Ar-Ar spectra on minerals from KTB and related medium-pressure units

H. KREUZER, F. HENJES-KUNST, Hannover , E. SEIDEL, Köln, U. SCHÜßLER, B. BÜHN, Würzburg

K-Ar and Ar-Ar analyses on micas and amphiboles are performed in order to elucidate the thermal history of the tectonic units pierced by KTB drilling. At a later stage, presumably decreasing dates due to increasing in-situ temperatures are expected to provide a better knowledge about blocking temperatures of argon in these minerals.

Progress to the latter aim is complicated by scattered dates due to locally different influences of poly-stage Devonian, Carboniferous, and Mesozoic events known from all the medium-pressure (MP) units (e.g. SÖLLNER et al., 1981; KREUZER et al., 1989; HAMMERSCHMIDT & FRANZ, 1992). Ar-Ar age spectra help to unravel such influences. Yet, artefacts can be introduced by the required neutron irradiation: In our cases (nuclear pile FR I, GKSS, Geesthacht) in sound biotites elevated temperature causes an up to 1.3 % larger loss of radiogenic ^{40}Ar than of the accumulating ^{39}Ar. Only recently realized, our previous datings of hornblendes and white micas which were calibrated using a biotite standard have to be reduced by up to 1.2 % after future spot-checks. If small-sized sites of different retentivities are present in a mineral its spectrum is disturbed by recoil losses and interferences. As a consequence, biotites in general yield elevated total gas dates and irregular age spectra (e.g. Figs. 1b, 3b). Also, trends to >380 Ma in spectra of amphiboles with intergrowths are to be regarded with caution, especially, if the ratio 37Ar/39Ar (i.e. the ratio Ca/K) varies (Fig. 1g).

In **KTB samples** a Devonian *biotite* age is indicated only for the pegmatoide at 433m. All other biotite dates are strongly governed by Carboniferous events (Figs. 1a, b).
Muscovites with late Devonian to early Carboniferous K-Ar dates mostly show inclined spectra with trends to about 370 Ma (KREUZER et al., 1989: Fig. 2a). Between 2300 and 2600m small amounts of several fine-grained micas could be only poorly enriched by an electrostatic manner. Low K contents (HÖHNDORF et al., 1992) indicate K-poor contaminations. However, fractions with different K concentrations did not signifficantly deviate in their K-Ar dates. In this section muscovites are generally strongly rejuvenated to Carboniferous dates with the prominent exception of the coarse muscóvite from the pegmatite at 3297m (Fig. 1a: P).
Among the apparently youngest *biotites* is the one from the lamprophyre at 2231m (Fig. 1a: L) with K-Ar dates of 296.3 and 295.1 ± 3 Ma for two size fractions (errors 2s). Because of low K concentrations of 5.8 and 5.4 wt.% the dates are to be regarded as minimum estimates. The age spectrum (Fig. 1c) is irregular. The elevated total gas date of 305 Ma indicates recoil losses. Using the K-Ar date for calibration these losses were, on average, eliminated. The flat part then yields 306 ± 4 Ma - a maximum age estimate because of possible interferences.

The Ar-Ar spectra of the *amphiboles* suggest that K-Ar dates much younger than 380 Ma are mainly caused by contaminations (Figs. 1f, g). Strongly varying 37Ar/39Ar ratios show that future mineral separation has to be refined in order to avoide possible recoil interferences.

