**Supplementary text S1**

*Analytical details of the carbon and sulphur elemental and isotopic analyses*

The analyses of carbon (C) and sulphur (S) contents (expressed in wt.%) and the relative isotope ratios (13C/12C, 34S/32S) were carried out at the Department of Physics and Earth Science of University of Ferrara using an elemental analyser (EA) PYRO Cube(Elementar) operating in combustion mode and coupled with the isotope ratio mass spectrometer (IRMS) precisION (Elementar).

Homogenous powdered samples (around 40 mg) were weighed in tin capsules, wrapped, and finally loaded in the EA autosampler to be analyzed. The Vario PYRO Cubeconsists of a combustion oven operating at 1150°C. After the sample has been burnt, the released C and S gaseous species are transferred in a reduction column operating at 850°C that contains chips of native copper to remove the excess of oxygen. The analyte gases pass into the original purge and trap module before to enter in the IRMS. The CO2 and SO2 are trapped respectively in two distinct traps. When CO2 trap is heated at 110°C, it releases CO2 which flows in the IRMS to start the isotopic C analyses. After that, the SO2 trap is heated at 220°C to release the gas.

In the mass spectrometer the molecules of the sample gas are ionized by the source (*i.e.*, a thorium oxide filament), and the ions pass through a magnet, which deflects and sorts them into beams with distinctive mass/charge ratios (m/z). Then ion beams arrive at the collector where three Faraday cups detect the ions of each of the three different masses of analyzed gas simultaneously (*i.e.*, for CO2 the masses are 44, 45, and 46 and for SO2 the masses 64 and 66).

The detection of the distinct isotopic masses of the sample is bracketed between those of reference gases (CO2, SO2, 5 grade purity), which have been calibrated using reference materials. In the cups, the impact of the ions is translated into a recordable electrical signal, forming peaks, whose areas are proportional to the number of incident ions. The isotope ratios are calculated through peak definition and integration through the ionOS software.

The signal intensity is amplified by an integrated Amplifier and is expressed in nano-ampere (nA). The signal intensity is referred as “peak height”, and the minimum acceptable signal is 1 nA (optimum between 2 and 10 nA) in amplitude and at least 5 seconds in duration.

Calibration of the instruments were performed using several standards: the Tibetan human hair powder USGS42 (Coplen and Qi, 2011), the Barium Sulfate IAEA-SO-5 (Halas and Szaran, 2001).

13C/12C, 34S/32S isotopic ratios (R) were expressed with the δ notation (in ‰ units):

δ= (Rsam/Rstd -1)×1000

where Rsam is the isotopic ratio of the sample and Rstd is the isotopic ratio of the international isotope standards Pee Dee Belemnite (PDB) and Canyon Diablo troilite (CDT) for C and S, respectively.

Analytical uncertainties (1 sigma) for the isotope analyses were in the order of ± 0.1‰ for δ13C and ± 0.3‰ for δ34S, as indicated by repeated analyses of samples and standards.

**References**

Coplen T. B., Qi H., 2011. USGS42 and USGS43: Human-hair stable hydrogen and oxygen isotopic reference materials and analytical methods for forensic science and implications for published measurement results. Forensic Sci. Int., 214: 1-3.

Halas S., Szaran J., 2001. Improved thermal decomposition of sulfates to SO2 and mass spectrometric determinations of δ34S of IAEA-SO-5, IAEA-SO-6 and NBS-127 sulfate standards. Rapid Commun. Mass Spectrom., 15: 1618-1620.