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The pre-Variscan petrogenesis of HP granulite and Gföhl gneiss in Lower Austria (Bohemian Massif): constraints from whole-rock geochemistry and U-Pb zircon dating

Christoph Hauzenberger (1), Philip Schantl (1), Fritz Finger (2), Manfred Linner (3), and Hoang Nguyen (4)

(1) University of Graz, NAWI Graz Geocenter, Petrology and Geochemistry, Graz, Austria, (2) University of Salzburg, Salzburg, Austria, (3) Geological Survey of Austria, Vienna, Austria, (4) Vietnamese Academy of Science and Technology (VAST), Hanoi, Vietnam

The Gföhl Unit in the Austrian section of the Bohemian Massif exposes large volumes of meta-granitic rocks, including the prominent Gföhl gneiss and the overlaying high-pressure (HP) felsic granulite. Minor bodies or lenses of mafic orthopyroxene bearing granulite with a granodioritic composition typically accompanies the felsic granulite. In an attempt to elucidate the pre-Variscan evolution history of these three rock types, we combined whole-rock geochemistry with zircon geochronology. In view of a complex polyphase zircon growth history, we additionally differentiated between metamorphic and protolithic zircon domains by using their distinctive trace element and REE characteristics as well as Ti-in zircon thermometry. The protoliths of the felsic Gföhl gneisses crystallized at ∼480 Ma, as indicated by abundant prismatic zircons with well-preserved magmatic zoning. Moreover, two groups of inherited zircon core domains can be distinguished. The first exhibits ages of ∼540 Ma, while the second group is stringed along a Discordia with a lower intercept at the age of the Variscan metamorphism (∼340 Ma) and an upper intercept at >2000 Ma, indicating pre-Cambrian recycled crustal material in the Gföhl gneiss. The protolithic ages of felsic and mafic granulites are more complex due to pronounced recrystallization of zircon during the HP granulite facies event (∼1000 °C, ∼1.6 GPa) at ∼340 Ma, resulting in a wide age scatter from 410 to 340 Ma. The oldest age of ∼410 Ma was obtained from zircons with well-preserved oscillatory zoning, without any visible recrystallisation patches, interpreted as minimum age of precursor emplacement since a certain degree of recrystallasation still cannot be ruled out. A group of inherited cores in one felsic granulite sample plot along a Discordia with a lower intercept at ∼340 Ma and an upper intercept at >1800 Ma, suggesting also pre-Cambrian crustal recycling as is assumed for the Gföhl gneiss.