

DIGITAL MAPPING TECHNIQUES 2013

The following was presented at DMT'13
(June 2-5, 2013 - Colorado Geological Survey and Colorado School of Mines
Golden, CO)

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2013)

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

**U.S. GEOLOGICAL SURVEY
Alaska Science Center
Geology Office**

**Update on the Alaska state map
compilation – towards completion
but not closure**

Frederic Wilson, Chad Hults, and Keith Labay

Outline

Background

A new state map: The Geology of Alaska

Basic data structure

Spatial and attribute databases

Compilation issues and challenges

Map scales

Mapping style

Description variances

Age and geochronology

Tools we used, linking the databases

Checking the spatial databases

Creating a draft Correlation of Map units and all those colors

Preparation of the review draft

Here is where the rubber meets the road

USGS participants and other collaborators

USGS Emeritus and former staff – George Plafker, Florence Weber, Gil Mull, Warren Coonrad, Hank Schmoll, Lynn Yehle, Dave Brew, Tom Hamilton, Bill Patton (deceased), Bill Brosgé (deceased), Don Richter (deceased), Joe Hoare (deceased), Hank Condon (deceased), and Bob Detterman (deceased) have been important.

In the Alaska Science Center, Solmaz Mohadjer and Chad Hults have been extremely valuable assistants and Alison Till and Julie Dumoulin are important participants for northern Alaska efforts and Sue Karl for southeast Alaska.

GIS help has come from Nora Shew, Keith Labay, and a large number of other staff over the more than a decade of this effort.

Alaska State agencies

Alaska Division of Oil and Gas (DOG)

Alaska Division of Geological and Geophysical Surveys (DGGS)

Regional Native Corporations

Such as Calista Corp. and Bristol Bay Native Corp.

National Park Service

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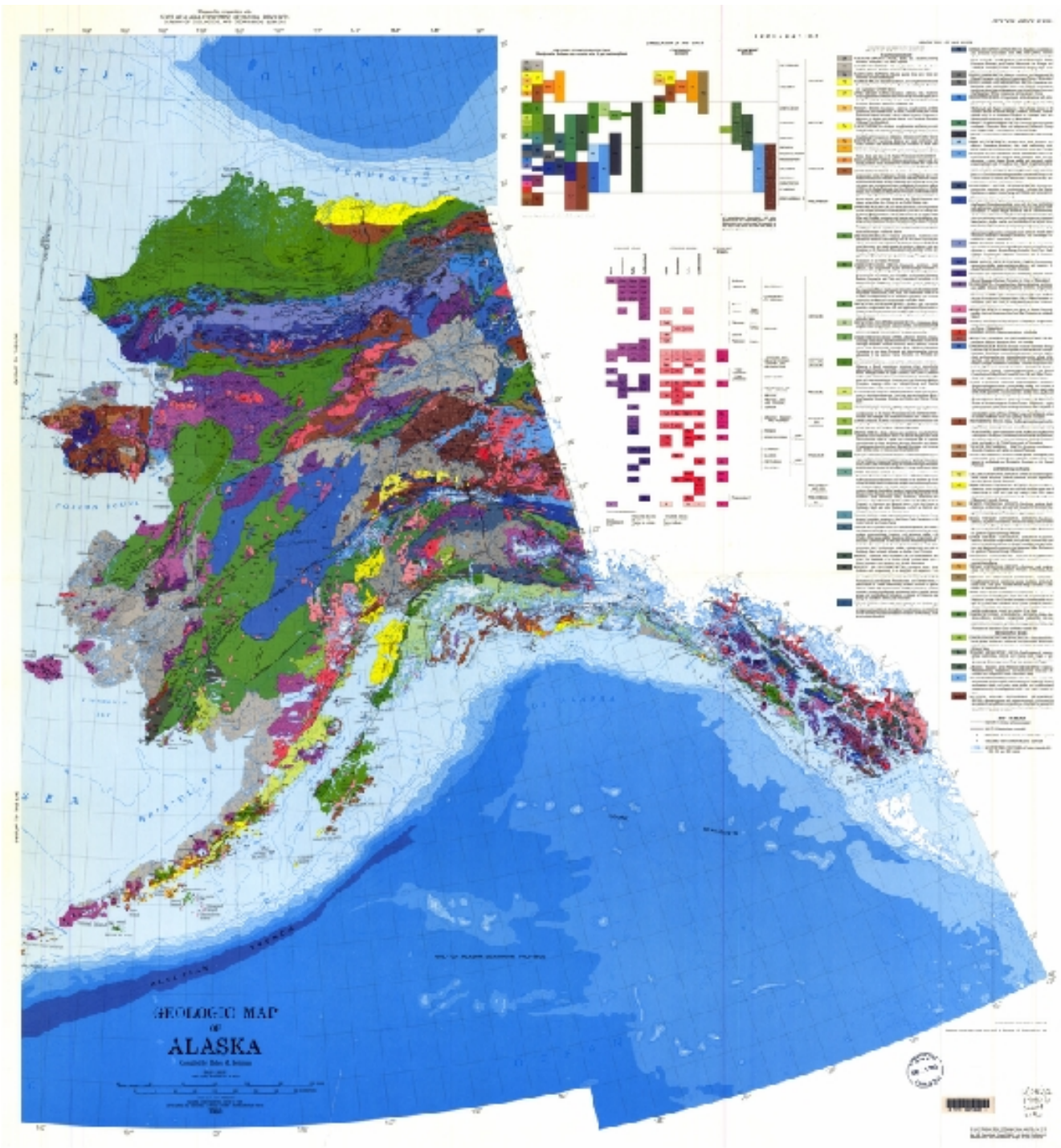
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Beikman, 1980
 1:2,500,000

A new Alaska Geologic map

Existing map published in 1980

Compiled in the 1970's, it largely reflects pre-plate tectonic thinking.

It is not digital and efforts to make so have yielded poor results.

Since publication, an incredible amount of mapping in the state has been done.

It depicts the state in something on the order of 60 to 70 map units

A new map was begun in 1998

100% digital

Compiled from data sources of all vintages; seeking the best data.

Released initially as a series of regional maps

Challenges and Goals for the new map

Nominal scale to be 1:500,000

Acquire/Digitize maps suitable for this scale; actual data capture is at 1:250,000 or better

Integrate statewide (Nationwide)

Define standardized attributes and language:

Description,

Age,

Lithology....

Build a searchable database that captures the data

So, what did this mean for Alaska?

Our spatial database presently contains:

About 450,000 arcs or lines

About 250,000 polygons

Stored in 153 1:250,000-scale quadrangle datasets

The attribute database contains:

Nearly 17,000 individual map unit descriptions

More than 1,300 composite map units, with related age, lithologic, and geologic-setting databases

More 6,000 radiometric age determinations

Additionally, 15 regional compilations reflect:

More than 1,700 regional map unit descriptions

Database structure



POLYGONS

SOURCE
CLASS
NSA CLASS
NSA SUB
OCLASS
NSAMOD

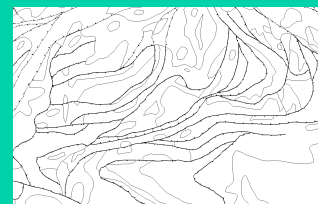
wpgcmk.style

NSAClass
SYMBOL
OVERPRINT
NSA LABEL
DESCRIPTION
STATE LABEL

NSA KEY

NSAClass
OCLASS
NSAMOD
SOURCE
CLASS
QUAD
MAP UNIT
UNIT NAME
DESCRIPTION
ROCK CLASS
AGE
FOSSIL
RAD AGE

NSA UNITS



ARCS

ARC-CODE
ARC-PARA1
ARC-PARA2
LINE ID
SOURCE

arccode.style

NAME
DESCRIPTION
AGE
LINE ID

LINEID KEY

REFERENCE
SOURCE

NSA REFS

NSA LITH

NSAClass
LITH LEVEL1
LITH LEVEL2
LITH LEVEL3
LITH LEVEL4
LITH LEVEL5
FORM
RANK
PERCENT
LITHCOMMENT

LITH LIST
LITHFORM

NSA AGE

NSAClass
MAX AGE
MIN AGE
MAX Ma
MIN Ma

IUGS LIST

NSA DESCRIP

NSAClass
LABEL
NAME
AGE
DESCRIPTION
SOURCES
SYMBOL
OVERPRINT

STATE LINK

STATE LABEL
SEQUENCE
DESCRIPTION
NAME
RANK
MIN AGE
MAX AGE
LITH TYPE

TO NSAKEY

TO NSA DESCRIP

Units:

Source Map Fields

Assigned Fields

Links:

Keys

References

Lithology

Age

Quadrangle	Charley River	Description							
Map unit	Pzl	Mod_date	4/25/2011						
Unit name	Limestone and dolomite								
Age	Paleozoic								
Description	Limestone and dolomite. Contains a few poorly preserved brachiopods. A few hundred feet thick.								
Fossil									
Radiometric age									
Source	CY003	Rock class	Sedimentary	NSAmod					
Class	1206	NSAclass	5735	Qclass		NSAsub		Label	Pzl
Key	896	5735	Pzl	Tahkandit Limestone, massive bioclastic limestone					
Qkey									
Refs	Brabb, E.E., and Churkin, Michael, Jr., 1969, Geologic map of the Charley River quadrangle, east-central Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-573, scale 1:250,000.								
Lith	Limestone	Bed	Major						
	Sandstone	Bed	Incidental						
	Conglomerate	Bed	Incidental						
Age	Minimum age		Maximum age						
	Permian	251	Permian	299					

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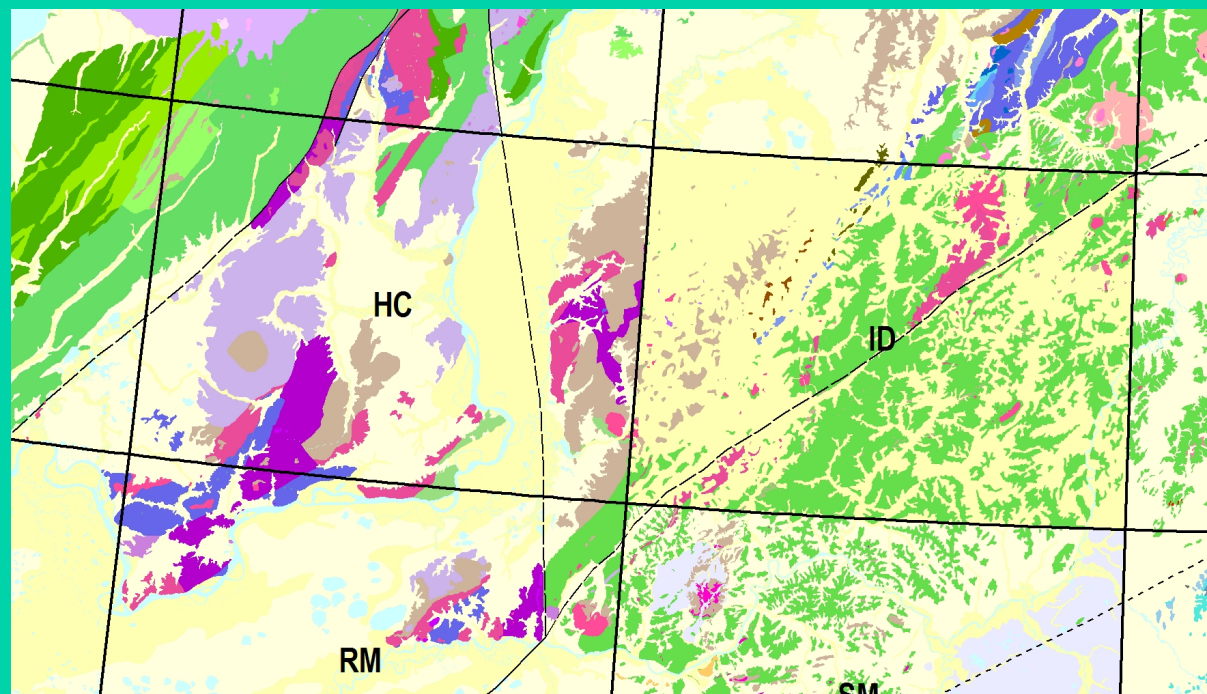
Here is where the rubber meets the road

Map scale and mapping style

The adjacent Holy Cross and Iditarod quadrangles reflect distinctly different mapping styles and also reflect differing scales of data.

The Holy Cross (HC) map is at best a 1:500,000-scale reconnaissance map product, whereas the adjacent Iditarod (ID) map was compiled originally from 1:63,360-scale mapping.

The Holy Cross map also reflects the geologists inference of the extent bedrock, whereas the Iditarod map is more akin to an outcrop map.



Unit description variances

Same unit, different maps:

Kss -- Shallow marine sandstone, siltstone, and shale -- Late Cretaceous -- Fine-to medium-grained, thinly cross-bedded, fossiliferous sandstone and poorly exposed dark siltstone and shale. Clasts composed of 40 to 45 percent quartz, 45 to 50 percent volcanic and sedimentary lithic fragments, and 5 to 15 percent feldspar, chiefly plagioclase. Clasts set in a finely divided calcareous and argillaceous matrix. Unit deposited in a nearshore marine environment. Unit contains abundant early Late Cretaceous (Cenomanian) species of *Inoceramus*.

Kkq -- Kuskokwim Group, quartzose sandstone and siltstone -- Late Cretaceous, (Paleocene?) Campanian to Turonian? -- Quartzose sublithic sandstone, conglomerate, siltstone, and siliceous shale. Finer-grained layers locally contain abundant coaly leaf and stem debris; thin coal seams are present locally. Coquina layers composed of brackish to fresh water bivalves are locally interbedded with sandstone and siltstone. Rocks are interpreted as shallow-marine to locally nonmarine. Dicotyledon leaf fragment of probable Turonian to Paleocene age but may be as old as Cenomanian. K-Ar age of 77 Ma on interbedded andesite tuff in upper part of section.

Age and geochronology

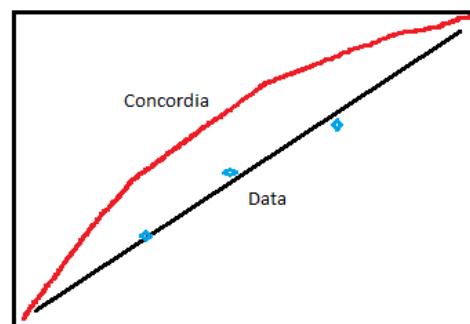
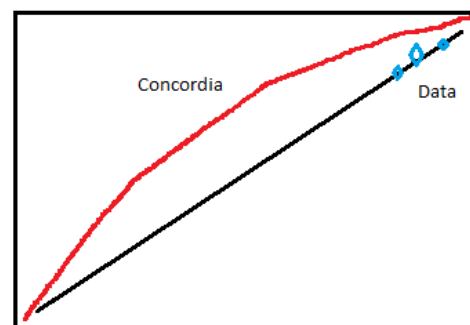
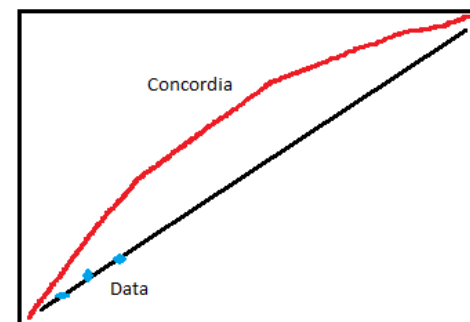
As the compilation came together, access to about 7,000 radiometric dates, ranging from generally discredited 1950's era Lead-alpha dates to conventional K/Ar, $^{40}\text{Ar}/^{39}\text{Ar}$, Rb/Sr, and U/Pb (both TIMS and SHRIMP analyses) required careful examination of the analytical data of many dates.

