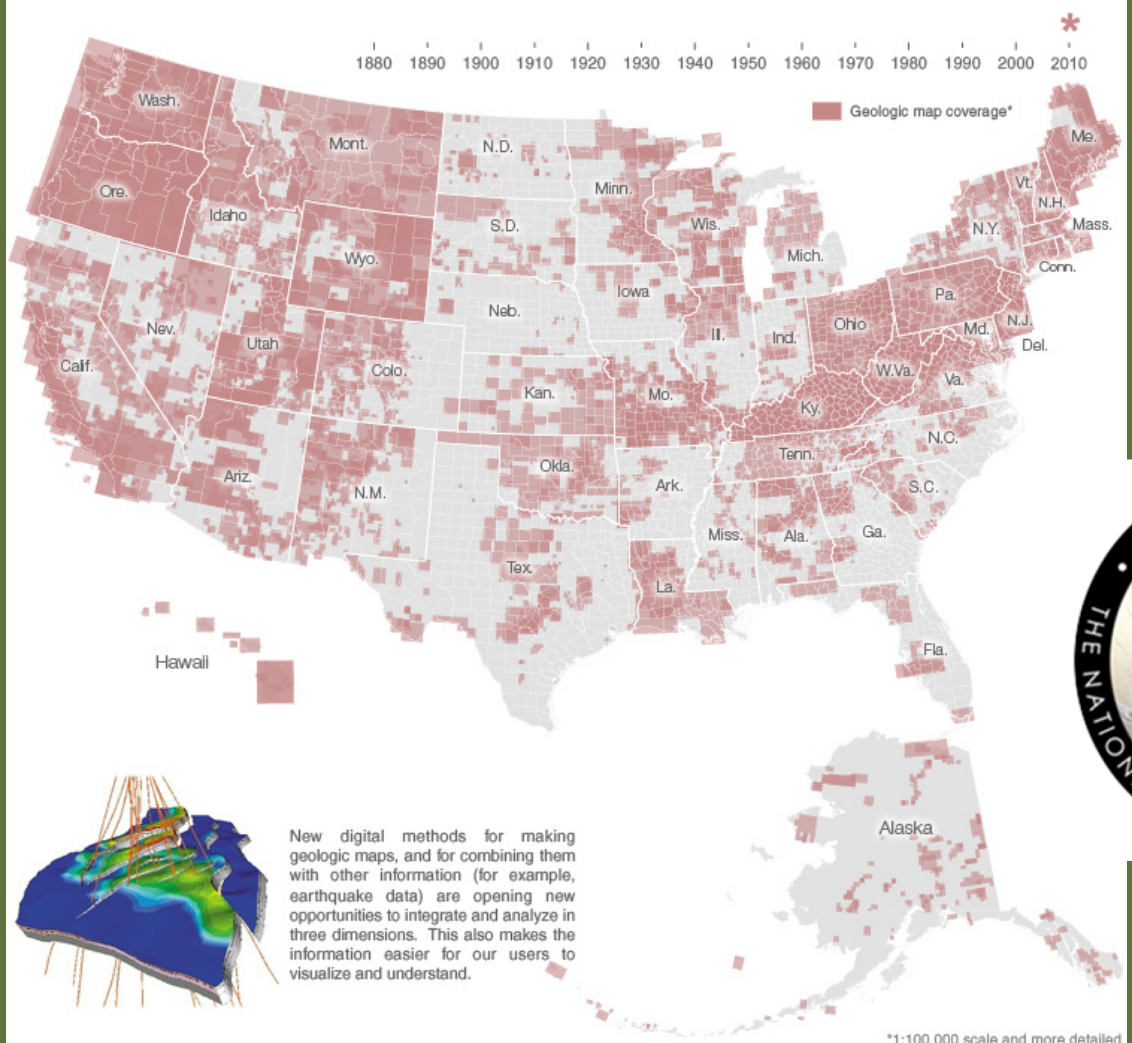
Initiative Status as of 2/05/2003

364	Authorized Initiative
246	Compilation in Progress
80	Compilation Complete
56	Digitizing Complete
52	Digital Review in Progress
1422	SSURGO Archived
2220	Total

Source:
Status from NASIS Replicate Data Base and Kenneth W. Lubich, SSURGO Coordinator.
DMA Operational Navigation Chart (ONC) 1:1,000,000 series & Bureau of Census 1992 TIGER 1:100,000 series.

