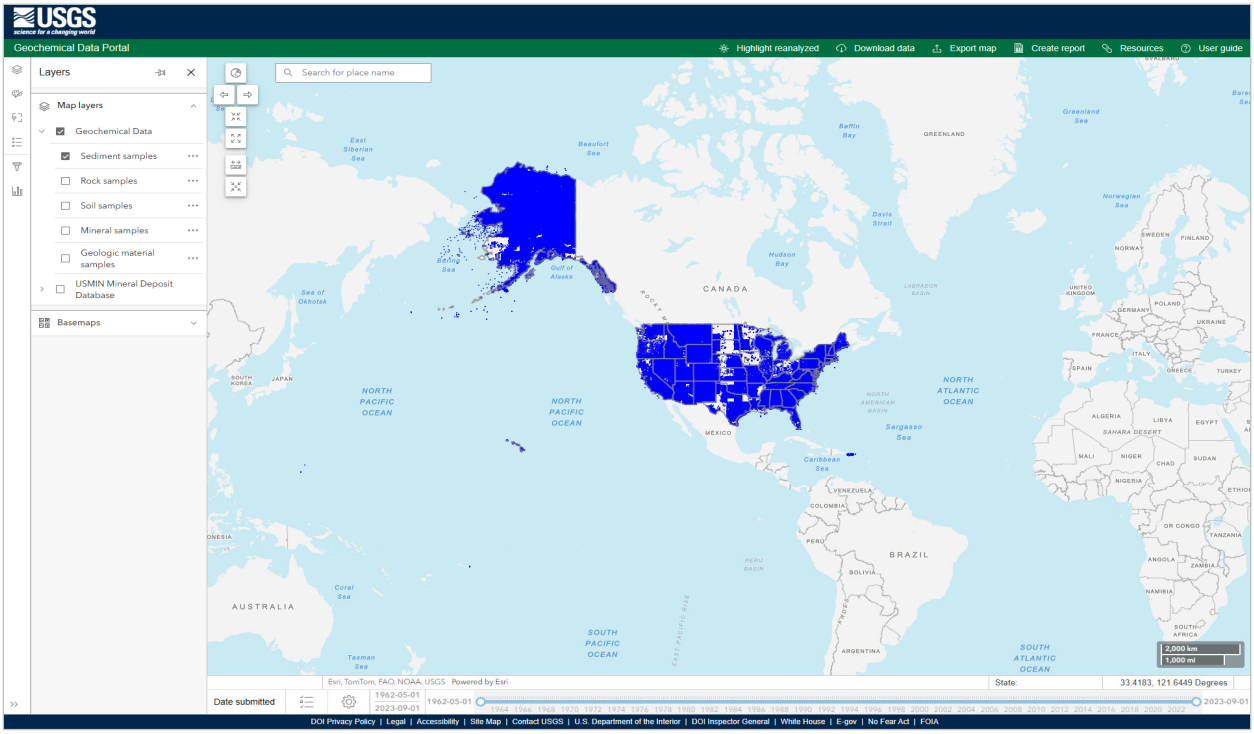
Geochemical Data Portal
User Guide



Introduction

This data portal assembles, reformats, corrects, and archives data obtained from the geochemical analysis of samples collected for U.S. Geological Survey and Department of Energy studies.

Geochemical data compilations are provided where each geologic material sample has one analytical result provided for an analyzed element. In the case of multiple results for the same sample and element the value with the highest-ranking analytical method is used. Downloading data through the portal will provide access to fields for each element containing the additional analytical results for a sample. Negative values for an element indicate results less than the detection limit of the analytical method. Limits may vary within method and over time.

Terms and conditions

Unless otherwise stated, all data, metadata and related materials are considered to satisfy the quality standards relative to the purpose for which the data were collected. Although these data and associated metadata have been reviewed for accuracy and completeness and approved for release by the U.S. Geological Survey (USGS), no warranty expressed or implied is made regarding the display or utility of the data on any other system or for general or scientific purposes, nor shall the act of distribution constitute any such warranty.

Getting started

Downloading data

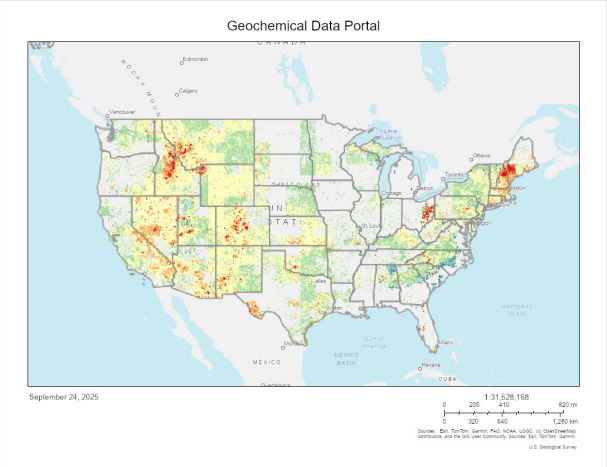
Data for the geochemical layers can be downloaded and saved to a local file through the download data panel. All the samples for a layer can be downloaded in a single file, or they can be prefiltered based on their location or attributes. See “Download data panel” under the “Header buttons” section for more information.

