Research Squirrel Engineering

Community-driven grassroots Research FAIRification Tools (RFAIRT) coded from Humanities and Geosciences

RESEARCH SQUIRREL ENGINEERS Network

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Squirrels, LOD and RFAIRT

The comprehensible and collaborative collection and FAIRification of research data is becoming increasingly important in the Citizen Science community to become part of, for example, an archaeological or geoscientific **Linked Open Data** (LOD) Knowledge Graph and to enrich the already connected data network with qualified data (*Schmidt et al. 2022*). Only in this way can these data be linked with other data and actively integrated into international initiatives such as **NFDI4Objects** and community hubs (e.g., Wikidata, OpenStreetMap). Unfortunately, open-source (**FOSS**) research and **Research FAIRification Tools** (**RFAIRT**) are often not available. However, these can be created and curated by community and volunteer initiatives such as the Research Squirrel Engineers Network (*Thiery et al. 2025*), in collaboration with Linked Open Data projects as demonstrators. One example is the SPARQL Unicorn Research Toolkit (*Thiery et al. 2025*) which contains the **SPARQLing Unicorn QGIS Plugin**, the **SPARQL Unicorn Ontology Documentation Tool** and **SPARQLing Jupyter Python Minions**.

Research Squirrel Engineers

The **Research Squirrel Engineers Network** (founded in 2019 to implement the SPARQL Unicorn Research Toolkit) is an informal association of Linked Open Data/Wikidata enthusiasts, research software engineers, and citizen scientists with a focus on computational archaeology, digital humanities, and geoinformatics. The members collaboratively develop and maintain research and **Research FAIRification Tools** and implement them in interoperable **data-driven projects**.