Revised February 07, 2003 1008294


AVAILABILITY OF SSURGO DATA
Northern Mariana
Saipan and Tinian
Rota
Guam
Republic of Palau
Republic of the Marshall
Taroa
Airik
Majuro
Arno
Federated States of Micronesia
Chuuk Islands (Truk)
Pohnpei (Ponape)
Yap
Kosrae
American Samoa
Tutuila
Manua
Hawaii
Alaska
Availability
Spatial and Tabular, Complete 3088
Spatial and Tabular, Incomplete 90
Tabular Only 0
Unpublished 90
Puerto Rico & U.S. Virgin Islands
Publication Date: 1/2/2018
Web Soil Survey: http://websoilsurvey.nrcs.usda.gov
SSURGO: Soil Geography Web Page
USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service
USDA is an equal opportunity provider and employer

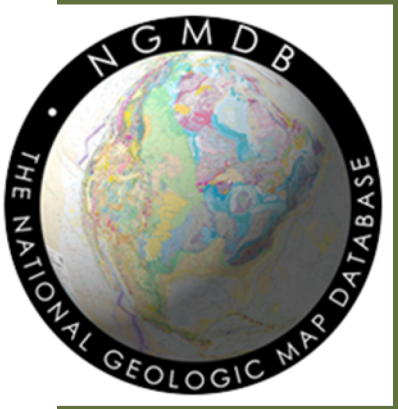


New digital methods for making geologic maps, and for combining them with other information (for example, earthquake data) are opening new opportunities to integrate and analyze in three dimensions. This also makes the information easier for our users to visualize and understand.