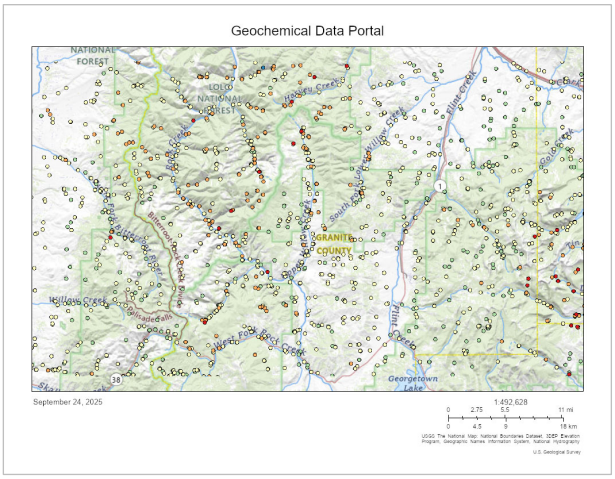
Filtering data

Each geochemical layer can be independently filtered using the controls in the “Date filter”, “Area of interest”, “Element groups”, and “Attribute filter” panels. These filters can be used together or separately as needed.

- The date filter will apply a temporal filter to points based on their submittal date. See “Date filter panel” under the “Panel buttons” section for more information.
- Many points do not have a submittal date assigned, so enabling the date filter will immediately exclude all points where submittal data is null.
- Setting an area of interest will exclude points based on their location only. See “Area of interest panel” under the “Panel buttons” section for more information.
- Group filters provide a way to filter for the presence of multiple elements using predefined groups of elements such as critical minerals or precious metals. These filters only indicate that a sample has an analytical value for one or more elements in the group. See “Element groups panel” under the “Panel Buttons” section for more information.
- Attribute filters provide the finest level of filtering available. Individual fields from the database can be selected and their values used to precisely control the points displayed. See “Attribute filter panel” under the “Panel buttons” section for more information.

Creating and saving a map



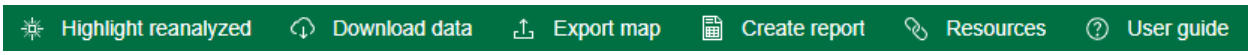


Maps can be created at a wide range of scales from nationwide to local areas of interest. A map can be as simple as showing samples from a single layer using the default symbology, or as complex as multiple layers with different symbol shapes, classified colors, and one or more filters applied to the layers. Each of the geochemical layers can be independently displayed, symbolized, and filtered.

- Layers panel – Turn layers on or off, change their drawing order, or change their opacity.
- Symbology panel – Change the shape of a symbol, its color, or classify by best values for an element and color using a blue to red color ramp.
- Area of interest panel – Restrict points displayed using a user defined box or polygon.
- Element groups panel – Use a group filter to display points with values for one or more preset groups of elements.
- Attribute filter panel – Filter points by one or more database fields using specific attribute values.

Exporting a map to a pdf or other file type is accomplished through the export map panel. See “Export map panel” under the “Header buttons” section for more information.

Header buttons

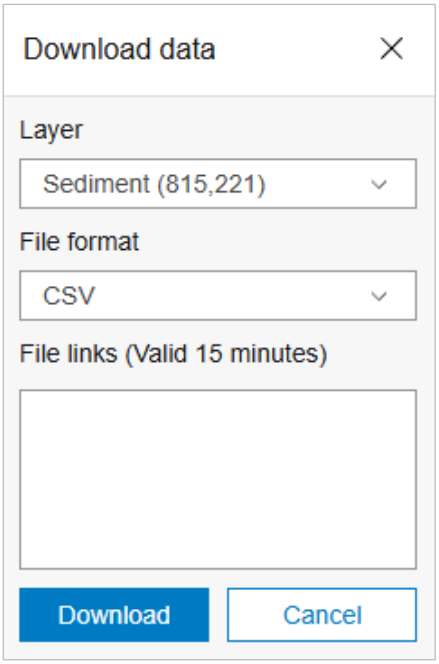


Highlight reanalyzed

Highlight points for reanalyzed samples. Highlighting can be toggled for each of the geochemical layers. Reanalyzed samples can also be filtered through the Attribute filter panel using the Reanalysis field.

Download data panel

Download data for a geochemical layer and save it to a local file. The samples available for download from each layer can be filtered using the area of interest, element groups, or attribute filters. A count next to the layer name will indicate how many samples will be downloaded based on any filters in place. Downloaded files will include all the fields and attributes from the published database. Coordinates will be in geographic WGS84. For large downloads CSV is the fastest option. GeoPackages may take twice as long, and file geodatabases up to three times as long for the server to process.



1. Layer

   Select geochemical layer for downloading.

2. File format

   Files can be saved in these formats.

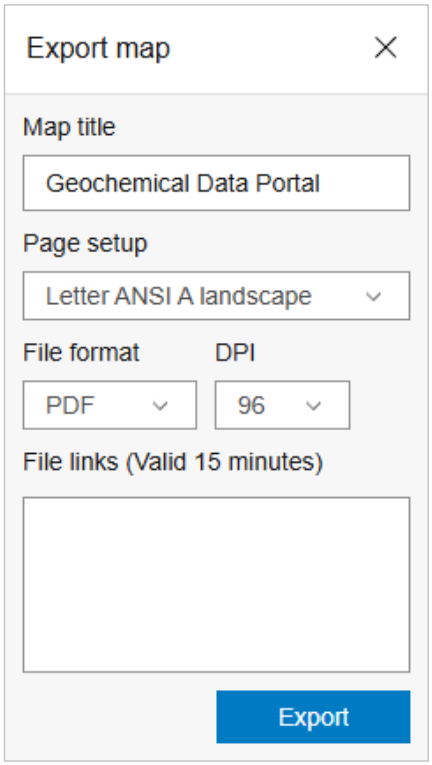
   - CSV (comma separated value)
   - GeoPackage
   - File geodatabase

3. File links

   When a download request is completed by the server a link to the file will be provided in this box. This link will remain valid for fifteen minutes. After that time the file will be automatically removed from the server.

