

IUPAC-IUGS Task Group on Isotope Data in Geosciences – Convention on the use of SI units in Earth Sciences

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The International Union of Pure and Applied Chemistry, IUPAC, and the International Union of Geological Sciences, IUGS, have set up a task group in October 2006 with the goal of updating the recommendations on radioactive decay constants for geochronological use, last formalized in 1976.

In the course of the initial assessment, it was noticed that use of SI (Système International) units in the geological literature is inconsistent. We propose to address this issue immediately as it requires neither new experiments nor extensive literature evaluations but only judgment and adherence to SI rules.

The SI unit of time, the second [s], is impractical for earth scientists and nuclear physicists alike. In such cases the SI tolerates other units, and for geological applications the annum [a] is used, where $1 \text{ a} = 3.16 \times 10^7 \text{ s}$ (Holden, 2001). As with other units, thousands, millions and billions of these are appropriately designated ka, Ma, and Ga, respectively. These derived units are in widespread use in Earth Science literature. The departure lies in the use of different units (e.g., m.y., from the American Engineering Society) for time differences, such that the interval between 90 Ma and 100 Ma, for example, is sometimes designated as 10 m.y.. Instead, following correct SI usage (Nelson, 2002), units must follow algebraic rules such as the distributive law: $100 \text{ Ma} - 90 \text{ Ma} = (100-90) \text{ Ma} = 10 \text{ Ma}$, and so on. Similarly, rates and decay constants should be expressed in $(\text{ka})^{-1}$, $(\text{Ma})^{-1}$ or $(\text{Ga})^{-1}$. Analogies are useful: it is rarely denied that the interval between 100 m and 200 m depths in a borehole is 100 m, or that a magma at 1000 °C is 100 °C hotter than one at 900 °C.

We recommend that geoscientists abandon the incorrect habit of expressing time differences in k.y., M.y., or G.y., and thereby achieve compliance with the SI standard.