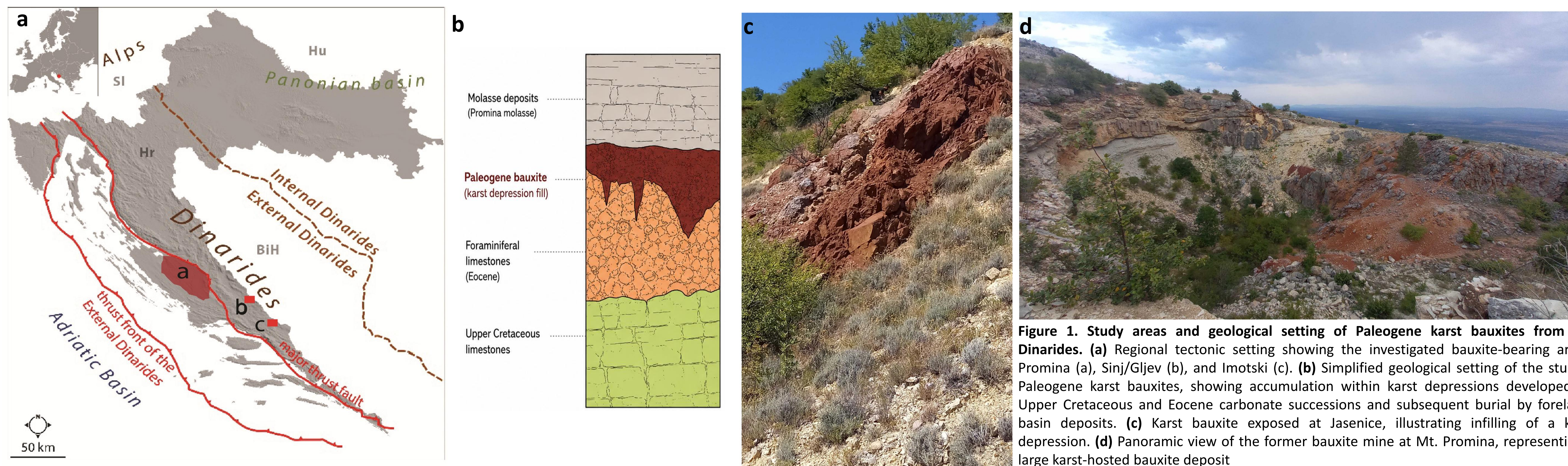


Can karst preserve the memory of volcanoes long after they disappear?

Large explosive eruptions can leave a regional geochemical footprint far beyond the volcanic source. However, volcanic centres may be destroyed, volcanic deposits eroded, and much of the eruptive record lost through time. Where, then, can evidence of ancient volcanism still be preserved?

Karst depressions are natural sediment traps capable of accumulating and preserving external material under conditions of low detrital input.