Export map panel

Export a copy of the current map view. File can be viewed in the web browser or saved to a local file. Parameters that can be adjusted include the map title, layout size and orientation, export file type, and export file resolution. A scalebar and credit information will be automatically added to the file.



1. Map title

   Set custom title for map.

2. Page setup

   Select size and orientation of map layout.

   - Letter ANSI A landscape, Letter ANSI A portrait
   - Tabloid ANSI B landscape, Tabloid ANSI B portrait
   - A3 landscape, A3 portrait
   - A4 landscape, A4 portrait

3. File format

   Maps can be exported to these formats.

   - PDF, JPG, or PNG32

4. DPI

   Maps can be exported at these resolutions.

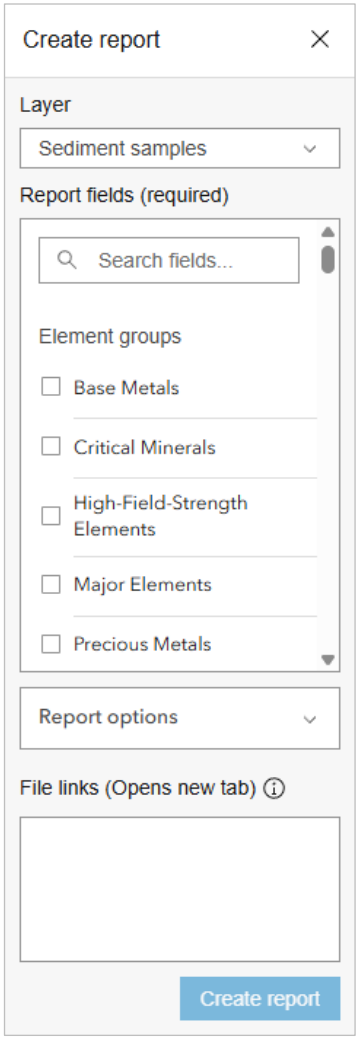
   - 96, 150, or 300 dpi

5. File links

   When an export request is completed by the server a link to the file will be provided in this box. This link will remain valid for fifteen minutes. After that time the file will be automatically removed from the server.

Create report panel

Output a report showing a screenshot of the map, the settings for any filters, a table of statistical information for selected fields, and optionally a chart if one is available. The generated link will open the report in a new tab where it can be viewed or saved.



1. Layer

   Select one of the geochemical layers for the report.

2. Report fields

   Select which fields will be included in the statistics table. Predefined groups or individual fields can be selected. Selecting a field is required.

3. Report options

   - Map screenshot – Include a screenshot of the current map view in the report. Default is true.
   - Chart – If a chart for the layer exists include a small or page sized version. Default is false.

4. File links

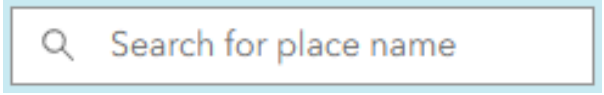
   When a report request is completed, a link will be provided in this box. The link will open the report in a new browser tab. From here the report can be printed or saved to a local file as needed. When printing the background graphics option on the print screen should be enabled if the print preview shows that shaded boxes on the web page are missing.

Resources

Menu of links to related publications that may be of interest.