Key considerations emerged:

1. Ignore most Lead-alpha dates,
2. Look for discordant K/Ar or $^{40}\text{Ar}/^{39}\text{Ar}$ or disagreement between the two complementary methods,
3. U/Pb, TIMS multi-grain or SHRIMP single-grain? If multi-grain, concordant or discordant, upper or lower intercept and how close to the intercept?

Ultimately, we found most K/Ar dates are in pretty good agreement with good U/Pb dates, but many TIMS multi-grain dates are questionable and some quite dubious.

In the example to the right, the top sketch shows a reasonable interpretation of age for a lower intercept and a likely spurious upper intercept. The middle sketch is the converse, a reasonable upper intercept and spurious lower intercept. The lower sketch shows data that is most likely completely spurious. Yet many age reports simply indicate a single age and maybe if it is concordant or an upper or lower intercept.



Lumping Map Units for the description (DMU)

An important step was to see if the 1,300 composite units could be reduced for the new map.

Step 1 was to link a number of existing databases to a copy of the "NSAkey" file (The database that tracks each of the 1,300 composite units.)

Another link was to a database that contained the unit descriptions used on published regional maps for each composite unit. The display then showed each description. And another link showed the description from each source map for that unit.

Step 2 was to examine that database with the links in place and do a rudimentary lumping based on related information.

For example, could all early Tertiary sedimentary units be combined?
Or can Cretaceous plutons be lumped?

The screenshot shows the NSAkey software interface. At the top, there are navigation controls including a search bar with '1020', a 'Records' indicator showing '1339 Total (Sorted)', and buttons for 'Show All', 'New Record', 'Delete Record', 'Find', and 'Sort'. Below this is a 'Layout: Map descriptions' dropdown and a 'View As' button. The main content area displays a record for 'symbol 505', 'overprint 101', 'label Spf', and 'nsaclass 6620'. The description is 'Paradise Fork Formation and correlative units'. Below the description are three detailed entries:

- DOG Nixon Fork sequence: Paradise Fork middle Silurian, late Llandoveryan to**
Spf Dark, platy limestone and limy shale. Is the middle third of the Nixon Fork sequence in its type area in the Medfra quadrangle. Age based on conodonts and graptolites. Depositional setting interpreted as deeper water, off-platform. Includes the type Paradise Fork Formation in Medfra quadrangle (Patton and others, 1980; Dutro and Patton, 1982) and unit Ssh in the western McGrath quadrangle (Bundtzen, unpublished data, 1997)
- NAP Farewell terrane, Nixon Fork subterrane of Upper Silurian, late Llandoveryan to**
Sls Primarily thin- to medium-bedded, laminated, dark gray to dark brown, platy lime mudstone, having strong petroliferous odor (Blodgett and Wilson, 2001). Coarse-grained limestone debris-flows having clasts of algal boundstone reef material common in uppermost part of unit; immediately below contact with overlying Sab unit. Age control comes from graptolites and conodonts, see Blodgett and Wilson (2001). Equivalent to uOll of Gilbert (1981) and Paradise Fork Formation of Dutro and Patton (1982)
- Y-K Paradise Fork Formation Early Devonian and Silurian**
DSp Deep-water turbiditic and hemipelagic deposits of dark, thin-bedded, fissile to laminated limestone, limy shale, and siltstone. The formation has an abundant graptolite, conodont, and ostracod fauna. It was originally assigned an Early to Late Silurian age by Dutro and Patton (1982), but subsequent investigations by Dumoulin and others (1997) indicate that it ranges from Silurian to Early Devonian

Below these entries is an 'Age' section with a table:

Wenlock	427.4		
Llandovery	443.4	date_add	rec_no 596

There are also sections for 'Units linked on State Label' and 'Descriptions' (a yellow button) and 'Units' (a red button). The 'Units linked on State Label' section shows a list of units with their state labels:

6620	DOG	State_label	DSpf	6615
6620	NAP	Sequence	B360	6620
6620	Y-K			6640

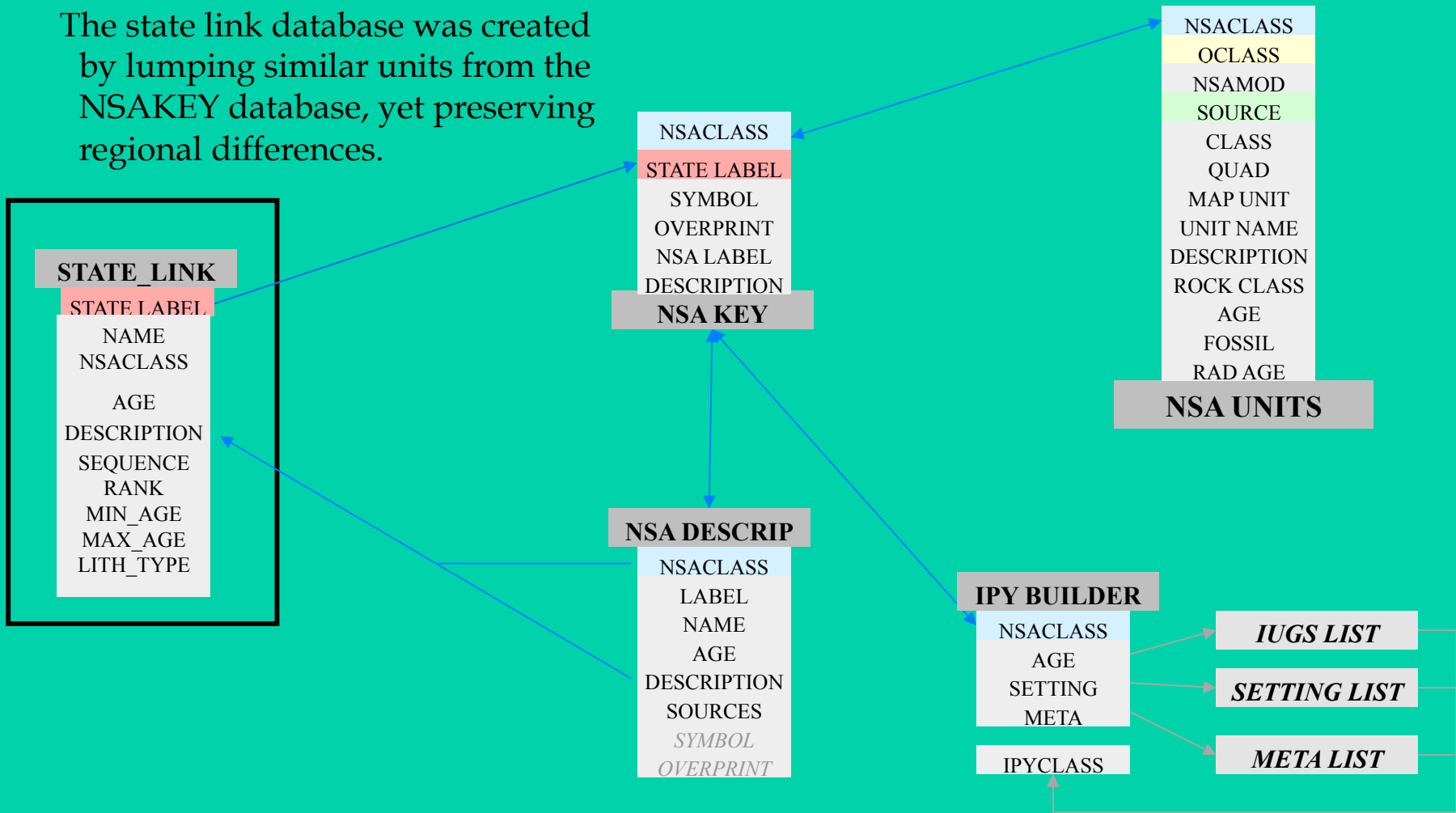
At the bottom, there is a list of units with their descriptions:

Sls	MD002	Dark-gray to black platy limestone and limy shale.
DSp	MD004	Deep-water turbiditic and hemipelagic deposits of dark, thin-bedded, fissile to
Ssh	MG003	Shale and siltstone; equivalent to Paradise Fork Formation of Dutro and
Sls	TA007	Thin- to medium-bedded, laminated, dark gray to dark brown, platy lime
Sls	TA008	Thin- to medium-bedded, laminated, dark gray to dark brown, platy lime

The bottom of the window shows a 'Browse' button and a status bar with '100'.

