The timing of volcanism and associated precious metal mineralization in the Apuseni Mountains, Romania

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The Apuseni Mountains of Romania contain a large number of precious metal deposits, many of which are epithermal in character and closely associated with calc-alkaline, Miocene volcanism. These magmatic rocks which host the mineralization have recently been subjected to several detailed geochemical and isotopic studies and our understanding of their genesis and evolution is now fairly well-developed. However, in spite of the detailed mineralogical studies which have over the years been carried out on the mineral deposits, there are still many aspects about their formation which are poorly understood. The timing of the mineralization in particular is not well defined, and so a geochronological study using K-Ar and Ar-Ar methodology and focussing mainly on the mineralization at the classic Sacaramb deposit, was initiated.

In order to check the published K-Ar ages of fresh, host magmatic rocks, two Ar-Ar ages for amphibole were obtained (from Zuckerhut, Sacaramb, and Rovina Remetea, near Brad). The ages of these rocks (Ar-Ar 11.2 and 15.2, compared to published K-Ar ages of 10.9 and 15.2 Ma respectively) appear to conform the validity of the K-Ar technique for these magmatic rocks.

There is a general lack of minerals in the mineralized veins which are suitable for age dating. However, hydrothermal alteration selvedges to the mineralized veins contain K-mica (sericite) and K-feldspar and these have been analysed and used as a proxy for the metallic mineralization.

K-Ar ages of sericite from veins in the Sacaramb area are in the range 9.9-10.8 Ma, whilst the ages of host rocks in the near vicinity are in the range 10.9 and 11.2 Ma. Hydrothermal K-feldspar from Hondol gives similar ages of 10.6 Ma (K-Ar) and 9.8 Ma (Ar-Ar), compared to the K-Ar age of the host rock of 10.8Ma. A K-Ar age of sericite from Magura of 11.1 Ma is slightly younger than a K-Ar age of the host rock of 11.5 Ma. Ar-Ar analyses of sericitic mica tend to give apparent ages which are 1-3 Ma older than the K-Ar ages but it is at present unclear whether these are real or a result of the analytical method (argon recoil in fine-grained mica samples). These results also suggest that earlier attempts at dating the alteration using Rb-Sr isochrons are probably inaccurate.

The mineralization in this region occurred at a roughly similar time to that proposed by previous studies in the Baia Mare region of northern Romania. The ages of the Apuseni mineralization appear to be slightly younger than the ages of the host volcanic rocks, although this difference is usually within the analytical uncertainty of the analyses (typically <1 Ma), and there is no confirmation of perceived gap in time between mineralization and volcanism seen at Baia Mare (0.5-1.5+ Ma). Although there is quite a large span in age for the volcanism of the Apuseni Mountains as a whole (7.4-14.9 Ma) these age data indicate that the associated hydrothermal activity (and thus most likely the mineralization also) was directly linked to the immediate, host magmatic rocks, was fairly short-lived, and took place within a limited time interval after the cessation of volcanism.