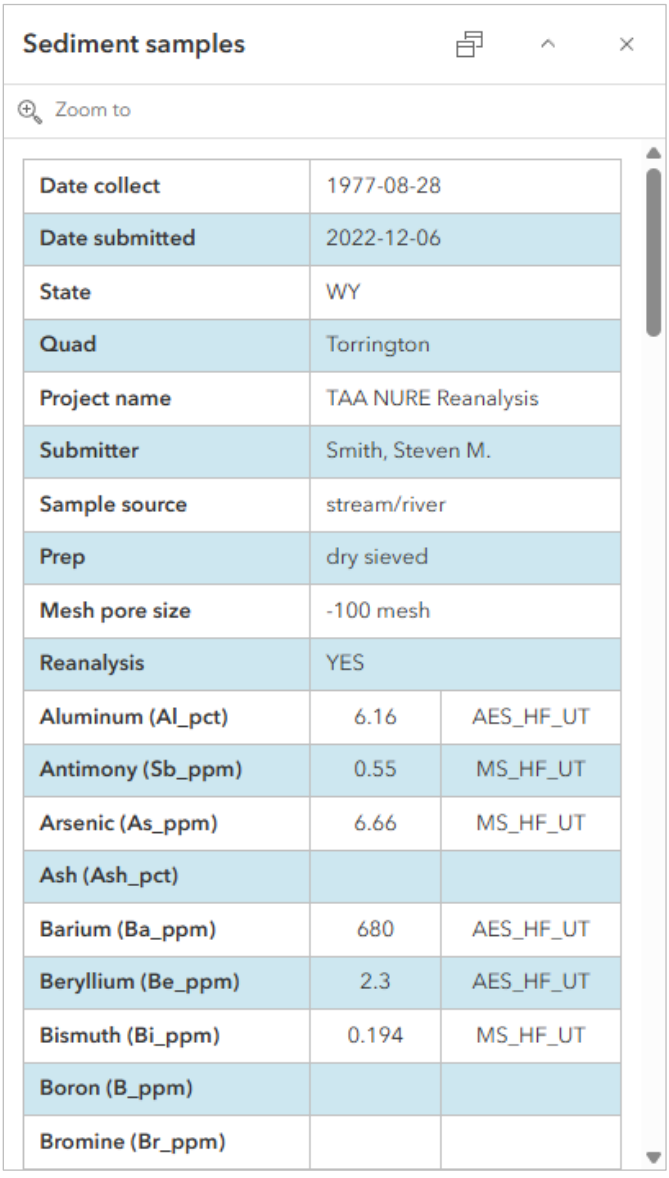
Location search

Place names for geographic features within the U.S. can be located using the search box in the upper left of the map. As the name is entered a list of suggested matches will appear beneath the box. Selecting a feature name will zoom to the location and mark it with a symbol.

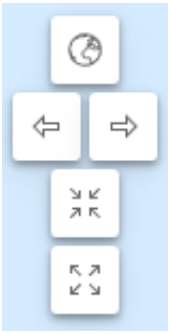


Popups

Clicking on points from the geochemical or USMIN layers will open a popup window listing its attributes. By default, this window will be docked in the upper right corner of the map. For geochemical locations sample properties are listed first followed by the analytical result and associated analytical method for each element. Hovering over the method name will provide a description.



Navigation buttons



A group of five buttons in the top left corner of the map view that can be used to change the map extent.

- Full extent – Return map to a full view of the map
- Previous extent – Go back to previous view of map
- Next extent – Return to view of map before previous extent
- Zoom in
- Zoom out

The mouse wheel can also be used to zoom in or out. Clicking and holding down the left mouse button will pan the map. Holding down the shift key and dragging a box will zoom the map to that extent.

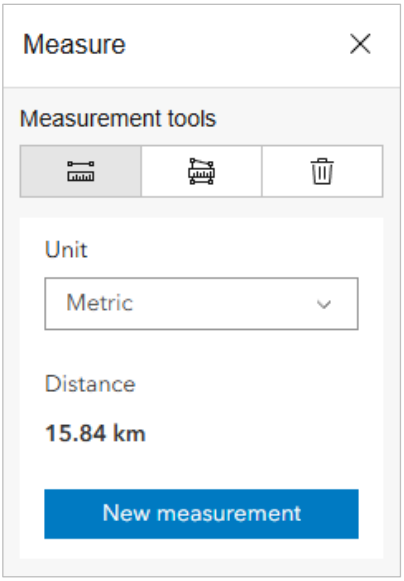
Measure button

Measure distances or areas on the map.

1. Measurement tools
   - Distance measurement – Activate straight line measure tool to draw line segments on the map.
   - Area measurement – Activate area measure tool to draw a polygon on the map.
   - Clear measurement – Remove any existing measurements.
2. Unit

   Distances and areas can be reported using a variety of different units. Default is Metric.
3. New measurement

   Take new measurement for active tool.



Zoom to visible points button

Zooms the map to the full extent of any visible geochemical points.

Panel buttons

Group of six buttons along the left side of the map. The first four buttons can be used to display one of the panels that will open to the left of the map. These panels can be pinned open for viewing side by side with neighboring panels. The last two buttons will open panels below the map.

- Layers
- Symbology
- Area of interest
- Element groups
- Attribute filter
- Charts

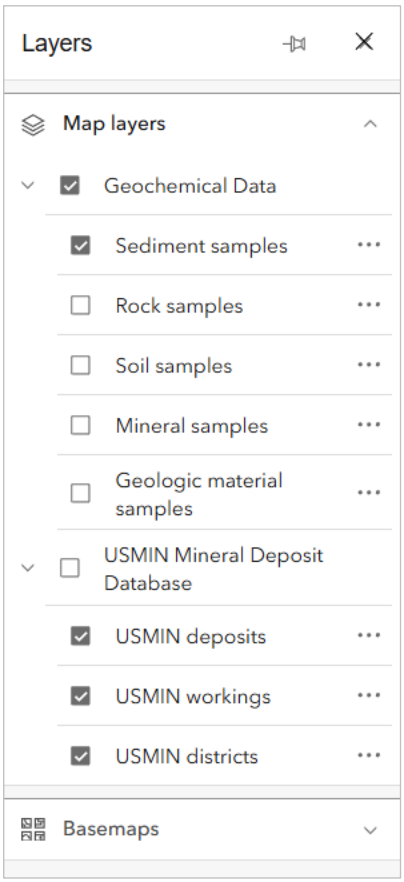
Date filter toolbar

Filter points in the geochemical layers by their submittal date. When a layer is selected using the button on the toolbar the slider will be enabled and points with a submittal date between the date range set by the slider will be filtered. Not all samples have a submittal date, so when enabled for a layer some points will always be filtered even at the maximum date range. One or more layers can be selected for filtering. Unselecting all layers will disable the toolbar again.

The step interval of the slider can also be adjusted using the settings button on the toolbar. Available options are weeks, months (default), or years.

