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A XAFS study of organic sulfur in carbonaceous chondrites

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Introduction

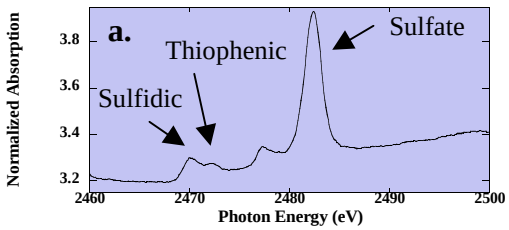
The major fraction of the carbonaceous matter in carbonaceous chondrites is insoluble macromolecular matter. This matter becomes graphitic as a result of thermal metamorphism in its parent body, and the degree of graphitization is an indicator of the degree of the metamorphism [1]. This matter contains sulfur heterocycle as one of its structural unit [2]. Sulfur *K*-edge XAFS (X-ray absorption fine structure) spectra show thiophenic absorption, and it is correlated with the degree of the thermal metamorphism [3]. Here we report some additional results to our previous report.

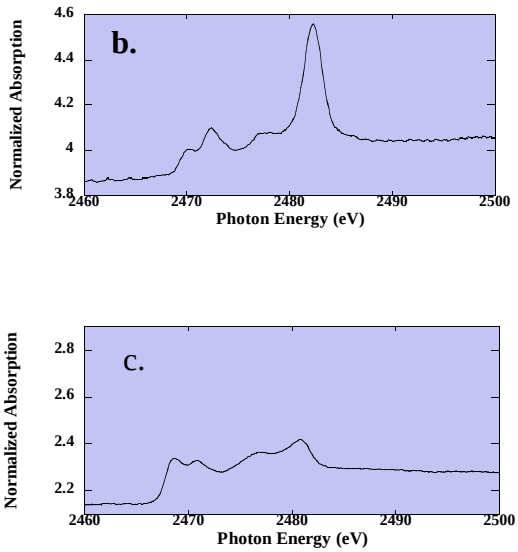
Experimental

Samples were prepared in the same manner as our previous report [3]. Powdered samples were pressed onto stainless plates and they were set in the sample chamber. Measurement was performed at BL-11B using total electron yield method. The samples include Boriskino (CM), Sayama (CM), Ornans (CO), Tagish Lake (tentatively classified as CI).

Results and discussion

Figs. 1 show the sulfur *K*-edge XAFS spectra of (a) Boriskino, (b) Sayama, and (c) Tagish Lake. As previously reported [3], unheated chondrites (Boriskino, Sayama, and Tagish Lake) show relatively strong thiophenic absorption. In particular, Sayama that suffered extensive aqueous alteration shows remarkably strong thiophenic absorption. Tagish Lake also shows relatively strong thiophenic absorption, and weak sulfate absorption is another characteristic of this sample. Ornans shows quite different spectrum from the CM chondrites. The spectrum did not show neither thiophenic nor sulfate absorption, as the Allende CV chondrite [3]. For quantitative treatment, we carried out the peak fitting of the spectra, and calculated each peak area. Fig.2 shows the (Thiophenic/Sulfidic) - (Sulfate/Sulfidic) plot. Correlation is not so clear, but it seems to be two groups corresponding to the degrees of thermal metamorphism.





Figs. 1. Sulfur *K*-edge XAFS spectra of (a) Boriskino, (b) Sayama, and (c) Tagish Lake.

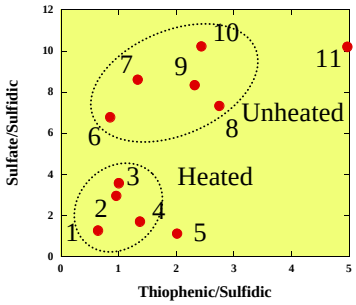


Fig. 2. The (Thiophenic/Sulfidic) - (Sulfate/Sulfidic) plot
1. Y82054, 2. Y86695, 3. Y793321, 4. A881334,
5. Tagish Lake, 6. Cold Bokkeveld, 7. Murchison,
8. Sayama, 9. Murray, 10. Boriskino, 11. A881458

References

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