NGDS Catalog Search: Discover Data and Accompanying Interpretations

Prerequisites: Web Browser

This data search scenario displays how single keyword searches from the NGDS Catalog will yield data from many sources, including raw data (in Excel files or Web Services) as well as publications with data interpretations.

1. Go to http://geothermaldata.org/dataset in a new window.
2. Type in **california well log** in the search field.
3. Click **Search.**
4. Click on the **California Well Log Observations** option.
4. Mouse-over the access options on the left.
5. Click on **Add WMS to Map**.
6. Scroll down the search returns and click the **Case History Report on East Mesa and Cerro Prieto Geothermal Fields** option.
7. On the left, click **More Details** to display more information about the selected resource. Close this box.
8. Mouse-over the **Access Options** on the left.
9. Click **Name for URL** to open the publication and discover more about well log analysis technology.

Powell & Cummings Geothermometry

Prerequisites: Web Browser, Microsoft Excel (or some comparable software)

This scenario is designed to show how NGDS geothermometry data can provide geochemical ternary diagrams and other helpful analyses by exploiting *Spreadsheets for Geothermal Water and Gas Geochemistry*, Powell and Cummings 2010.

1. Go to http://geothermaldata.org/dataset.
2. Type **California Powell Cummings** into the search box.
3. In the results, click on **California Powell and Cummings Geothermometry Analyses** option.
4. Mouse-over the access options on the left.
5. Click on Excel workbook containing geothermometry data for the state of California opening an Excel file containing all of the attributes from the CAPowellCummingsGeothermometry web service as a data download. Save this file to Desktop.
6. Back at the search page http://geothermaldata.org/dataset type **stanford geothermometry reports** into the search box.
7. In the results, click on **Geothermal Water and Gas Geochemistry; Constructing Geothermometry Reports (Stanford)** option.
8. Mouse-over the access options on the left.
9. Click on Liquid Analysis Excel Spreadsheets, Powell and Cumming 2010.xlsx to download and open. Click on the tab labeled **Input**.
10. You will now input the data download into the Powell and Cummings Liquid Chemistry analytical workbook.
    a. Open the data download file saved on Desktop in Step 5 and click on the tab labeled **LiquidAnalysis**.
    b. Copy the data in the entire column labeled **AnalysisName**. Paste this into the Powell and Cummings spreadsheet under the field labeled **Sample Name**.
    c. From the data download, copy the data in the entire column labeled **FluidTemperature_C**. Paste this into the Powell and Cummings spreadsheet under the field labeled **Temp C**.
    d. From the data download, copy the data in entire columns labeled **ph** through **del_D**. Paste this into the Powell and Cummings spreadsheet under the fields labeled **ph** through **del D**.
11. Note that in tabs labeled **Kmckn**, **Xkmc**, **Trlc** and **Tclb** the ternary diagrams have been populated based on the data entered.

USGS National Map Viewer: Geologic Maps with Borehole Temperature Data

Prerequisites: Web Browser

The scenario demonstrates how to view a Geologic Map and Borehole Temperature Data using the USGS National Map View and then query for information. For example, what wells and temperature data exist in a given geologic formation?

1. Go to http://geothermaldata.org/dataset. Type in **arizona geologic map** in the search field.
2. Click on the **Geologic Map of Arizona at 1:1,000,000-scale** option.
3. Mouse-over the access options on the left. Right click on ESRI Service Endpoint.
4. Select **Copy Link Location/Address/Shortcut**.
5. In a new web browser tab or window go to the National Map Viewer at http://viewer.nationalmap.gov/viewer/.
6. Under the Advanced tab, choose the green **Add Data** button. Add data to the **AGS, ArcGIS Server** option.
7. In the Rest Url box paste the link copied in the steps above (http://services.azgs.az.gov/ArcGIS/rest/services/OneGeology/AZGS_Arizona_Geology/MapServer).
8. Click **Connect**. This will add the Arizona Geologic data to the map.
9. Under User Added Content on the Overlays tab to the left of the map, click the down arrow to the left of the **AZGS_Arizona_Geology** layer.
10. Click **Transparency** and move the slider to 50%.
11. Back at the Catalog Search http://geothermaldata.org/dataset type in **arizona borehole temperatures** in the search field.
12. Click on **Arizona Borehole Temperatures**.
13. Mouse-over the **Access Options** on the left. Right click on ESRI Service Endpoint.
14. Select **Copy Link Location/Address/Shortcut**.
15. Go back to the National Map Viewer. Under the Advanced tab, again choose the green **Add Data** button. Add data to **AGS, ArcGIS Server**.
16. In the Rest Url box paste the link copied from the steps above (http://services.azgs.az.gov/ArcGIS/rest/services/aasggeothermal/AZBoreholeTemperatures/MapServer). Click **Connect.**
17. Still in the **Advanced** tab, click the **Query Builder** button. Click **Next** to Build a Simple Query.
18. On the drop down list for Select Service choose **AZGS_Arizona_Geology**. Click **Next**.
19. In the drop down list choose the **US-AZ_AZGS_1M_Lithostratigraphy** layer a. Click **Next**.
20. In Columns, click once on **geologicHistory** to add it the Query box. *It will not look like anything happens with one click, but in the Query box below the columns list you'll see geologicHistory is now listed as part of the query being created.*
21. Click once on the **=** sign under Operators.
22. Click **Get Sample Values**; the Sample Values box will display the unique data within