Layers panel

Controls which layers are visible on the map. It contains three group layers.



1. Geochemical Data

   Five separate point layers for each unique primary material classification identified in the geochemistry. Each layer can be turned on or off separately. The Options button to the right of the layer name will display an additional menu below the layer for opening the attribute table or changing the transparency of the layer. The attribute table will be displayed as a new closeable tab in the panel below the map.

   - Sediment samples
   - Rock samples
   - Soil samples
   - Mineral samples
   - Geologic material samples

2. USMIN Mineral Deposit Database

   The USMIN Mineral Deposit Database provides information on the most important mines, mineral deposits, and mineral districts of the United States.

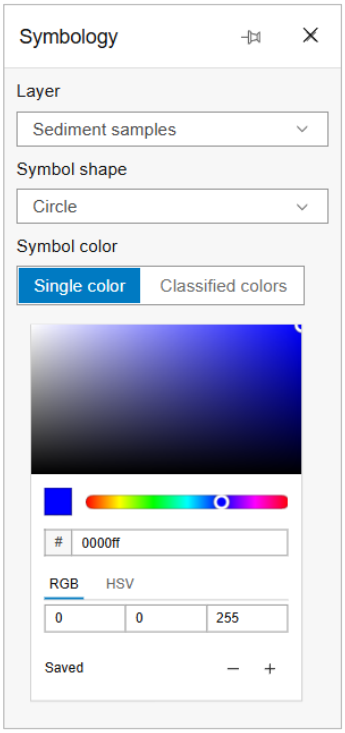
   - USMIN deposits
   - USMIN workings
   - USMIN districts

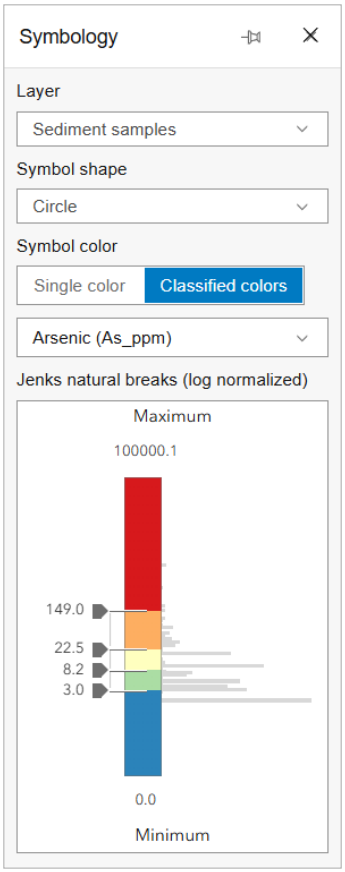
3. Basemaps

   - Light Gray Canvas (default)
   - State Geologic Map Compilation – A seamless, spatial database of geologic maps for the contiguous U.S. that range from 1:50,000 to 1:1,000,000 scale. Switching to this base will also add an additional "Geologic Unit" window to the map. When the cursor hovers over the geology this window will display the unit label, unit name, and age for geology at that location.
   - USGS The National Map – Most current topographic base for the U.S.
   - Satellite – Low to high resolution satellite imagery
   - USA Topo Maps – Legacy USGS topographic maps

Symbology panel

By default, the geochemical sample locations will be displayed on the map using a simple circle with a single different color assigned to each layer. Symbol sizes will automatically adjust with the map scale. Outlines will be shown around the symbols when zoomed in past a certain scale with the exceptions of the cross and “x” symbol shapes.





Through this panel the symbols for each layer can be changed to create more complex maps. Symbol parameters that can be changed include: the shape of the symbol, and the color(s) used for the points.

1. Layer

   Select layer to view or change its current symbol parameters

2. Symbol shape

   Change shape of all symbols in layer. Options: circle, cross, diamond, square, triangle, “x”

3. Single color

   Change the colors used by all points within the layer.

4. Classified colors

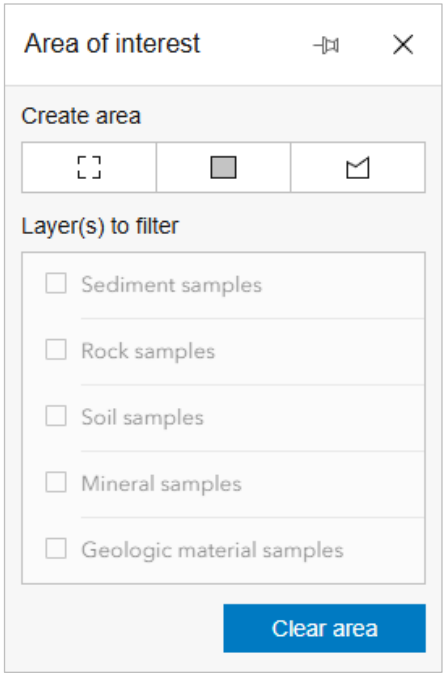
   Assign colors to the points using analytical results for one of the element fields. All positive values in the selected field will be normalized using a base 10 log to reduce the influence of outliers before dividing them into five classes using the natural breaks (Jenks) method. An interactive blue to red color ramp of the break values with accompanying histogram will be added to the symbology panel.

   The break values and max/min values of the classification can be manually changed to refine the appearance of the data. The values displayed with the color ramp will be the original data values to remain consistent with values shown in other areas. Samples with negative values, indicating results less than the detection limit of the analytical method, and null values are not included in the classification and are instead shown on the map using smaller gray circles. If the max/min range of the color ramp is decreased newly excluded values will also display as small gray circles.

