# Re-evaluating Caledonian magmatism and associated base metal mineralisation: A case study of the Black Stockarton Moor porphyry copper system

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## 1. Motivation

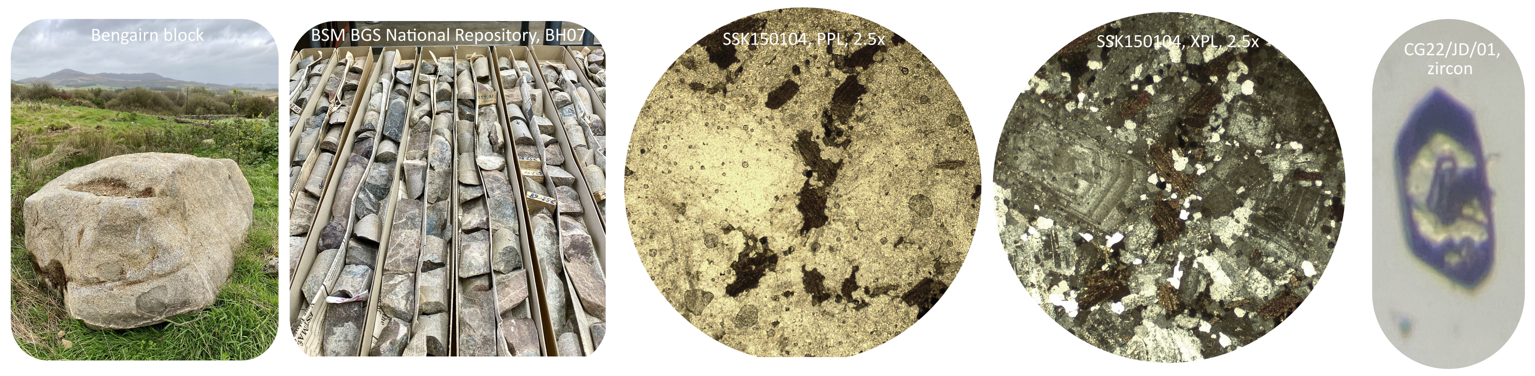
- Few modern studies **characterising** and **quantifying** base and **precious metal mineralisation** in the **UK**, specifically their **paragenesis, geochronology, critical raw materials (CRM = economically significant commodities at risk e.g., Li, REE'S**[14]**)** **deportment** and **ore forming processes**.
- Poorly understood **geochronological** and **petrogenetic relationship** between **magmatism** and **mineralisation** in Caledonian granites/**minor intrusive suites**.
- BGS CMIC and government interest: UK mainly relies on international critical mineral supplies to meet demand [1]. With increased focus on **NetZero, CRM** and **supply risk, old UK mineral deposits** should be **revisited** and new deposits identified to **secure sustainable UK-based CRM supplies**.

## 2. Questions addressed

1. Can this **cost-effective** workflow be **applied** to other less studied **UK Caledonian** areas of mineralisation?
2. Are the following **methods effective** at **characterising** and **quantifying** base and **precious metal mineralisation** in the UK:
   - **A)** SEM-EDX analysis → to image mineralised regions, highlight sites of interest, produce chemical maps
   - **B)** LA-ICP-MS → for further trace element (e.g., CRM) chemical maps
   - **C)** U-Pb dating of calcite/ epidote → to date alteration assemblage as proxy for timing of mineralisation
   - **D)** FIB tomography → to understand 3D grain morphology, 3D structural processes (e.g., clumping), CRM distribution
3. Do the **Caledonian granites** indicate **diachroneity** of **Iapetus slab break-off**? What are their **geodynamic associations** with **mineralisation**?

