Unlocking access to the National Virtual Core Library with nvcl_kit

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Australia's National Virtual Core Library (NVCL) is an online library containing mineralogy data and imagery from more than one million metres of drill core rock samples from all around Australia.

Up until now this data was only available for downloading from government geological survey websites and the AuScope Portal.

'nvcl_kit' is a Python library which makes this huge dataset available to geoscience practitioners via Python's more convenient and powerful interface. Tools such as Jupyter notebooks can be employed to their maximum advantage to develop, demonstrate and share useful and hopefully insightful code documents.

Package name:	nvcl_kit
PYPI package download:	https://pypi.org/project/nvcl-kit
Source code home page:	https://gitlab.com/csiro-geoanalytics/python-shared/nvcl_kit
PIP install command:	pip install nvcl_kit
API documentation:	https://csiro-geoanalytics.gitlab.io/python-shared/nvcl_kit
Demonstration script:	https://gitlab.com/csiro-geoanalytics/python-shared/nvcl_kit/-/blob/master/demo.py
Python notebook examples:	https://gitlab.com/csiro-geoanalytics/python-shared/nvcl_kit/-/tree/master/notebooks

Table 1: nvcl_kit package and resources information

Architecture

nvcl_kit is written in Python v3 and uses the OWSLib[1] Python library to fetch data from OGC WFS[2] services. Communication with NVCL services are handled directly by the service interface class.

The service interface class is used to isolate the API interface from the machinations of back end network protocols and procedures.
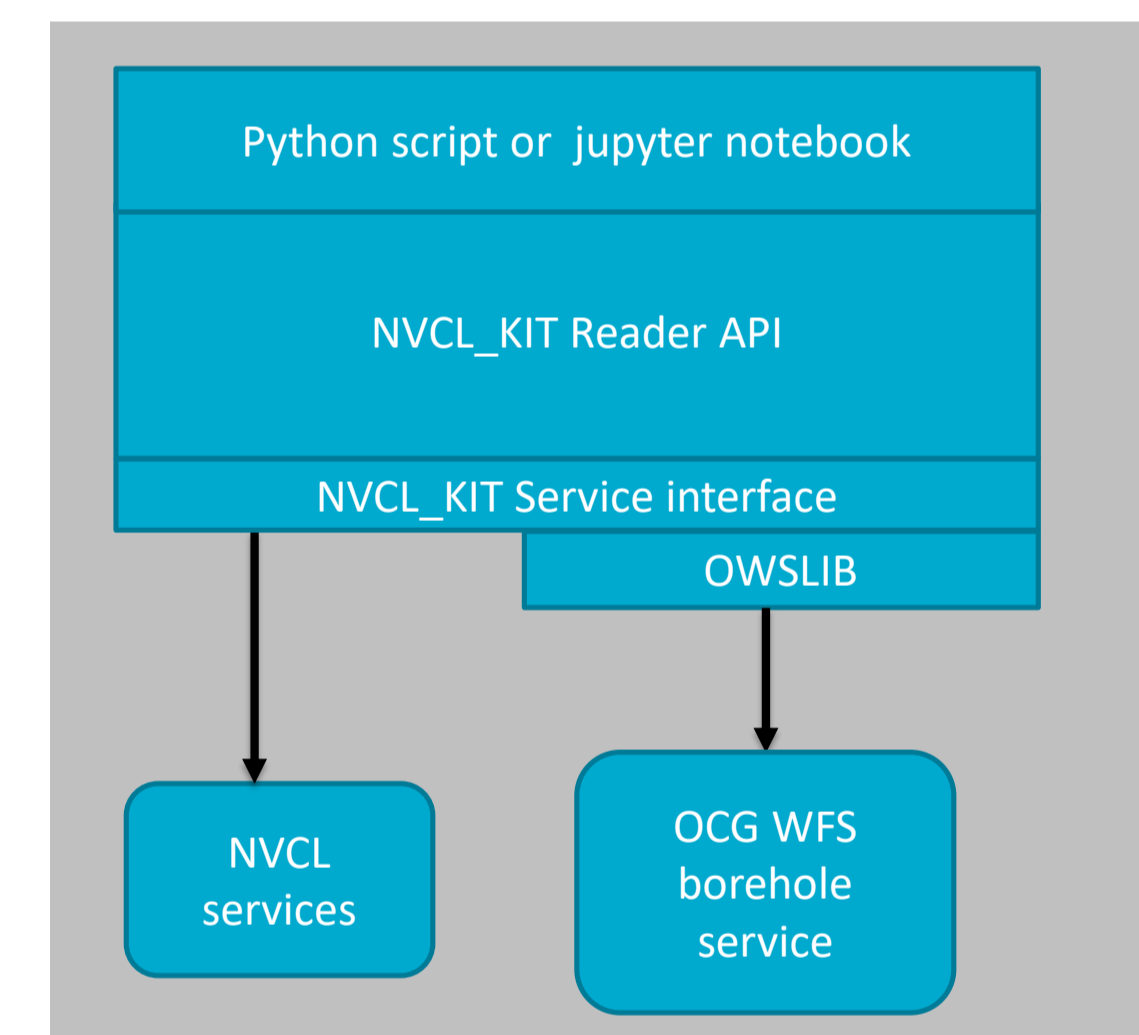
This enables future modifications to the back end without affecting the externally facing API.

