

PRELIMINARY INTEGRATED GEOLOGIC MAP DATABASES FOR THE UNITED STATES:

DIGITAL DATA FOR THE RECONNAISSANCE GEOLOGIC MAP OF THE LOWER YUKON RIVER REGION, ALASKA

by

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INTRODUCTION

These digital files represent part of a systematic effort to release geologic map data for the United States in a uniform manner. Geologic data in this series has been compiled from a wide variety of sources, ranging from state and regional geologic maps to large-scale field mapping. It is presented for use at a nominal scale of 1:500,000, although individual datasets may contain data for use at larger scales. The map area encompasses the land area of seven 1:250,000-scale quadrangles

on the southwestern Alaska mainland. The metadata associated with this release will provide more detailed information on sources and appropriate scales for use. Associated attribute databases accompany the spatial database of the geology and are uniformly structured for all maps in the series for ease in developing regional- and national-scale maps. This compilation was done as part of the U.S. Geological Survey's National Surveys and Analysis project, whose goal is to compile geologic, geochemical, geophysical, and mineral occurrence data for the United States.

The reconnaissance geologic map of the lower Yukon River region in southwest Alaska covers more than 30,000 square miles (78,000 square kilometers) of western Alaska or nearly five percent of the total land area of the state (fig. 1). It stretches from Norton Sound on the north to the Kilbuck Mountains on the south and from the Fox Hills and Russian Mountains on the east to the Bering Sea on the west and includes the delta of the Yukon River. Much of the western and southern parts of the region are a delta plain standing less than 100 meters above sea level and covered by Quaternary surficial deposits. Exposures of bedrock are confined to isolated mountain groups within the delta plain and to dissected uplands that border the delta plain in the eastern and northcentral parts of the map area. The geologic map of the lower Yukon River region was compiled from unpublished reconnaissance studies by J.M. Hoare, W.H. Condon, and W.L. Coonrad during the years between 1946 and 1971 and from more recent investigations in the Russian Mission C-1 1:63,360-scale quadrangle by Bundtzen and Laird (1991). Data from studies in the Kilbuck Mountains of the southern Russian Mission quadrangle by Box and others (1993), and in the southern Holy Cross quadrangle by Miller and others (1996; 1998a; b), as well as unpublished data from field work in 1987 by W. W. Patton Jr., M.L. Miller, J.M. Murphy, S.E. Box, and T.K. Bundtzen along the Yukon River in the Holy Cross and Russian Mission quadrangles were also used in this compilation.

The digital datasets that form the basis for this product were compiled and created using existing published and unpublished data. The spatial and text databases here are linked through use of a field, called *nsaclass* that is related to the age and lithology of the map units contained on each map. *Nsaclass* and the similar *qclass* field have been added to the polygon attribute table (PAT) of the spatial database (ARC/INFO coverage) and can also be found in the text databases of supplemental attribute data. These fields store information that correlates individual map units between sources. *Nsaclass* is used to make regional unit assignments and generally reflects a known or an inferred correlation of map units. For example, all "Surficial deposits, undivided" are assigned an *nsaclass* code of 100. The schema for *nsaclass* was developed as regional maps throughout Alaska were compiled and therefore reflects an iterative process. As new or additional information becomes available, the *nsaclass* code for a particular map unit may be changed, either to reflect lumping or, more generally, finer separation of map units. *Nsaclass* is used to cover the entire geologic time scale, whereas *qclass* is restricted to and provides finer detail for Quaternary map units. Fields called *source* and *nsamod* have also been added to the PAT. *Source* is a coded reference citation, indicating the manuscript or other source for the map information. The format for *source* is XX###, where XX is the two letter quadrangle code (CAPITAL letters) and ### is a three digit number (using leading zeros) to indicate a specific reference. *Nsamod* provides information with respect to hydrothermal alteration or contact metamorphism of a map unit, either for the entire unit or for an individual polygon. In this way, the *nsaclass* field needs only to store the primary map unit information. Fields also in the PAT are *class*, *label*, *min_age*, and *max_age* which are more fully described below. Finally, a field called *lith2* is in the PAT as a scratch field; no uniform schema has been developed for this field.