Symbols will be assigned to all points. To remove points from the display, such as the negative or null values, use one of the filtering options.

Area of interest panel

Filter points shown on the map by their geographic location. Setting an area of interest for a layer will limit the data available to other filters.



1. Create area

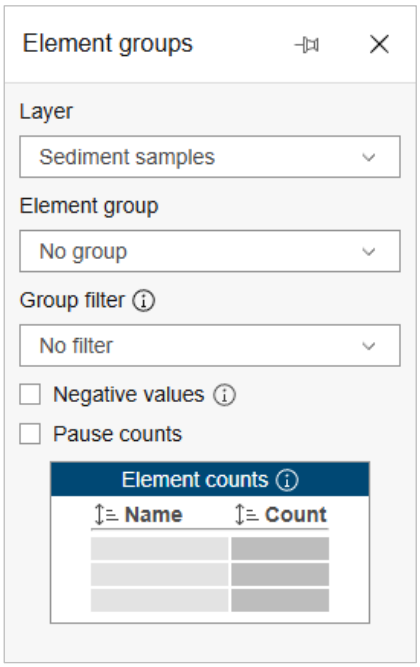
   There are three ways to define an area of interest.

   - Create a box from the current map extent
   - Draw a box on the map
   - Draw a polygon on the map

2. Layer(s) to filter

   Once the area has been defined this section will be enabled and the layers can be selected. A count of all the samples within the area will also be shown next to the layer name. This count is not restricted by settings in other filters. The area of interest can be applied to or removed from one or more layers without removing the area drawn on the map. To delete the box or polygon use the “Clear area” button at the bottom of the panel.

Element groups panel



Provides access to sample counts and filtering options for eight preset element groups of interest. These groups are not separate fields in the database. Instead, they provide a quick way to query and filter data from multiple fields. The queries for each element will be for either all positive values, all positive and negative values if the negative values box is checked, or a mix of positive and negative values if negative values are included using the attribute filter expressions and the group negative values box is unchecked.

For the selected group a table listing the element name and count of samples will be displayed. This table can be sorted by name or count. By default, the table will be sorted by name.

If a blue line is shown at the beginning of a table row this indicates that there is an expression for the element in the attribute filter panel. A blue line at the end of the table row means the negative values checkbox for the expression in the attribute filter panel has been checked and counts for the element will include negative values.

After selecting a group, the counts will automatically update when changes are made to the area of interest, group filter, or attribute filter unless the pause counts option is selected.

When a group filter is set an entry showing the filter parameters will be shown at the top of the expression list in the attribute filter panel for the corresponding layer. Group filters will limit the data available to all attribute filter expressions.

1. Layer

   Select layer name to switch between the group information for each layer.

2. Element group

   Select from these element groups.

   - Base Metals – Copper, Lead, and Zinc
   - Critical Minerals – As defined by the USGS in 2025
     USGS, 2025, 2025 Final list of Critical Minerals: Federal Register, v. 90. No 214
     https://www.govinfo.gov/content/pkg/FR-2025-11-07/pdf/2025-19813.pdf.
   - High-Field-Strength Elements – Hafnium, Niobium, Tantalum, Thorium, Titanium, and Zirconium
   - Major Elements – Aluminum, Calcium, Iron, Magnesium, Manganese, Phosphorus, Potassium, Silicon, Sodium, and Titanium

- Precious Metals – Gold, Silver, Platinum, Palladium, Rhodium, Ruthenium, Iridium, and Osmium
- Light Rare Earth Elements – Lanthanum, Cerium, Praseodymium, Neodymium, Samarium, Europium, and Gadolinium
- Heavy Rare Earth Elements – Terbium, Dysprosium, Holmium, Erbium, Thulium, Ytterbium, Lutetium, Yttrium, and Scandium
- All Rare Earth Elements – Combination of Light and Heavy REEs

3. Group filter

   Select from these filter options

   - Partial suite – Sample must contain a value for one or more of the group elements
   - Total suite – Sample must contain values for every group element

   A count of all the samples remaining after applying the group filter will be shown next to the layer name in the group panel. This count can be restricted by the area of interest, but not by the attribute filter.

4. Negative values

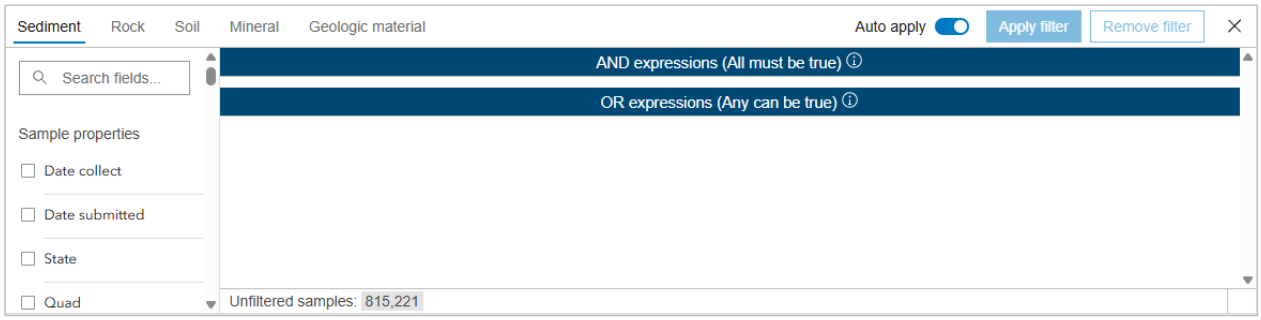
   Allow negative values in the queries for the counts and group filter. Negative values for an element indicate results less than the detection limit of the analytical method. Limits may vary within method and over time.