Linked files to create unit descriptions

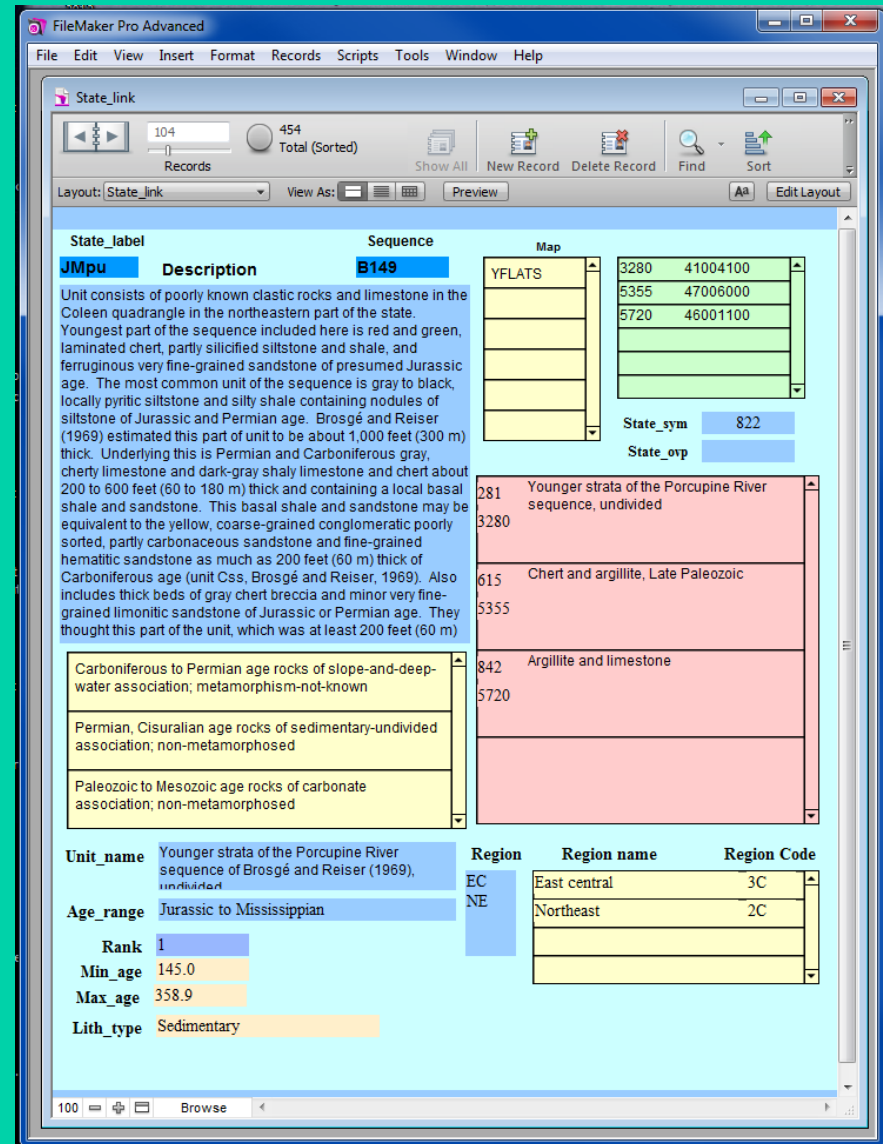
The state link database was created by lumping similar units from the NSAKEY database, yet preserving regional differences.



Winnowing the units down

This database was populated with the new lumped labels and also linked to a number of existing databases.

Map unit descriptions from either source maps or regional compilations that appeared to be useful were dragged into this database's description field for the regional map description database. Linked databases showed which regional maps were represented, which NSACCLASS codes and related IPYCLASS codes were included, and abstracted descriptions from the key and IPY databases. Also added was a unit rank, numeric maximum and minimum age and lithology type.

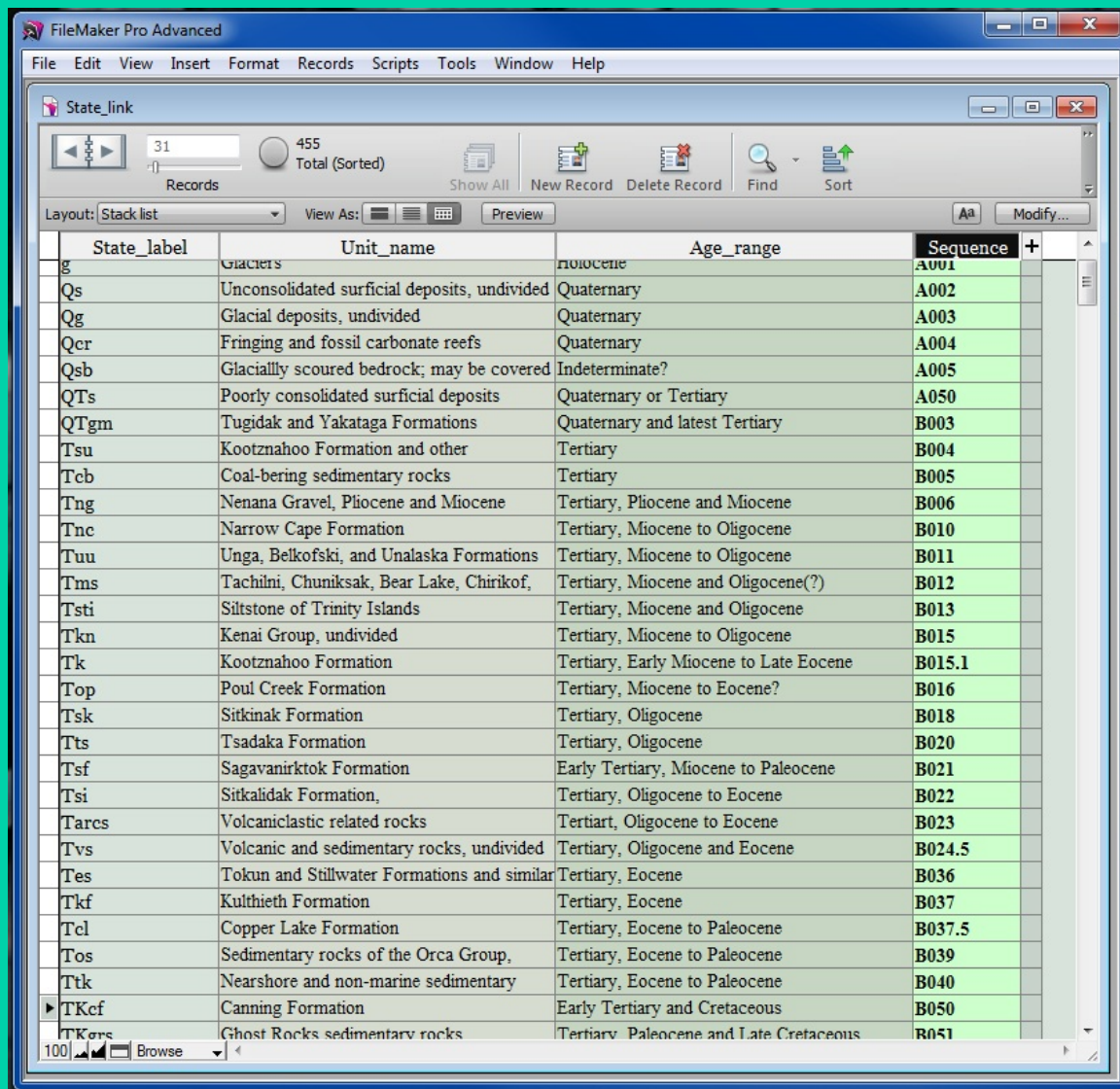


An initial sort and scan

The view of the data was switched to a table-like view and records were sorted by sequence number.

A quick scan of the table indicated any units that might be significantly out of sequence.