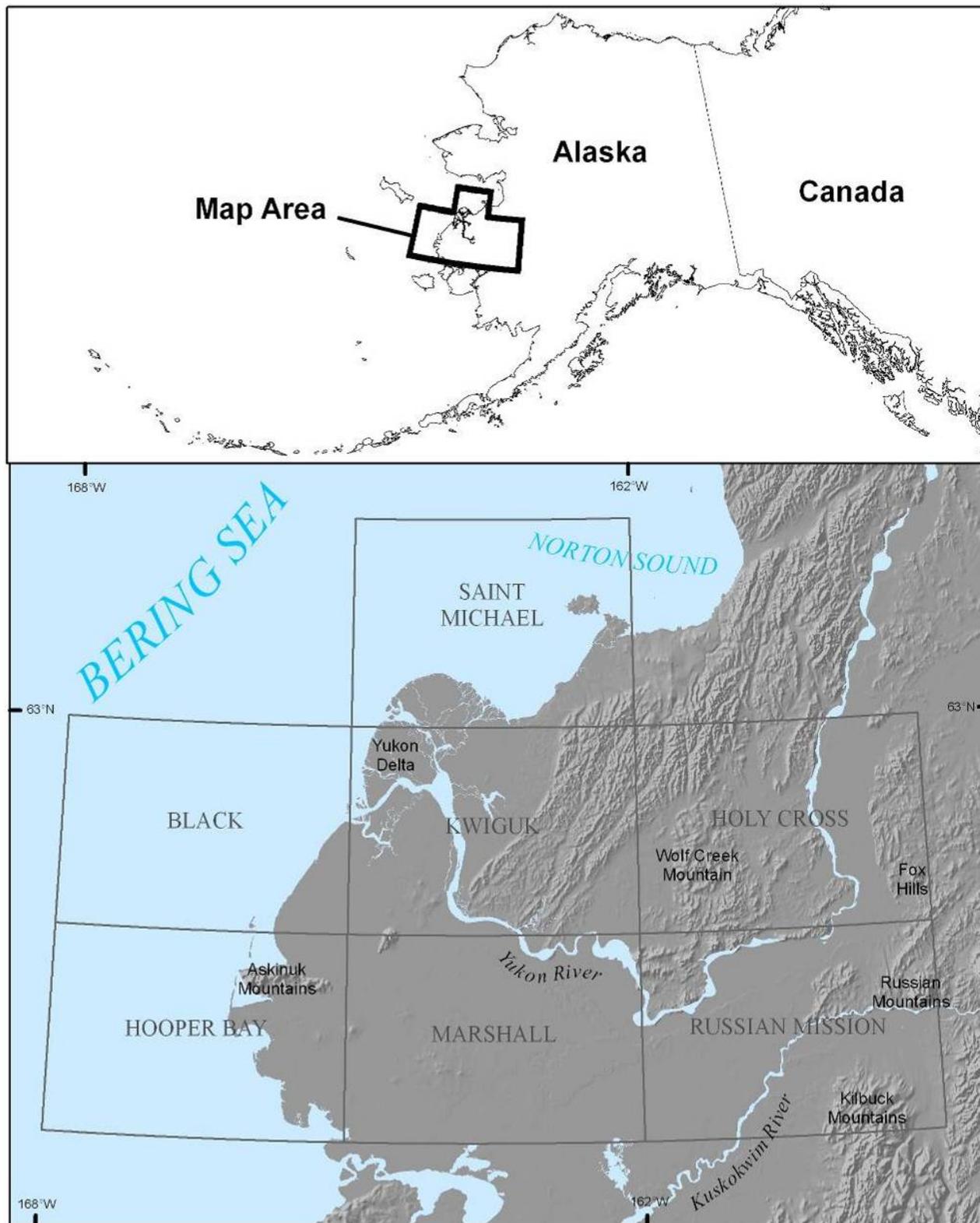


Figure 1. Location of the reconnaissance geologic map of the Lower Yukon River region showing the geographic setting and corresponding 1:250,000 scale quadrangles.

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The arc attribute table (AAT) stores attributes indicating the type of line features in the coverages and shape files. Inherent in the coding is information defining the type of line shown, such as a stratigraphic or fault contact, and location (certain, approximate, inferred, or concealed). In addition, each arc within a spatial database has a *source* attribute.

The standardized supplemental attribute tables were generated by extracting information from the legends of the source maps and from unpublished data by the compilers of this regional map. Thus, the age and lithologic information in the attribute tables may, in some cases, conflict with the information on the legends of the original source maps. This reflects new information for map areas for which maps may have been compiled decades ago. The standardized supplemental attribute tables record an abstracted map unit description, lithologic and age information, and references.