*1:100,000 scale and more detailed

Christopher Garrity and David Soller–U.S. Geological Survey

Source: National Geologic Map Database, www.ngmdb.usgs.gov

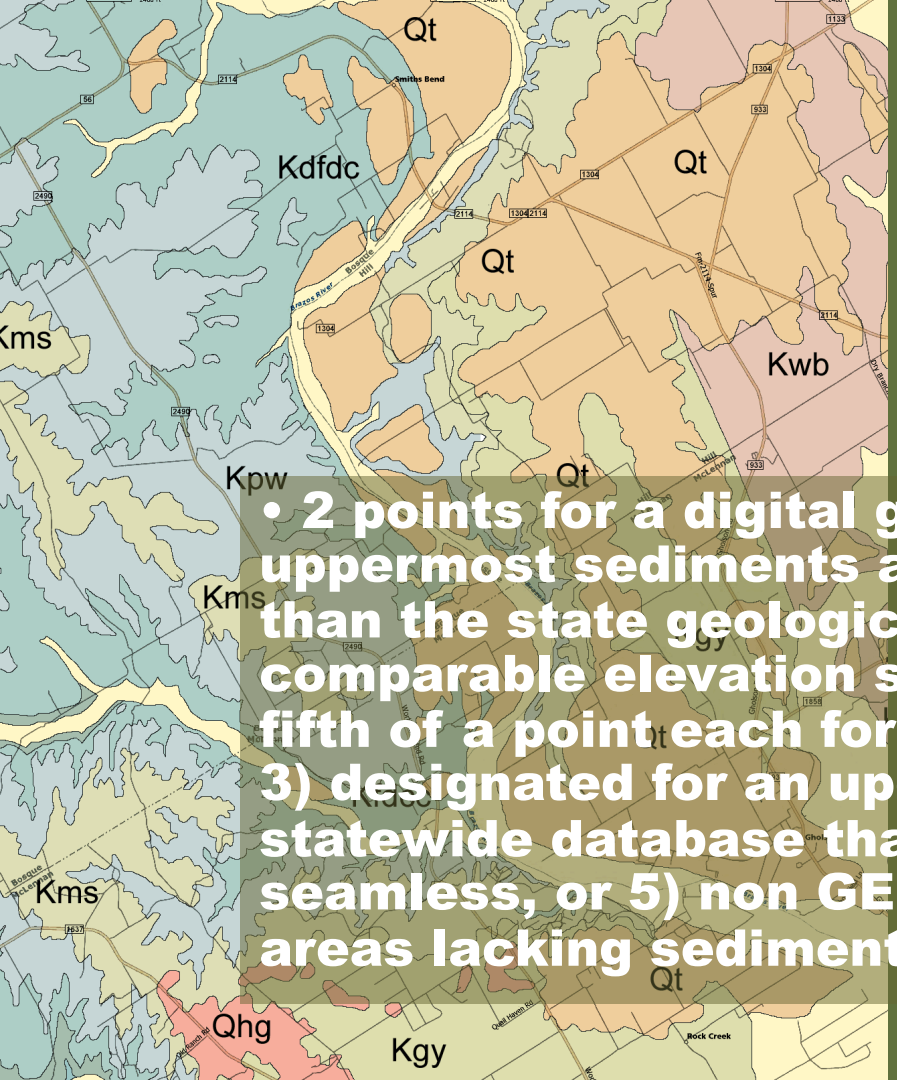


Proposed procedure

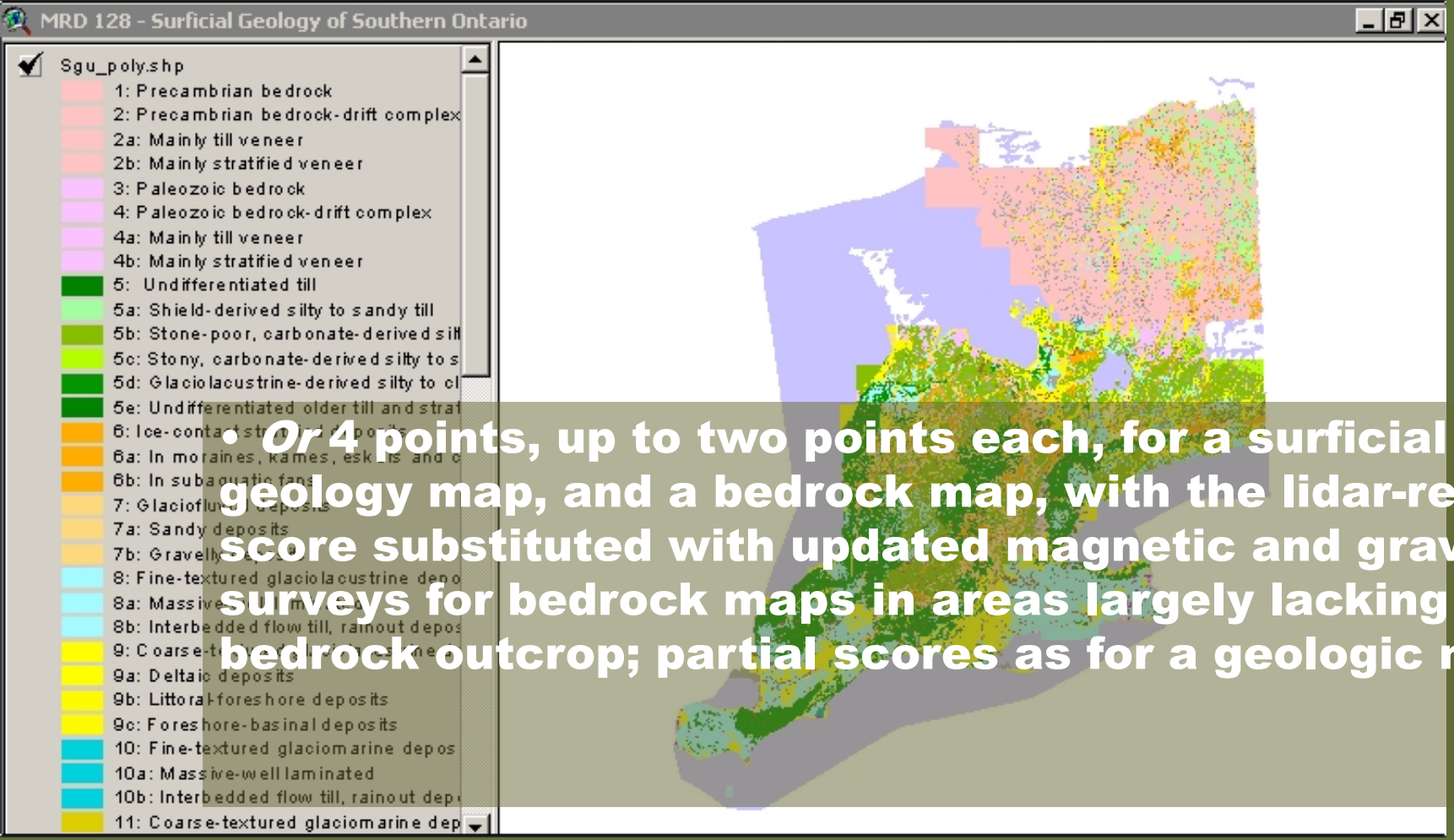
- ***Objective***: a 1-page map that presents an assessment, on a nationally consistent basis, of the status of geological mapping, broadly defined, onshore and offshore, that is more detailed than state geologic maps, and a vintage, resolution, or format not meant to be upgraded in the foreseeable future, for assessing status and not priority, utilizing polygons such as counties or quadrangles