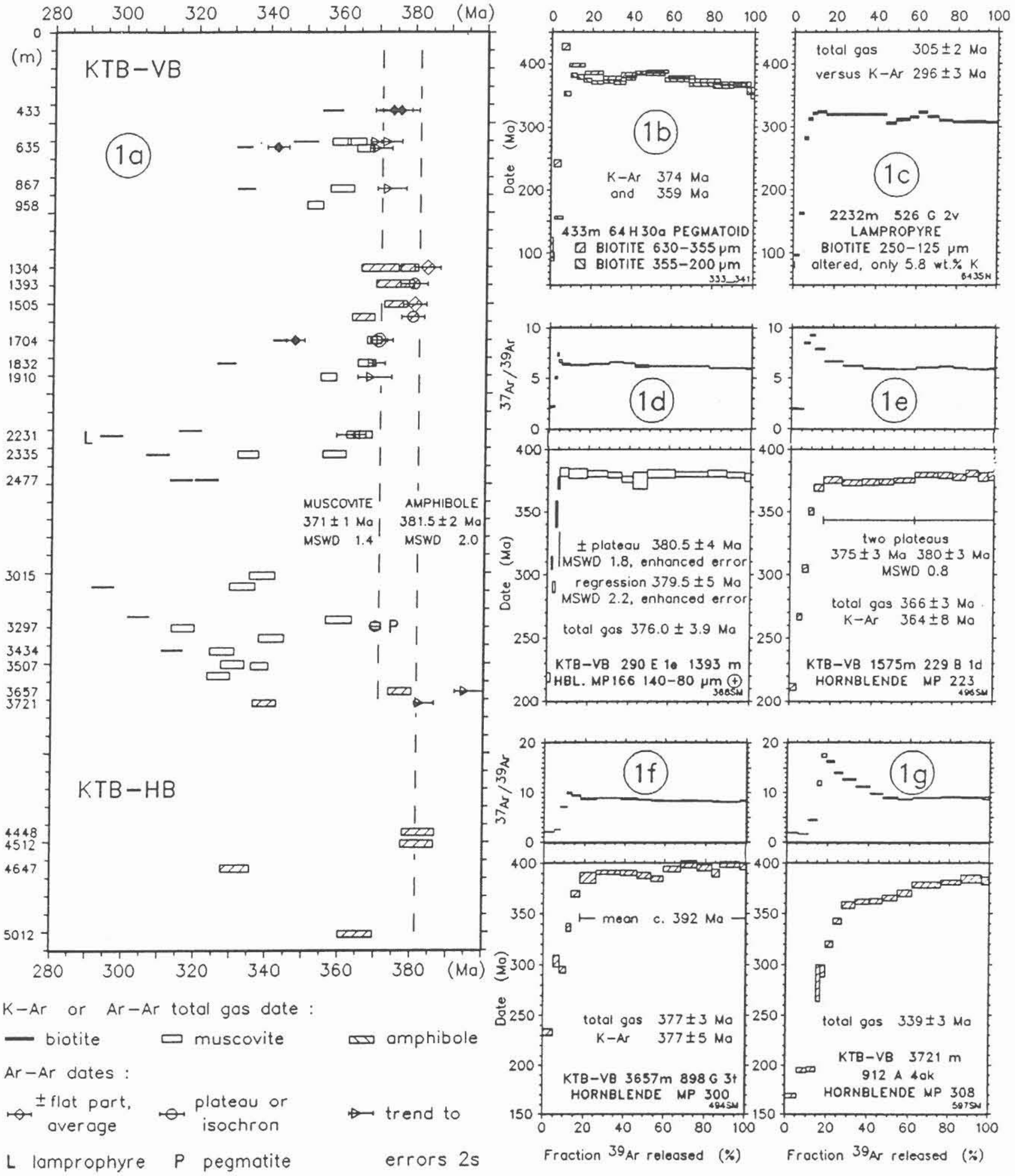

Fig. 1: (a) Synopsis of K-Ar and Ar-Ar dating on samples from the KTB, (b - g) selected age spectra.

As in other MP units, scattered *hornblende* dates from the **Hangendserie of the Münchberger Gneismasse** had been interpreted by locally different rejuvenations of minerals that had cooled

