

# **The application of the Argus VI multi-collector rare gas mass spectrometer in the high-precision $^{40}\text{Ar}/^{39}\text{Ar}$ dating**

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As one of the most important method in the research of geological event, the high precision of  $^{40}\text{Ar}/^{39}\text{Ar}$  dating becomes more and more important. The high precision of ages is limited, in part, by the stability of the mass spectrometer, mass discrimination and the precision of the measurement of small ion beam, where the measurement process plays the most important role in the uncertainty of the  $^{40}\text{Ar}/^{39}\text{Ar}$  dating result. As the new generation of Argus multi-collector mass spectrometer, the instrument of Argus VI has big advantages in the application of obtaining accurate and high-precision  $^{40}\text{Ar}/^{39}\text{Ar}$  data. Through the comparison of the measurement results of small ion beam  $^{36}\text{Ar}$  collected by Faraday cup with  $10^{12}\Omega$  amplifier and CDD respectively, it is found that the CDD could highly improve the precision of the measurement, the precision can be improved up to one order of magnitude if the signal size is smaller than 5000cps. However, the efficiency of CDD fluctuates sometimes without regularity as a result of environmental change and self-consuming, which relative standard error is as high as 5.3‰ during continuous measurement, indicates that the CDD should be calibrated frequently to avoid the obvious error of the data. During the course of two months run cycle 60 air calibrations yielded mass discrimination factor  $\delta\lambda_{\text{amu}}$  of  $1.009\pm0.002$  ( $2\sigma$ ), proved that the instrument is very stable, and different size of sample has little effect on the mass fraction bias correction. We choose two typical samples to check the advantages of the CDD in the process of  $^{40}\text{Ar}/^{39}\text{Ar}$  dating measurement, the CDD can improve the precision of the dating data for the sample which includes extremely low  $^{36}\text{Ar}$ . Meanwhile, the slight change of efficiency of the CDD can greatly change the  $^{40}\text{Ar}/^{39}\text{Ar}$  calculation age when the sample includes a certain atmospheric  $^{40}\text{Ar}$  but lack of radiogenic  $^{40}\text{Ar}$ , highlights the importance of routine calibration of the CDD for the accurate high-precision  $^{40}\text{Ar}/^{39}\text{Ar}$  dating.