All geologic maps on which this compilation is based were published using the Universal Transverse Mercator projection (UTM; Zones 3 and 4), North American Datum 1927 (NAD-27). The spatial databases are provided in the native UTM projection of the sources as well as geographic coordinates. The UTM projection parameters are described in the metadata. Because of the distortions use of the UTM projection would produce on a map of small scale and large area, regional-scale products derived from this data that cross UTM zones should be plotted using a more appropriate Albers Equal-area projection. Regional maps in Alaska are commonly presented using an Albers Equal-area projection and the parameters for this projection are as follows:

Projection: Albers Equal-area
Horizontal datum: NAD'27
Spheroid: Clarke, 1866

1st Standard parallel: 55 degrees North
2nd Standard parallel: 65 degrees North
Central meridian: 154 degrees West
Latitude of projection origin: 50 degrees North
Units: meters
False easting (meters): 0
False northing (meters): 0

ArcView files can be viewed with the free viewer, ArcExplorer, which can be downloaded from: <http://www.esri.com/software/arcexplorer/>.

DATABASE TABLES

In order to manage the textural and coding information related to the lower Yukon River region geologic map, we have created a series of related and interlinked databases. These databases are a subset of the databases maintained statewide. As provided here, in addition to the native database format files (.fp5), as well as “.dbf” and “.csv” (comma separated values) files, we also include a runtime version of the primary databases, which are maintained using the commercial Filemaker Pro (version 5 or 6) database software. These databases are not directly connected to the ARC/INFO coverages; however, the data can be linked through either the native database files or the .csv or .dbf files that accompany this report. In a standalone mode, these databases can be used to guide searches of the coverages seeking particular sorts of information. A runtime version of the linked databases, as described below, is provided. By way of background, the .PAT files of the coverages have seven fields in them that correspond to fields in the FP5 databases. These fields are *class*, *nsaclass*, *qclass*, *label*, *min_ma*, *max_ma*, and *source*.

Eleven database tables are included here. They are:

LYUNITS: Subset of the statewide database containing abstracted geologic unit descriptions for each source map in the lower Yukon River region. Four .PAT fields, *class*, *nsaclass*, *qclass*, and *source*, mentioned above are duplicated in this database.

LYDESCRIP: This database ties *nsaclass* numbers to the more complete unit descriptions used on the lower Yukon River region geologic map. Linked to the LYUNITS database through the *nsaclass* field.

LYREFS: A subset of the statewide database containing the references for the source maps of the lower Yukon River region geologic map. Linked to the LYUNITS database through the *source* field.

NNSAKEY: The statewide database that shows the color symbol and label to be used for each *nsaclass* in the state. Note that these are **not** the colors and labels used on the lower Yukon River region geologic map. We used a custom shadeset for the lower Yukon River region geologic map and do not include it here. The geologic units will display well using the symbols as defined in NNSAKEY. The labels used on the lower Yukon River region geologic map are included in the LYDESCRIP database. This NNSAKEY database table is linked to the LYUNITS database through the *nsaclass* field. The required ARC/INFO shadeset is not included with this report; please contact the senior author for information on obtaining this shadeset or the color definitions. Alternatively, the statewide shadeset can be downloaded from

the following url in the arc-related files section of Wilson and others (1998):
<http://geopubs.wr.usgs.gov/open-file/of98-133-a/>.

NSAQKEY: Database is similar to NNSAKEY but it is used to subdivide the Quaternary surficial deposits by assigning color symbols and labels to only the Quaternary units. Linked to LYUNITS through *qclass*.

NSALITH: The statewide database that provides information to assign to geologic units specific rock types, lithologic form or mode of occurrence, and relative proportion of the unit that rock type represents. Linked to the LYUNITS database through the *nsaclass* field.

LITHLIST: Database containing all the lithologic terms (rock types) used in the lithologic coding – duplicated here in Appendix 1 of this document. Linked to the NSALITH database.

LITHFORM: Database containing the lithologic-form terms used for lithologic coding of geologic units – duplicated here in Appendix 1 of this document. Linked to the NSALITH database.

NSAAGE: The statewide database that provides information to assign specific ages to geologic units. Linked to the LYUNITS database through the *nsaclass* field.

TIME THESAURUS: Database containing the time terms used in age coding of geologic units. Linked to the NSAAGE database.

AGELIST: Database containing the minimum and maximum ages for every Eon, Era, Period, Epoch, and Age. Linked to the NSAAGE database through *Eon*, *Era*, *Period*, and *Epoch*.