At the completion of this phase, the number of units had been reduced from a little more than 1,300 to about 450. Our desire was to reduce this further, without compromising the geologic or tectonic story, but it hasn't proved possible.



The screenshot shows the FileMaker Pro Advanced interface with a table view of geological data. The table is sorted by sequence number. The columns are State_label, Unit_name, Age_range, and Sequence. The records are listed in a table format with alternating row colors.

State_label	Unit_name	Age_range	Sequence
g	Glaciers	miocene	A001
Qs	Unconsolidated surficial deposits, undivided	Quaternary	A002
Qg	Glacial deposits, undivided	Quaternary	A003
Qcr	Fringing and fossil carbonate reefs	Quaternary	A004
Qsb	Glacially scoured bedrock; may be covered	Indeterminate?	A005
QTs	Poorly consolidated surficial deposits	Quaternary or Tertiary	A050
QTgm	Tugidak and Yakataga Formations	Quaternary and latest Tertiary	B003
Tsu	Kootznahoo Formation and other	Tertiary	B004
Tcb	Coal-bearing sedimentary rocks	Tertiary	B005
Tng	Nenana Gravel, Pliocene and Miocene	Tertiary, Pliocene and Miocene	B006
Tnc	Narrow Cape Formation	Tertiary, Miocene to Oligocene	B010
Tuu	Unga, Belkofski, and Unalaska Formations	Tertiary, Miocene to Oligocene	B011
Tms	Tachilni, Chuniksak, Bear Lake, Chirikof,	Tertiary, Miocene and Oligocene(?)	B012
Tsti	Siltstone of Trinity Islands	Tertiary, Miocene and Oligocene	B013
Tkn	Kenai Group, undivided	Tertiary, Miocene to Oligocene	B015
Tk	Kootznahoo Formation	Tertiary, Early Miocene to Late Eocene	B015.1
Top	Poul Creek Formation	Tertiary, Miocene to Eocene?	B016
Tsk	Sitkinak Formation	Tertiary, Oligocene	B018
Tts	Tsadaka Formation	Tertiary, Oligocene	B020
Tsf	Sagavanirktok Formation	Early Tertiary, Miocene to Paleocene	B021
Tsi	Sitkalidak Formation,	Tertiary, Oligocene to Eocene	B022
Tares	Volcaniclastic related rocks	Tertiary, Oligocene to Eocene	B023
Tvs	Volcanic and sedimentary rocks, undivided	Tertiary, Oligocene and Eocene	B024.5
Tes	Tokun and Stillwater Formations and similar	Tertiary, Eocene	B036
Tkf	Kulthieth Formation	Tertiary, Eocene	B037
Tcl	Copper Lake Formation	Tertiary, Eocene to Paleocene	B037.5
Tos	Sedimentary rocks of the Orca Group,	Tertiary, Eocene to Paleocene	B039
Ttk	Nearshore and non-marine sedimentary	Tertiary, Eocene to Paleocene	B040
TKkf	Canning Formation	Early Tertiary and Cretaceous	B050
TKKrs	Ghost Rocks sedimentary rocks	Tertiary, Paleocene and Late Cretaceous	B051

Creation of the draft document

Following the quick check, an export of the data was made.

The fields:

State_label,

Unit_name,

Age_range,

Description,

Sequence number,

and the applicable **NSACCLASS**

values were exported as tab delimited text, for import into MS Word.

A template in Word, provided by our publications unit was then used to set the basic format.

A unit description would come in looking like:

Tng Nenana Gravel Tertiary, Pliocene and Miocene Yellowish-gray to reddish-brown well-sorted, poorly to moderately consolidated conglomerate and coarse-grained sandstone having interbedded mudflow deposits, thin claystone layers, and local thin lignite beds widely distributed on the north side of the Alaska Range. Unit is more than 1,300-m-thick and moderately deformed (Csejtey and others, 1992; Bela Csejtey, written commun., 1993)
B006 570, 571

And upon revision and editing (minimal in this case) would look like:

Tng **Nenana Gravel** (Tertiary, Pliocene and late Miocene)—Yellowish-gray to reddish-brown well-sorted, poorly to moderately consolidated conglomerate and coarse-grained sandstone having interbedded mudflow deposits, thin claystone layers, and local thin lignite beds widely distributed on the north side of the Alaska Range. Unit is more than 1,300-m-thick and moderately deformed (Csejtey and others, 1992; Bela Csejtey, USGS, written commun., 1993)

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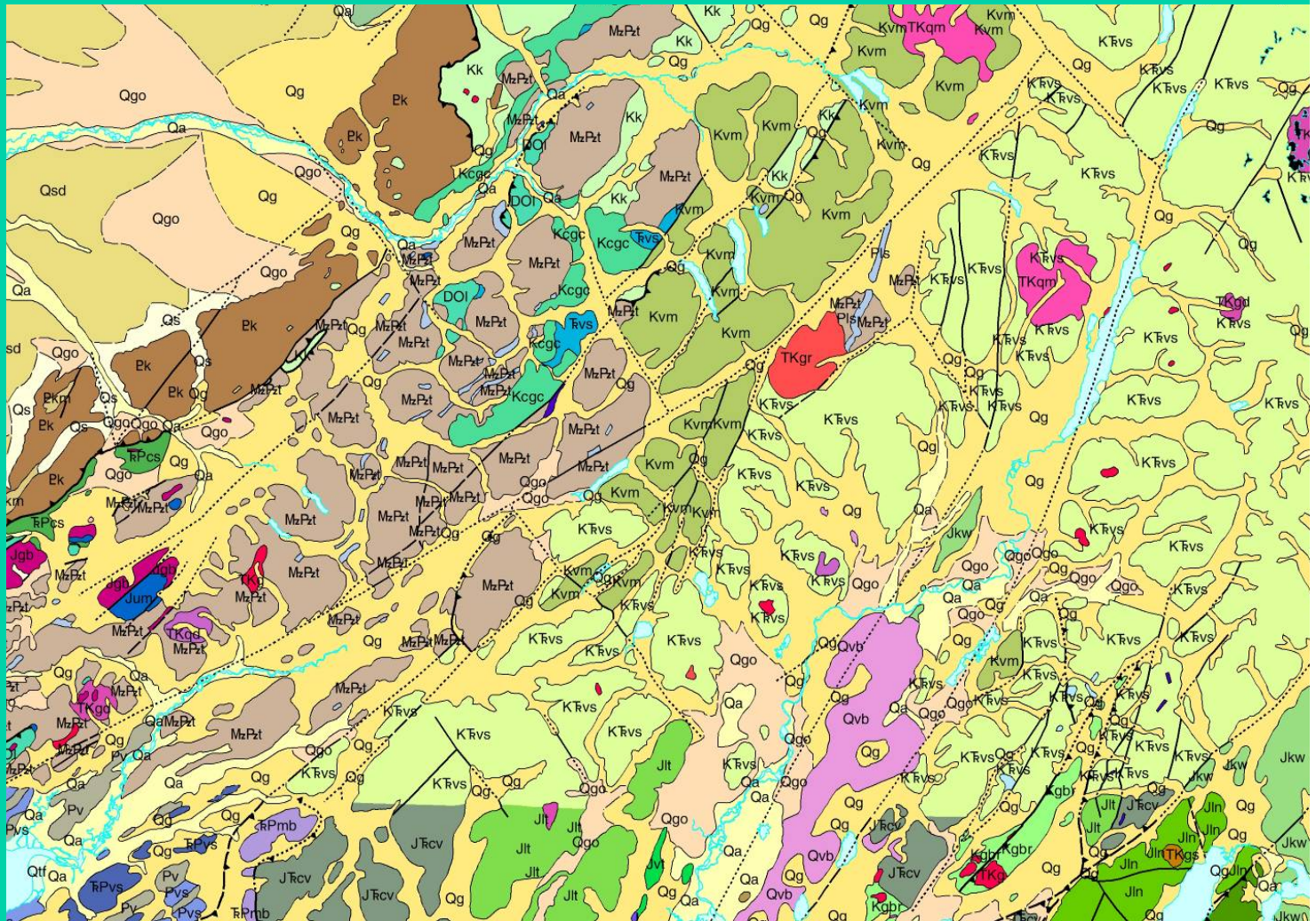
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Check routines

As we use geo-databases as well as coverages, we have created Python or AML check routines which generate a report we use to insure consistent coding. Items checked include:

- 1) Topology issues,
- 2) That polygon and arc codes are within proper ranges,
- 3) That polygon codes used are consistent with the master units database.



