The Common Lead Correction Methods of LA-(MC)-ICP-MS In-situ U-Pb Dating for the Accessory U-bearing Minerals

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Abstract: In recent years, the LA-(MC)-ICP-MS in-situ U-Pb dating has been a dominant trend of the U-Pb chronology development, more and more U-bearing minerals have been widely used in LA-(MC)-ICP-MS in situ U-Pb dating. The common lead correction has an important impact on the U-Pb isotopic dating results. It is very important to choose an appropriate common lead correction method in LA-(MC)-ICP-MS in situ U-Pb dating. The commonly used methods contain 204Pb, 206Pb and 207Pb correction methods. Because it is difficult to accurately measure the 204Pb signal in LA-(MC)-ICP-MS in situ U-Pb dating, the 206Pb correction method is generally not used; The 207Pb correction method is suitable for samples with low Th/U ratio, and the 207Pb correction method is more suitable for younger samples. Meanwhile, the Tera-Wasserburg concordia and the isochronal correction method have been applied more and more in the in-situ LA-(MC)-ICP-MS U-Pb dating of the U-bearing Minerals. Because 208Pb is difficult to measure accurately, 208Pb is used instead of 206Pb for the isochronal correction method. For samples with low U content and high common lead content (common lead content is more than 50% of total lead content), the 206Pb/207Pb-238U/207Pb isochron correction method can deduct the common lead better. However, for older samples (such as greater than 400Ma), it is not appropriate to use the 206Pb/207Pb-238U/207Pb isochronal method. It should be noted that the effect of the isotopic fractionation is not taken into account when the isochron correction method is used to deduct common lead. It is necessary to correct the isotopic fractionation effect in order to obtain the accurate U-Pb age. The advantage of the Tera-Wasserburg concordia method is that it can simultaneously correct the common lead and the isotopic fractionation effects. In summary, different methods have different advantages and limitations in deducting the common lead, it is very important to choose an appropriate correction method according to the age range of mineral, total U, Pb content, common lead content and dating accuracy requirement of the sample. For minerals with low common lead content, such as xenotime and monazite, the 208Pb, the isochron and the Tera-Wasserburg concordia methods are generally used to deduct the common lead; The isochronal and the Tera-Wasserburg concordia methods are also better choices for some minerals with high common lead content, such as apatite, titanite, cassiterite,rutile and perovskite.

Key words: U-bearing Minerals, LA-(MC)-ICP-MS, U-Pb dating, common lead correction methods

Acknowledgments: This work is granted by the national Science Foundation for Young Scientists of China(Grant No.41803047)

Reference

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