To the left, Figure 1 displays a block diagram of the architecture.

Basic package and resource information can be seen in Table 1 above.

Figure 1: Simple block diagram of nvcl_kit

Standing on broad shoulders

Every State and Territory Geological Survey in Australia has an AuScope NVCL borehole service and OGC WFS[2] borehole services. nvcl_kit can retrieve the following information and graphics from these services:
- Borehole information (via OGC WFS)
- Mineral concentrations at requested depths
- Drill core data logs
- Images of drill cores extracted from borehole
- Pre-generated graphs

What follows are examples of how nvcl_kit and Python scripts or jupyter notebooks[5] can be used to do more with the information available from these services.

Display borehole images

Using Python's 'Pillow'[4] package, drill core images and pre-generated graphs from any NVCL service can be displayed. A sample drill core image is shown on the left in Figure 2

Figure 2: Image of drill core extracted from 'OBD 12' borehole. Borehole data courtesy of South Australia Department for Energy and Mining (https://energymining.sa.gov.au/minerals)

Reveal minerals at depths

With Python's 'matplotlib'[3,] nvcl_kit can be used to display which mineral classes occur at any particular depth in the borehole (Figure 3 below). This is similar to what can be seen in geoscientific websites like AuScope Portal (http://portal.auscope.org.au) and AusGIN (https://portal.geoscience.gov.au/) The AuScope Portal equivalent is shown in Figure 4.