Typical check output

Shown here is a typical output from a "check" run for a quadrangle database. These check runs help us to ensure our data is topologically correct, properly and completely attributed.

Coverage location: o:\nsa\bt\btgeol
 Check run by: klabsy
 Date: 29 May 13 10:01:16 Wednesday
 Arc look-up table used: O:\LUTS\GEOLINE.LUT
 Polygon look-up table used: O:\LUTS\GFWPKEY.LUT
 Unit labels keyed to: NSACLASS

NSACLASS lut last updated:
 05/01/2013
 Filemaker lut last updated:
 05/29/2013

Labelerrors:
 Polygon 1 has 0 label points.
 Total number of Polygons with No Labels: 1
 Total number of Polygons with Multiple Labels: 0

Labels or arcs with non-LUT values:
 Arcs that may need to be flipped.
 Use O:\pantry\ams\direction.aml to flag the arcs
 listed with TMP = 1:

Number of arcs with same CLASS code on each side: 0
 Number of CONCEALED arcs separating different NSACLASS values: 0
 Number of invalid arcs bounding GLACIERS: 0
 Number of invalid arcs bounding WATER BODIES: 0
 Number of invalid BOUNDARY arcs: 0
 Number of ARC-CODE = 99 not defining the BOUNDARY: 0

ITEM STRUCTURE OF THE .PAI

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC	ALTERNATE NAME	INDEXED?
1	AREA	8	18	F	5		-
9	PERIMETER	8	18	F	5		-
17	BTGEOL#	4	5	B	-		-
21	BTGEOL-ID	4	5	B	-	ID	-
25	CLASS	4	5	B	-		-
29	QCLASS	4	5	B	-	QC	-
33	SOURCE	6	8	C	-		-
39	NSACLASS	4	5	B	-	NSA	-
43	NSAMOD	8	10	C	-	MOD	-
51	NSASUB	4	5	B	-	SUB	-
55	TMP	4	5	B	-		-

ITEM STRUCTURE OF THE .AAI

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC	ALTERNATE NAME	INDEXED?
1	FNODE#	4	5	B	-		-
5	INODE#	4	5	B	-		-
9	LPOLY#	4	5	B	-		-
13	RPOLY#	4	5	B	-		-
17	LENGTH	8	18	F	5		-
25	BTGEOL#	4	5	B	-		-
29	BTGEOL-ID	4	5	B	-	ID	-
33	ARC-CODE	3	3	I	-	AC	-
36	ARC-PARA1	3	3	I	-	AF1	-
39	ARC-PARA2	3	3	I	-	AF2	-
42	SOURCE	6	8	C	-		-
48	LINEID	8	10	C	-		-
56	TMP	4	5	B	-		-

UNIQUE ATTRIBUTES IN THE .PAI

Record	FREQUENCY	NSACLASS	CLASS	QCLASS	NSAMOD	SOURCE	LABEL2	FILEMAKER
1	1	0	0	0	0			
2	18	100	100	1000		BT003	Qa	X
3	481	102	102	102		BT001		
4	126	105	109	1050		BT003	Qa	X
5	6	120	112	1200		BT003	Qd	X
6	48	190	111	1900		BT003	Qew	X
7	1	285	127	2850		BT003	QTg	X
8	2	1103	105	0		BT002	Tvab	X
9	4	1160	110	0		BT002	Tfv	X
10	1	1160	135	0		BT002	Tfv	X
11	6	1602	129	0		BT003	TKgp	X
12	3	1603	136	0		BT003	TKvr	X
13	10	1990	115	0		BT002	Kgc	X
14	1	1990	171	0		BT003	Kgc	X
15	2	2030	116	0		BT003	Kipc	X
16	7	2030	120	0		BT002	Kipc	X
17	58	2180	125	0		BT002	Kvm	X
18	22	2491	131	0		BT003	Kmqm	X
19	1	2545	134	0		BT003	Ksy	X
20	10	3498	118	0		BT003	Jtu	X
21	1	3498	145	0		BT002	Jtu	X
22	9	5130	132	0		BT003	Jrtmu	X
23	24	5133	119	0		BT003	Jmtu	X
24	1	5133	140	0		BT002	Jmtu	X
25	3	5145	172	0		BT003	MzPz1	X
26	11	5340	150	0		BT002	Pzrm	X
27	1	5340	173	0		BT003	Pzrm	X
28	8	5561	155	0		BT002	Pzp	X
29	6	9325	122	0		BT003	PzZrqm	X
30	6	9325	170	0		BT002	PzZrqm	X

UNIQUE ATTRIBUTES IN THE .AAI

Record	CASE#	FREQUENCY	ARC-CODE	ARC-PARA1	ARC-PARA2	SOURCE
1	1	283	2	0	0	BT002
2	2	247	2	0	0	BT003
3	3	707	7	0	0	BT001
4	4	3	10	0	0	BT003
5	5	22	11	0	0	BT002
6	6	13	11	0	0	BT003
7	7	19	19	0	0	BT003
8	8	1	30	0	0	BT003
9	9	28	31	0	0	BT002
10	10	23	31	0	0	BT003
11	11	1	51	0	0	BT003
12	12	12	52	0	0	BT002
13	13	1	53	0	0	BT003
14	14	14	57	0	0	BT003
15	15	6	88	0	0	BT003
16	16	134	99	0	0	BT001

UNIQUE ATTRIBUTES IN THE .AAI

Record	CASE#	FREQUENCY	ARC-CODE	ARC-PARA1	ARC-PARA2	SOURCE
1	1	283	2	0	0	BT002
2	2	247	2	0	0	BT003
3	3	707	7	0	0	BT001
4	4	3	10	0	0	BT003
5	5	22	11	0	0	BT002
6	6	13	11	0	0	BT003
7	7	19	19	0	0	BT003
8	8	1	30	0	0	BT003
9	9	28	31	0	0	BT002
10	10	23	31	0	0	BT003
11	11	1	51	0	0	BT003
12	12	12	52	0	0	BT002
13	13	1	53	0	0	BT003
14	14	14	57	0	0	BT003
15	15	6	88	0	0	BT003
16	16	134	99	0	0	BT001

Description of DOUBLE precision coverage O:\nsa\bt\btgeol

FEATURE CLASSES

Feature Class	Subclass	Number of Features	Attribute data (bytes)	Spatial Index?	Topology?
ARCS			60		
POLYGONS		1514	58		Yes
NODES		878			
		1229			

SECONDARY FEATURES

Tics 92
 Arc Segments 75909
 Polygon Labels 877

TOLERANCES

Fuzzy = 10.000 V Dangle = 50.000 N

COVERAGE BOUNDARY

Xmin = 500000.000 Xmax = 636123.794
 Ymin = 7319720.173 Ymax = 7434345.982

STATUS

The coverage has not been Edited since the last BUILD or CLEAN.

COORDINATE SYSTEM DESCRIPTION

Projection UTM
 Zone 5
 Datum NAD27
 Units METERS Spheroid CLARKE1866
 Parameters:

Correlation of Map Units (CMU)

Levering off of the "State_link" database, a graph tool was written using a Python script that reads the database, capturing State_label, sequence number, color symbol, and the numeric maximum and minimum age, and lithologic type.

This Python script, run through ArcToolbox, is used to create the draft CMU graphic. The script uses the ArcMap graph tool to create a minimum-maximum age bar graph that shows the age relationships of units. Each bar on the graph is colored using the assigned color and identified by its unit label and sequence number. A numeric age scale-bar is drawn along the left side while the right side shows a geologic time scale.

Input to the tool can be a feature dataset or standalone table.