   If this box is unchecked and negative values have been selected for one of the group elements in the attribute filter panel the checkbox will display an intermediate state, shown as a white horizontal line over a blue background, indicating that the filter and counts include a mix of positive and negative analytical results.

5. Pause counts

   Stop automatic updating of the element counts in response to changes in the group or other filters. Will reset to off when the element group selection is changed.

Attribute filter panel



Opens in the bottom panel below the map. It can be used to build query expressions for filtering points in a geochemistry layer based on their attributes. All attributes shown will be from the best value field for the element. Separate groups of queries can be built for each layer. Multiple queries for a layer can be chained together using “AND” or “OR” logical operators. This is the most detailed level of filtering available.

The filter interface is divided into three sections. A set of controls across the top, a list of field names on the left, and an area for expressions to display on the right.

Attribute Filter » Filter controls

1. Layer tabs

   Select layer name to switch between the field and query expression lists for each layer.

2. Auto apply

   Control if each change in the expression list automatically updates the layer in the map. Default is on. When off the attribute filter will be automatically removed from the layer when the next change to the filter takes place.

3. Apply filter

   Manually apply query expressions to the layer when auto apply is off. This button is disabled by default. It will be enabled only when there are changes in the filter that have not been applied to the layer. For example, when the filter has been removed, or the auto apply switch is off.

4. Remove filter

   Removes only the attribute filter applied to the layer. Does not remove the attribute query expressions or remove element group or area of interest filters.

Attribute Filter » Field list

Searchable list of field names to add to the expression list. Fields are organized into the following groups.

1. Sample properties

   Selected set of date and text fields describing who collected a sample and where and when it was collected. By default, these fields will be added to the "AND" section of the expression list. The initial query that will be set is for the field to be equal to the first unique value listed.

   Default expressions for text fields will contain three selection boxes after the field name and a footer section.

   - Comparison operators – equals, not equal to, in list, not in list, is null, and not is null. List options allow for selection of multiple values.
   - Attribute value – A list of unique values preceded by a count. Values and counts may be filtered by previous "AND" expressions, group filters, or an area of interest. Values listed can be searched by typing in the selection box.
   - Logical operator – Move the expression between the "AND" and "OR" sections of the expression list
   - Pause updates – Prevent currently selected attribute values from automatically updating when other filter expressions change. Previously loaded values can still be selected.

   Default expressions for date fields will contain four selection boxes after the field name and a footer section.

   - Comparison operators – is between, is not between, equals, not equal to, less than, greater than, less than or equal to, greater than or equal to, is null, and is not null
   - MIN attribute value – An entry box containing the current minimum value for the date. New dates can be selected from a list of unique values.
   - MAX attribute value – An entry box containing the current maximum value for the date. New dates can be selected from a list of unique values.
   - Logical operator – Move the expression between the "AND" and "OR" sections of the expression list
   - Pause updates – Prevent currently selected attribute values from automatically updating when other filter expressions change. Previously loaded values can still be selected.

2. Elements

   All best value analytical results fields in the database. Elements are listed alphabetically by their full name followed by the name of the database field in parenthesis. By default, these fields will be added to the "OR" section of the expression list. The initial query that will be

set is for the field to be equal to the full range of unique positive min/max values for all analytical methods.

Expressions for numeric fields will contain five selection boxes after the field name and a footer section. Attribute values can be searched by typing in the selection box.

- Analytical method – A list of unique analytical methods preceded by a count. Select one or more methods to limit the unique attribute values for the element. Default is all methods allowed. Values and counts may be filtered by previous "AND" expressions, group filters, or an area of interest.
- Comparison operators – is between, is not between, equals, not equal to, less than, greater than, less than or equal to, greater than or equal to, is null, and is not null
- MIN attribute value – An entry box containing the current minimum value for the element. The input box is set so that only numbers can be entered, and the numbers cannot fall outside of the min/max range set when the field was added or last updated. Clearing the box will reset it back to the initial min value. Values may be filtered by previous "AND" expressions, group filters, or an area of interest.
- MAX attribute value – An entry box containing the current maximum value for the element. The input box is set so that only numbers can be entered, and the numbers cannot fall outside of the min/max range set when the field was added or last updated. Clearing the box will reset it back to the initial max value. This box will be hidden when not using the "is between" or "is not between" comparison operators.
- Logical operator – Move the expression between the "AND" and "OR" sections of the expression list
- Pause updates – Prevent currently selected attribute values from automatically updating when other filter expressions change. Previously loaded values can still be selected, but their associated counts may become outdated.
- Negative values – A checkbox that can be used to include negative results in the list of unique values for an element. If the element is part of a currently selected element group, it can also be used to include negative values in the group filter and count.

  These values indicate results less than the detection limit of the analytical method. Limits may vary within method and over time. Values may be filtered by analytical method, previous "AND" expressions, group filters, or an area of interest.

Attribute Filter » Expression list

Area to hold query expressions for selected fields. Divided into two sections based on logical operator.