## 3. Workflow/Methods

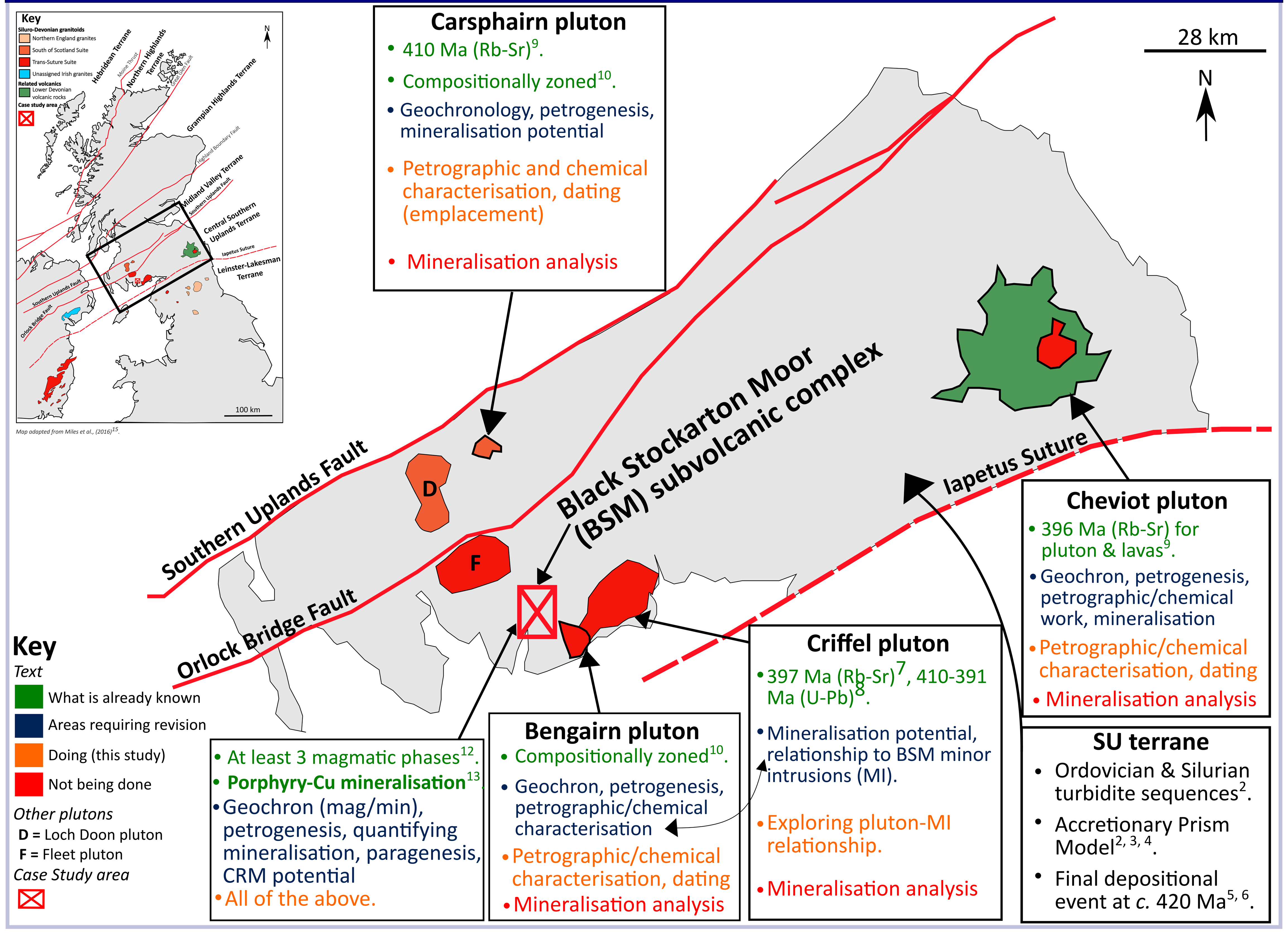
**Field** and BGS **National Repository** sampling → **Optical** and **scanning electron microscopy** (SEM) → **SEM-energy dispersive X-ray** (EDX) analysis → **LA-ICP-MS** for **accessory mineral dating** and **ore trace element** analysis → **Focused ion beam (FIB) tomography** for analysing **CRM distribution** → **Revisit literature** to investigate **ore forming processes** responsible for **CRM enrichment**