SPARQL Unicorn Research Toolit

One FAIRification tool for digital data management is within the **SPARQL Unicorn Research Toolkit** is an implementation for the FLOSS GIS software QGIS. The **SPARQLing Unicorn QGIS Plugin** (*Thiery & Homburg 2020*) allows sending Linked Data queries in (Geo)SPARQL to triple stores and prepares the results for the geocommunity in QGIS. It currently offers three main functions: (A) simplified querying of semantic web data sources, (B) transformation of QGIS vector layers to RDF, and (C) documentation of LOD as an HTML page. Additionally, the **SPARQL Unicorn Ontology Documentation Tool** (*Homburg & Thiery 2024*) enables, for example, the automated creation of HTML pages from Linked Open Data publications in other applications via GitHub Action. The example (*Fig. 1-4*) shows findspots of the Campanian Ignimbrite eruption (*Schenk et al. 2022*) as LOD in QGIS and GitHub.
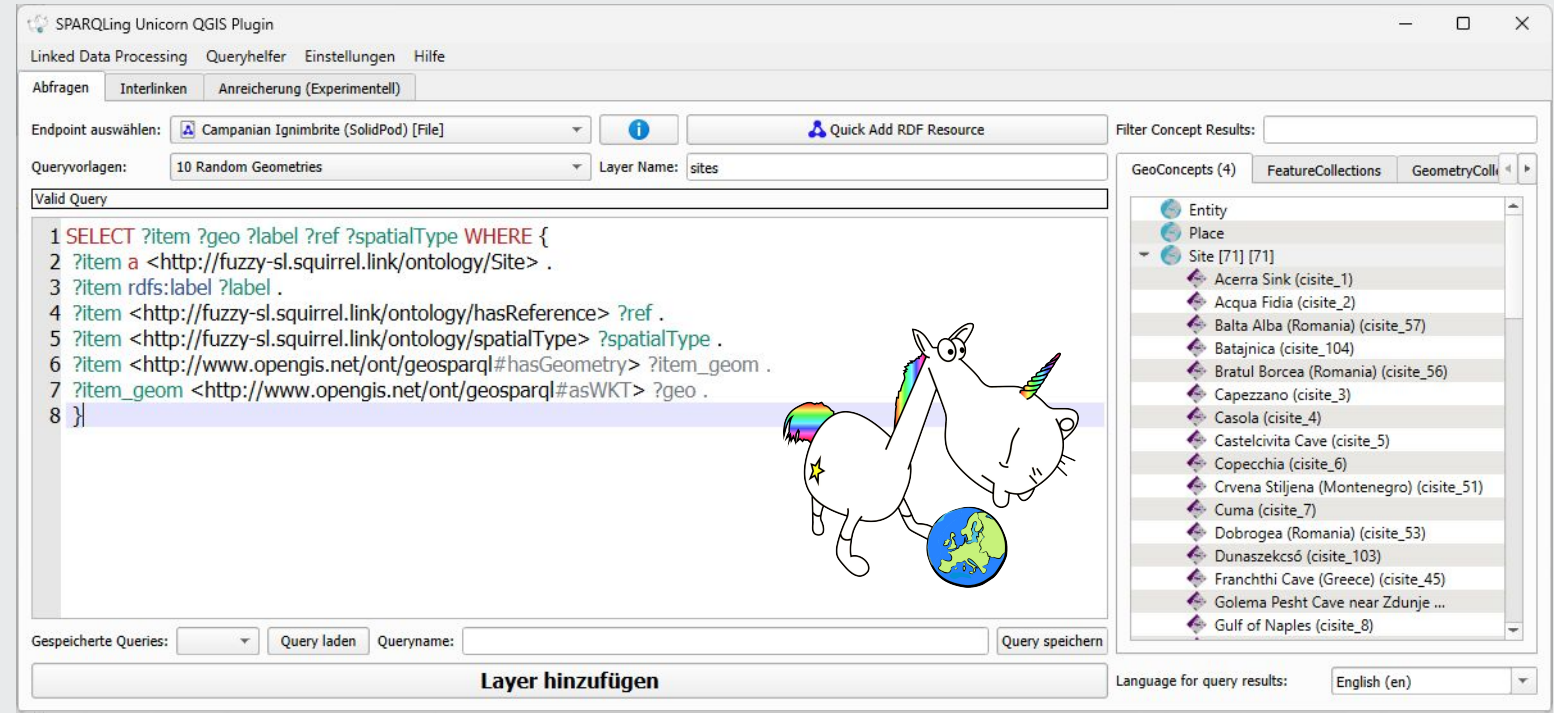
Fig. 1: SPARQL query using the SPARQLing Unicorn QGIS Plugin on a TTL file in a SolidPod for Campanian Ignimbrite find spots (Spatial Types).
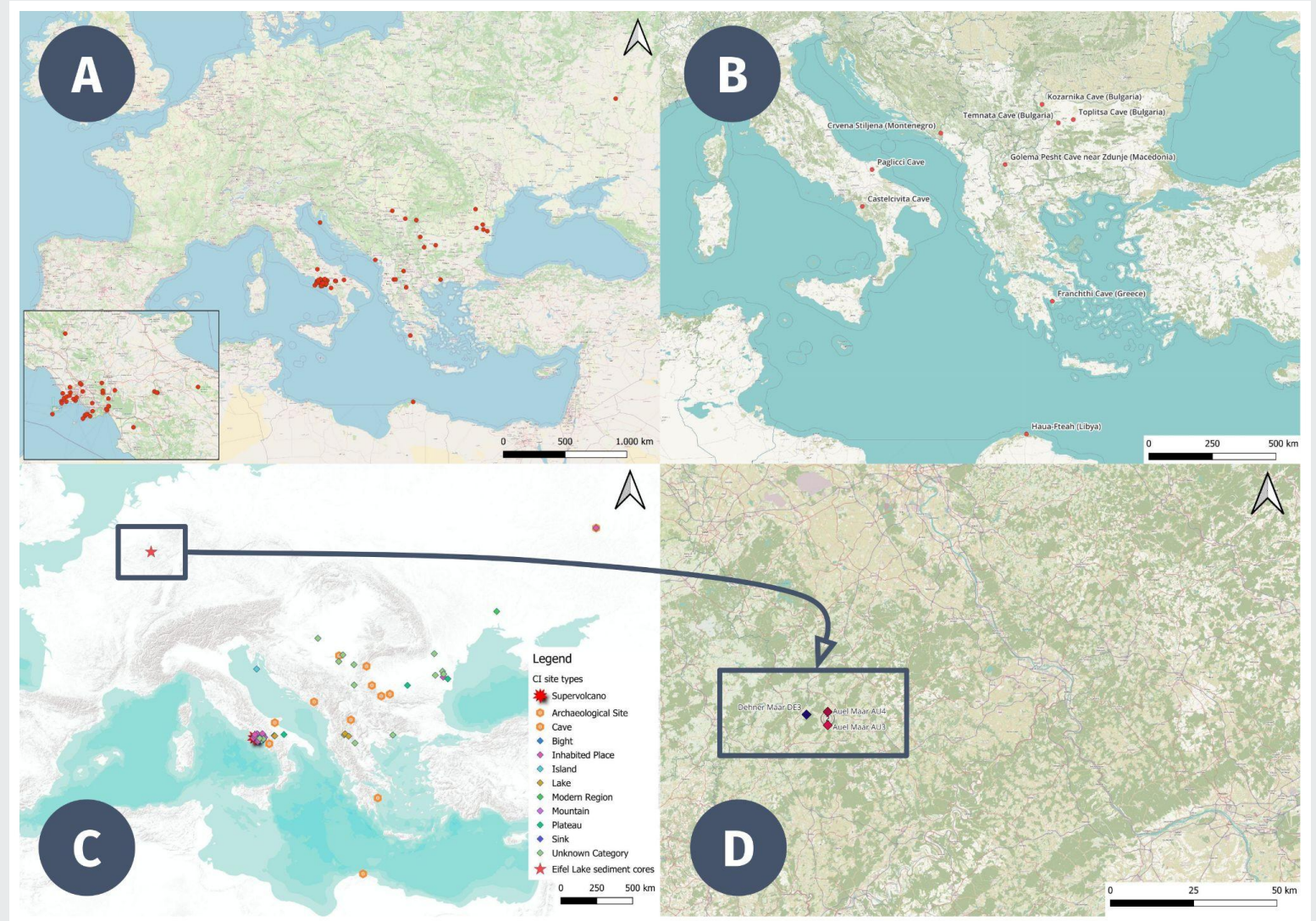
Fig. 2: Maps as a result of the SPARQL query, visualised in QGIS. A: all findspots; B: caves; C: findpots by spatial types; D: findspots in the Auel and Dehner Maar (Eifel, Germany) from *Schenk et al. (2024)*.
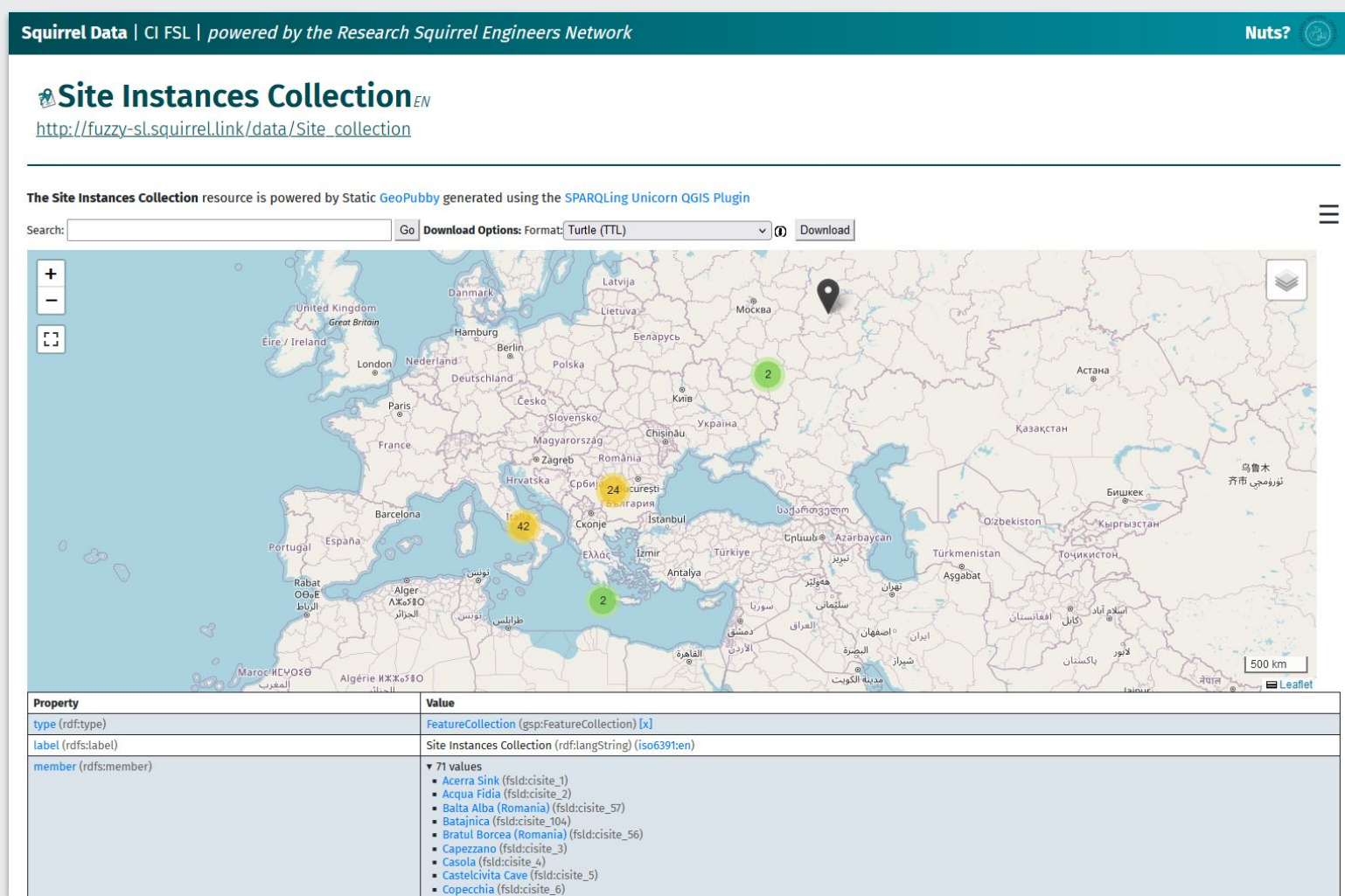
Fig. 3: Campanian Ignimbrite findspots as dynamic Javascript-HTML page, created with GitHub Actions.
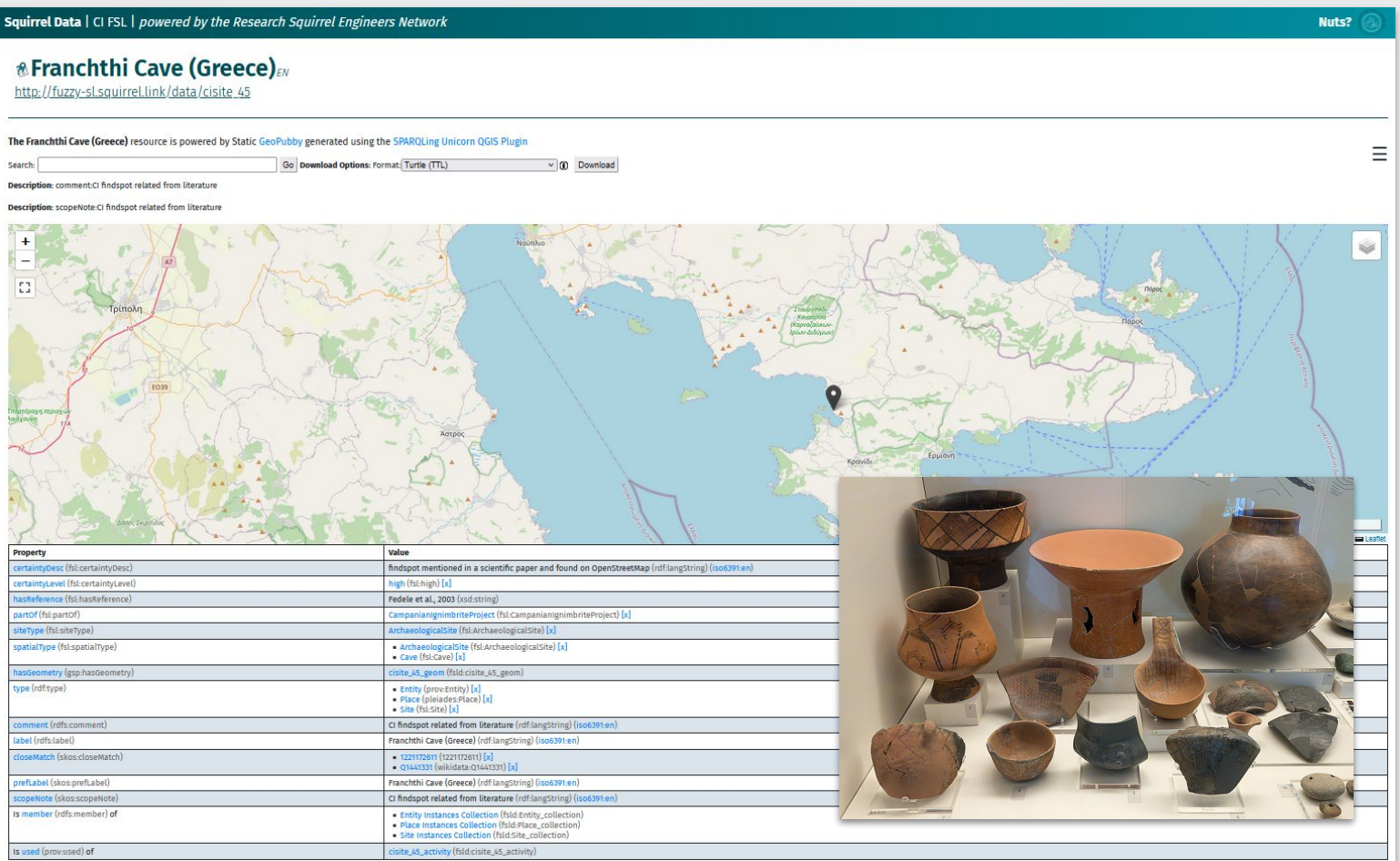
Fig. 4: Franchthi Cave (Greece) containing archaeologcial finds (Zde, CC BY-SA 4.0, via Wikimedia Commons) as HTML page, created with GitHub Actions.

