Age determinations on retrograde processes and investigations on the blocking conditions of isotope systems of KTB rocks

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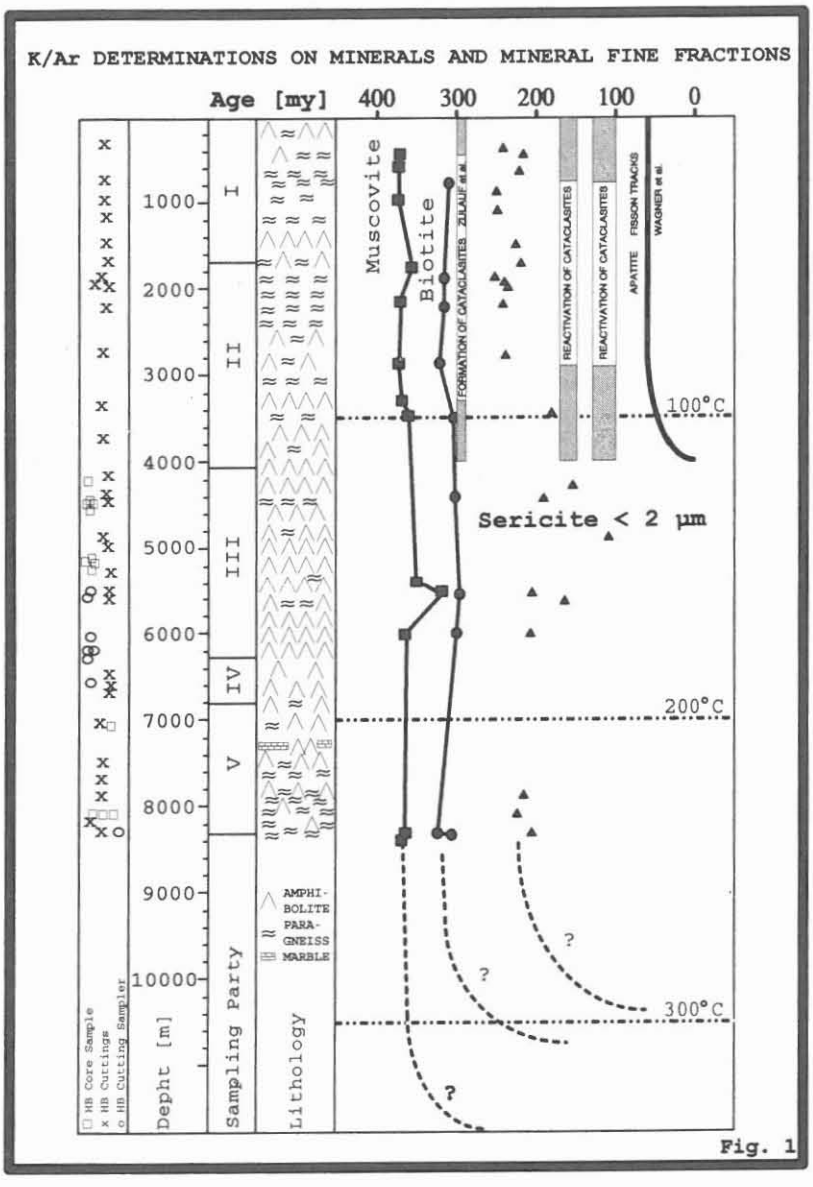
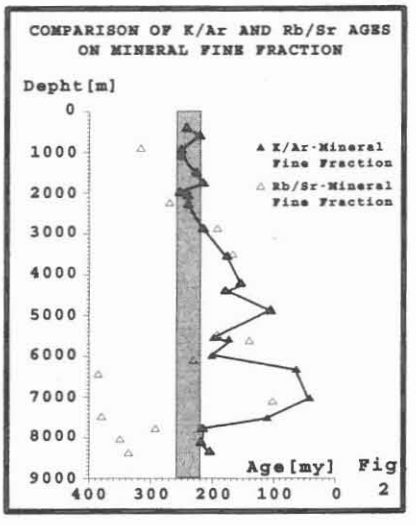
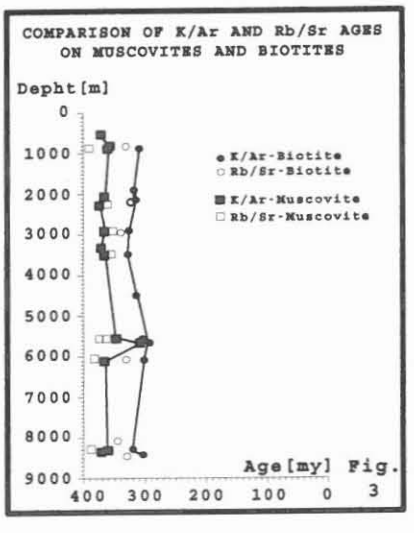


