TRACE ELEMENT CONCENTRATIONS OF QUARTZ FROM ALPINE FISSURES

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In the year 2000 mineral collectors found artefact-like quartz fragments and a flint fragment showing distinct hewing signs in an Alpine fissure near the Riepenkar. The fissure, measuring around 15 m in length and 3 m in depth, is located west of the Olpererhütte at around 2700 m altitude. The findings of blades and bladelet-shaped quartz flakes, partial lateral retouching and signs of usage have led to the conclusion that the quartz crystals show evidence for lithic reduction. Geologically, the fissure at the Riepenkar is located in the "Tux-Gneis-Kern". This unit belongs to the Venediger thrust sheet system of the Sub-Penninicum and consists of various metagranodiorites and metatonalites. The fissure itself is situated in a leucocratic orthogneiss host rock with minor tonalite lenses nearby (at least 200 m distance). The trace elemental concentrations in quartz from this as well as other Alpine fissures were studied using LA-ICP-MS, EPMA, SEM, CL, micro-XRF, micro-Raman spectroscopy, single-crystal XRD and PXRD. The aim of this study was to test the ability of using the trace elemental contents of Alpine fissure quartz as a possible provenance tool in archaeology. Most samples were provided by the mineral collector Walter Ungerank and derive from the Tyrolean part of the Tauern Window. Further samples were collected in various locations in the Tauern Window in South Tyrol. Thus, the sample locations are distributed over large areas of the western part of the Tauern Window, while their host rocks cover various rock types including metagranites, metapelites and metabasites.

The trace elemental concentrations of quartz from these Alpine fissures typically contain only minor amounts of Li, B, Mg, Al, P, Ca, Ti, Fe and Ge. Their abundance depends on the quartz variety and was quantified by applying LA-ICP-MS. Combined with CL imaging these measurements revealed a chemical zonation, which is expressed as sector zoning in the quartz crystals. LA-ICP-MS results indicate that slight differences in the median trace elemental concentrations from Alpine fissure quartz have at least the potential to discriminate between quartz from fissures in different host rocks. The total trace elemental content depends on the quartz variety: amethyst shows high Fe contents; milky quartz shows a tendency towards increasing Al and Li contents. Hence, a use of the quartz trace elemental content as a provenance tool has to take into account the quartz variety. Sector zoning was confirmed through CL imaging and the LA-ICP-MS profiles show that it affects the variability of trace elemental contents (especially for Al and Li) within both single crystals and quartz from Alpine fissures. A relatively clear distinction based on trace elemental contents can be made between samples from outside the Tauern Window and those from within the Tauern Window. Further extensive sampling in the central and eastern part of the Tauern Window should be conducted to confirm these observations.