Simultaneous measurement of S and Pb isotopes of sulfides using a nanosecond laser ablation coupled with two MC-ICPMSs

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This study coupled the nanosecond laser ablation system with large-scale MC-ICPMS (Nu 1700) and the conventional MC-ICPMS (Nu Plasma II) for the simultaneous laser ablation as well as determination of S and Pb isotopic compositions at a single sulfide micron region. The aerosol distribution depends on the content of Pb. For sulfide with 100 - 3000 ppm of lead, the aerosol was distributed between the Nu1700 and the Nu Plasma II in a ratio of 1:1. For lead content >3000 ppm, this was 5:1 (galena), and for <100 ppm it was 1:3. S isotopic analysis showed pronounced matrix effect, therefore matrix-matched external standard was used for standard-sample bracketing correction, while the NIST NBS997 Tl dry aerosol internal standard and NIST SRM610 external standard together as correction could obtain accurate results for the analysis of Pb isotopes. In the tandem experiment with airflow condition approaching that of stand-alone analysis, small change in the aerosol carrier gas flow did not significantly influence the accurate determination of S and Pb isotope ratio. With the careful optimization of the flow ratio of aerosol carrier gas He and the makeup gas Ar to match stand-alone instrument conditions, the S and Pb isotope ratios obtained in both cases were the same within the range of error. The results of tandem analysis were consistent with existing stand-alone analysis for S and Pb isotopes in chalcopyrite, pyrite, galena, and sphalerite, which showed that this method can be applied to the simultaneous analysis of S and Pb isotopes in natural sulfide minerals, providing an effective solution to determine S and Pb isotope composition in the sulfides of multi-stage deposits.

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