Jupyter Python Minions

Another key tool within the SPARQL Unicorn Research Toolkit are **SPARQLing Python Minions**, which enables users to send SPARQL queries from Jupyter Notebooks and Python Scripts to Wikidata, Wikibases, triple stores, and Solid Pods and visualise the results. This allows for direct integration of Semantic Web data into **Python-based data analysis workflows**. By leveraging Jupyter Notebooks, users can efficiently process, analyse, and visualise the retrieved data, further expanding the usability of SPARQL Unicorn tools for researchers across various domains. The example shows queries on Wikidata (*Fig. 5-6*).
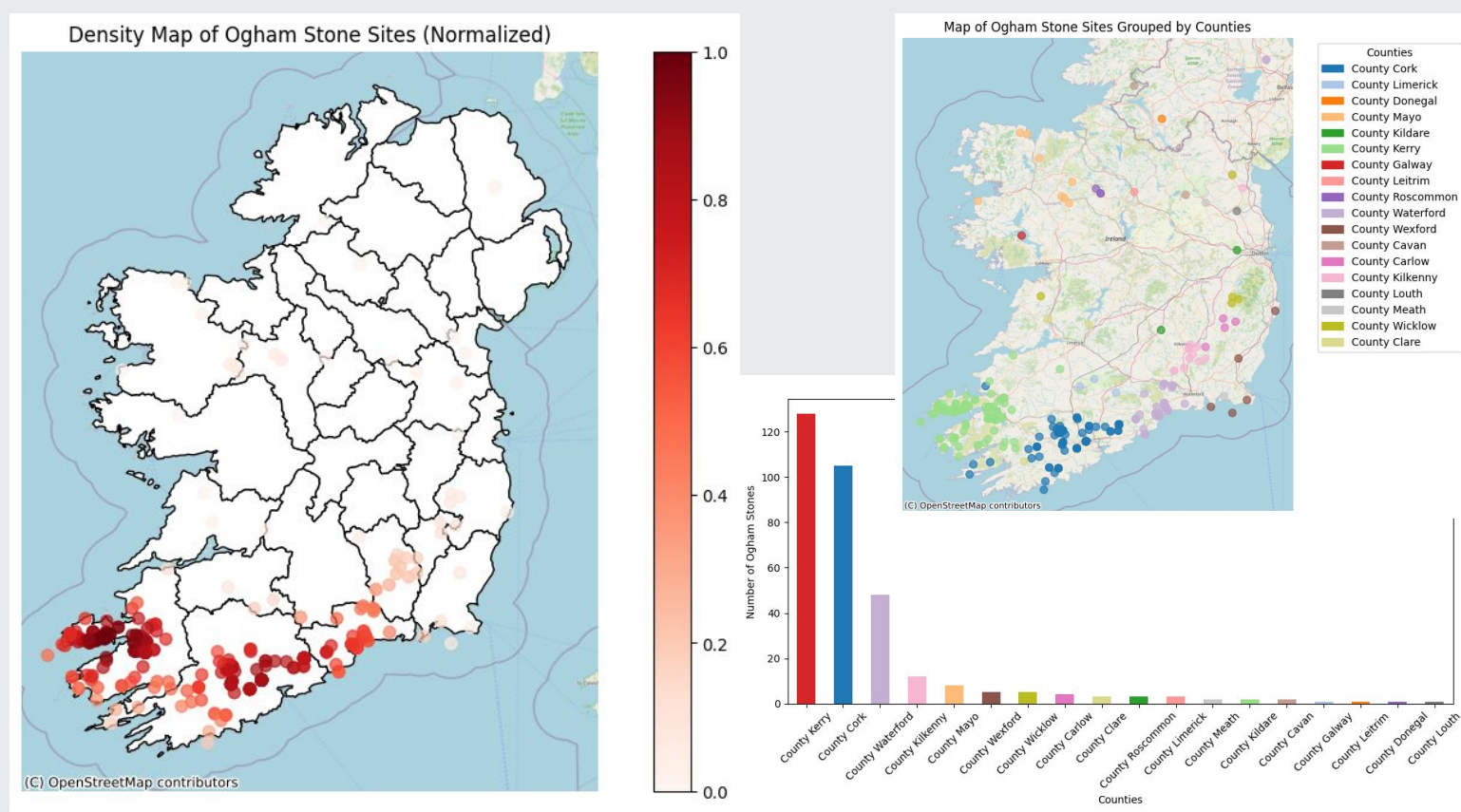
Fig. 5: SPARQL queries on Ogham via Wikidata, visualised as maps and bar chart with a Jupyter Python Minion.

Fig. 6: Python Code to perform the Jupyter Python Minion

Literature & Data/Code-Repositories

Homburg, T. & Thiery, F. (2024). The SPARQL Unicorn Ontology documentation: Exposing RDF geodata using static GeoAPIs. *Tagungsband FOSSGIS-Konferenz 2024*, pp. 82–93. https://doi.org/10.5281/zenodo.10570985.

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Schenk, F., Hambach, U., Britzius, S., Veres, D. & Sirocko, F. (2024). A Cryptotephra Layer in Sediments of an Infilled Maar Lake from the Eifel (Germany): First Evidence of Campanian Ignimbrite Ash Airfall in Central Europe. *Quaternary*, 7(2), 17. https://doi.org/10.3390/quat7020017.

Thiery, F. & Homburg, T. (2020). QGIS – A SPARQLing Unicorn? Eine Einführung in Linked Open Geodata zur Integration von RDF in QGIS Plugins. *Tagungsband FOSSGIS-Konferenz 2020*, pp. 68-72. https://doi.org/10.5281/zenodo.3719128.

Thiery, F., Schenk, F. & Thiery, P. (2025). Das Research Squirrel Engineers Network: FAIRification Tools und LOD-Projekte aus der Archäoinformatik und den Geowissenschaften. *Archäologische Informationen*, 47, Early View. https://doi.org/10.5281/zenodo.14801070.

https://github.com/Research-Squirrel-Engineers /campanian-ignimbrite-geo

https://github.com/Research-Squirrel-Engineers /jupyter-nb-lod/