- ***Definitions***: A layer is a 2D map polygon or deposit whose thickness can everywhere be mapped, and for which underlying geology can be drawn; sediments or rocks that are not a layer are basement; in some areas, there are Precambrian layers, so the basement map ≠ Precambrian map

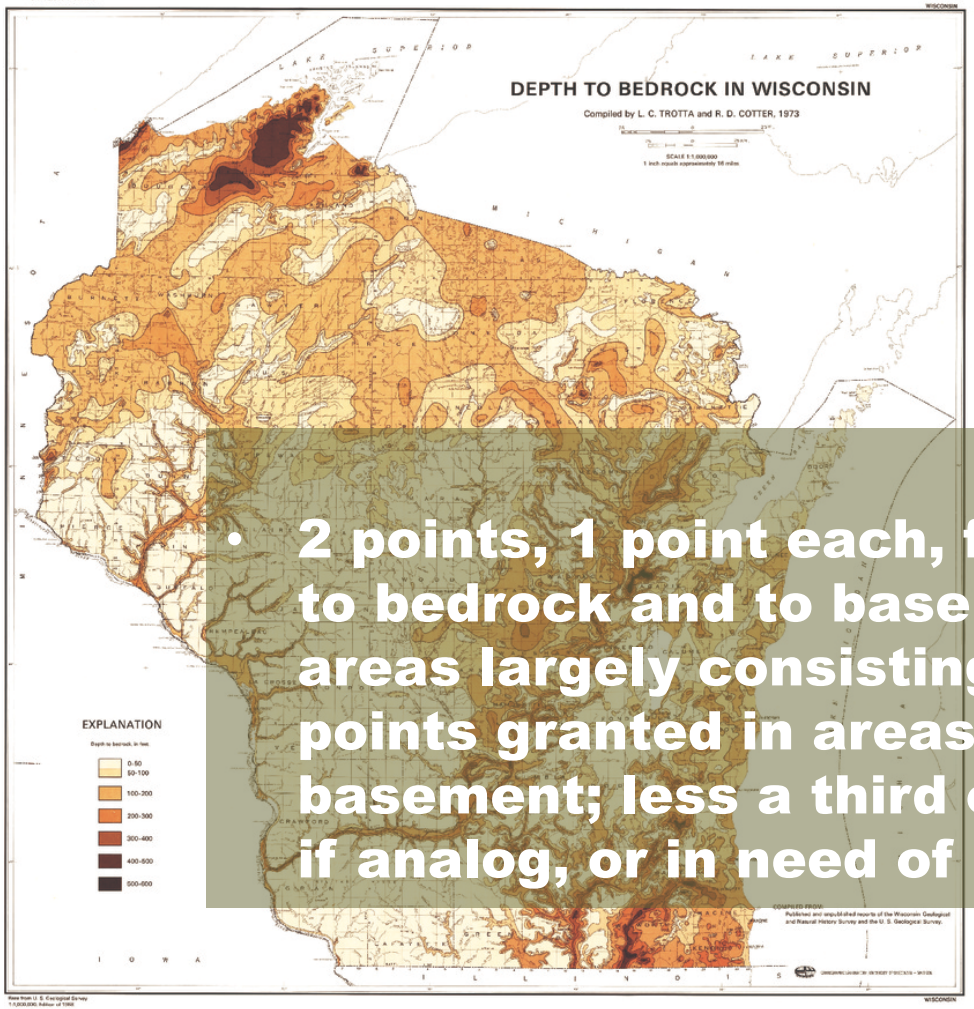
- ***Scoring***: The maximum score of 10 would be assigned to a county or quadrangle, or equivalent, for which, in the entire area, there are, with the score prorated by approximate extent of completion, the following:



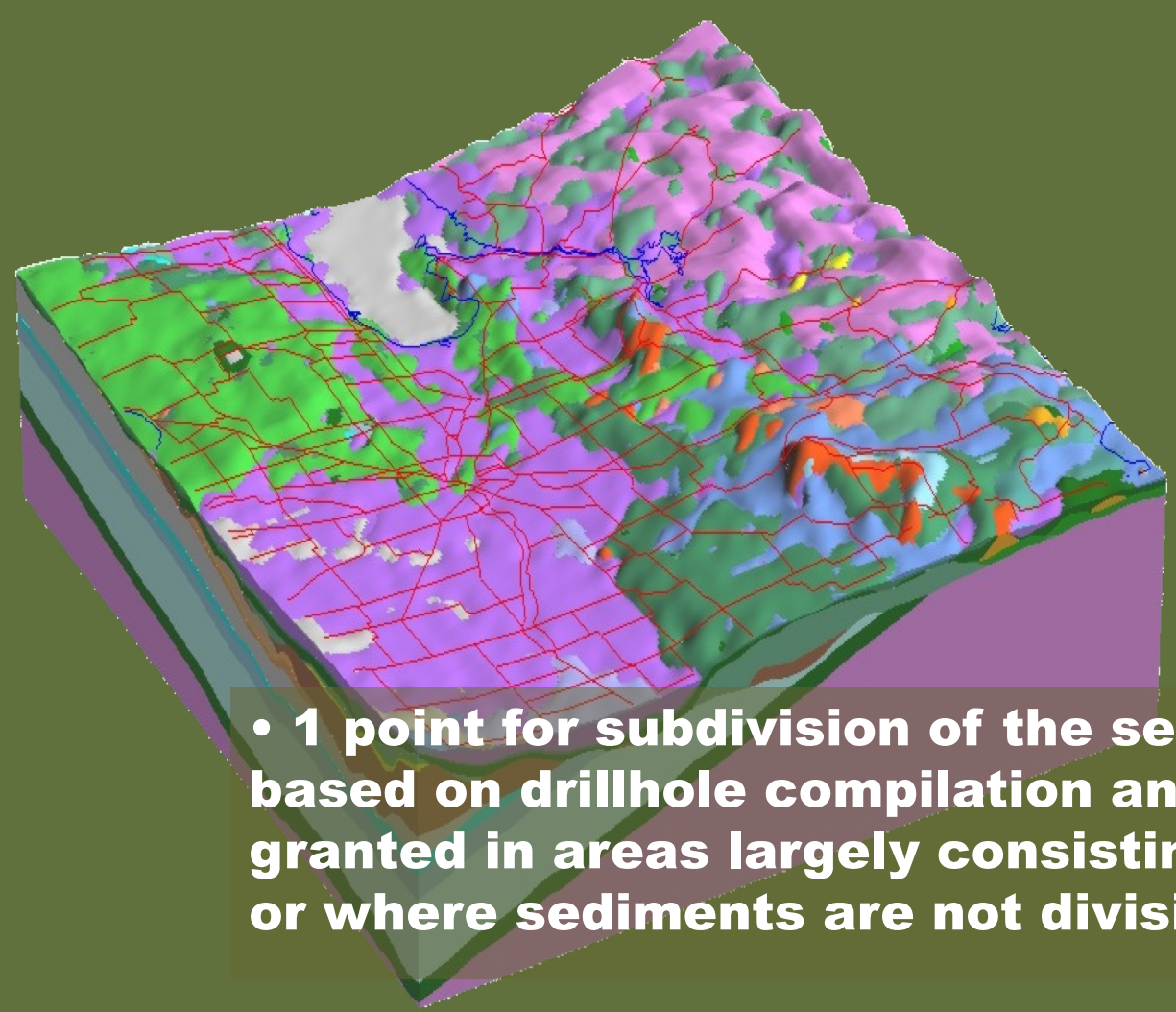
• 2 points for a digital geologic map, showing both uppermost sediments and uppermost rocks, more detailed than the state geologic map, that was based on lidar or comparable elevation surveys, and that is current; less a fifth of a point each for 1) analog, 2) no lidar or equivalent, 3) designated for an update, 4) not yet added to a statewide database that is meant to eventually be seamless, or 5) non GEMS-compliant; 2 points are added in areas lacking sediment cover



