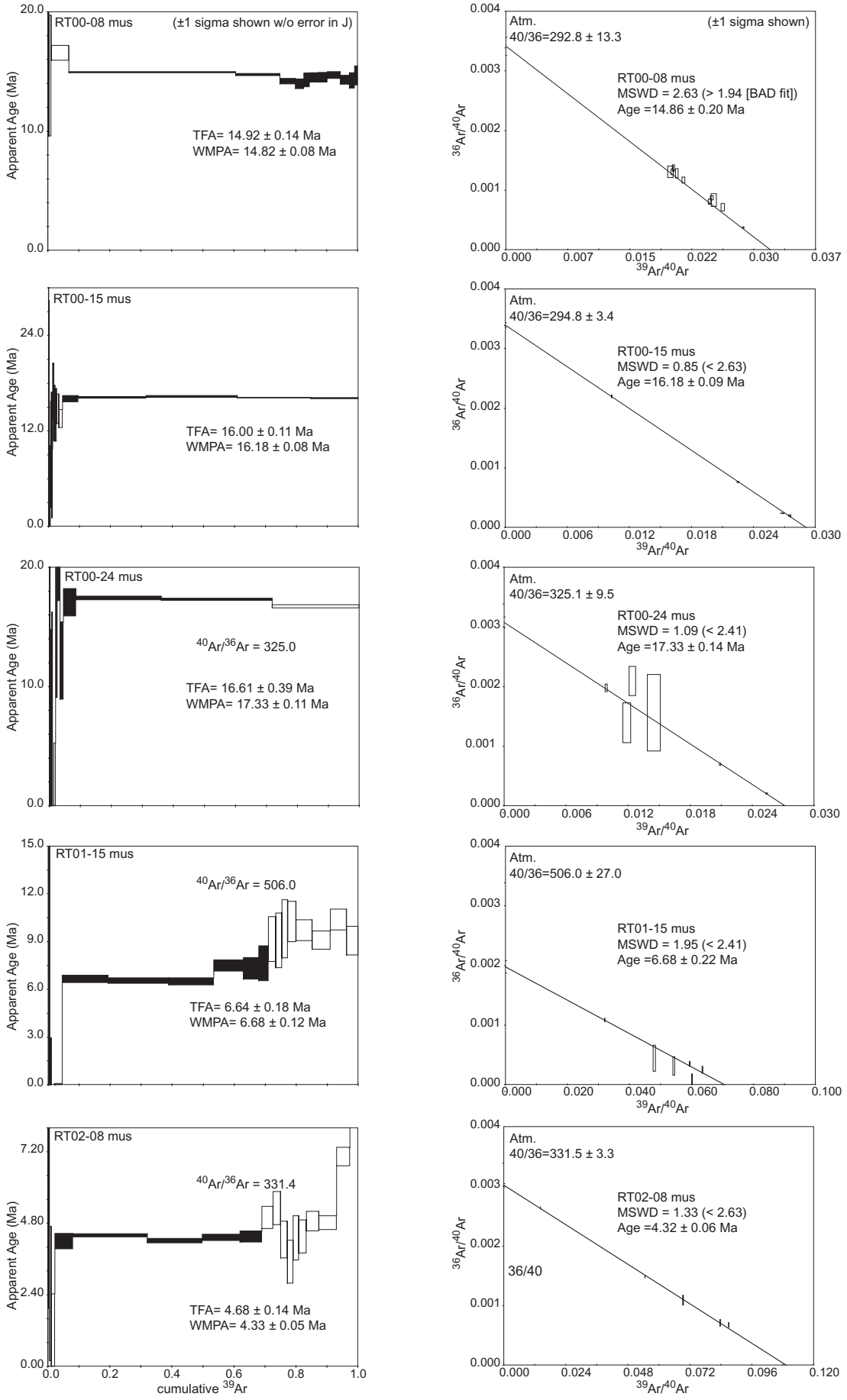
DR2005128



Appendix Fig. 1, Thiede et al. Geology.

Sample number	Altitude [m]	Latitude [DD]	Longitude [DD]	Rock type	Tectonic unit	# Xls	Spontaneous		Induced		Dosimeter		Chi-sq. P (%)	Pooled Age [Ma]	±2σ	Dpar [μm]/ ±σ/ n	Uran. [ppm]
							Rho-S	Ns	Rho-I	Ni	Rho-D	Nd					
RT02-02	1860	31.411	77.723	Gneiss	LHC	30	0.126	21	6.692	1111	13.86	5413	76	5.1	2.4		6.3
RT02-07	1200	31.511	77.745	Mica-shist	LHC	20	0.577	90	118	18411	13.69	5413	82	1.3	0.4		104
RT02-08	1430	31.543	77.801	Gneiss	LHC	30	0.103	28	16.47	4484	13.61	5413	64	1.7	0.6		15
RT02-76	2350	31.685	78.492	Shist	Tethyan Himalaya	19	0.647	159	32.69	8032	11.89	4721	95	4.6	1.0	2.5/0.15/76	32
RT02-84	1900	31.519	78.271	Gneiss	HHCS	30	0.361	103	38.42	10948	11.73	4721	54	2.2	0.6		39
RT01-37	2015	31.543	78.281	Gneiss	HHCS	25	0.222	44	21.61	4288	11.65	4721	45	2.3	0.8		22
RT01-44	2100	31.596	78.298	Gneiss	HHCS	25	0.305	68	51.82	11539	11.49	4721	71	1.3	0.4	2.5/0.16/100	53
RT01-45	2130	31.598	78.347	Gneiss	HHCS	22	0.517	125	91.07	22019	11.33	4721	35	1.3	0.2	2.3/0.12/84	98
RT01-47	2360	31.666	78.453	Shist	Tethyan Himalaya	20	0.424	108	35.31	8986	11.17	4721	57	2.6	0.6	2.5/0.16/80	38