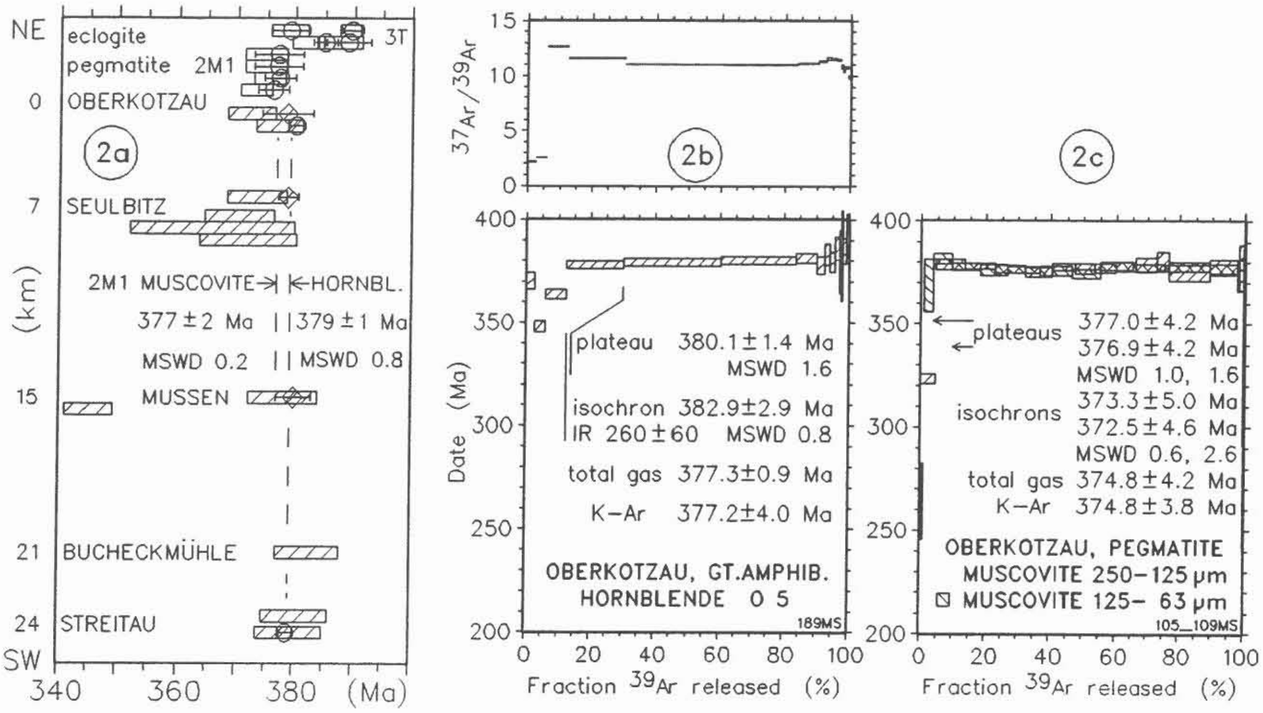

Fig. 2: Synopsis (a) and selected age spectra (b - c) for samples from the Hangendserie. Symbols as in Fig. 1.

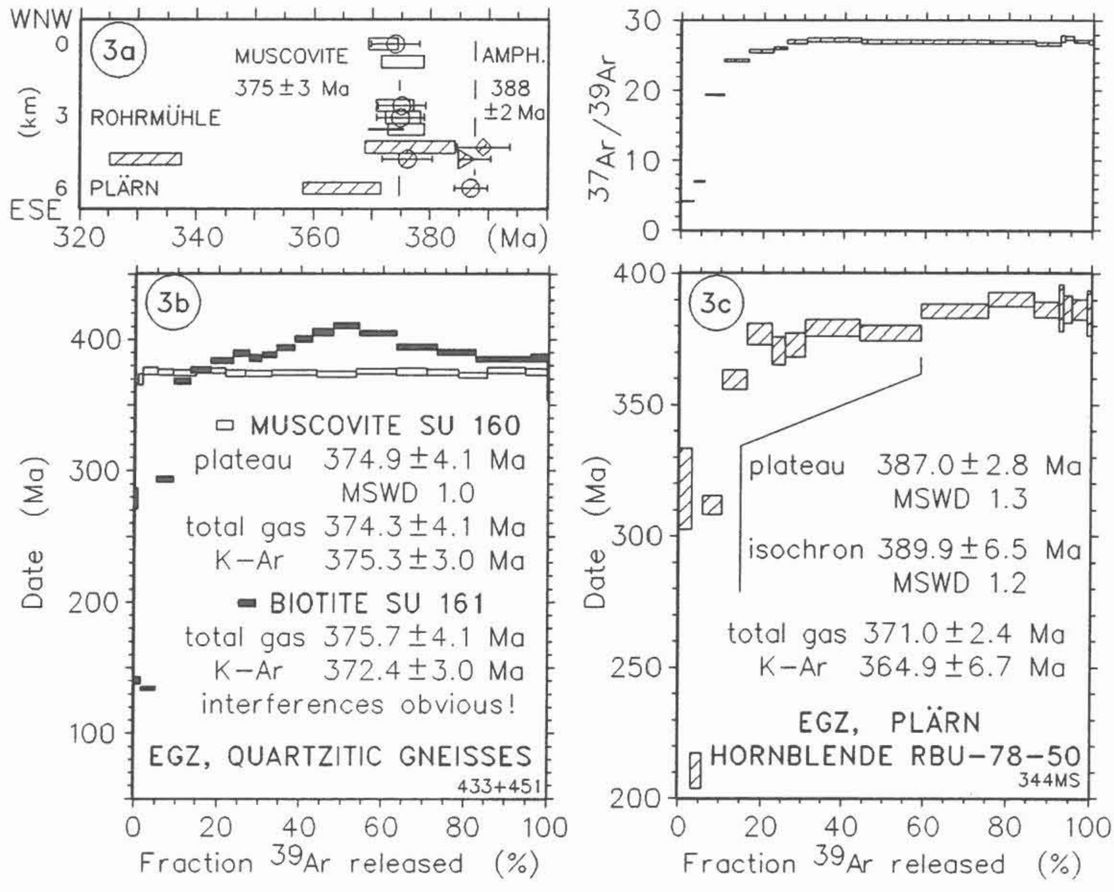

Fig. 3: Synopsis (a) and selected age spectra (b - d) for samples from the EGZ. Symbols as in Fig. 1.