that field.

23. Click once on the result **Early Jurassic, about 180-210 MA** to add it to the query.
24. Click **Run Query** at the bottom. When the query runs, a pop-up box is displayed to show how many features have been selected by the query. There should be 20. Click **OK.** The Early Jurassic, about 180-210 MA selected areas are now highlighted in green.
25. Above the Map, go to the Standard Tab and click the **Zoom In Box** button (magnifying glass + icon). Zoom in to the green selected area near the Utah-Arizona border between St. George, UT and Kanab, UT.
26. From the Standard tab, click the **Identify** button.
27. In the panel to the left of the map, in the Selection - Identify Layers tab **uncheck** every layer except AZBoreholeTemptures.
28. Draw a box around the two points near Hildale, UT which are in the green highlighted Early Jurassic lithostratigraphy.
29. In the Results tab to the left of map, for each of the two points, click **More** and then **Get Elevation**.
30. A pop-up will appear with more details about the boreholes with a recorded temperatures in the Early Jurassic lithostratigraphy.

ArcMap: Finding Thermal Springs near Major Roads

Prerequisites: Web Browser, ArcMap

This scenario demonstrates how to perform simple analysis with ArcMap using NGDS data and freely available infrastructure data from the US Census Bureau.

1. Go to http://geothermaldata.org/dataset.
2. Type in **Utah Thermal Spring Features** in the search field.
3. Click on the **Utah Thermal Spring Features** option.
4. Mouse-over the access options on the left.
5. Right click on **WFS Capabilities**.
6. Select **Copy Link Location/Address/Shortcut**.
7. Open **ArcMap** from the icon on the Desktop.
8. On the toolbar, under **Geoprocessing**, select **Search For Tools.**
9. In the search box type **wfs**.
10. From the results click on **WFS To Feature Class (Conversion)**.
11. In **WFS Server** paste the link copied from above (http://web2.nbmg.unr.edu/ArcGIS/services/UT_Data/UTThermalSprings/MapServer/WFSServer?request=GetCapabilities&service=WFS).
12. Delete the question mark (**?**) and all text after it from the link, so that the text in the box now reads: http://web2.nbmg.unr.edu/ArcGIS/services/UT_Data/UTThermalSprings/MapServer/WFSServer.
13. Click in the box **Select Feature Type to Extract** and select **ThermalSpring**.
14. Choose the OutputLocation of **Default** geodatabase in Documents/ArcGIS.
15. Click **OK** and the thermal springs will be added to the map. *If the feature class is not automatically added to the map, go to **Windows** and choose **Catalog**. Navigate to the Documents/ArcGIS folder, Default.gdb, then click on ThermalSpring feature class and drag it directly onto the map.*
16. Back in your web browser go to http://www.census.gov/cgi-bin/geo/shapefiles2013/main.
17. Select **Roads** as the layer type from the **Select a layer type** drop-down list.
18. Click **Submit**.
19. Under Primary and Secondary Roads, select **Utah**.
20. Click **Download** to download a shapefile of major roads in Utah. Choose **Save**.
21. Open a Windows Explorer window and navigate to the **Downloads** folder.
22. Choose the tl_2013_49_prisecroads.zip file, right-click and choose **Extract All…** This will pop-up a new window with the extracted files.
23. Highlight and drag the files directly onto the map in **ArcMap.** *If you receive a Geographic Coordinate Systems Warning, click **Close**.*
24. On the map toolbar, under **Selection**, choose **Select By Location...**.
25. For Selection Method choose **select features from**.
26. Check **ThermalSpring** as the Target layer.