Note: # Xls, number of individual grains dated;Rho-D, induced track density in external detector adjacent to dosimetry glass (x 10^6 tracks/cm^2); Nd number of tracks counted in determining Rho-D; Rho-S, spontaneous track density (x 10^6 tracks/cm^2); Ns, number of spontaneous tracks counted; Rho-I, induced track density in external detector (muscovite) (x 10^6 tracks/cm^2); Ni, number of induced tracks counted; Chi-sq. P (%), chi-sqare probability (Green, 1981; Galbraith, 1981); Age is the sample pooled fission track age (Hurford and Green, 1983); calculated using zeta calibration method (Galbraith and Laslett, 1993). Trackkey was used for calculating the counting results (Dunkl, 2002).

The following is a summary of key laboratory procedures. Samples were all analyzed by R. Thiede (zeta factor of 391 ± 27). Apatites were etched for 20 s in 5.5 N nitric acid at a temperature of 21.0 ±0.1°C. CN5 dosimetry glass was used as a neutron flux monitor. Samples were irradiated at Oregon State University TRIGA reactor. External detectors were etched in 40% HF, 21°C, 45 minutes. Tracks were counted with a Leica microscope with 100x air objective, 1.25x tube factor, 10x eyepieces, using transmitted light with supplementary reflected light as needed; external detector prints were located with kinetek computer-automated scanning stage (Dumitru, 1993).

The AFT analysis employs the external detector method following the zeta calibration approach of Hurford and Green (1983). Analytical precisions with and error of 0.2 to 0.8 Ma (±2σ) could be obtained from these young AFT ages due to the high U-content and the large number of grains counted per sample. Only grains with c axes parallel to slide plane were dated; zero-track grains were analyzed.

Appendix Table 1**:** Apatite fission track data , see Fig. 1D for location.

Appendix

Electronic appendix and supplementary material for the submitted manuscript: "From a tectonically to erosionally controlled development of the Himalayan fold-and-thrust belt" by Thiede, Arrowsmith, Bookhagen, McWilliams, Sobel, Strecker.

Appendix Fig. 1): Spectra and inverse isochron diagrams of the $^{40}Ar/^{39}Ar$ measurements. Solid boxes show concordant steps used to compute weighted mean plateau age. One sigma uncertainties shown excluding error in irradiation parameter, J. TFA, total fusion age; WMPA, weighted mean plateau age MSWD, mean square weighted deviation (Wendt and Carl, 1991), which expresses the goodness of fit of the isochron.

Thermochonology

All samples used for $^{40}Ar/^{39}Ar$ and AFT analysis are fresh, unaltered bedrock samples. The micas were separated from the five coarse-grained gneisses that we also used for the AFT method. Pure Mica separates were prepared by crushing, sieving, washing in H_2O and handpicking to achieve the desired purity of (>99%). The $^{40}Ar/^{39}Ar$ analyses were conducted at the Stanfrod University geochronology laboratory. The separates were rinsed in acetone and alcohol, subsequently wrapped in pure Cu foil, baked at 125ºC for 1 hour in air, and stacked in a pure SiO_2 vial together with foil-packaged neutron flux monitors. They were irradiated at the TRIGA reactor at Orogon State University. Sanidine from Taylor Creek rhyolite, with an assumed age of 27.92 ± 0.17 Ma (Duffield and Dalrymple, 1990) was used as a neutron flux monitor. All analyses were conducted in a double-vacuum resistance furnace. Ages and isotopic ratios are reported at a 2σ-uncertainty level. Samples were step-heated to obtain three-isotope plots to correct for the composition of trapped Ar. Figure 2 illustrates $^{40}Ar/^{39}Ar$ release spectrum and inverse isotope correlation diagram for each sample. The solid steps within the release spectra indicate the increments used for calculating plateau ages. Further analytical details are found in Hacker et al. (1996).

Apatite Fission Tracks (AFT) are linear damage trails in the crystal lattice that form as the result of spontaneous nuclear fission of trace ^{238}U nuclei (Wagner and Van den Haute, 1992). New ^{238}U fission tracks form at an essentially constant rate and with a constant track length, while older tracks simultaneously anneal (and ultimately are erased) at high temperatures, making AFT an effective tool for reconstructing cooling and exhumation histories (e.g., Gleadow et al., 1986; Green et al., 1989; Dumitru, 2000). At temperatures hotter than ~110-150 °C, all fission tracks are totally annealed, resetting the fission track clock to zero. The total annealing temperature (TAT) and the effective closure temperature depend on the kinetic characteristics of the apatite and the cooling rate (Ketcham et al., 1999). The partial annealing zone (PAZ) extends from the TAT down to ~60 °C, and within this temperature range tracks are partially annealed. Below ~60 °C, AFT are effectively stable because annealing occurs at a very slow rate (e.g., Gleadow et al., 1986). The kinematic characteristics of apatite can be evaluated by measuring etch-pits-figures (Dpar, Donelick et al., 1999). Durango apatite standarts were etched together with our samples. Length deviations between Dpar measurements derived from Donelik measurements (Donelick et al., 1999) of Durango apatites and our own measurement were corrected by linear correlation.

All samples are bedrock samples. For very young apatites, it may be impossible to obtain sufficient Dpar data for a robust interpretation and it was impossible to obtain sufficient track length data. However, several samples with older ages and/or higher U-content yielded multiple Dpar measurements for most analyzed crystals, permitting the calculation of closure temperatures (Ketcham et al., 1999). All of the single population ages in this study pass the chi-squared test, and pooled ages are reported with 2σ errors.

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