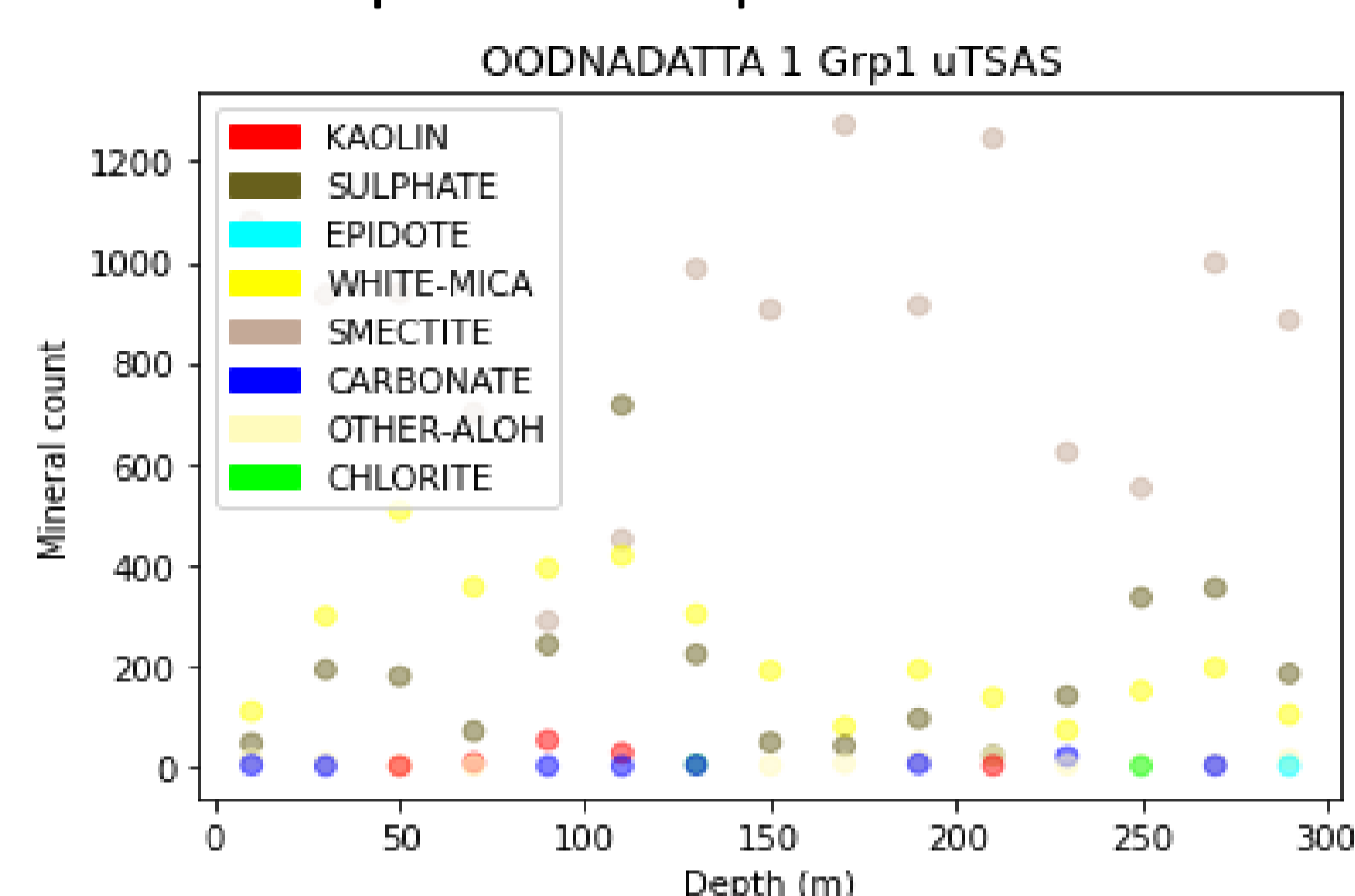
Figure 3: Mineral groups from 'OODNADATTA 1' borehole, derived from drill core sampled using short wave infra-red light (1300nm-2500nm). The graph data is displayed at a depth spacing of 40m. Borehole dataset courtesy of South Australia Department for Energy and Mining. (https://energymining.sa.gov.au/minerals)
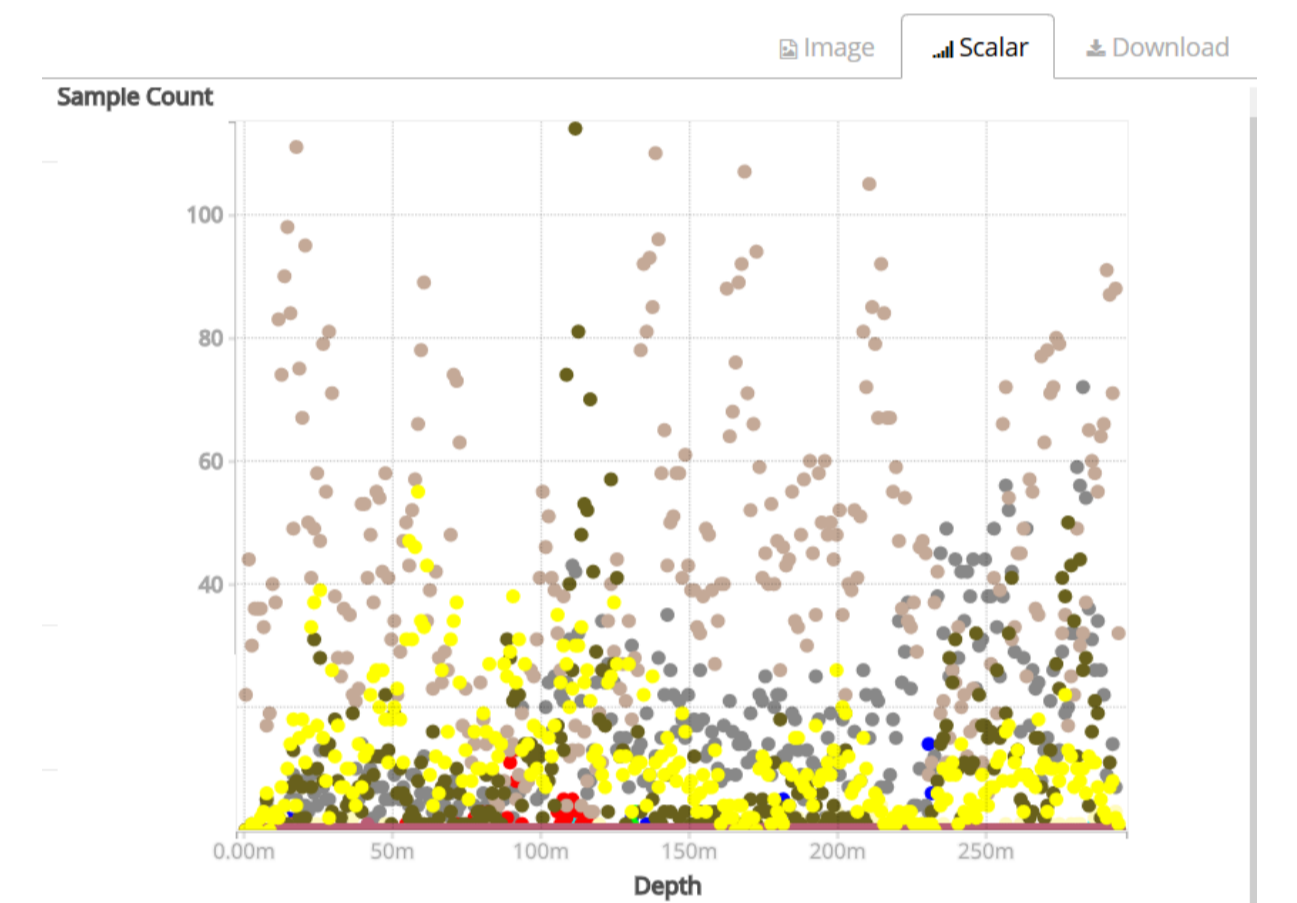
Figure 4: A cropped screenshot of AuScope Portal's version of Figure 3, at a 10m depth spacing. Borehole dataset courtesy of South Australia Department for Energy and Mining (https://energymining.sa.gov.au/minerals)