RUNTIME APPLICATION

Included with this data release is a runtime application of the Filemaker Pro database tables. This application, which only functions under the Windows operating system, is provided as a zipped directory that contains the database tables and the necessary files to provide much of the functionality of the Filemaker Pro software. To use this application, unzip the supplied zip file, which will create a folder (directory) containing needed files. Within that folder will be a file named LYunits Solution.exe. Double click on this file to start the runtime application. The database tables can be scrolled by clicking on the “rolodex”-like icon in the upper left corner. Searches can be made by selecting the “Find mode”, found under the “View” tab and typing the desired search item in the appropriate field on the Find screen. A complete explanation of the software is not appropriate here, but experimentation will reveal many capabilities.

DATABASE STRUCTURES

LYUNITS database

The main database for the project is called LYUNITS. Entered into this database (Table 1) are brief abstracts of the unit descriptions from each source map, which are then classified into regional or statewide units. This database is the root for correlations of units, although not necessarily the final word (more on this below). For example, Early Cretaceous granodiorite from various maps might get the same *nsaclass* and therefore be assigned to a single map unit, yet when drawn to produce a particular map, it might be given the same symbol and color as granite and quartz monzonite of that age (only for that map). The standard view (called “GSA color”) of the database in Filemaker Pro software has portals to three other related databases, NNSAKEY, LYREFS, and NSALITH, which show the related values in these databases. These databases are linked through either the *nsaclass* or *source* fields in the LYUNITS database. The first seven fields in the database

come directly from the source, each of the other fields is assigned either at the time of entry into the database or later.

Using the LYUNITS database, a user can determine the disposition of any geologic unit from any source map for the map area that is in the statewide database. As such it includes unit descriptions from maps used for differing purposes or at different stages of the project.

Each source map used in the compilation will have all of its geologic units entered in this database. If a source map covers more than one quadrangle, units are entered for all covered quadrangles; however, only the geologic units that actually appear in a quadrangle will be entered for a quadrangle. The reference record for the source map will have an entry for each quadrangle covered by the map.

Table 1. LYUNITS field definitions.

	Field name	Information type	Field type	Links
1	<i>Quadrangle</i>	1:250,000–scale quadrangle, with the name fully spelled out. If a map covers multiple quadrangles, each quadrangle will have a set of entries for the appropriate units from that map in the database.	Text	
2	<i>Map unit</i>	Label given on the source map for a geologic unit. Some maps do not use labels; hence a color or pattern description would be entered here. In other cases, a unit subdivided using an overprint pattern (such as limestone lenses in a clastic unit) has an entry for each variation.	Text	
3	<i>Unit name</i>	Map unit name from the source map. If a map is divided in regions, terranes, or allochthons, etc., or the unit name explicitly mentions stratigraphic divisions, then this information is included in the unit name (for example, “Lisburne Group, Kuna Formation”, or “Greenstone of Venetie Subterrane of Arctic Alaska Terrane”). However, in general terrane terminology is not used in this database.	Text	
4	<i>Age</i>	Geologic age of the unit as given in the source. (Note this is age and not stratigraphic position; convert Upper to Late and Lower to Early.) In some cases, the age assignment has been subsequently revised; nevertheless, the age from the source map is entered.	Text	

Table 1. LYUNITS field definitions (cont.).

	Field name	Information type	Field type	Links
5	<i>Description</i>	An abstracted version of the unit description from the source map. Focuses on lithology and important relationships as described on the source map. Also includes any special notes regarding this unit from the source. This field, though of unlimited length, is kept short.	Text	
6	<i>Fossil</i>	Brief notes on any fossil control mentioned on the source map.	Text	
7	<i>Radiometric age</i>	Brief notes on radiometric ages.	Text	
8	<i>Source</i>	Unique code assigned to each source; uses the 2-letter quadrangle code and a three digit number. By default, 001 is reserved for the topographic map for each quadrangle. Numbers above 100 indicate sources that may be significant but not captured digitally.	Text and number combined	LYREFS, Arc coverage
9	<i>Rock class</i>	General classification of unit: Igneous, Sedimentary, Metamorphic, Unconsolidated, or Melange. For mixed units, the dominant category.	Text, defined values	
10	<i>Nsamod</i>	An item to indicate if unit is altered, contact metamorphosed, or has a queried unit assignment. Some maps show contact metamorphosed areas as separate units; these units are assigned the <i>nsaclass</i> for the appropriate protolith and have “HFS” selected as <i>nsamod</i> value. If only a few polygons of a unit are altered or contact metamorphosed, then the <i>nsamod</i> value will be set for those polygons only in the ARC coverage. Queried units, Tk? versus Tk for example, have the same <i>nsaclass</i> codes, but Tk? will have “Q” selected as <i>nsamod</i> value.	Text, defined values	Arc coverage
11	<i>Class</i>	Unique numeric code assigned to each <i>source</i> unit. (Unique only within a given quadrangle and specific to each <i>source</i> .)	Number	Arc coverage
12	<i>Nsaclass</i>	Regional numeric code assigned to like units – the main key field in the database.	Number	Arc coverage, NNSAKEY, NSALITH

Table 1. LYUNITS field definitions (cont.).