Graphs are created for each lithologic category selected when the tool is run. More than one category can be selected at once. For example, if just sedimentary rocks only one graph would be created; if sedimentary and igneous rocks were selected, two separate graphs would be created.

Output is a graphics file such as an image or eps file. There is also an option to output an ArcMap graph file that can be loaded into the ArcMap Graph Manager.

The graph tool is intended to provide a quick way to view the age relationships between units within different lithologic categories and to assist with the creation of a correlation of map units chart, but it is not a substitute for the cartographic process of creating the published version of a correlation of map units chart.

The screenshot shows the FileMaker Pro Advanced interface for a database named 'State_link'. The main window displays a data entry form with the following fields and values:

- State_label:** J149
- Description:** Unit consists of poorly known clastic rocks and limestone in the Coleen quadrangle in the northeastern part of the state. Youngest part of the sequence included here is red and green, laminated chert, partly silicified siltstone and shale, and ferruginous very fine-grained sandstone of presumed Jurassic age. The most common unit of the sequence is gray to black, locally pyritic siltstone and silty shale containing nodules of siltstone of Jurassic and Permian age. Brosgé and Reiser (1969) estimated this part of unit to be about 1,000 feet (300 m) thick. Underlying this is Permian and Carboniferous gray, cherty limestone and dark-gray shaly limestone and chert about 200 to 600 feet (60 to 180 m) thick and containing a local basal shale and sandstone. This basal shale and sandstone may be equivalent to the yellow, coarse-grained conglomeratic poorly sorted, partly carbonaceous sandstone and fine-grained hematitic sandstone as much as 200 feet (60 m) thick of Carboniferous age (unit C5s, Brosgé and Reiser, 1969). Also includes thick beds of gray chert breccia and minor very fine-grained limonitic sandstone of Jurassic or Permian age. They thought this part of the unit, which was at least 200 feet (60 m)
- Sequence:** B149
- Map:** YFLATS
- State_sym:** 822
- State_otp:** (empty)

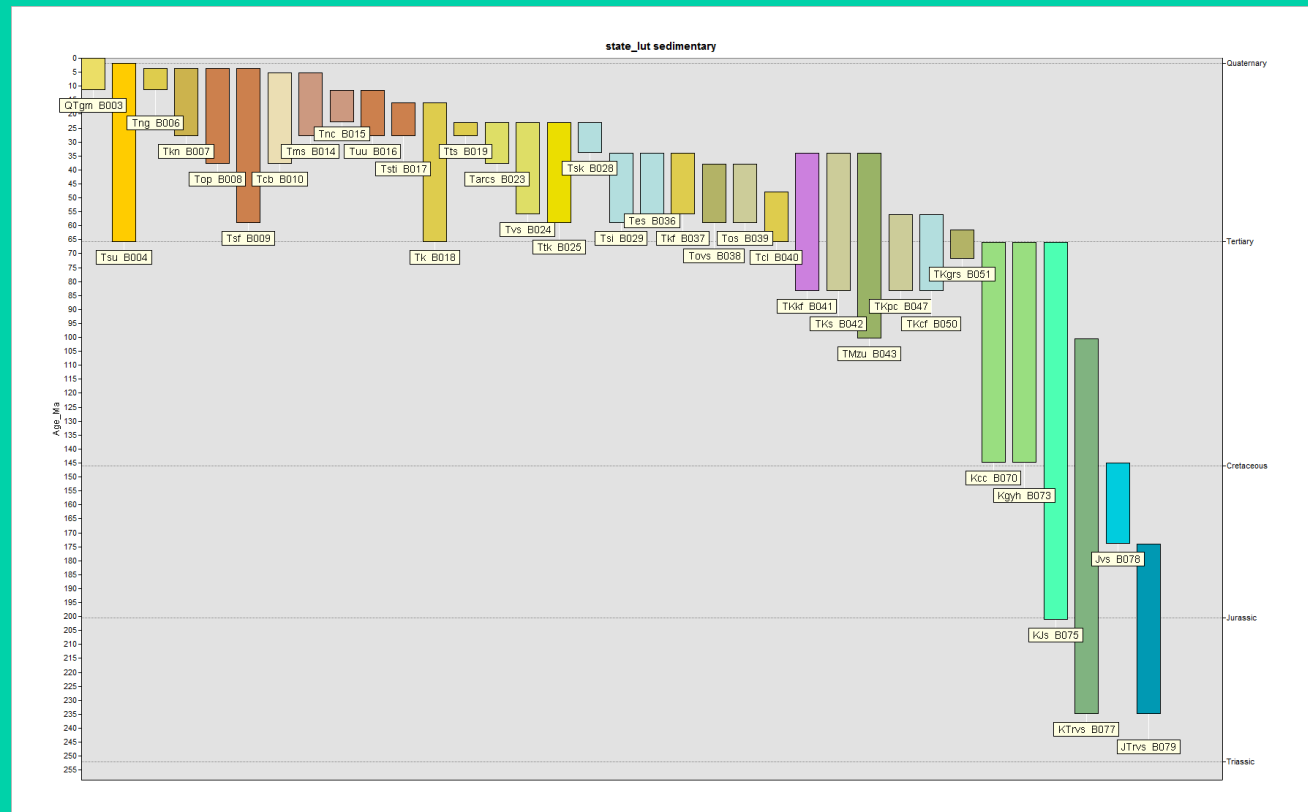
Below the main form, there is a table of map units with the following columns: Unit name, Age_range, Rank, Min_age, Max_age, Lith_type, Region, Region name, and Region Code.

Unit name	Age_range	Rank	Min_age	Max_age	Lith_type	Region	Region name	Region Code
Younger strata of the Porcupine River sequence, undivided	Jurassic to Mississippian	1	145.0	358.9	Sedimentary	EC NE	East central Northeast	3C 2C

Next - Correlation of Map Units

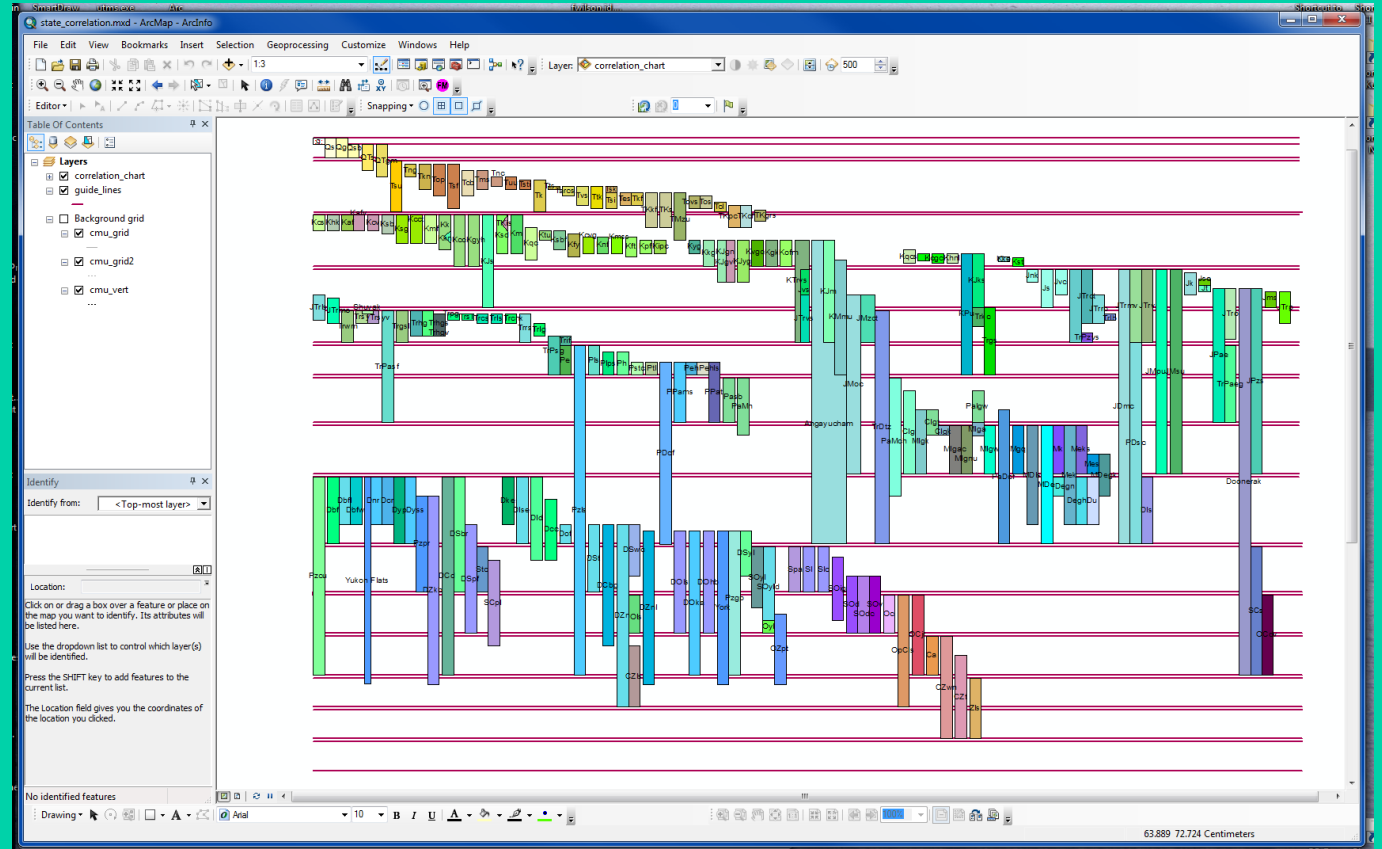
Shown is output from the Python script was created that read the State_link database and its newly added minimum and maximum age fields and generated a graphic of a draft Correlation of Map Units (CMU). As there are about 450 units, the images are sub-divided by lithologic type and apportioned to a reasonable units number per image.

