

Study on Ar-Ar dating technique for superfine minerals

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The Ar-Ar dating approach has therefore attracted more and more attention due to its wide range of dating, abundant mineral types and high accuracy. However, because of the existence of a nuclear recoil effect during fast neutron irradiation of samples, there will be a significant deviation between the age results obtained from Ar-Ar dating of fine minerals and their true age. In general, the finer the mineral grain is, the higher the proportion of ³⁹Ar lost by nuclear recoil, and the greater the deviation of age results obtained. However, there is no defined finest mineral particle size for conventional Ar-Ar dating. This defect limits the application of the Ar-Ar dating approach in geochronology. By systematic and comprehensive research, our laboratory has made breakthroughs in the research of the Ar-Ar dating technique for superfine minerals. Firstly by determining the size range of mineral particles for which Ar-Ar dating produces significant deviations resulting from nuclear recoil effects. Secondly, the establishment of Ar-Ar dating experimental procedures for superfine mineral samples, and thirdly, studying the characteristics of Ar release from different grain sizes of superfine mineral samples, etc.

The Ar-Ar dating of the reference material samples and the superfine aggregates of neogenetic K-bearing minerals with different grain diameters in tectonite samples shows that the effect of nuclear recoil on Ar-Ar dating results is still negligible when the sample size is fine to 300-800 meshes. According to the study of Ar release characteristics and age spectra of different grain diameters samples, it was found that with the fining of grain size, the release peak of ⁴⁰Ar* moved forward, and the age spectrum pattern also changed obviously (age plateau shortened). From maximum to minimum grain diameters, the release peak of ⁴⁰Ar* moved forward by about 100 °C and the age plateau was shortened by about 3.5%. However, neither the advance of ⁴⁰Ar* release peak nor the shortening of age plateau had any effect on the accuracy of Ar-Ar dating results.

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