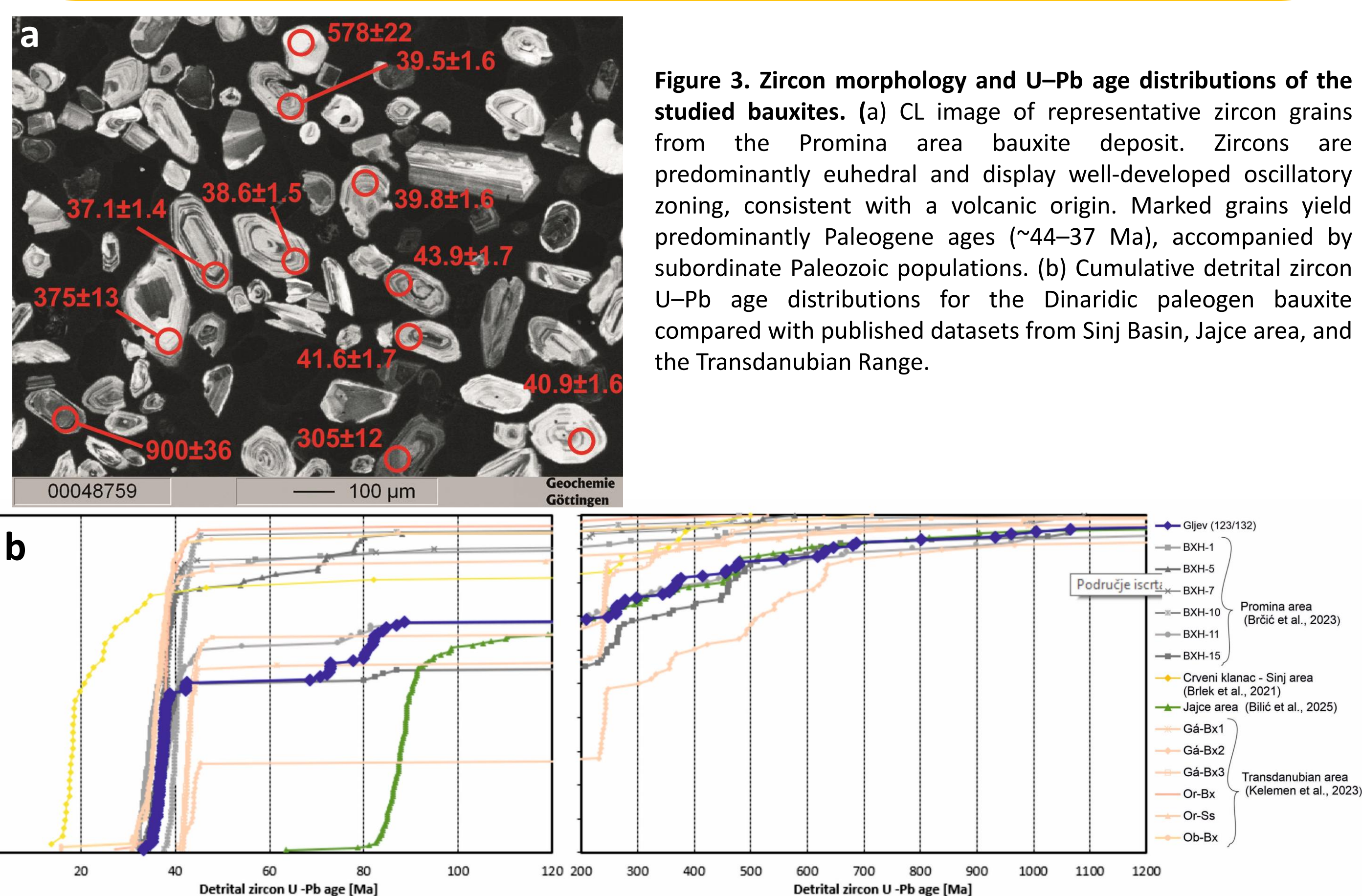
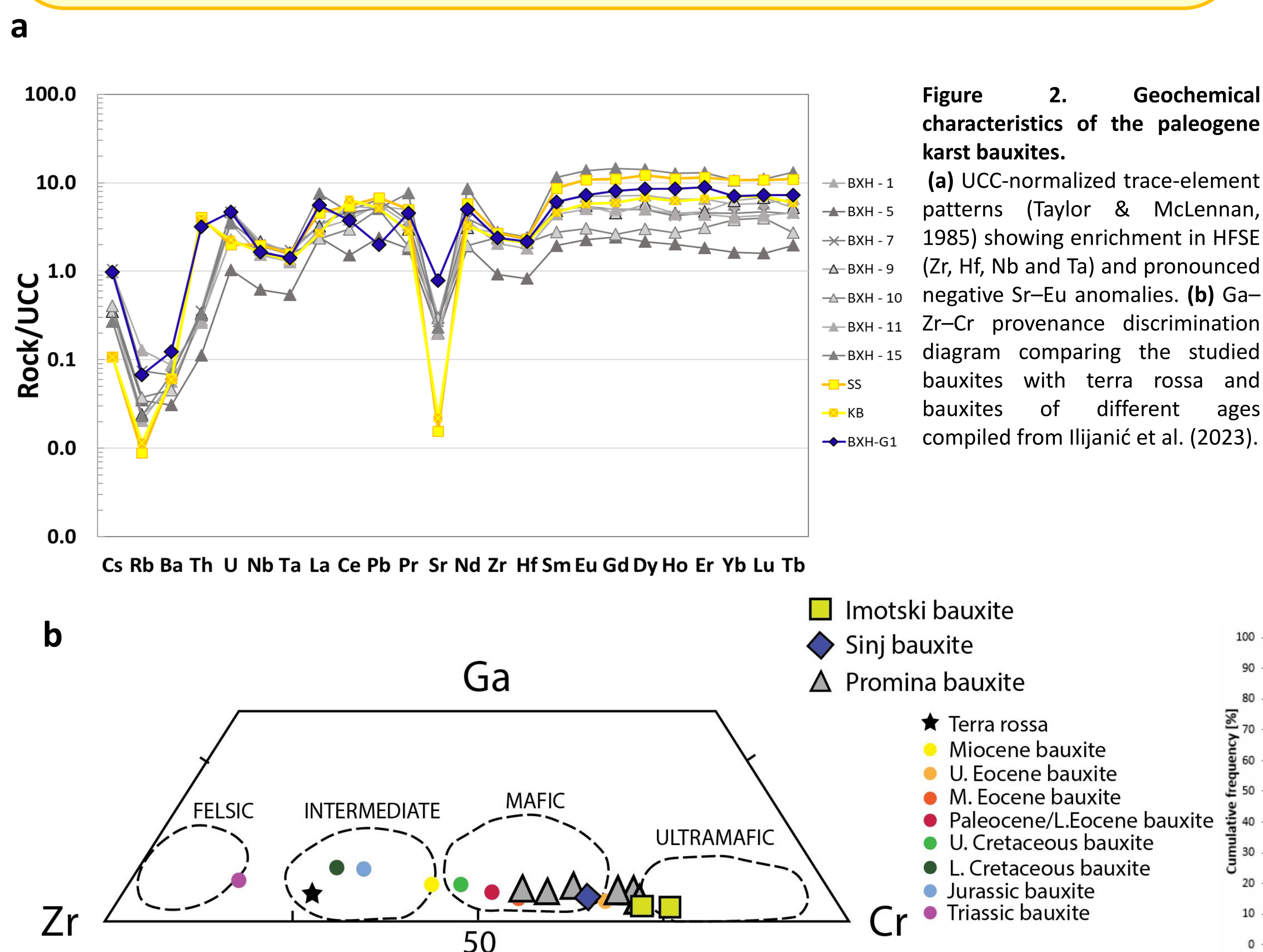
The Paleogene bauxites of the Dinarides offer an exceptional opportunity to test whether such systems can retain volcanogenic signals over tens of millions of years and provide insights into regional volcanic activity no longer preserved elsewhere. These bauxites accumulated within karst depressions developed on exposed Upper Cretaceous and Eocene carbonate successions and were subsequently buried by foreland-basin deposits