Compare minerals from two different locations

There are many useful ways of displaying borehole data that aren't currently available on geospatial websites.
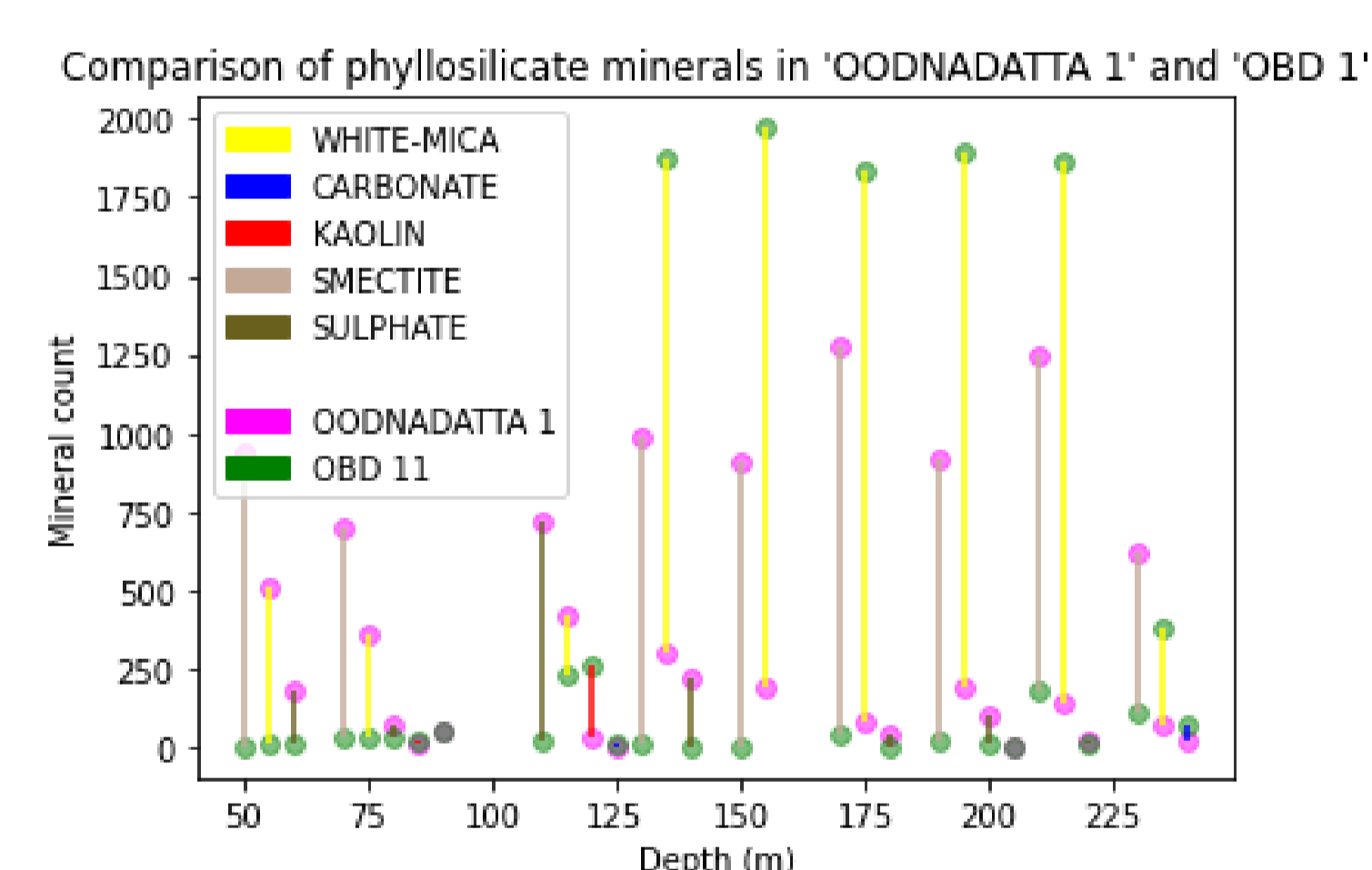
For example, Python's matplotlib can generate the dumbbell plot shown in Figure 5 to the left. It compares the mostly phyllosilicate mineral groups found in two distinctly different boreholes.

Figure 5: Comparison of mineral groups in two boreholes 'OBD 1' and 'OODNADATTA 1' using analysis of short wave infra-red light. Borehole datasets are courtesy of South Australia Department for Energy and Mining (https://energymining.sa.gov.au/minerals)

Plot a geospatial mineral distribution in 3D

nvcl_kit can be used to search for boreholes within a given a rectangle or polygon.

