PREPROCESSING

In the source file, first complete the following procedures.

First, combine all descriptions from the "Description" and "Composition" columns from the DNR database, into a single column containing all lithology descriptions

  This function works well for this purpose: =IF(G2="Other",F2,CONCATENATE(G2," ",F2)) *(G2 is Composition, F2 is Description)*

Find all "ditto", "same as above", and "DO" rows and fill in from above rows if necessary

Then, use find and replace to convert adjectives to nouns

FIND = REPLACE

SANDY CLAY = CLAY AND SAND

CLAYEY SAND = SAND AND CLAY

SILTY CLAY = CLAY AND SILT

CLAYEY SILT = SILT AND CLAY

SANDY SILT = SILT AND SAND

SILTY SAND = SAND AND SILT

SANDY GRAVEL = GRAVEL AND SAND

GRAVELLY SAND = SAND AND GRAVEL

SILTY GRAVEL = GRAVEL AND SILT

GRAVELLY SILT = SILT AND GRAVEL

CLAYEY GRAVEL = GRAVEL AND CLAY

GRAVELLY CLAY = CLAY AND GRAVEL

  And perhaps these as well, <u>after</u> doing the above

CLAYEY = CLAY

SILTY = SILT

SANDY = SAND

GRAVELLY = GRAVEL

SHALEY = SHALE

LIMEY = LIMESTONE

Then, use find and replace to reverse the order of grain-size description terms (The program assumes the grain size descriptions precede the primary lithology, and that is the way most drillers have done it over the years).

Sand fine-med = FINE TO MEDIUM SAND

Sand med-coarse = MEDIUM TO COARSE SAND

Then, replace all punctuation (commas, periods, dashes, forward slashes, backslashes, colons, semicolons, and quotations) with a space. This is because the search functions below assume all words exist between spaces. Also, make sure there are no ampersands connecting words without spaces.

To take care of "same as above" and "ditto", use this formula =IF(ISNUMBER(SEARCH("same as above",A2,1)),B1,A2)

LITHOKAT PROGRAM

This series of functions searches for "find terms", which are user-defined text strings (lithology descriptors) within the driller's description. It populates an array with numbers representing the position, from left to right, of the start of each "find term" within the description.

      1   2   3

=IF(ISNUMBER(SEARCH(" "&B$2&" "," "&'Borehole Log'!$D2&" ",1)),SEARCH(" "&B$2&" "," "&'Borehole Log'!$D2&" ",1),"")

      A logical test of the driller's description to determine whether or not it contains a specific lithology (user-defined text string).

      1 logical test; 2 value if TRUE, 3 value if FALSE

=IF(ISNUMBER(SEARCH(" "&B$2&" "," "&'Borehole Log'!$D2&" ",1)),SEARCH(" "&B$2&" "," "&'Borehole Log'!$D2&" ",1),"")

      Checks whether the search function below returns a number (whether the text string exists or not), and returns TRUE or FALSE

=IF(ISNUMBER(SEARCH(" "&B$2&" "," "&'Borehole Log'!$D2&" ",1)),SEARCH(" "&B$2&" "," "&'Borehole Log'!$D2&" ",1),"")

      Searches for the user-defined word in B$2 within the driller's description in 'Borehole Log'!$D2. Returns the number of the character at which the text string is first found, reading left to right. The SEARCH function is not case-sensitive.
      A space is added before and after the text string to separate lithologic terms that are parts of other lithologies (i.e. sand vs sandstone). The 1 specifies the character number, starting from the left, where the search will begin.

=IF(ISNUMBER(SEARCH(" "&B$2&" "," "&'Borehole Log'!$D2&" ",1)),SEARCH(" "&B$2&" "," "&'Borehole Log'!$D2&" ",1),"")

      If the ISNUMBER function returns TRUE, then the SEARCH function described above is performed and the number of the character is written to the cell.

=IF(ISNUMBER(SEARCH(" "&B$2&" "," "&'Borehole Log'!$D2&" ",1)),SEARCH(" "&B$2&" "," "&'Borehole Log'!$D2&" ",1),"")

      If the ISNUMBER function returns FALSE, then the cell remains blank.

PRIMARY LITHOLOGY

This series of functions finds, within the array, the "find term" with the lowest rank, i.e., the first occurrence, or primary lithology. It then writes a "replacement term" for the "find term" to the cell.

=IFNA(INDEX($B$3:$CW$3,MATCH(MIN($B4:$CW4),$B4:$CW4,0)),"")

      Returns a blank cell if there are no occurrences of any find terms in the driller's description. Otherwise, returns the replacement term for the lowest-rank find term, as specified below.

=IFNA(INDEX($B$3:$CW$3,MATCH(MIN($B4:$CW4),$B4:$CW4,0)),"")

      Returns the replacement term for the find term with the lowest rank, defined using the function below.

=IFNA(INDEX($B$3:$CW$3,MATCH(MIN($B4:$CW4),$B4:$CW4,0)),"")

      Finds the position of the cell in the range B4:CW4 that contains the lowest number (defined in function below). The zero at the end of the argument specifies that the MATCH function finds the first value that is exactly equal to the lookup value, and that the values in the lookup array can be in any order.

