

Karst sedimentary traps as archives of distal volcanoclastic material in the Dinarides

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Carbonate karst terrains of the Dinarides are characterized by extremely limited siliciclastic input, making even minor clastic components valuable archives of distal sedimentary and volcanic processes. Karst sedimentary traps may preserve volcanoclastic material transported over long distances, offering a unique record of the wide dispersal of volcanic products beyond their source regions. This study presents an integrated overview of volcanoclastic signatures preserved in different karst sedimentary traps of the Dinarides, ranging from Paleogene residual deposits to Quaternary cave and surface sediments. A multi-proxy approach combining mineralogical, geochemical, heavy-mineral, scanning electron microscopy (SEM), electron microprobe (EPMA), and detrital zircon U–Pb geochronological analyses was applied to constrain the provenance and age of volcanogenic material.

Paleogene karst bauxites and related residual deposits preserve abundant euhedral zircon populations with dominant Paleogene ages, accompanied by HFSE enrichment and felsic geochemical signatures, indicating input of distal volcanoclastic material derived from Paleogene volcanic activity. In Quaternary red clays and colluvial deposits from the Plitvice Lakes, beside volcanic quartz, heavy mineral assemblages dominated by idiomorphic zircons and ilmenite, together with Miocene zircon age populations, point to preservation and redeposition of volcanogenic material linked to eruptions in the Carpathian–Pannonian region. In contrast, Quaternary cave sediments and surface soils from Mt. Biokovo contain volcanic glass, sanidine, clinopyroxene, and Fe–Ti oxides whose mineral chemistry imply provenance related to explosive eruptions of Italian volcanic provinces.

Despite variation in age, depositional setting and weathering degree that consequently require different analytical approach, all studied examples demonstrate that karst sedimentary traps preserve evidence of volcanic activity across a wide range of spatial and temporal scales. Together, they highlight the potential of karst archives to reconstruct the transport, dispersal, and long-term preservation of volcanoclastic material in the Dinarides.

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