

High resolution ion microprobe analysis of sulphur isotopes in speleothem carbonate

P.M. WYNN¹, I.J. FAIRCHILD¹, A. BAKER¹, S. FRISIA², A. BORSATO², M. MIORANDI², C. SPÖTL³ AND E.I.M.F.⁴

¹School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, Edgbaston, B15 2TT (p.m.wynn@bham.ac.uk)

²Museo Tridentino di Scienze Naturali, Trento, Italy (frisia@mtsn.tn.it)

³Institut für Geologie und Paläontologie, Universität Innsbruck, Austria (christoph.spoetl@uibk.ac.at)

⁴Edinburgh Ion Microprobe Facility, Institute of Earth Science, University of Edinburgh (john.craven@ed.ac.uk)

Sulphur emitted into the atmosphere from the combustion of fossil fuels is regarded as a key mechanism in climate forcing at both the local and regional scale. Trace amounts of sulphate in speleothem carbonate at some cave sites show an increase in concentration towards the present day, reflecting the increase in SO₂ emissions since the onset of the industrial era and the early 1980's. This suggests speleothems may record local aspects of atmospheric sulphate content. However, speleothem sulphur concentrations are low and manual techniques for sulphur isotope analysis allow only low resolution sampling. Microanalytical techniques are thus required to build a comprehensive palaeoclimate record.

Ion microprobe analysis has been used to extract sulphur isotopes from speleothem carbonate at high resolution. Two stalagmites from the Italian and Austrian Alps have been used to pioneer this technique. Growth rates are less than 100 µm/yr and concentrations of sulphate range between pre-industrial levels of 10 ppm to modern day values of 70 ppm. Analysis at annual resolution encompassing the past 100 years demonstrates an excursion in sulphur isotopic composition from values close to the carbonate bedrock end-member value in the pre-industrial era, to values isotopically depleted in ³⁴S, reflecting the increase in SO₂ emissions with industrial activity.

Counting statistic errors for the low sulphur concentrations (~10 ppm) are ±4 ‰ while for the higher concentrations (~70 ppm), these errors approach ±1.5 ‰. New, low sulphur standard material is being investigated so that instrumental conditions can be optimized to provide higher precisions at low (10-50 ppm) sulphur concentrations.

EMP Study of Early Cambrian Barite Deposits in East Guizhou, China

F. XIA^{1,2}, J-Y. PAN^{1,2}, FAN. XIA³, D-S. MA² AND Z-X. SUN¹

¹Key Laboratory for Nuclear Resources and Environmental Research of Ministry of Education, East China Institute of Technology, Nanchang 330013, China (xf730@163.com)

²State Key Laboratory for Mineral Deposits Research, Department of Earth Sciences, Nanjing University, Nanjing 210093, China (jypan@nju.edu.cn)

³Shanghai Environmental Monitoring Centre, Shanghai 200030, China (xiahoufan@sohu.com)

Geological Setting

The Lower Cambrian black shale sequence of the Niutitang Formation in southeast Guizhou China hosts a barite layer. The ore-bearing rock series is composed of black silicalite, carbonaceous shale interbedded with phosphorite, barite and carbonaceous shale in ascending sequence. The stratified main ore bodies, partially in lenticular form, are dominantly embodied in the silicalite and black shale of the lower section of the Niutitang Fm. of the early Cambrian.

Discussion of Results

Systematical samplings for the electron microprobe (EMP) were taken in the Dahebian barite deposit in Tianzhu County of Guizhou Province China. Samples of barite ore were analyzed using JEOL JXA8100 in the Key Laboratory for Nuclear Resources and Environmental Research of Ministry of Education, East China Institute of Technology.

Based on the electron microprobe (EMP) study, the hyalophane K₂Ba [Al₂Si₂O₈] was reported for the first time in the barite deposits which is a typical low-temperature mineral (Table 1), and we analysed the origin of hyalophane based on studying about its chemistry composition, optical character and their correlation, more, researched the genesis of Dahebian and Xinhuan barite deposits. The study provides mineral evidence for the submarine hydrothermal exhalative genesis of Dahebian and Xinhuan barite deposits

Table 1. The electron microprobe analyses of the hyalophane in Dahebian and Xinhuan barite deposits (w_B/%)

Sample No	mineral	SiO ₂	Al ₂ O ₃	FeO	CaO	Na ₂ O	K ₂ O	BaO	MnO	SO ₃	TiO ₂	SrO
Yx-6	1 hyalophane	49.28	22.96	0.00	0.02	0.29	7.63	18.87	0.00	0.00	0.17	0.21
	2 hyalophane	47.23	23.92	0.07	0.03	0.18	5.87	23.49	0.08	0.00	0.14	0.19
DHB-11	1 hyalophane	54.03	21.68	0.06	0.02	0.25	8.66	12.88	0.00	0.04	0.00	0.00
	2 hyalophane	52.39	22.56	0.14	0.02	0.26	7.99	16.15	0.04	0.09	0.01	0.00

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