=IFNA(INDEX($B$3:$CW$3,MATCH(MIN($B4:$CW4),$B4:$CW4,0)),"")

> Returns the smallest number in the set of numbers B4:CW4. This number represents the primary lithology: the first appearance of any find term within the driller's description.

SECONDARY LITHOLOGY

This series of functions finds, within the array, the "find term" with the second-lowest rank, i.e., the second occurrence, or secondary lithology. It then writes a "replacement term" for the "find term" to the cell.

=IFERROR(INDEX($B$3:$CW$3,MATCH(SMALL(($B4:$CW4),2),$B4:$CW4,0)),"")

> Returns a blank cell if there is not more than one find term in the driller's description. Otherwise, returns the replacement term for the second-lowest rank find term, as specified below.

=IFERROR(INDEX($B$3:$CW$3,MATCH(SMALL(($B4:$CW4),2),$B4:$CW4,0)),"")

> Returns the replacement term for the find term with the second-lowest rank, defined using the function below.

=IFERROR(INDEX($B$3:$CW$3,MATCH(SMALL(($B4:$CW4),2),$B4:$CW4,0)),"")

> Finds the position of the cell in the range B4:CW4 that contains the second-lowest number (defined in function below). The zero at the end of the argument specifies that the MATCH function finds the first value that is exactly equal to the lookup value, and that the values in the lookup array can be in any order.

=IFERROR(INDEX($B$3:$CW$3,MATCH(SMALL(($B4:$CW4),2),$B4:$CW4,0)),"")

> Returns the second smallest number in the set of numbers B4:CW4. This number, 2, represents the second appearance of any find term within the driller's description.

MIXED LITHOLOGY

This series of functions determines whether two lithologies occur together as the primary and secondary lithologies, in either order. If so, it concatenates them and writes them as a mixed lithology term.

=IF(AND(CX76<>CY76,OR(CX4="GRAVEL",CX4="SAND",CX4="SILT",CX4="CLAY"),OR(CY4="GRAVEL",CY4="SAND",CY4="SILT",CY4="CLAY")),CONCATENATE(CX4," AND ",CY4),"")

> If the following "AND" function returns TRUE, this function combines the primary and secondary lithologic terms into one, mixed lithology term. Otherwise, the cell is left blank.

=IF(AND(CX76<>CY76,OR(CX4="GRAVEL",CX4="SAND",CX4="SILT",CX4="CLAY"),OR(CY4="GRAVEL",CY4="SAND",CY4="SILT",CY4="CLAY")),CONCATENATE(CX4," AND ",CY4),"")

> Checks whether the primary and secondary keywords are equivalent

=IF(AND(CX76<>CY76,OR(CX4="GRAVEL",CX4="SAND",CX4="SILT",CX4="CLAY"),OR(CY4="GRAVEL",CY4="SAND",CY4="SILT",CY4="CLAY")),CONCATENATE(CX4," AND ",CY4),"")

> Checks whether the primary and secondary keywords are gravel, sand, silt, or clay, in any order

---

BEDROCK LITHOLOGY

=IF(IF(ISNUMBER(SEARCH(DA$3,'Borehole Log'!$D2,1)),SEARCH(DA$3,'Borehole Log'!$D2,1),"")<MIN($B4:$CW4),DA$2,"")

A logical test of the driller's description to determine whether or not it contains a specific grain size description term (user-defined text string).

1 logical test; 2 value if TRUE, 3 value if FALSE

=IF(IF(ISNUMBER(SEARCH(DA$3,'Borehole Log'!$D2,1)),SEARCH(DA$3,'Borehole Log'!$D2,1),"")<MIN($B4:$CW4),DA$2,"")

If the following function returns TRUE, then the SEARCH function returns the number of the character at which the text string in DA$3 is first found. If it returns FALSE, the cell is left blank.

=IF(IF(ISNUMBER(SEARCH(DA$3,'Borehole Log'!$D2,1)),SEARCH(DA$3,'Borehole Log'!$D2,1),"")<MIN($B4:$CW4),DA$2,"")

Checks whether the search function below returns a number (whether the text string exists or not), and returns TRUE or FALSE

=IF(IF(ISNUMBER(SEARCH(DA$3,'Borehole Log'!$D2,1)),SEARCH(DA$3,'Borehole Log'!$D2,1),"")<MIN($B4:$CW4),DA$2,"")

Searches for the user-defined word in DA$3 within the driller's description in 'Borehole Log'!$D2. Returns the number of the character at which the text string is first found, reading left to right. The SEARCH function is not case-sensitive. The 1 specifies the character number, starting from the left, where the search will begin.

=IF(IF(ISNUMBER(SEARCH(DA$3,'Borehole Log'!$D2,1)),SEARCH(DA$3,'Borehole Log'!$D2,1),"")<MIN($B4:$CW4),DA$2,"")

Tests whether the grain size term precedes the primary lithology term within the driller's description.