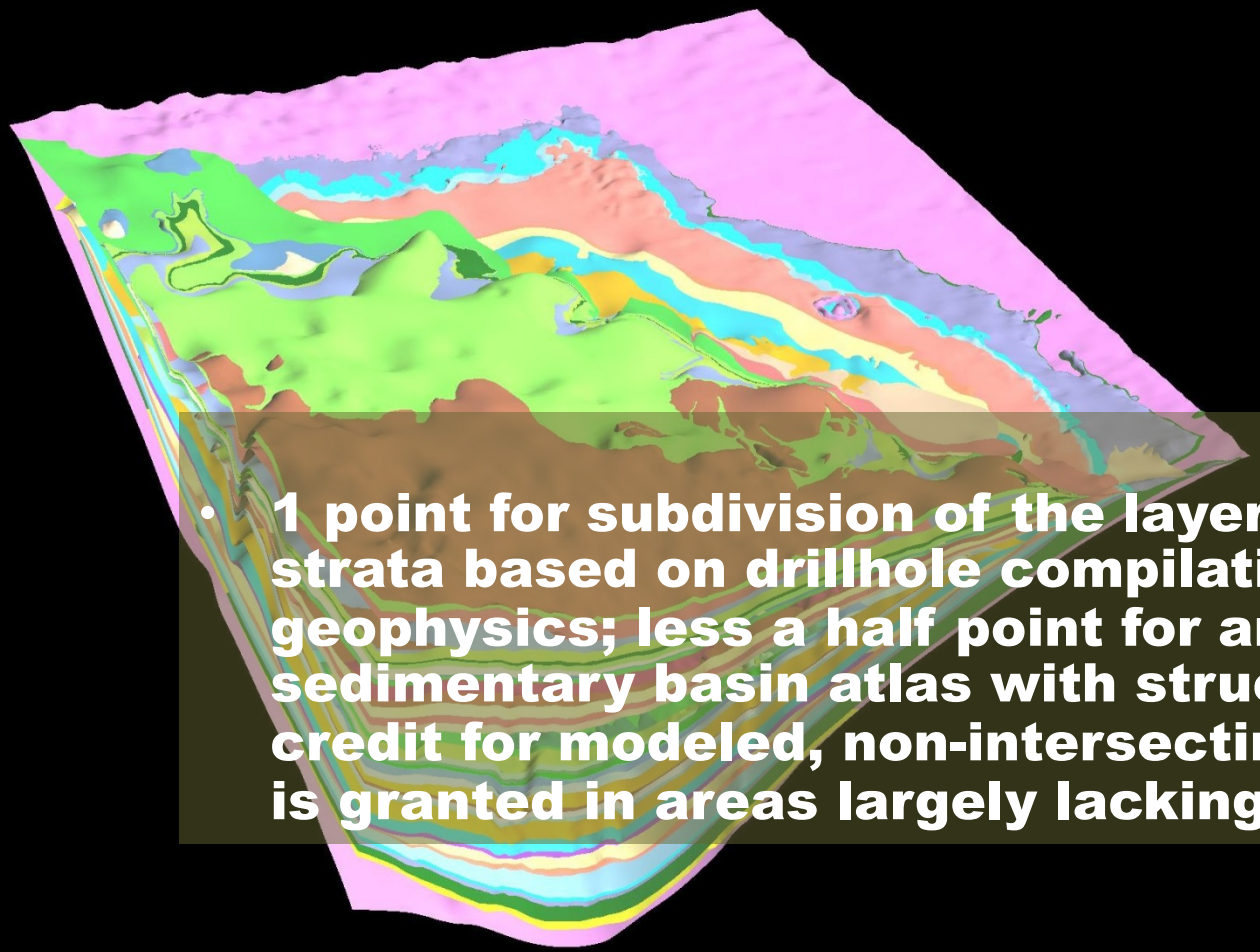
- *Or* 4 points, up to two points each, for a surficial geology map, and a bedrock map, with the lidar-related score substituted with updated magnetic and gravity surveys for bedrock maps in areas largely lacking bedrock outcrop; partial scores as for a geologic map



