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LA-ICP-MS U-Pb geochronology of carbonates from Ag-Bi-Co-Ni-As±U veins in the Erzgebirge (Germany and Czech Republic): New insights into the timing of mineralization

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Hydrothermal Ag-Bi-Co-Ni-As±U (five-element) veins are particularly prevalent across Central Europe, where this type of mineralization has been mined throughout the ages for its high-grade resources of Ag, Co, Ni, and U. The timing and the detailed geodynamic setting in which this style of mineralization formed remains, however, insufficiently understood due to the limited amount of geochronological data. In this contribution, we report the results of innovative LA-ICP-MS U-Pb geochronology on the carbonate gangue of Ag-Bi-Co-Ni-As±U mineralization from six districts in the Erzgebirge/Krušné Hory metallogenic province of Germany and the Czech Republic, with the goal to constrain the timing of ore formation in the context of Central Europe's geodynamic framework.

In-situ U-Pb ages of twelve samples, including dolomite-ankerite, calcite, and siderite cogenetic with Co-Ni-Fe-arsenides, range from 129.4 ± 8.2 to 85.93 ± 3.4 Ma. The ages of Ag-Bi-Co-Ni-As±U and fluorite-barite-Pb-Zn veins from the same occurrence (Annaberg-Buchholz district) overlap each other, suggesting that these two styles of mineralization are genetically related and may form coevally. The compilation of geochronological data from other Ag-Bi-Co-Ni-As±U occurrences in Europe suggests that the origin of this style of mineralization in Central Europe can be related to continental rifting associated with the Mesozoic opening of the Atlantic and/or the Alpine Tethys (200-100 Ma). This provides for the first time evidence for the formation of Ag-Bi-Co-Ni-As±U vein mineralization across Central Europe in response to continental rifting.