REPLY

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Apologies are certainly in order for the misquoting of Cosca, Essene, and Sutter (1987) on p. 726: the "plagioclase" dates were from potassium feldspars, and the next sentence properly identified cooling rate estimates for the "biotite-to-microcline" interval. Also, the peak metamorphic ages reported by van Breemen and others (1986) were indeed switched: for the Parry Sound Domain the peak age should be 1161 ± 3 Ma (upper intercept U/Pb concordia); for the Algonquin Domain the peak age should be 1030 ± 50/-30 Ma (lower intercept: van Breeman and others (1986) also reported an estimate of 1027 + 14/-15 Ma using fewer data points). As a consequence the peak-to-hornblende cooling rates should also be simply swapped: 1.2° to 1.4°C/Ma for the Parry Sound Domain (identical with the results from specific samples shown by Cosca, Sutter, and Essene, 1989); 3.8° to 7.5°C/Ma for the Algonquin Domain. The range of uplift rates on p. 729 for the peak-to-hornblende interval does not require any revision.

On p. 732 I too expressed concern with the quality of the data available for cooling and uplift rate estimates in the Grenville Orogen. The work in progress by Cosca and others appears to contain exactly the improvements advocated: recognition of the effects of excess argon and partial resetting, determination of dates from several minerals in the same sample, comparison with dates from other isotopic systems, coordination with detailed mapping and with structural and metamorphic studies.

I stand by my statement that the uplift/denudation rates for the Grenville Orogen, particularly from the most reliable dates, appear to overlap the slower end of the range of reported uplift/denudation rates from the Himalaya (Zeitler, 1985: 0.07–4.5 mm/yr; Copeland and others, 1987a: 0.58–5.49 mm/yr; Copeland, Harrison, and Heizler, 1989: greater than 5 mm/yr) and the Tibetan Plateau (Copeland and others, 1987b: 0.07–3.7 mm/yr) but are slower than published rates from the Alps (Clark, 1979: 0.3–1.1 mm/yr; Hurford, 1986: 0.5–2.2 mm/yr; Gubler and others, 1981: 0.3–1.4 mm/yr). This exercise was an attempt to see whether uplift/denudation rates from the Grenville Orogen at all resembled rates from younger orogenic belts, mainly as a check on the choices made in winnowing out dates thought to have been affected by partial resetting or excess argon. However, the data from both inside and outside the Grenville Orogen are still sparse, and the rates were determined in various ways (relevelling, dates of one type from a traverse with significant relief, several types of dates from a single sample or small area) and for different stages in orogenic develop-
ment. In particular, it is probably premature to make a distinction in uplift rates between the Himalaya and the Tibetan Plateau because so little work has yet been done in the Plateau, and only near the southern edge. The plutons examined by Copeland and others (1987b) were intruded during development of an Andean-type continental-margin arc, earlier in the same episode of convergence, that culminated in mid-Eocene continent-continent collision along the Indus-Zangpo Suture: better analogies for the Parry Sound and Algonquin Domains might be found somewhere in the Kunlun Terrane to the north, a continental fragment sutured to Asia in the late Permian (Chang and others, 1986; Dewey and others, 1988). This is because the closest analogy to the Grenville Front is probably the northern edge of the Tibetan Plateau. Therefore, the real question for comparisons with the western Grenville Orogen is whether uplift rates in the Miocene in the Himalaya will be anything like uplift/denudation rates tens of millions of years from now in the Kunlun, after convergence ends, the Plateau is nearly eroded down to sealevel, and continental crust in the whole orogen is approaching normal thickness.

References