1. AND expressions

Expressions listed in this section are chained together using the "AND" logical operator. Each of these expressions must be true for a point to display on the map. To assist with narrowing down the unique values the "AND" expressions work in a hierarchical manner. As

each “AND” expression is added it will filter the attributes available to the expressions listed afterwards. This applies to both “AND” and “OR” expressions.

For example, if the QUAD field is selected first, it will provide a unique list of quad names with counts of samples in the quad to select from. The second expression added to the “AND” section will have its unique values filtered by the selected quad(s). The unique list of attributes in each subsequent expression will continue to be refined as more “AND” expressions are added.

As “AND” expressions are added, removed, or set to new queries any expressions lower in the hierarchy will be automatically updated with new values unless “Pause updates” has been selected for an expression. By default, the first item in the list of unique values will be selected.

2. OR expressions

   Expressions listed in this section are chained together using the “OR” logical operator. Any of these expressions can be true for a point to display on the map. One “OR” expression will not filter the unique values available to another “OR” expression. The unique attribute values listed in any “OR” expression will be filtered by all “AND” expressions.

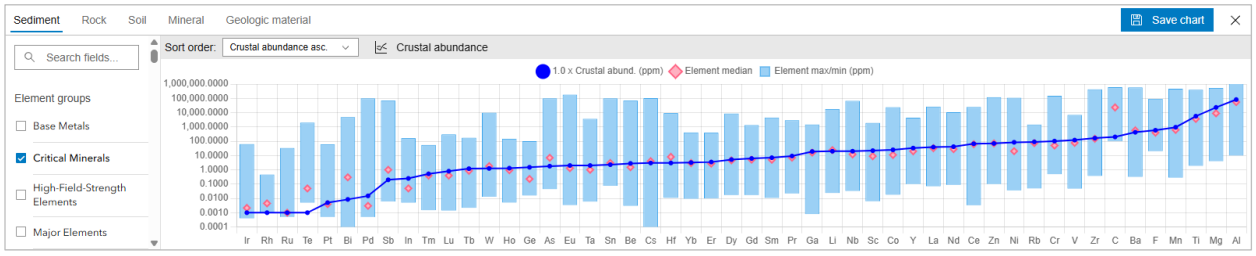
3. Sample counts

   The footer section of the expression list provides a breakdown of the filters and their associated counts. Starting with the initial unfiltered count of samples in the layer each subsequent filter is listed in the following hierarchy:

   Unfiltered samples » Area filter » Date filter » Group filter » Attribute filter

   Entries will only be shown for currently active filters. If there are changes in the attribute filter that have not been applied, due to removing the filter or turning off the auto apply, the entry for the attribute filter counts will be shown with reduced intensity to indicate that the filter is not applied to the layer. While in this state the counts will continue to update, however.

Charts panel



Opens in the bottom panel below the map. It can be used to create bar charts showing the max/min range and median of selected elements. Lines showing the average crustal abundance of the elements can be overlain on the bars. As filters are applied or removed from a layer the chart will automatically update. Hovering the cursor over a bar will display a tooltip listing the full

name of the element, a count of the number of samples, and the values for max/min and median. Tooltips are also available for the crustal abundance points.

The chart interface is divided into three sections. A set of controls across the top, a list of field names on the left, and an area for charts to display on the right.

Charts panel » Chart controls

1. Layer tabs

   Select layer name to switch between charts for each layer.

2. Save chart

   Save a copy of the currently displayed chart in the png image format.

3. Sort order

   Change the order of elements displayed in the chart. Options include:

   Ascending/descending by crustal abundance
   - Crustal abundance asc. (default)
   - Crustal abundance dec.

   Ascending/descending by max value
   - Element max asc.
   - Element max dec.

   - Element name A-Z
   - Element name Z-A

4. Crustal abundance

   Display one or more crustal abundance lines on the chart for the following multiples:

   - 0.5 x Crustal background
   - 1.0 x Crustal background
   - 1.5 x Crustal background
   - 3.5 x Crustal background
   - 7.5 x Crustal background
   - 15.5 x Crustal background

Charts panel » Field list

Searchable list of field names to add to the chart. Fields are organized into the following categories.

1. Element groups

   Select from these element groups:

   - Base Metals – Copper, Lead, and Zinc
   - Critical Minerals – As defined by the USGS in 2025

USGS, 2025, 2025 Final list of Critical Minerals: Federal Register, v. 90. No 214 https://www.govinfo.gov/content/pkg/FR-2025-11-07/pdf/2025-19813.pdf.

- High-Field-Strength Elements – Hafnium, Niobium, Tantalum, Thorium, Titanium, and Zirconium
- Major Elements – Aluminum, Calcium, Iron, Magnesium, Manganese, Phosphorus, Potassium, Silicon, Sodium, and Titanium
- Precious Metals – Gold, Silver, Platinum, Palladium, Rhodium, Ruthenium, Iridium, and Osmium
- Light Rare Earth Elements – Lanthanum, Cerium, Praseodymium, Neodymium, Samarium, Europium, and Gadolinium
- Heavy Rare Earth Elements – Terbium, Dysprosium, Holmium, Erbium, Thulium, Ytterbium, Lutetium, Yttrium, and Scandium

2. Elements

All best value analytical results fields in the database. Elements are listed alphabetically by their full name followed by the name of the database field in parenthesis.