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Regional implications of a Miocene acid sulphate alteration, Austria : insights from the H, O, S and K-Ar isotopic record

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The studied area is situated in the Styrian basin, which was formed during Miocene eastward tectonic extrusion and orogen-parallel extension. The Miocene to Pliocene volcanic rocks are found as an arc, extended between the Styrian basin to the west and lake Balaton to the east. The Miocene volcanics are characterised by high-K trachyandesites, trachites and basaltic trachyandesites. The Gossendorf volcanic body is the only one in the Styrian basin, showing extensive hydrothermal alteration. In this study we investigated the age of rocks and alteration as well as the source of fluids by determining the stable isotopic composition of mineral concentrates from the magmatic body and alteration zone. The study allows to constrain the origin of Gossendorf hydrothermal alteration and to associate it with other Miocene hydrothermal alterations from the Alpine-Carpathian-Pannonian area.

For K-Ar dating, the %K was determined on a TIMS by isotope dilution using a ^{41}K enriched spike. Radigenic Ar was determined by isotope dilution method with pure ^{38}Ar spike on a static vacuum MS. K-Ar dating of primary volcanic biotite and alteration products (alunite) suggests that the emplacement of the volcanic body and hydrothermal alteration took place synchronously, 15 Ma ago.

The sulphur, oxygen and hydrogen stable isotope composition of the alteration products such as opal, barite, pyrite and alunite combined with mineralogical investigations as XRD indicate temperatures between 150 and 200˚C for the formation of the

alteration zones. The calculated stable isotopic compositions of the parent fluid, responsible for the alteration, show an exogene component of marine origin, which interacted with the host rock. This is in agreement with palaeogeographical reconstructions, which place the active Gossendorf volcano in the marine coastal zone of the Paratethys

Sulphur isotopic compositions of sulphur, sulphides and sulphates indicate disequilibrium, and progressive oxidation. This fact combined with the mineral zonation of the alteration zone reflects not only change in the pH but also change in the fO_2 of the ascending fluids.

During the Miocene, in the Alpine-Carpathian-Pannonian area a non-subductional volcanism occurred in the Apuseni Mountains as well. Similar to the Styrian basin the Miocene volcanism from the Apuseni is related to deep-seated shear zones active during the Miocene escape tectonic, although the Apuseni rocks are largely hydrothermal altered. The reduced extensional component in the Styrian basin may explain the low influx of exogene fluid and thus the limited extent of volcanic alterations.