	Field name	Information type	Field type	Links
13	<i>Maplabel</i>	Label used on the lower Yukon River region geologic map map.	Text	LYDESCRIP
14	<i>Qclass</i>	Similar to <i>nsaclass</i> ; allows finer subdivision of Quaternary geologic units.	Number	Arc coverage

Within the database itself (see runtime version), portals in the LYUNITS database provide views into the LYDESCRIP, NNSAKEY, NSALITH, NSAAGE, and LYREFS database tables, allowing the user to see the linked data applicable to any record.

NNSAKEY database

The second most used database is called NNSAKEY (Table 2). This table is analogous to an ARC/INFO lookup table from which labels and colors are applied to the map. In fact, the primary lookup table used within ARC for many derivative products is derived directly from this database by importing it (NNSAKEY) into INFO. The primary field in this database is *nsaclass*, linking it to the LYUNITS database and to the ARC coverages for each quadrangle. It is here that each unit gets assigned a symbol (color), overprint pattern, and tentative label to be used on geologic map products. This database allows control of the symbols and labels assigned to units and it helps to eliminate undesired duplication. The database also includes a description field, which summarizes the regional unit in a sentence or less and commonly lists the source maps that contain the unit. This database is not only exported to INFO to create the lookup table but is also exported to MS Word to assist in the classification of units. Portals in the NNSAKEY database provide a view into LYUNITS and back into itself (NNSAKEY). The portal that looks inward is particularly useful because it allows a user to see instantly what other units have been assigned a particular symbol. This is important, because although our shadeset ostensibly has 999 colors, in reality, only about 130 can be distinguished by eye on plots. As a result, a color will get assigned to more than one unit and overprint patterns must be used to distinguish subsets. The ARC/INFO Shadeset used can be downloaded from the following url in the arc-related files section of (Wilson and others, 1998): <http://geopubs.wr.usgs.gov/open-file/of98-133-a/>. The NNSAKEY database is also used to assign duplicate colors and labels to units that are lumped in some map products, but otherwise need to be maintained as separate units in the database.

Table 2. NNSAKEY field definitions

	Field name	Information type	Field type	Links
1	<i>Symbol</i>	Color number used, derived from an ARC/INFO shadeset.	Number	NNSAKEY (self-linked)
2	<i>Overprnt</i>	Pattern number used, also derived from an ARC/INFO shadeset.	Number	
3	<i>Label</i>	Map label printed on map products.	Text	
4	<i>Nsaclass</i>	Regional numeric code assigned to like units – the main key field in the database	Number	LYUNITS, Arc coverage
5	<i>Description</i>	Brief (5-10 words) summary of unit on a regional basis.	Text	

LYDESCRIP database

This database (Table 3) ties *nsaclass* numbers to the more complete unit descriptions used on the lower Yukon River region geologic map compilation and it is linked to the LYUNITS database through the *nsaclass* field. This database has portals into LYUNITS and NNSAKEY databases.

Table 3. LYDESCRIP field definitions

	Field name	Information type	Field type	Links
1	<i>Label</i>	Map unit label as used on the lower Yukon River geologic map.	Text	
2	<i>Name</i>	Map unit name as used on the lower Yukon River geologic map.	Text	
3	<i>Nsaclass</i>	Regional numeric code assigned to like units – the main key field in the database.	Number	LYUNITS, NNSAKEY
4	<i>Age</i>	Assigned age (range).	Text	
5	<i>Description</i>	Full text of unit description as used on the lower Yukon River geologic map.	Text	
6	<i>Sources</i>	Source for unit descriptions (not the same form the “ <i>source</i> ” in other database tables).	Text	
7	<i>Symbol</i>	Color number used, derived from an ARC/INFO shadeset. Only included here if a custom color assignment used that varies from NNSAKEY.	Number	
8	<i>Overprnt</i>	Pattern number used, also derived from an ARC/INFO shadeset. Only included here if a custom shade assignment used that varies from NNSAKEY.	Number	

LYREFS database

The LYREFS database (Table 4) contains the reference citation for each source map and other publication used. Included in the reference database will be maps that have been digitized, as well as other publications that result in changes to the map (say a paper reassigning some rocks from one unit to another or giving age determinations). It will also list as "written commun." the source of unpublished information responsible for changes to particular aspects of the map. If a source map covers multiple quadrangles, it will be assigned an identification code for each quadrangle. This database has a portal into LYUNITS, showing the units from any given source in the LYUNITS database.