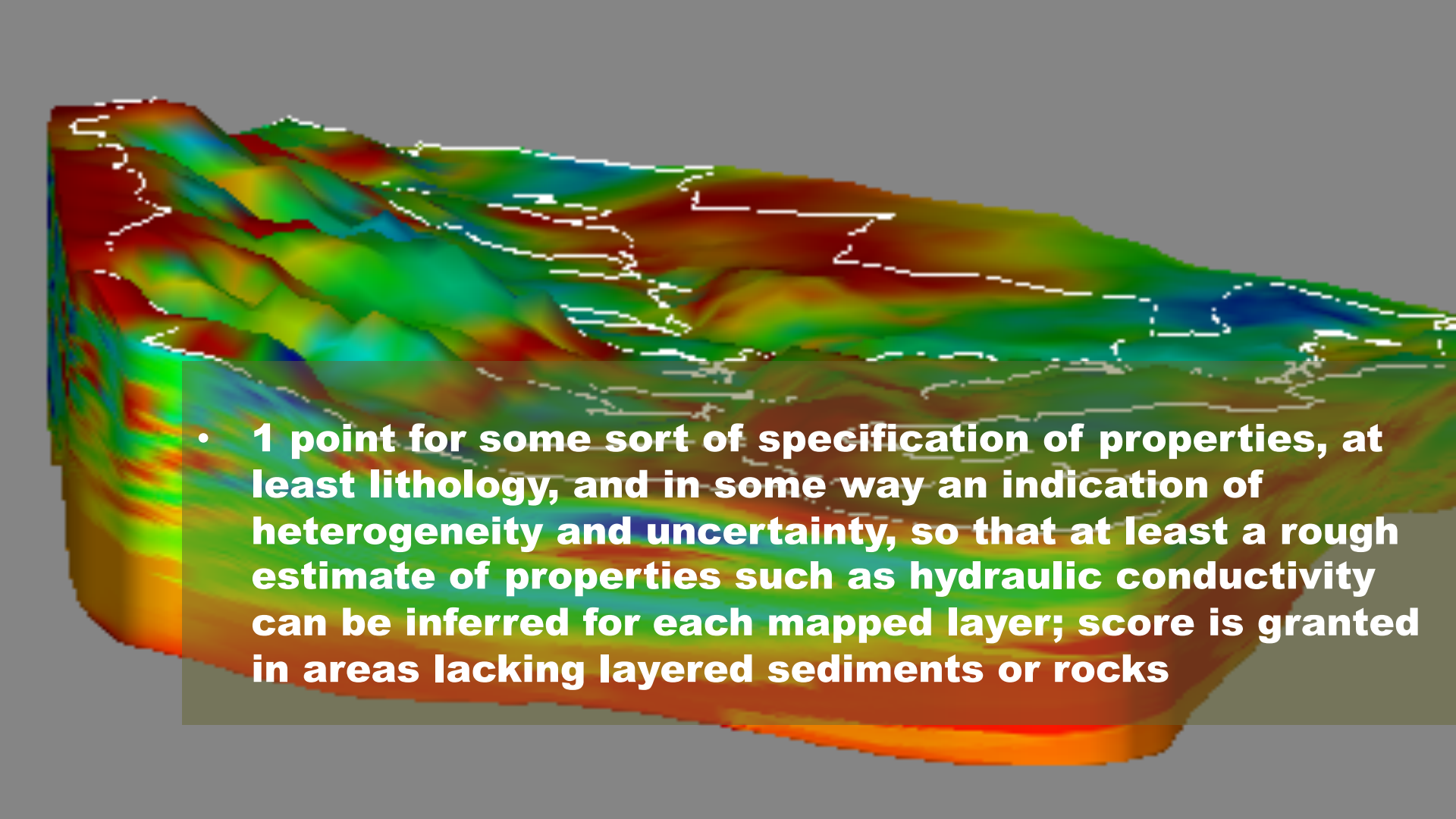
- 2 points, 1 point each, for digital and up to date depth to bedrock and to basement maps; 1 point granted in areas largely consisting of exposed bedrock; 2 points granted in areas largely consisting of exposed basement; less a third of a point each, for each map, if analog, or in need of an update



