# Evaluating $^{238}U/^{235}U$ in U-bearing accessory minerals: Implications for U-Pb geochronology

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U-daughter (U-Pb, Pb-Pb, and U-series) geochronology and cosmochronology utilise the value of the present day $^{238}U/^{235}U$ ratio to calculate U/Pb and Pb/Pb isotopic dates. For decades, this value has been assumed to be invariant and equal to 137.88, but recent experiments indicate that there is potential for per mil level variation in $^{238}U/^{235}U$ in natural materials, hypothesized to be the result of redox reactions. These studies have largely focused on materials formed in low-temperature environments (e.g. speleothems, corals) and U ore deposits. At present there is no published high-precision $^{238}U/^{235}U$ data for U-bearing accessory minerals commonly used for U-Pb geochronology.

We present $^{238}U/^{235}U$ determinations (total uncertainties of ~200 ppm) for a suite of common U-bearing accessory minerals (zircon, monazite etc.), from a variety of geological environments and ages. Measurements have been made by multi-collector thermal ionization mass spectrometry (MC-TIMS) and multi-collector inductively coupled plasma mass spectrometry (MC-ICPMS), accurately correcting for mass fractionation using the IRMM 3636 $^{233}U$-$^{236}U$ double spike. These results indicate that accessory mineral $^{238}U/^{235}U$ ratios are in general lower than the 'consensus' value of 137.88 and record limited but resolvable variation.

Systematic discordance has been observed between $^{238}U$-$^{206}Pb$ and $^{235}U$-$^{207}Pb$ dates for closed-system minerals, and has been used to reassess the relative decay constants of $^{238}U$ and $^{235}U$ [1,2,3]. Our new determination of coupled $^{238}U/^{206}Pb$, $^{235}U/^{207}Pb$ and $^{238}U/^{235}U$ measurements on closed system zircons permits further refinement of $\lambda^{238}U/\lambda^{235}U$ estimates using parameters whose values and uncertainties are all traceable to SI units.

[1] Mattinson, (2000). EOS, *AGU Fall* V**61**A-02. [2] Mattinson, (2010) *Chem Geol* **275**: 186-198. [3] Schoene *et al*., (2006) *GCA* **70**: 426-445.

# The impact of aerosols on radiation and climate

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## Overview

Aerosols have played a major role in past climate change, and it is likely that they will continue to do so in the future. Although our understanding of the underlying physical processes has improved over recent years, the mechanisms by which they affect climate are still more uncertain than those relating to well mixed greenhouse gases. This overview talk will discuss the various ways in which atmospheric aerosols can interact with radiation thereby producing a climate forcing and initiating a climate response.

## Examples used

1) The optical properties and direct effect of Saharan dust from aircraft measurements and models
2) Optical closure studies for aerosol in anthropogenically perturbed air masses and the influence of uncertainty in aerosol refractive index
3) The impact of sulphate and black carbon aerosol on the East Asian summer monsoon.
4) Mechanisms involved in the semi-direct effect of absorbing aerosols.