Table 4. LYREFS field definitions

	Field name	Information type	Field type	Links
1	<i>Source</i>	Unique code assigned to each source that uses the two letter quadrangle id and a three digit number. This field is forced to have only unique entries by the database software.	Text and number	LYUNITS, Arc coverage

Table 4. LYREFS field definitions (cont.)

	Field name	Information type	Field type	Links
2	<i>Refnum</i>	A unique tracking number assigned by the database software to each reference.	Number, auto entry	
3	<i>Reference</i>	USGS style reference citation. Also lists written communications where appropriate for modifications to maps.	Text	

NSAQKEY database

The NSAQKEY database (Table 5) is similar to NNSAKEY but it is used to subdivide the Quaternary surficial deposits by assigning color symbols and labels to the Quaternary units. The table is used as an ARC/INFO lookup table to assign the symbols, overprints, and labels to the surficial deposits.

Table 5. NSAQKEY field definitions

	Field name	Information type	Field type	Links
1	<i>Symbol</i>	Color number used, derived from an ARC/INFO shadeset.	Number	
2	<i>Overprnt</i>	Pattern number used, also derived from an ARC/INFO shadeset.	Number	
3	<i>Unit Label</i>	Map label printed on map products.	Text	
4	<i>Nsaiclass</i>	Regional numeric code assigned to like units – the main key field in the database.	Number	
5	<i>Qclass</i>	Numeric code used to subdivide surficial deposits.	Number	LYUNITS, Arc coverage
6	<i>Geologic Unit</i>	Brief (5-10 words) summary of unit on a regional basis.	Text	
7	<i>Sources</i>	Sources containing the unit and name of unit on original source map.	Text	

NSALITH database

The NSALITH database (Table 6) contains lithologic coding for each *nsaiclass* in the database. It uses a lithologic dictionary that is contained in special linked database tables called LITHLIST and LITHFORM (listed as Appendices 1 and 2 herein). It allows for the entry of as many lithologies for a unit as needed and therefore has a many-to-one relationship through the *nsaiclass* field. This database has a portal into the LYUNITS database, showing which source maps contain that *nsaiclass*.

A special field in this database combines the values of 5 other fields in the database. This field allows searching of the database at any level of the lithologic hierarchy without the need to be concerned about the level of a given term. Possible searches, for example, are for any unit containing carbonate or for any unit where limestone is a major lithology. The *rank* field has four defined values allowed; Major, meaning greater than or equal to 33 percent; Minor, between 10 and

33 percent; Incidental, less than 10 percent; and Indeterminate (major). Major is added to the indeterminate category to insure “failsafe” or inclusive searches for major rock types, as rock types listed in the indeterminate category could well be major components of a map unit. These can be eliminated from search results by explicitly omitting “Indeterminate” from the result.

Table 6. NSALITH field definitions

	Field name	Information type	Field type	Links
1	<i>Nsaclass</i>	Regional numeric code assigned to like units – the main key field in the database.	Number	LYUNITS
2	<i>Lith1</i>	Highest level lithologic classification.	Text, value list	
3	<i>Lith2</i>	Next level lithologic classification, values are based on the value of <i>lith1</i> field.	Text, value list	
4	<i>Lith3</i>	As above, based on the value of <i>lith2</i> field.	Text, value list	
5	<i>Lith4</i>	As above, based on the value of <i>lith3</i> field.	Text, value list	
6	<i>Lith5</i>	As above, based on the value of <i>lith4</i> field.	Text, value list	
7	<i>Form</i>	Description of form of units, derived from a list based on the value of <i>lith1</i> field.	Text, value list	
8	<i>Rank</i>	Values allowed are: Major, Minor, Incidental, and Indeterminate (major).	Text, value list	
9	<i>Lithology</i>	Field from an earlier lithologic classification and generally not used.	Text	
10	<i>Percent</i>	Optional field containing an estimate of percent of unit that given lithology represents. This information is rarely available in Alaska.	Number	
11	<i>Comment</i>	Free form comment field – optional.	Text	
12	<i>Record_no</i>	Unique tracking number assigned by the database software to each record.	Number, auto entry	
13	<i>Totallith</i>	Text string that combines the information in all of the <i>lith</i> fields, allowing searches based on any aspect of the lithologic hierarchy.	Text, auto entry	