**GEOCHEMICAL DESCRIPTION**

- Consistent trace-element patterns across Promina, Sinj and Imotski bauxites. HFSE enrichment (Zr, Hf, Nb, Ta) and LREE-enriched compositions indicate a significant felsic component.
- Elevated Cr concentrations point to an additional ultramafic contribution, likely related to ophiolitic sources.
- Combined geochemical data suggest a mixed provenance comprising local ultramafic detritus and felsic volcanogenic input.

GEOCHRONOLOGICAL DESCRIPTION**U-Pb zircon geochronology using LA-ICP-MS:**

- Zircon grains are predominantly euhedral and display well-preserved oscillatory zoning, consistent with a volcanogenic origin.
- Paleogene zircons dominate the age spectra in both Promina and Gljeve deposits, comprising >50–90% of the analyzed grains.
- Most Paleogene ages cluster between ~45 and 32 Ma, with prominent peaks at ~42–41, ~38–37 and ~34–33 Ma. The narrow age range suggests temporally constrained volcanic input and supports deposition of distal volcanoclastic material during Paleogene bauxitisation.
- Minor pre-Paleogene zircon populations (Late Cretaceous to Paleozoic) indicate a limited contribution from recycled crustal and sedimentary sources

**DISCUSSION**

- Similar **Paleogene zircon populations** in the Promina and Sinj (Gljeve) deposits indicate a **shared volcanic source**.
- The obtained ages overlap with Paleogene magmatism of the Periadriatic belt (e.g., the Adamello intrusive complex), although evidence for regionally dispersed explosive volcanism remains limited. Comparable ages are not directly recorded within the Eocene–Oligocene caldera-forming systems of Bulgaria, where older eruptive products may have been obscured by younger volcanic activity.
- Comparison with published zircon datasets from Cretaceous and Miocene bauxites reveals distinct age distributions, arguing against extensive recycling of pre-existing bauxite material and suggesting that **individual bauxite generations may preserve independent volcanogenic records**.
- Karst bauxites may therefore preserve primary records of volcanogenic input and represent previously overlooked archives of regional volcanic activity.**

FUTURE WORK

- Extend zircon U–Pb dating to the Imotski area and additional Paleogene bauxite deposits further south along the Dinarides to test the regional extent of the volcanogenic signal.
- Apply zircon Lu–Hf isotope analyses to better discriminate between potential Paleogene source regions and evaluate links to Periadriatic and Balkan magmatic provinces.
- Reconstruct Paleogene ash-dispersal pathways across the Alpine–Balkan domain.
- Evaluate the potential of Dinaridic karst bauxites as archives of regional volcanic activity and volcanic events no longer preserved in the primary volcanic record.