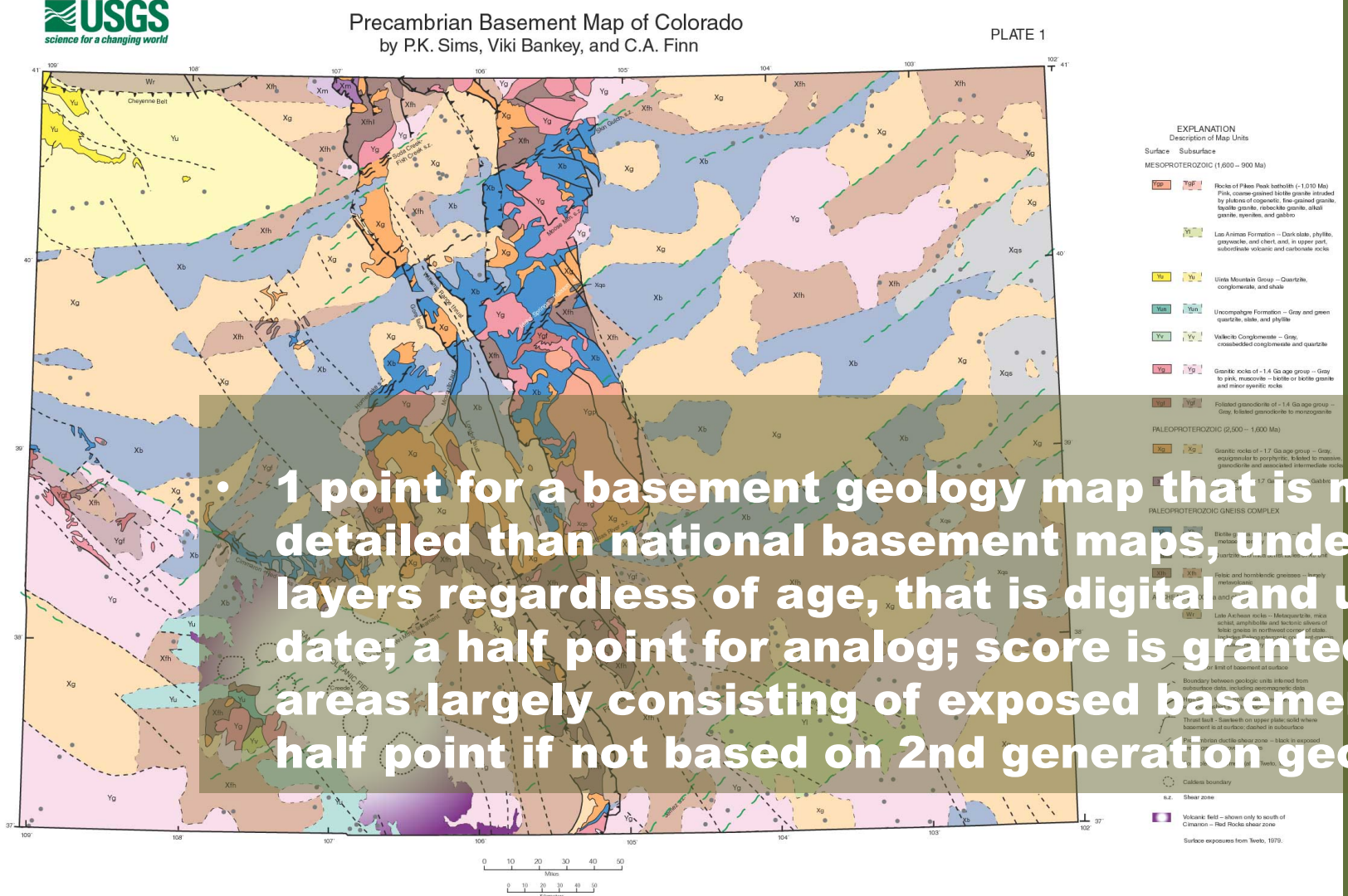
- 1 point for subdivision of the sediments into strata based on drillhole compilation and geophysics; score is granted in areas largely consisting of exposed bedrock, or where sediments are not divisible



- 1 point for subdivision of the layered rocks into strata based on drillhole compilation, markers, and geophysics; less a half point for an analog sedimentary basin atlas with structure contours; full credit for modeled, non-intersecting surfaces; score is granted in areas largely lacking layered rocks



- 1 point for some sort of specification of properties, at least lithology, and in some way an indication of heterogeneity and uncertainty, so that at least a rough estimate of properties such as hydraulic conductivity can be inferred for each mapped layer; score is granted in areas lacking layered sediments or rocks



- 1 point for a basement geology map that is more detailed than national basement maps, under the layers regardless of age, that is digital and up to date; a half point for analog; score is granted in areas largely consisting of exposed basement; less a half point if not based on 2nd generation geophysics

Examples –

Exposed basement

- **10 points for a sediment-free area of basement rocks if the entire area has a geologic map that was based on updated elevations, not in need of an update, more detailed than the state geologic map, digital and GEMS-compliant, and incorporated into a statewide database meant to eventually be seamless**

Sediment over basement

- **10 points if the entire area has a surficial geology map based on updated elevations and a bedrock map based on updated geophysics, with both maps being not in need of an update, more detailed than the state geologic map, digital and GEMS-compliant, incorporated into a statewide database meant to eventually be seamless**

Layered rocks over basement

- **10 points if the entire area has a geologic map that was based on updated elevations, not in need of an update, more detailed than the state geologic map, digital and GEMS-compliant, and incorporated into a statewide database meant to eventually be seamless; plus depth to basement not in need of an update; plus subdivision of the strata based on drillhole compilation, markers, and geophysics, as modeled, non-intersecting surfaces, with at least lithology, and some indication of heterogeneity and uncertainty; and a basement map more detailed than national maps, if possible, that is not in need of an update, and that was based on updated geophysics**

Sediment over layered rocks over basement

- **10 points if the entire area has a surficial geologic map and a bedrock geologic map that were based on updated elevations and geophysics, respectively, not in need of an update, both more detailed than the state geologic map, digital and GEMS-compliant, and incorporated into a statewide database meant to eventually be seamless; plus depth to bedrock and to basement, both digital and not in need of an update; plus subdivision of the sediment and rock strata based on drillhole compilation, markers, and geophysics, as modeled, non-intersecting surfaces, with at least lithology, and some indication of heterogeneity and uncertainty; and a basement map more detailed than national maps, if possible, that is not in need of an update, and that was based on updated geophysics**

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