**Rationale?**

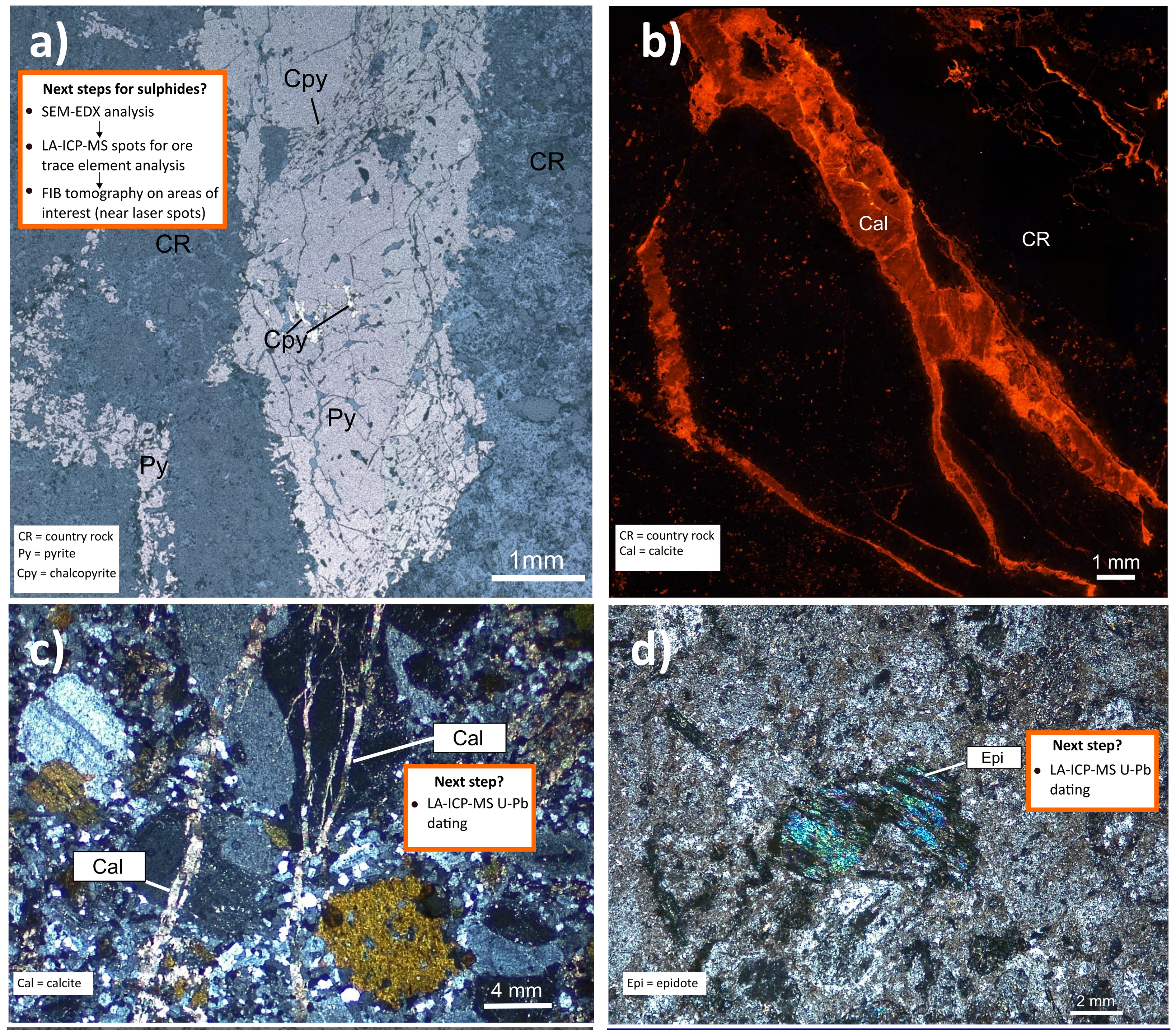
- **Cost-effective** trusted methods
- **Testing** the capacity of **new methods** e.g., FIB
- Ability to **complete** methods **rapidly**
- **Establishing** a **pathway** for **BGS** and **academia** to work **collaboratively**

## 4. Case Study: The Southern Uplands of Scotland




## 5. BSM subvolcanic complex

### Preliminary results





**Reflected light (a, e), cathodoluminescence (b) and transmitted light images (c, d) highlighting:**

**a)** Sulphide mineralisation in host granitoid.
**b)** Chunky calcite vein.
**c)** Calcite veining (alteration mineral).
**d)** Epidote alteration.
**e)** Sulphides hosted in calcite.

## 6. The future - the CMIC & CRM's

- **No CRM's** are **currently** being **extracted** in the **UK** (excluding tungsten). The **CMIC** in line with the **UK Critical Minerals Strategy**[1] have **identified** possible **CRM target areas** in the **UK**.
- **Further research**, **exploration** and **geological investigations** of **potential UK CRM prospects and associated precious/base metal mineralisation** as outlined in the **CMIC report**[14] are required. Work is **currently underway** in **all key prospective areas**[14].

## References

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