This feature can be used to plot a geospatial mineral distribution in 3D. The size and colour intensity of the coloured circles are proportional to the mineral count of each mineral class. One such plot is shown in Figure 6.
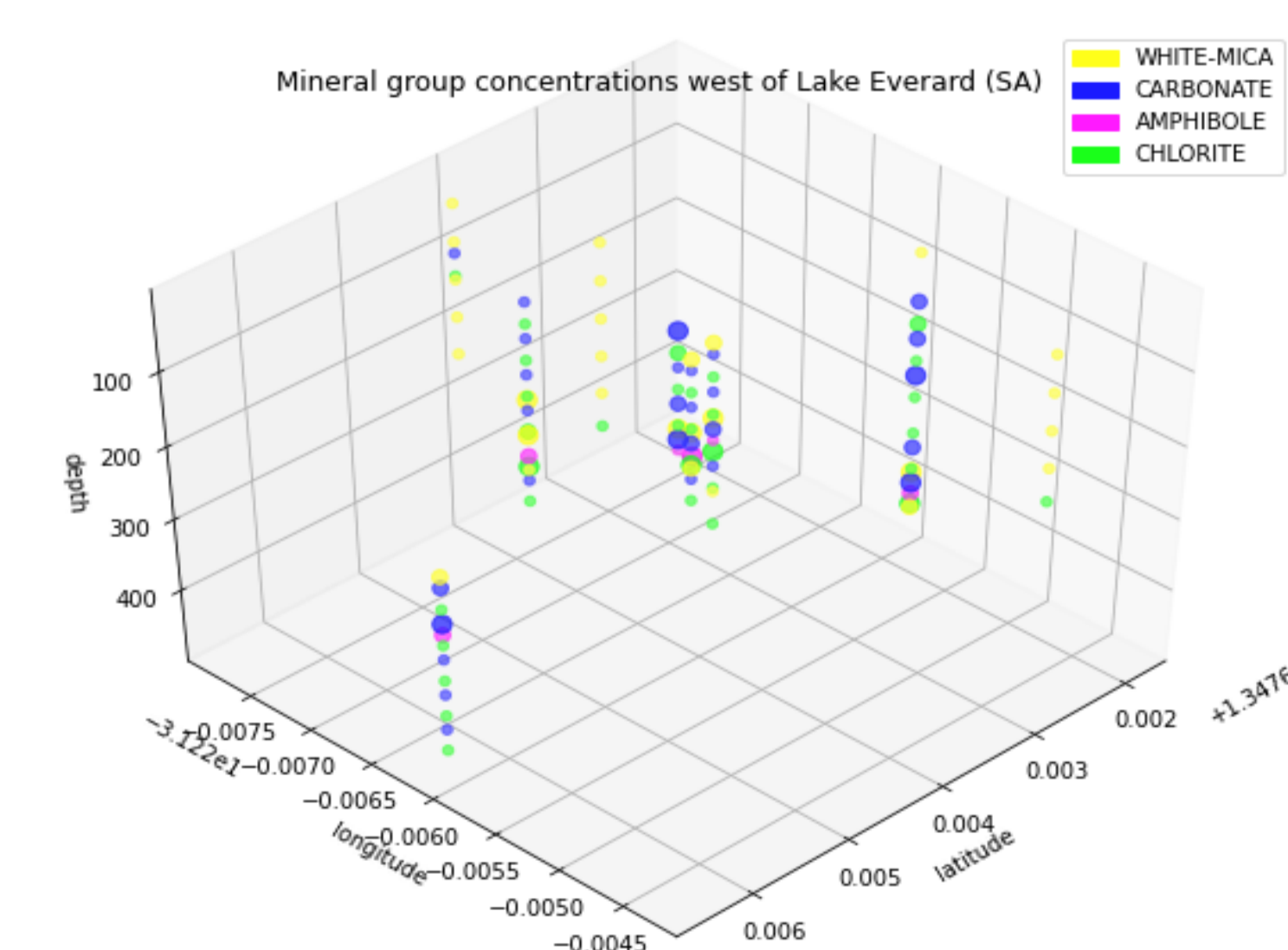
Figure 6: Boreholes found within a rectangular bounding box. Borehole datasets are courtesy of South Australia Department for Energy and Mining (https://energymining.sa.gov.au/minerals)

REFERENCES

1. OWSLIB HTTPS://GEOPYTHON.GITHUB.IO/OWSLIB/
2. OGC WFS: HTTPS://EN.WIKIPEDIA.ORG/WIKI/WEB_FEATURE_SERVICE
3. MATPLOTLIB HTTPS://MATPLOTLIB.ORG/
4. PILLOW HTTPS://PYTHON-PILLOW.ORG/
5. JUPYTER NOTEBOOK: HTTPS://JUPYTER.ORG/