Fig. 1





Samples: Fig.1 shows a strongly simplified profile of the drilled lithology down to a depth of approximately 8300m. In the first column all sampled spots are marked. Cuttings were taken continuously, core samples were available in a few spots only. In the lower part of the profile, it was also possible to take samples from the so-called Cutting Sampler which are much bigger in size than ordinary cuttings and therefore much more convenient to proceed.

Retrograde structures: Unfortunately all core samples available were taken from the metabasite sequences. For this reason no investigations on the age of cataclastic faults could be done up to now. Previous work on the pilot well has shown that only core samples of gneissic rocks are suitable for K/Ar dating. Cataclasites in metabasites do not generate sufficient sericite, because of their low potassium content. The assumption of an early Permian age for the first formation of brittle shear zones was proved by the dating of several cataclastic faults in outcrops S' of the well yielding ages of about 290 Ma. In the pilot well itself this information is overprinted by phases of later reactivations. Two stages, one in the upper Jurassic and one during the entire lower Cretaceous time could be distinguished (s. shaded bars in Fig.1).

Mica cooling ages: Cooling ages of coarse grained muscovites and biotites are going to be measured over the whole profile of depth/temperature using the K/Ar and the Rb/Sr methods. The up to now existing K/Ar and Rb/Sr ages are shown in Fig.2. Down to the depth of 8300m, the coarse grained mica show patterns as they are known from the pilot well. Muscovites yield ages between 363 and 372 Ma which are interpreted as the cooling after the HP/MP-metamorphism. Biotite ages of 316 and 319 Ma correspond to the age of the LP-metamorphism in the surrounding Moldanubikum. In the middle parts, the muscovites rejuvenate to ages of 348 and 306 Ma, the biotites show ages of 302 and 293 Ma. Because of the fact, that the lowermost parts show the same age pattern as the upper part, these young ages are interpreted as disturbed isotope systems, due to hydrothermal overprint.

Retrograde overprint: To get an idea of the timing of the penetrative overprint which all KTB rocks have suffered, an attempt is made by dating mineral fine fractions. The K/Ar ages obtained down to the depth of 2847m strongly correlate with those of the pilot well (s. shaded bar in Fig.2). The data scatter between 220 and 260 Ma. Any older information due to Variscan events which can be found very easily in outcrops nearby is totally overprinted in the rocks of the KTB location.

The sericitization of feldspar during Permian and Triassic time has to be seen as a retrograde process which penetrated the whole series of rocks in the KTB and cannot be correlated to any visible deformation. A similar age pattern has also been found in the lowermost part of the well. Younger ages in between are interpreted as local rejuvenations, so that no systematic decrease in age with increasing depth (temperature) can be observed. The comparison of K/Ar and Rb/Sr data is still a matter of discussion.

Outlook: The above described age determinations on muscovites, biotites, WR and mineral fine fractions are going to be completed systematically until the final depth of the KTB. If possible, all samples will be dated by K/Ar and Rb/Sr so that a comparison between both methods can be done over a long range of temperature. The so-called blocking temperature for sericite bearing mineral fine fractions is not known up to now but is estimated to be below 300° C. If this is true, the opportunity would be given to measure "zero ages" on mineral fine fractions or coarse grained minerals like feldspars in the lower parts of the profile like it already has been done with fission tracks on apatites by Wagner and collaborators.

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