27. Select the downloaded Roads file, **tl_2013_49_prisecroads**, as the Source layer.
28. For the Spatial selection method choose **Target layer(s) features are within a distance of the Source layer feature**.
29. Apply a search distance of **5 miles**. Click **OK**.
30. In the Layers list right click on the **ThermalSpring** layer.
31. Select **Open Attribute Table** to view all of the thermal springs in Utah within 5 miles of a major road.

uDig: Discover Related Datasets Using Foreign Keys

Prerequisites: Web Browser, uDig (Free download from http://udig.refractions.net/)

This scenario show how the free desktop GIS platform, uDig, provides data access, editing, and viewing for NGDS data published as either a Web Map Service (WMS) or Web Feature Service (WFS). Additionally, discover how NGDS web services use foreign keys to make associated data services discoverable.

1. Go to http://geothermaldata.org/dataset. Type in **california aqueous chemistry** in the search field.
2. Click on the **California Aqueous Chemistry** option.
3. Mouse-over the access options on the left. Right click on **WMS Capabilities**.
4. Select **Copy Link Location/Address/Shortcut**.
5. Open **uDig**.
6. On the toolbar click on the **Layer** drop-down list and choose **Add** to add data.
7. Select **Web Map Server** and click **Next**.
8. **Paste** the link copied in the steps above http://services.azgs.az.gov/ArcGIS/services/aasggeothermal/CAAqueousChemistry1_10/MapServer/WMSServer?request=GetCapabilities&service=WMS) and click **Next**.
9. Make sure all of the layers are **checked**. Click **Finish** to add the data to the map.
10. In the Layers Box, right click **CommonAnalytes**. Select **ZoomToLayer**.
11. Uncheck all of the layers in the Layers box except **CommonAnalytes**.
12. On the far right of the uDig window click **Info** to expand and in the **Info** submenu click **Info**.
13. Click on any point to show the attributes for that feature in the **Information** window below.
14. In the Information display, move the horizontal scroll bar to the right to find the **SamplingFeatureURI** field. This field acts as a foreign key to another Tier 3 NGDS service (in this case, the CAThermalSprings service) associated with the features in this service.
15. Use your cursor to highlight the entire URL listed in that field. Right-click and choose **Copy**.
16. Open a new tab in your browser and paste in the copied URL. You will get an XML-representation of that data point from the associated service.
17. Also explore California well headers related resources by adding the CAWellHeaders WFS.
18. Go to http://geothermaldata.org/dataset. Type in **california well headers** in the search field.
19. Click on the **California Well Headers** option.
20. Mouse-over the access options on the left. Right click on **WFS Capabilities**.
21. Select **Copy Link Location/Address/Shortcut**.
22. Back in uDig, click on the **Layer** drop-down list and choose **Add** to add data.

23. Select **Web Feature Server** and click **Next**.
24. **Paste** the link copied in the steps above (http://services.azgs.az.gov/arcgis/services/aasggeothermal/CAWellHeaders/MapServer/WFSServer?request=GetCapabilities&service=WFS) and click **Next**.
25. Choose **Window** then **Show View**.
26. From that drop-down list, choose **Table**. The features from the WFS will be added to the Table window below the map.
27. In the Table display, move the horizontal scroll bar to the right to find the **RelatedResource** field. Some links in this field act as a foreign key to another Tier 3 NGDS service (in this case, the CAWellLogs service), while some links explore other related material.
28. Use your cursor to highlight an entire URL listed in that field. Right-click and choose **Copy**.
29. Open a new tab in your browser and paste in the copied URL. You will get an XML-representation of that data point from the associated service.

OneGeology: View and Download Multiple-Scale Geologic Maps

Prerequisites: Web Browser

View OneGeology geologic maps registered with NGDS.