c. 380 Ma ago (KREUZER et al., 1989). Ar-Ar plateuaus and isochrons do confirm this with a mean age of 379 ± 1 Ma (Figs. 2a, b). A fast cooling is suggested by nearly the same age also for four 2M1 white mica fractions from Oberkotzau, consistent plateau ages of 377 ± 2 Ma. It is somewhat questioned by faintly U-shaped spectra of one sample (Fig. 2c). The dates of 390 Ma for coarse 3T micas from the eclogite from Oberkotzau (KREUZER & SEIDEL, 1989) need further confirmation. These 3T micas differ by higher atmospheric concentrations (KREUZER et al., 1989: Tab. 3) and ideal plateaus do not exclude excess radiogenic argon.

Amphiboles from amphibolites of the **Erbendorfer Grünschieferzone** suggest a cooling 388 ± 2 Ma ago, somewhat earlier than those of other MP units (Figs 3a, c, d).
K-Ar dates as well as Ar-Ar plateau ages of muscovites from tectonic slices of quartzitic gneisses are consistently at 375 ± 3 Ma (Figs. 3a, b). A low-potassium biotite (K 6.1 wt.%) has a K-Ar date of 372 ± 3 Ma but an irregular, upwards convex age spectrum (Fig. 3b).

Ar-Ar anlyses on amphiboles from the **eastern part of the Erbendorf-Vohenstrauß zone** (ZEV-E) suggest varying degrees of rejuvenation by the 326 ± 4 Ma old (SIEBEL, 1993) Leuchtenberg granite, e.g. a trend to 330 Ma versus an almost ideal plateau of 324 ± 3 Ma (Figs. 4a, b, c).

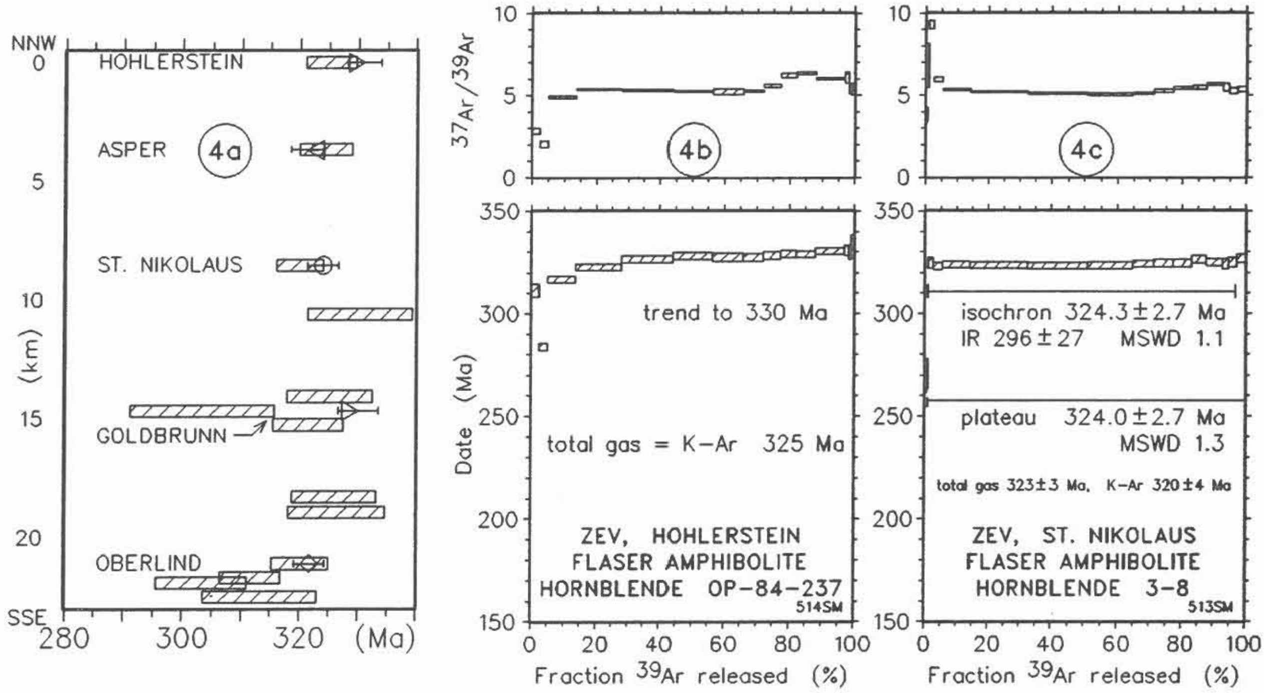

Fig. 4: Synopsis (a) and selected age spectra (b - c) for samples from the ZEV-E. Symbols as in Fig. 1.

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