Sample image



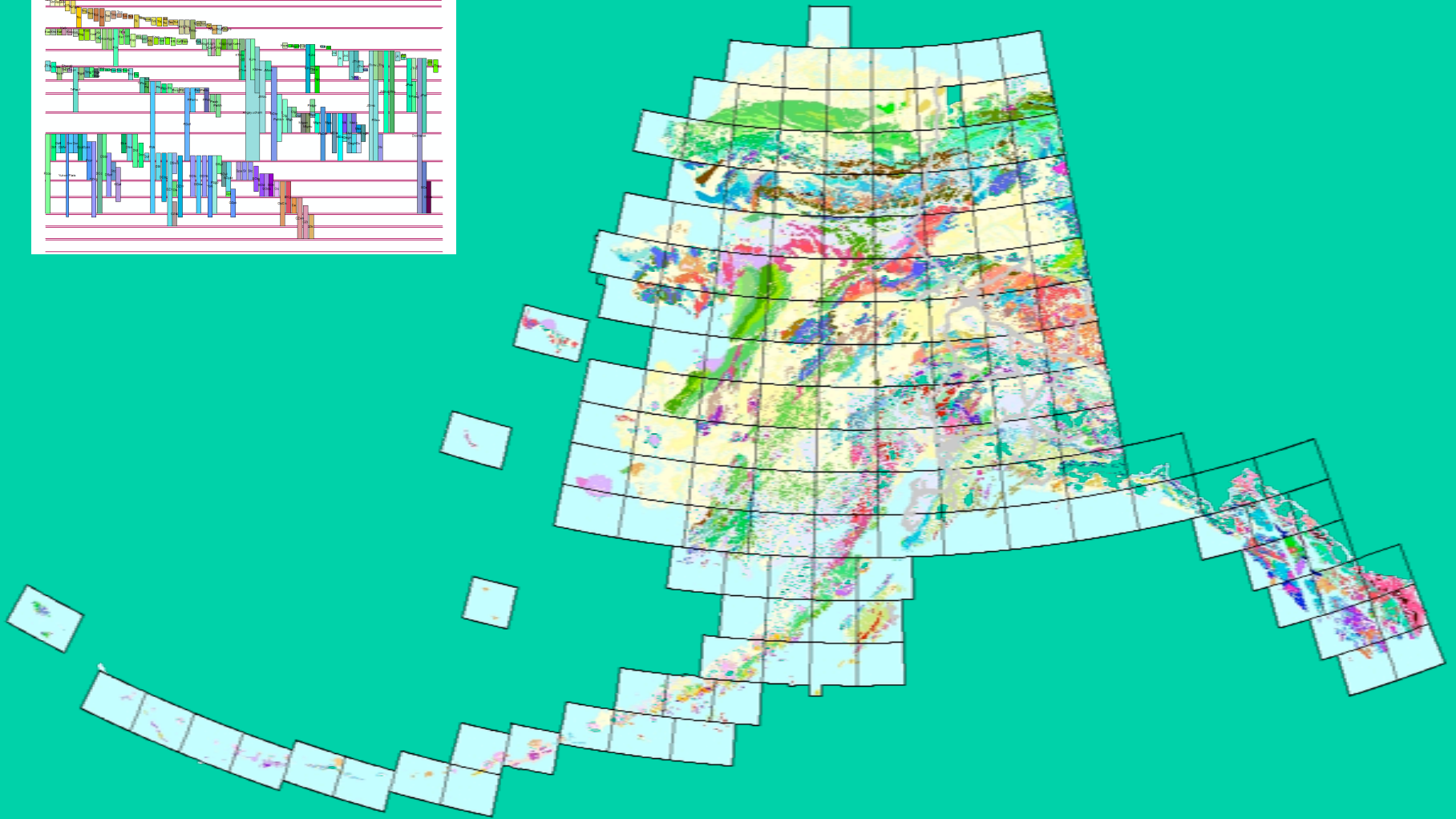
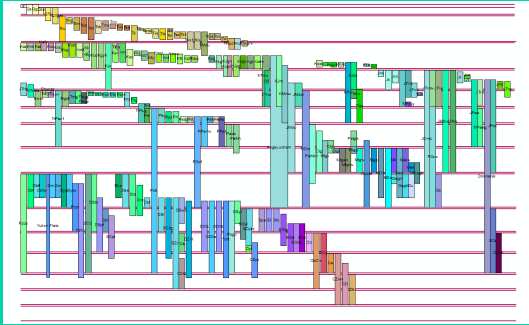
CMU next step

The draft CMU images were used as guides to create an ArcGIS MXD for the final CMU. The MXD is linked to the Filemaker Pro State_link database (using ODBC) such that once a box is drawn and attributed with a sequence number, the label and color symbol are automatically added. A hidden fishnet grid is used to snap vertices, ensuring proper alignment of boxes. If a label or color symbol is changed in the database, this change is reflected in the MXD by doing a refresh.



This draft version covers only the sedimentary rock units for the state map; additional charts will cover igneous and metamorphic rock units.

A mock-up of the new Alaska map



END OF PRESENTATION

Following slide adds information regarding
CMU python script.

CMU tools

A python script, run through ArcToolbox is used to create the draft CMU graphic. The tool is written as a python script that is run through ArcToolbox.

The python script uses the ArcMap graph tool to create a min.-max. age bar graph that shows the age relationships of units for a particular lithology. Each bar on the graph is colored using the correct color from the map and identified by its unit label and sequence number. A numeric age scale-bar is shown along the left side while the right side shows a geologic time scale.

Input to the tool can be a feature dataset or standalone table.

The input data for the geologic units must include the unit label, lithologic category, numeric minimum and maximum ages, and the color symbol values to apply.

Graphs are created for each lithologic category selected when the tool is run. More than one category can be selected at once. For example, if just sedimentary only one graph would be created; if sedimentary and igneous were selected, two separate graphs would be created.

Output from the tool are graphics files such as images or eps files. There is also an option to output an ArcMap graph file that can be loaded into the ArcMap Graph Manager.

The graph tool is intended to provide a quick way to view the age relationships between units within different lithologic categories and to assist with the creation of a correlation of map units chart, but it is not a substitute for the cartographic process of creating the published version of a correlation of map units chart.