NSAAGE database

The NSAAGE database table (Table 7) is used like the NSALITH table to assign a uniform age to each *nsaclass* unit. The fields in it are assigned using a data dictionary (using the AGELIST database table) derived from the 1983 DNAG time scale (Geological Society of America, 1983) to assign maximum and minimum ages (using the TIME THESAURUS database) to geologic units. The database software then creates a field that has the full definition of the minimum or maximum age of the unit, allowing searches based on any part of the time scale, similar to the *totalith* field described above. For example, searches could be for units that are Paleozoic but no older than

Devonian. Because minimum and maximum numeric ages are also populated in the databases, any unit can be searched based on a numeric maximum and minimum age as well.

Note that the ages assigned in this database are for an *nsaclass* unit and may not necessarily match the assignments made on any given source map. The assignment of a geologic unit to an *nsaclass* controls the lithology and the age referenced to that unit by the database. For example, a source map may call a unit Paleozoic, yet current knowledge may indicate that unit is actually Permian in age. The LYUNITS database will list the Paleozoic age as shown in the source whereas the NSAAGE database will most likely show the Permian age assignment, based on current knowledge and the assignment of an appropriate *nsaclass*.

Table 7. NSAAGE field definitions

	Field name	Information type	Field type	Links
1	<i>Nsaclass</i>	Regional unit code as used above.	Number	LYUNITS, Arc coverage
2	<i>Unit_link</i>	Field only used in the conterminous US and is similar in some respects to <i>nsaclass</i> (included for compatibility with Conterminous US databases).	Text	(Conterminous US databases)
3	<i>Min_eon</i>	The minimum or youngest age assignment for the eon of the unit, based on geologic interpretation.	Text, value list	
4	<i>Min_era</i>	As above, for era.	Text, value list	
5	<i>Min_period</i>	As above, for period.	Text, value list	
6	<i>Min_epoch</i>	As above, for epoch.	Text, value list	
7	<i>Min_age</i>	As above, for age.	Text, value list	
8	<i>Full_min</i>	Complete, concatenated minimum age assignment.	Text, auto entry	
9	<i>Max_eon</i>	The maximum or oldest age assignment for the eon of the unit, based on geologic interpretation.	Text, value list	
10	<i>Max_era</i>	As above, for era.	Text, value list	
11	<i>Max_period</i>	As above, for period.	Text, value list	
12	<i>Max_epoch</i>	As above, for epoch.	Text, value list	
13	<i>Max_age</i>	As above, for age.	Text, value list	
14	<i>Full_max</i>	Complete, concatenated maximum age assignment.	Text, auto entry	

Table 7. NSAAGE field definitions (cont.)

	Field name	Information type	Field type	Links
15	<i>Type</i>	Unit age assigned relatively (stratigraphic position or fossils) or absolutely (radiometric age).	Text, value list (Relative or Absolute)	
16	<i>Cmin_age</i>	The most precise minimum age coded, derived from the <i>full_min</i> field.	Text, auto entry	
17	<i>Cmax_age</i>	The most precise maximum age coded, derived from the <i>full_min</i> field.	Text, auto entry	
18	<i>Min_Ma</i>	Numeric, either from the DNAG table or radiometric determinations.	Number, auto entry	
19	<i>Max_Ma</i>	Numeric, either from the DNAG table or radiometric determinations.	Number, auto entry	
20	<i>Age_comments</i>	Free form comment field – optional.	Text	

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APPENDIX 1. LITHOLOGIC DATA DICTIONARY

Lith1	Lith2	Lith3	Lith4	Lith5
Unconsolidated	Coarse-detrital	Boulders Gravel Sand		
	Fine-detrital	Clay Silt		
	Coral Marl Peat			
Sedimentary	Clastic	Mixed-clastic	Conglomerate-mudstone Conglomerate-sandstone Sandstone-mudstone Siltstone-mudstone	
		Conglomerate Sandstone	Arenite Arkose Graywacke	Calcarenite
		Siltstone Mudstone	Claystone Shale	Bentonite Black-shale Oil-shale Phosphatic-shale
	Carbonate	Sedimentary-breccia Dolostone Limestone	Chalk Coquina	
	Chemical	Marlstone Banded-iron-formation Barite Chert Diatomite		

APPENDIX 1. LITHOLOGIC DATA DICTIONARY (CONT.)