1. Go to http://portal.onegeology.org/ to access OneGeology data.
2. In the top right of the page, deselect the box next to **Automatically display layers depending on scale and location**.
3. Zoom into the southwestern United States, centered on Nevada.
4. Click the **Add OneGeology map layers** icon (with the green + sign and folder image).
5. In the pop-up window, scroll down to **North America** and expand the **United States of America** folder.
6. Expand the **Nevada** folder.
7. Turn on and off a few of the layers listed for a better understanding of the scope of the Nevada geologic data available.
8. Turn on the last 3 layers by clicking the boxes of Contacts, Faults, and Geology for **US-NV NBMG 1:62.5k**.
9. Close the pop-up window.
10. Zoom in to the largest and most southern map section.
11. Zoom in again to the smaller of the two areas.
12. Click the icon with the arrow and blue identify symbol.
13. Click on any of the light blue map sections. A pop-up window appears with the features in the web service.
14. Move the scroll bar of the window to the right to find the **metadata_uri** field. This indicates the URL for the metadata housed at NGDS.
15. Using your mouse, highlight the entire URL in the field and right-click. Select **Copy**.
16. Paste this URL into a new browser tab. This shows the NGDS metadata record for that specific geologic quad map, having downloadable shapefiles and more information about the map.

QGIS: Searching for and Displaying Data Variably by Temperature Attributes

Prerequisites: Web Browser, Excel or text editor, QGIS (Free download at http://qgis.org)

This scenario exemplifies how web service data is arguably the most accessible form of data distribution, as is the format ingested by countless free and open source GIS applications and map viewer. QGIS (QuantumGIS) is such an application which runs on a variety of platforms with numerous available plugins which allow the user to perform terrain analysis and input GPX and DEM data as well as WFS and WMS. Additionally, this application has the functionality to display points variably based on the WFS data.

1. In a browser, go to http://geothermaldata.org/dataset. Type in arizona borehole temperatures in the search field.
2. Click on the Arizona Borehole Temperatures option.
3. Mouse-over the access options on the left. Right click on WFS Capabilities.
4. Select Copy Link Location/Address/Shortcut.(http://services.azgs.az.gov/ArcGIS/services/aasggeothermal/AZBoreholeTemperatures/MapServer/WFSServer?request=GetCapabilities&service=WFS)
5. Open QGIS.
6. On the toolbar select Layer then choose Add WFS Layer.
7. In the window Add WFS Layer from a Server, choose New.
8. In the Connection Details area type AZBoreholeTempertures for the name and paste the WFS link copied from the steps above into the URL box. Click OK.
9. Click Connect and then highlight the layer displayed in the box below.
10. Click Add to add the layer to the map.
11. To identify a feature, click the Identify tool (in the middle of the lowest toolbar) and choose a point on the map. A pop-up box will display with the data from the chosen feature. Click Close to close the pop-up.
12. In the toolbar, click the down arrow next to the Select Single Feature icon (yellow box with white arrow) and choose Select Features by Rectangle.
13. Draw a rectangle around a subset of features.
14. Right-click the layer from the Layers tree on the left. Choose Open Attribute Table.
15. In the Attribute Table window in the drop-down menu in the bottom left select Show Selected Features. Choose the Copy selected rows to clipboard icon at the top or press Ctrl+C on your keyboard.
16. Open an Excel or text file and paste or press Ctrl+V on your keyboard for a copy of the selected data.
17. Back in QGIS, right-click on the WFS layer (aasg:BoreholeTemperature) and choose Properties from the list.
18. Under the Style tab, choose Rule-based from the drop-down list in the upper-left

corner.
19. Click the Add Rule icon (green plus symbol) at the bottom.
20. In the new Rule properties pop-up, type 100F-200F into the Label field.
21. Click … button next to Filter.
22. In the Expression box of the new pop-up, type in the following expression: "MeasuredTemperature" > '100' AND "MeasuredTemperature" < '200'. Click OK.
23. Back in the Rule Properties pop-up, click the color box to change the color of the symbol to orange. Click OK.
24. Click OK again to close the Rule Properties window.
25. Back in the Layer Properties pop-up, click Add Rule again.
26. In the new Rule properties pop-up, type 200F+ into the Label field.
27. Click … button next to Filter.
28. In the Expression box of the new pop-up, type in the following expression: "MeasuredTemperature" > '200'. Click OK.
29. Back in the Rule Properties pop-up, click the color box to change the color of the symbol to dark red-orange. Click OK.
30. Next to the Size parameter, change the size to 4.00. Click OK.
31. Click OK again in the Layer Properties pop-up to close it.
32. Back in the Attribute Table window click the Select Features by using an Expression icon.
33. In the Expression box of the new pop-up, type in the following expression: "MeasuredTemperature" > '200'. Click Select and then Close.
34. Look next to the title of the Attribute Table window to see how many features have been selected.