Lith1	Lith2	Lith3	Lith4	Lith5	
Sedimentary		Evaporite			
			Anhydrite Gypsum Salt		
		Novaculite Phosphorite			
	Coal	Anthracite Bituminous Lignite Sub-bituminous			
Igneous	Plutonic	Granitic	Alkali-feldspar-granite	Alkali-granite	
			Granite	Monzogranite Syenogranite	
			Granodiorite Leucocratic-granitic	Alaskite Aplite Pegmatite Quartz-rich-granitoid	
			Tonalite	Trondhjemite	
			Charnockite Syenitic		
				Alkali-feldspar-syenite Monzonite Quartz-alkali-feldspar-syenite Quartz-monzonite Quartz-syenite Syenite	
		Dioritic	Diorite Monzodiorite Quartz-monzodiorite Quartz-diorite		

APPENDIX 1. LITHOLOGIC DATA DICTIONARY (CONT.)

Lith1	Lith2	Lith3	Lith4	Lith5
Igneous				
	Plutonic			
		Gabbroic		
			Gabbro	Gabbronorite Norite Troctolite
			Monzogabbro Quartz-gabbro Quartz- monzogabbro	
		Anorthosite Ultramafic		
			Hornblendite Peridotite	Dunite Kimberlite
			Pyroxenite	
		Foidal-syenitic		
			Foid-syenite Cancrinite-syenite Nepheline-syenite Sodalite-syenite	
		Foidal-dioritic Foidal-gabbroic Foidolite Melilitic Intrusive- carbonatite		
	Hypabyssal			
		Felsic-hypabyssal		
			Hypabyssal-dacite Hypabyssal-felsic- alkaline Hypabyssal-latite Hypabyssal-quartz- latite Hypabyssal-quartz- trachyte Hypabyssal-rhyolite Hypabyssal-trachyte	
		Mafic-hypabyssal		
			Hypabyssal-andesite Hypabyssal-basalt Hypabyssal-basaltic- andesite Hypabyssal-mafic- alkaline	
		Lamprophyre		

APPENDIX 1. LITHOLOGIC DATA DICTIONARY (CONT.)

Igneous			
	Volcanic		
		Alkalic-volcanic	Basanite Foidite Phonolite
		Felsic-volcanic	Dacite Latite Quartz-latite Quartz-trachyte Rhyolite Trachyte
		Mafic-volcanic	Andesite Basalt Basaltic-andesite
		Ultramafic	Komatiite Picrite
Metamorphic			
	Amphibolite Argillite Eclogite Gneiss		
		Orthogneiss Paragneiss	
	Granofels Granulite Greenstone Hornfels Marble Metasedimentary Metavolcanic Migmatite Phyllite Quartzite Schist Serpentinite Skarn Slate		
Tectonite			
	Cataclastite Mylonite		
		Phyllonite	
	Melange		
Water			
Ice			
Indeterminate			

APPENDIX 2. LITHFORM DATA DICTIONARY

Lith1	Lithologic form	Lith1	Lithologic form
Unconsolidated		Igneous	
	Alluvial		Batholith
	Beach		Diabase
	Bed		Dike or sill
	Colluvial		Dome
	Eolian		Flow
	Eolian, loess		Flow, pillows
	Estuarine		Laccolith
	Flow, mass movement		Melange
	Fluvial		Pluton
	Glacial		Pyroclastic
	Glacial, drumlin		Pyroclastic, air fall
	Glacial, esker		Pyroclastic, ash-flow
	Glacial, outwash		Pyroclastic, cinder cone
	Glacial, rock glacier		Pyroclastic, tuff
	Glacial, till		Stock or pipe
	Lacustrine		Volcaniclastic
	Landslide		Volcaniclastic, lahar
	Mass wasting		Volcaniclastic, volcanic breccia
	Solifluction	Metamorphic	
	Swamp		Amphibolite
	Tailings		Amphibolite, epidote-amphibolite
	Terrace		Eclogite
	Terrace, marine		Glaucophane-schist
	Terrace, stream		Granulite
Sedimentary			Greenschist
	Bed		Hornfels
	Calcareous		Hornfels, biotite
	Carbonaceous		Hornfels, hornblende
	Coquina		Hornfels, pyroxene
	Deltaic		Hornfels, sanidine
	Dome		Pelitic
	Glaucconitic		Zeolitic (prehnite-pumpellyite)
	Lens	Tectonite	
	Melange		Melange, blocks
	Olistrostrome		Melange, matrix
	Reef	Water	
	Tuffaceous		Lake, stream, or ocean
		Ice	
			Mass